REC POWER DEVELOPMENT AND CONSULTANCY LIMITED

(As Project Implementing Agency)

On Behalf of Jammu & Kashmir Power Transmission Corporation Limited

Invites Bid through e-Tendering mode only

FOR

Construction of balance works of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15 on Turn Key Basis

Tender Specification No. RECPDCL/PIA/JKPTCL/SS & LILO-01 of 2024
Dated: 15-01-2024

VOL-I

01/ 2024

REC Power Development Consultancy Limited
(A wholly owned subsidiary of REC, a *'Maharatna CPSE'*
Under the Ministry of Power, Govt of India)
D-Block, REC Corporate Headquarter,
Plot No. I-4, Sector-29
Gurugram, Haryana– 122 001
Website: www.recpdcl.in

SECTION – I

INVITATION FOR BIDS (IFB)

INVITATION FOR BIDS (IFB)
FOR

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15 ON Turn Key Basis"

(SINGLE STAGE TWO ENVELOPE BIDDING)
under e-procurement

DATE OF ISSUANCE OF IFB : **15/01/2024**

NIT No. : RECPDCL/PIA/JKPTCL/SS & LILO-01

FUNDING : DOMESTIC (PMDP Scheme-15)

1.0 This invitation for bids follows the e-procurement notice (Invitation for Bids) for the subject package which appeared in National and Regional Newspapers on **15/01/2024**. The tender document is available at RECPDCL website (**www.recpdcl.in**), REC website (**www.recindia.com**), e-bidding portal (**https://rec.ewizard.in) and** (**www.eprocure.gov.in).** Interested bidders may view, download the e-Bid document, seek clarification and submit their e-Bid online up to the date and time mentioned in the table at Clause no-5.0 of IFB:

2.0 **Jammu Kashmir Power Transmission Corporation Limited,** J&K (hereinafter referred to as 'JKPTCL/'Owner') has decided to set up, as an Owner, "**Strengthening of Transmission System in J&K under PMDP Scheme-15".**

2.1 The Project Implementing activities in respect of the aforesaid Project on behalf of JKPTCL have been entrusted to REC Power Development & Consultancy Company Limited (RECPDCL) is a wholly owned subsidiary of REC Limited, a Maharatna Public Sector Undertaking, and was incorporated on 8 January 2007 as Public Limited Company. RECPDCL's registered office is situated at D-Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram, Haryana– 122 001, India and Corporate office is at (hereinafter referred to as **'RECPDCL'/'EMPLOYER'/'PURCHASER'**) and RECPDCL intends to use funds to be provided by JKPTCL for eligible payments under the contracts for the Package as mentioned above. The Ownership of the project shall, however, remain vested with JKPTCL.

3.0 RECPDCL, on behalf of JKPTCL therefore, invites bids from eligible bidders for the aforesaid package on Domestic Competitive Bidding basis under secured e-procurement procedure.

This Invitation for Bids extended through media, website or written communication or by any other means, shall not be construed to mean that the prospective bidders to whom the Invitation for Bids has been extended is deemed to be an eligible bidder. The eligibility of the bidders shall be determined as per the provisions of Bidding Documents.

3.1 **Balance works Substation Package SS & LILO- 01 for (a) 2X 50 MVA, 220/33 kV Nagrota (New) substation including (b) LILO of 220kV Udhampur-Gladni on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation associated with Transmission System Strengthening under PMDP Scheme-15"**

The scope of work shall include design, engineering, manufacture, fabrication, testing at manufacturer's works, delivery, unloading at site, storage, erection, testing and commissioning of substations including associated civil works including Staff Quarter and the associated Transmission Line Tower works, including supply of conductor, Disc Insulators, OPGW, hardware fitting and accessories for conductor & OPGW of associated lines for the following:

a) Construction of 220/33 kV Nagrota Grid Substation: -

i. 220KV Line Bay- 2 nos.
ii. 220KV Bus Coupler Bay- 1 no.
iii. Aux., Neutral & Tertiary buses- 1 no.
iv. 220KV Transformer Bay- 2 nos.
v. 220 KV Transfer Bus Bay- 1 no.
vi. Power Transformer (2x50 MVA, 220/33KV, 3-Phase) - 2 nos.
vii. 33KV Line Bay- 4 nos.
viii. 33KV Bus Coupler Bay- 1 no.
ix. 33KV Transformer Bay (33 KV side of 220/33KV Transformer)- 2 nos.
x. 33KV Aux. Bay- 1 no.
xi. Common Miscellaneous works of 220/ 33 KV Grid Station
xii. Common Civil works of 220/ 33 KV Grid Station

b) Construction of S/C LILO of Udhampur-Gladni Transmission Line- 5 KMs on 220 kV D/C Tower

This covers the following scope of works:

(i) Detailed survey including route alignment, profiling, tower spotting, optimization of tower locations, soil resistivity measurement &

geotechnical investigation (including special foundation locations viz. pile/well foundation locations, whenever applicable;

(ii) Check survey;

(iii) Fabrication and supply of all type of transmission line towers, including River crossing towers (wherever applicable) as per Contractor's design/drawings including fasteners, step bolts, hangers, D-shackles etc. ;

(iv) Supply of all types of tower accessories like phase plate, circuit plate (where ever applicable), number plate, danger plate, anti-climbing device, Bird guard (where ever applicable);

(v) Supply of
   a) Hardware Fittings and Conductor Accessories
   b) Conductor, Insulators
   c) OPGW & associated fittings and accessories

(vi) Classification of foundations for different type of tower and casting of foundations for tower footings as per Contractor's foundations drawing;

(vii) Supply & Installation of Tower Earthing.

(viii) For transmission lines, to promote mechanization and safe working conditions, use of crane is being promoted. Erection of towers, tack welding of bolts and nuts including supply and application of zinc rich paint, fixing of insulator strings, stringing of conductors and OPGW along with all necessary line accessories by using crane (wherever feasible). However, where usage of crane is not possible, erection of towers has to be carried out by conventional method i.e. using Gin pole, Derrick, Centre mast etc. through usage of Power Operated Winch Machines. No tractor shall be allowed for tower erection;

(ix) De-stringing & dismantling of existing 765/400/220/132/66kV Transmission line. (whenever applicable)

(x) Stringing of Power line crossing section under Live Line Condition (where ever applicable);

(xi) Painting of towers &supply and erection of span markers, obstruction lights (wherever applicable) for aviation requirements (as required)

(xii) Testing and commissioning of the erected transmission lines and

(xiii) Installation of FODP (Fiber Optic Distribution Panel) and approach cable

(xiv) Other items not specifically mentioned in this Specification but are required for the successful commissioning of the transmission line, unless specifically excluded in the Specification.

Note: Bidders are requested to note that LILO of Nagrota Sub-station will be tapped from 220kV Udhampur- Gladni S/C Transmission Line.

c) Construction of Staff Quarters & associated facilities: -

Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation.

The above scope of work is indicative and the detailed scope of work is given in the Technical Specification (Volume-II) of the Bidding Documents.

3.2 The completion period for the subject Substation Package shall be the **15 Months**.

3.3 Bidding will be conducted through the Domestic Competitive Bidding procedures as per the provisions of ITB and the contract shall be executed as per the provisions of the Contract. The respective rights of the Employer and the Bidder/Contractor shall be governed by the Bidding Documents/Contract signed between the Employer and the Contractor for the package.

4.0 The detailed Qualifying Requirements (QR) are given in the Bidding Document.

5.0 The tender document is available at RECPDCL website (**www.recpdcl.in**), REC website **(www.recindia.com),** e-tendering portal **(https://rec.ewizard.in) and (www.eprocure.gov.in). However, in case of any contradiction the tender documents at e-tendering portal (https://rec.ewizard.in) shall prevail.** Interested bidders may view, download the e-Bid document, commence preparation of bids to gain time, seek clarification and submit their e-Bid online up to the date and time mentioned in the table below:

Important Dates	
Date of Release of Bid Document	**15/01/2024**
Last date of queries/ seeking Clarification	**25/01/2024, up to 11:00 Hrs. (IST)**
Pre bid Meeting	**29/01/2024, at 15:00 Hrs. (IST)**
Start of Tender and Registration on e Wizard portal	**15/01/2024, 10:00 Hrs. onwards**
Starting Date & Time of Bid submission	**15/01/2024, 10:00 Hrs. onwards**
Last Date & Time of submission of Bid	**15/02/2024, till 16:00 Hrs. (IST)**
Date of opening of Technical bid	**15/02/2024, at 17:00 Hrs. (IST)**
Tender Document	The details can be downloaded free of cost from the websites www.recpdcl.in/www.recindia.com /**https://rec.ewizard.in**/ www.eprocure.gov.in
Pre Bid Meeting Address	REC Power Development and Consultancy Limited D-Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram, Haryana– 122 001 Tel: 0124 – 4441300

Cost of Tender	Rs 25,000/- (Rs Twenty Five Thousand Only)
EMD #	**Rs.10,00,000.00 (Rs. Ten Lakhs only)**
Address for Bid submission/EMD/PBG	**Shri. P S Hariharan,** **HoD-Transmission,** REC Power Development and Consultancy Limited D-Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram, Haryana– 122 001 Tel: 0124 – 4441300 Email- pshariharan@recpdcl.in
Contact Person	**Shri. Deepesh Kalakar** **Manager (Engineering),** REC Power Development and Consultancy Limited D-Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram, Haryana– 122 001 Tel: 0124 – 4441300 Email- deepesh@recpdcl.in; nagrota@recpdcl.in

The bidding documents are meant for the exclusive purpose of bidding against this specification and shall not be transferred to any parts or reproduced or used otherwise for any purpose other than for which they are specifically uploaded.

6.0 Interested bidders have to necessarily register themselves on the e-bidding portal of e wizard and are strongly recommended to go through the e-Tendering Methodology & Registration process in e-bidding portal i.e **https://rec.ewizard.in** provided in the **Section-IIA (Annexure to ITB)** of the Bidding Document.

Resolution to all general queries and system setting is given in the bidders guide. In case of any other issue please contact:

e-Bidding portal:
https://rec.ewizard.in

S.no	Name	Email	Contact number
1	Birendra Kumar	eprochelpdesk.21@gmail.com	8448288988
2	Amrendra kumar	eprochelpdesk.18@gmail.com	8448288980

Even though the E wizard support team will be available from 0930 hrs. to 1800 Hrs. on all working days, but in case Bidders are unable to reach e wizard

then communications can also be done through e-mail supported by documentary evidence and E wizard team will respond to the queries within 24 hrs.

The said registration shall be on chargeable basis and bidders are requested to refer **Section-IIA (Annexure-A to ITB)** E wizard Registration for details.

Bidders are advised to deposit the transaction fee at least two days before the last date of submission and to submit their bids least one day before the last day of submission to avoid any last minute issues.

Bidder may obtain further information regarding this IFB from the **Office of HoD-Transmission, RECPDCL** at the address given at para 12.0 below from 15:00 hours to 17:00 hours on all working days.

7.0 For proper uploading of the bids on the portal namely **https://rec.ewizard.in** *(hereinafter referred to as the **'portal'**)*, it shall be the sole responsibility of the bidders to apprise themselves adequately regarding all the relevant procedures and provisions as detailed at the portal as well as by contacting from e wizard team, as and when required, for which contact details are mentioned above. The Employer in no case shall be responsible for any issues related to timely or properly uploading/submission of the bid in accordance with the relevant provisions of Section II – ITB of the Bidding Documents.

7.1 A pre-bid meeting will be held at the address mentioned in Clause no- 5 of IFB on **29.01.2024** at 15:00 Hrs. to clarify the bidders various issues raised in accordance with clause 6.4 of ITB.

8.0 A Single Stage Two Envelope Bidding Procedure will be adopted and will proceed as detailed in the Bidding Documents.

8.1 Soft Copy Part of the Bids must be uploaded under Single Stage Two Envelope Bidding Procedure on the portal at or before 16:00 hours on **15.02.2024**. The e-Procurement system would not allow any late submission of bids through the portal after due date & time as specified.

Hard Copy Part of the Bids must be submitted under Single Stage Two Envelope Bidding Procedure at the address given in Table at Clause no-5.0 of IFB at or before 16:00 hours on **15.02.2024**. **In case Hard copy part of the bid is not received by the Employer till the deadline for submission of the same prescribed by the Employer, but the bidder has uploaded the soft copy part of the bid, the bid will be considered as late bid. Such bids will be rejected during preliminary examination.**

First Envelope i.e. **Techno -Commercial Part** shall be opened on **15.02.2024** in the presence of the bidders' representatives who choose to attend in person at the address below at **17:00 hours**. Second Envelope i.e. **Price Part** of those

bidders who qualify techno-commercially, shall be opened in the presence Bid Opening Committee constituted by RECPDCL at the time and date and at the address given in the intimation for opening of Second Envelope in accordance with Clause 25 of ITB.

All bids must be accompanied by a bid security of **Rs.10,00,000.00 (Rs. Ten Lakhs only) for package SS & LILO -01**

Bid Security, Integrity Pact and Safety Pact must be submitted in physical form at the address given at para 12.0 below.

9.0 Employer/ Owner / Purchaser reserves the right to go in for e-Reverse Auction (e-RA) in accordance with clause 29.0 of ITB among the technically and commercially acceptable bidders. The decision to conduct reverse auction or not, will be conveyed to short listed bidders prior to opening of price bid. In view of this, the bidders must quote most competitive prices in the first instance itself.

Once the decision to conduct Reverse Auction is conveyed to the bidders, it will be mandatory for the bidders to participate in Reverse Auction, failing which, the bidder shall be liable for punitive action including but not limited to rejection of offer, encashment of bid security, wherever applicable, etc. For this purpose, even log-in to the system shall be construed as participation.

10.0 **RECPDCL reserves the right to annul the bidding process at any time prior to award of contract including rejection of any or all bids after the same has been received, without assigning any reason and without their by incurring any liability to the effected bidder or bidders or any obligation to inform the effected bidder or bidders on the ground of RECPDCL's action.**

11.0 The Integrity Pact Program (IPP) of RECPDCL will be applicable for the Package. ***Shri Sudhir Bhargava, IAS***, & ***Dr. Varesh Sinha, IAS*** shall be the Independent External Monitor. Correspondence, if any, to the IEM be addressed to the following:

Shri Sudhir Bhargava, IAS (Retd.)
Procurement and Contract Management (PCM) Division,
REC Limited,
I-4, Sector-29, Gurugram, Haryana, INDIA
Email: officesudhirbhargava[at]gmail[dot]com

Dr. Varesh Sinha, IAS (Retd.)
Procurement and Contract Management (PCM) Division,
REC Limited,
I-4, Sector-29, Gurugram, Haryana, INDIA
Email: vareshsinha[at]gmail[dot]com

12.0 Bidders are also requested to visit our website ***http://www.recpdcl.in / https://rec.ewizard.in*** for any corrigendum/addendum /errata/clarification/amendment which shall be considered integral part of bidding document. No separate notifications shall be published in the Newspaper(s) or any media for these activities.

13.0 All correspondence with regard to the above shall be to the following address.

(By Post/In Person)
HoD Transmisssion,
REC Power Development and Consultancy Limited
D-Block, REC Corporate Headquarter, Plot No. I-4,
Sector-29, Gurugram, Haryana– 122 001 Tel: 0124 – 4441300
Email- pshariharan@recpdcl.in

For more information on RECPDCL, visit our site at: http://www.recpdcl.in
For more information on the portal, visit on site of
E wizard at:
https://rec.ewizard.in

---- End of Section-I (IFB) ----

SECTION – II
INSTRUCTION TO BIDDERS (ITB)

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INSTRUCTION TO BIDDERS (ITB)

Preamble

This section (Section–II) of the Bidding Documents provides the information necessary for bidders to prepare responsive bids, in accordance with the requirements of the Employer. It also provides information on bid submission and uploading the bid on portal (https://rec.ewizard.in) on line bid opening, evaluation and on contract award. This Section (Section II) contains provisions that are to be used unchanged

However, provisions governing the performance of the Contractor, payments under the contract or matters affecting the risks, rights and obligations of the parties under the contract are not included in this section but instead under Section – IV: General Conditions of Contract and/or Section – V: Special Conditions of Contract.

The respective rights of the Employer and Bidders/Contractor shall be governed by the Bidding Documents/Contract signed between the Employer and the Contractor for the respective package.

A. Introduction

1. Source of Funds

1.1 **Jammu & Kashmir Power Transmission Corporation Limited**, J&K (hereinafter referred to as 'JKPTCL/'Owner') intends to use domestic funding under Prime Minster Development Project (PMDP-15) for this Project.

All eligible payments under the contract for the package for which this Invitation for Bids is issued shall be made by the Employer.

2. Eligible Bidders

2.1 This Invitation for Bids, issued by the Employer is open to all firms including company (ies), Government owned Enterprises registered and incorporated in India as per Companies Act, 1956/2013, barring Government Department as well as foreign bidders/MNCs not registered and incorporated in India and those bidders with whom business is banned by the Employer.

2.2 A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest with one or more parties in this bidding process, if:

(a) they have a controlling partner in common; or

(b) they receive or have received any direct or indirect subsidy from any of them; or

(c) they have the same legal representative for purposes of this bid; or

(d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the bid of another Bidder, or influence the decisions of the Employer regarding this bidding

process; or

(e) a Bidder submits more than one bid in this bidding process, either individually [including bid submitted as an authorized representative on behalf of one or more manufacturer(s) or through Licensee – Licensor route, wherever permitted as per the provision of Qualification Requirement for the Bidders in Section-III, Volume-I or as a partner in a joint venture, except for alternative offers if permitted under ITB Clause 9.3. This will result in the disqualification of all such bids. However, this does not limit the participation of a Bidder as a subcontractor in another bid, or of a firm as a subcontractor in more than one bid; or

(f) a Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the Plant and Installation Services that are the subject of the bid; or

(g) A Bidder or any of its affiliates has been hired (or is proposed to be hired) by the Employer as Project Manager for the contract.

2.3 The Bidder, directly or indirectly shall not be a dependent agency of the Employer.

3. Eligible Plant, Equipment, and Services

3.1 For the purposes of these Bidding Documents, the words "facilities," "plant and equipment," "installation services," etc., shall be construed in accordance with the respective definitions given to them in the General Conditions of Contract.

3.2 All plant and equipment to be supplied and installed and services carried out under the contract shall have their origin in any country barring those countries against whom sanction for conducting business is imposed by Government of India and barring those firms with whom business is banned by the Employer.

3.3 For purposes of this clause, "origin" means the place where the plant and equipment or component parts thereof are mined, grown, or produced. Plant and equipment are produced when, through manufacturing, processing or substantial and major assembling of components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.

3.4 The origin of the plant, equipment, and services is distinct from the nationality of the Bidder.

3.5 The Bidders must conform to all the requirements under all applicable laws including any order issued by the central government including Order No No.9/16/2016-Trans-Part (2) dated 18 November 2020, Order No. F/No.6/18/2019-PPD by Ministry of Finance, Department of Expenditure, Public Procurement Division dated 23 July 2020, latest Government of India Guidelines for Make in India, Domestically manufactured products, Atmanirbhar Bharat and circulars DIPP Office Memorandum No. P-45021/2/2017-PP (BE-II) date:16th Sept. 2020, MeitY Circular No.1(10)/2017-CLES dated 06.12.2019 and Order No. 11/05/2018-Coord. by the Ministry of Power dated 17 September 2020 including any amendments or modifications to the same from time to time.

4. Cost of Bidding

4.1 The Bidder shall bear all costs associated with the preparation and submission of its bid including post-bid discussions, technical and other presentations etc., and the Employer will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process.

4.2 The bidder has to ensure his registration with E wizard, New Delhi on their portal https://rec.ewizard.in . The said registration shall be on chargeable basis and the details are provided in (Annexure-A to ITB) e-Tendering Methodology & Registration process in e-bidding portal.

B. The Bidding Documents

5. Content of Bidding Documents

5.1 The facilities required, bidding procedures, contract terms and technical requirements are prescribed in the Bidding Documents. The Bidding Documents comprise of the following and shall include amendments, if any, thereto:

VOLUME – I: Conditions of Contract
Section I Invitation for Bids (IFB)
Section II Instructions to Bidders (ITB)
Section III Qualification Requirement
Section IV General Conditions of Contract (GCC)
Section V Special Conditions of Contract (SCC)
Section VI Model Rule for Health and sanitary Arrangement
Section VII Contractor's Labour Regulation
Section VIII Safety Regulation
Section IX Sample Format and Procedures

1. Bid Form & price Schedule
1.1 Bid Form
1.2 Price Schedule
2. Bid Security Form
3. Form of Notification by the Employer to the Bank
4. Form of Contract Agreement
4.1 Appendix-1: Procedures of Payment
4.2 Appendix-2: Price Adjustment
4.3 Appendix-3: Insurance Requirements
4.4 Appendix-4: Time Schedule
4.5 Appendix-5: List of Approved Subcontractors
4.6 Appendix-6: List of Document for Approval or Review
4.7 Appendix-7: Guarantees, Liquidated Damages for Non-Performance
4.8 Integrity Pact
4.9 Safety Pact
5. Performance Security Form
6. Form of Taking Over Certificate
7. Form of Indemnity Bond to be executed by the Contractor for the Equipment handed over in one lot by Employer for performance of

its contract.

8. Form of Indemnity Bond to be executed by the Contractor for the Equipment handed over in installments by Employer for performance of its contract.
9. Form of Authorization Letter
10. Form of Trust Receipt for Plant, Equipment and Materials received
11. Form of Extension of Bank Guarantee
12. Form of Power of Attorney for Joint Venture
13. Form of Joint Venture Agreement
14. Format for Evidence of Access to or Availability of Credit/ Facilities
15. Form of Operational Acceptance
16. Form of Safety Plan to be submitted by the Contractor within sixty days of award of contract
17. Form for Information to be furnished by the Contractor in respect of the Procurement made from MSE Vendors

Volume-II: Technical Specification

Volume-III: Bid Form, Price Schedules & Technical Data Sheets

5.2 The Bidder is expected to examine all instructions, forms, terms, specifications and other information in the Bidding Documents. Failure to furnish all information required by the Bidding Documents or submission of a bid not substantially responsive to the Bidding Documents in every respect will be at the Bidder's risk and may result in rejection of its bid.

5.3 Scope of Work is given in Volume-II of Bidding Documents titled "Technical Specifications". Utmost care has been taken by the Employer in formulating the programmed Attachments and Price Schedules. Bidders are expected to thoroughly verify with trial run at their end and notify to the Employer of Arithmetical, Logical, Formatting or any such error, if found in the same for suitable action. Irrespective of corrections made in this regard through amendment(s), if any, rectification of error for evaluation shall be carried out in accordance with stipulated provisions of Bidding Documents.

5.4 All the Bidders except those exempted pursuant to ITB Sub-Clause-5.5 shall submit along with the hard copy part of bid a non-refundable fee as mentioned below towards the cost of Bidding Documents in the form of demand draft in favour of REC Power Development & Consultancy Limited, payable at New Delhi.

The Fee may also be paid through on line mode as per below mentioned details:
Account Name: REC POWER DEVELOPMENT & CONSULTANCY LIMITED
Bank Name: IDFC FIRST BANK LTD.
Bank Branch Address: Birla Towers, 4th Floor East Tower & LGF West Tower, Barakhamba Road, New Delhi-110001
Bank Account No.: 10000697415
IFSC Code: IDFB0020101

The non-refundable fee towards the cost of Bidding Documents shall be INR 25,000/-

Any bid not accompanied by an acceptable mode of payment towards the cost of Bidding Documents, except as exempted in ITB Sub- Clause 5.5 below, shall be rejected

by the Employer as being nonresponsive.

5.5 Micro and Small Enterprises (MSEs) registered with National Small Industries Corporation (NSIC) or with any other designated Authority of GoI under the Public Procurement Policy for MSEs are exempted from submission of fee towards the cost of Bidding Documents as per the Provisions of the Public Procurement Policy for Micro and Small Enterprises (MSEs) order 2012. This shall be subject to production of documentary evidence with regard to registration with authorities mentioned above.

6. Clarification of Bidding Documents; and Pre-Bid Meeting

6.1 A prospective Bidder requiring any clarification of the Bidding Documents may notify the Employer and may also seek clarification in writing or by cable (hereinafter, the term cable is deemed to include Electronic Data Interchange (EDI) or telefax) at the Employer's mailing address indicated in the **IFB**. Similarly, if a Bidder feels that any important provision in the documents, such as those listed in ITB Sub-Clause 22.3.1, will be unacceptable, such an issue should be raised as above. The Employer will respond through the portal https://rec.ewizard.in to any request for clarification or modification of the Bidding Documents that it receives no later than Seven (07) days prior to the original deadline for submission of bids prescribed by the Employer. The Employer shall not be obliged to respond to any request for clarification received later than the above period. Further, the mere request for clarification from the Bidders shall not be a ground for seeking extension in the deadline for submission of bids. Employer's response (including an explanation of the query but not identification of its source) will be uploaded on portal https://rec.ewizard.in where all the bidders can see clarification/reply to query.

6.2 The Bidder is advised to visit and examine the site where the facilities are to be installed and its surroundings and obtain for itself on its own responsibility and cost all information that may be necessary for preparing the bid and entering into a contract for supply and installation of the facilities. The costs of visiting the site shall be at the Bidder's own expense.

6.3 The Bidder and any of its personnel or agents will be granted permission by the Employer/Owner to enter upon its premises and lands for the purpose of such inspection, but only upon the express condition that the Bidder, its personnel and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof and will be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of the inspection.

6.4 The Bidder's designated representative(s) is/are invited to attend a pre-bid meeting, which, if convened, will take place at the venue and time stipulated in the IFB. The purpose of the meeting will be to clarify any issues regarding the e-procurement method, the Bidding Documents in general and the Technical Specifications in particular. The Bidder is requested, as far as possible, to submit any question in writing, to reach the Employer not later than one week before the meeting. It may not be practicable at the meeting to answer questions received late, but questions and responses will be transmitted as indicated hereafter. Minutes of the meeting, including the text of the questions raised (without identifying name of the bidders) and the responses given, together with any responses prepared after the meeting, will be transmitted without delay through the e-bidding portal only. Any modification of the Bidding Documents listed in ITB Sub-Clause 5.1, which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of Clarification/Amendment/Addendum pursuant to ITB

Clause-6 & 7 respectively and not through the minutes of the pre-bid meeting.

Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

7. Amendment of Bidding Documents

7.1 At any time prior to the deadline for submission of bids, the Employer may, for any reason, whether at its own initiative, or in response to a clarification requested by a prospective Bidder, amend the Bidding Documents.

7.2 The amendment will be notified only through the portal https://rec.ewizard.in. The clarifications/amendments/addendums to the Bidding Documents will be binding on the bidders and the notification of the clarifications / amendments / addendums through portal shall be deemed to be construed that such clarifications / amendments / addendums to the Bidding Documents have been taken into account by the Bidder in its bid.

7.3 In order to afford reasonable time to the prospective Bidders to take the amendment into account in preparing their bid, the Employer may, at its discretion, extend the deadline for the submission of bids, in which case, the Employer will notify through portal https://rec.ewizard.in where all prospective bidders may see the extended deadline.

In case of extension of deadline for the submission of bids by the Employer for reasons inter-alia including the above, prospective bidders can download the Bidding Documents from the portal https://rec.ewizard.in , as per the provisions available therein.

C. Preparation of Bids

8. Language of Bid

8.1 The bid prepared by the Bidder and all correspondence and documents exchanged by the Bidder and the Employer related to the bid shall be written in the English language, provided that any printed literature furnished by the Bidder may be written in another language, as long as such literature is accompanied by English translation of its pertinent passages, in which case, for purposes of interpretation of the bid, the English translation shall govern.

9. Documents Comprising the Bid

I. Hard Copy Part

Hard copy part of the bid shall comprise of following documents to be submitted in sealed envelope, as part of First Envelope

(i) DD towards Bidding Document fee/Proof for deposit of Tender Fee of the amount as specified in the in accordance with clause 5.4 of ITB or documentary evidence in support of exemption of Bidding Document fee as per ITB 5.5

(ii) Bid Security (in Original) or documentary evidence in support of exemption of Bid Security, in separate envelope in accordance with clause 13 of ITB, Section-II

(iii) Integrity Pact (in Original) in accordance with clause 9.3 (o) of ITB, Section-II in separate envelope

(iv) Power of Attorney as per Clause 9.3 (b).

(v) In case of Bid from Joint Venture, the Joint Venture Agreement & Power of Attorney of Joint Venture Agreement, both in original

(vi) Safety Pact (in Original) in accordance with clause 9.3 (s) of ITB, Section-II in separate envelope

(vii) Bidders shall also submit Joint Deed of Undertaking by the collaborator along with the bidder/manufacturer, duly signed and stamped on each page in original, if applicable as per Qualification Requirement for the Bidders in Section-III and

(viii) Any other document further specified in the Bidding Document duly signed and stamped on each page.

(ix) Bidder shall submit signed copy of bid document along with all clarifications/ amendments/ addendums thereof issued in the e-bidding portal.

(x) The Bidder shall also submit Hard Copy of all the Documents as uploaded on E-Bidding Portal **except Price Bid.**

(xi) Notarized Undertaking related to Make in India & Cyber Security in the format enclosed duly signed by Authorized PoA holder.

Bidder shall note that no document is required to be submitted as part of Second envelope in Hard Copy.

II. Soft Copy Part

Soft copy part of the bid shall comprise of following documents to be uploaded on the portal as per provisions therein.

(a) As part of First Envelope **(Cover-1 of the e-bidding portal)**

(i) Programmed file -Attachments (Attachment to Bid Form including attachment to QR) in MS Excel format & its revision covering various attachments, Integrity Pact and bid form for first envelope.

(ii) Scanned copies of all the documents mentioned at 15.4 of ITB as part of **Cover-2 of the e-bidding portal.**

(iii) Bidder shall submit signed & scanned copy of bid document along with all clarifications/ amendments/ addendums thereof issued in the e-bidding portal.

(b) As part of Second Envelope **(Cover-3 of the e-bidding portal)**

(i) The Electronic Form/Template of the bid for Second Envelope (Price - Part) covering details regarding summary of price details.

(ii) Price Schedules & Bid Forms in MS excel format & its revision covering various price schedules and bid forms for Second Envelope.

9.1 The bid shall be submitted by the Bidder under "Single Stage – Two Envelope" procedure of

bidding. Under this procedure, the bid submitted by the Bidder in two envelopes - First Envelope (also referred to as Techno - Commercial Part) and Second Envelope (also referred to as Price Part) shall comprise of the following documents:

First Envelope: (Cover-1 & Cover-2 of the e-bidding portal)

(a) Bid Form (First Envelope) duly completed and signed by the Bidder, together with all Attachments & Technical Data Sheets (available in Volume-III) as uploaded on the portal https://rec.ewizard.in and identified in ITB Sub-Clause 9.3 below.

(b) Hard copy of the following documents submitted at the address mentioned at 1.1 above:

(i) DD towards Bidding Document fee of the amount as specified in the in accordance with clause 5.4 of ITB or documentary evidence in support of exemption of Bidding Document fee as per ITB 5.5

(ii) Bid Security (in Original) or documentary evidence in support of exemption of Bid Security, in separate envelope in accordance with clause 13 of ITB, Section-II

(iii) Integrity Pact (in Original) in accordance with clause 9.3 (o) of ITB, Section-II in separate envelope;

(iv) Power of Attorney as per Clause 9.3 (b);

(v) In case of Bid from Joint Venture, the Joint Venture Agreement & Power of Attorney of Joint Venture Agreement

(vi) Safety Pact (in Original) in accordance with clause 9.3 (s) of ITB, Section-II in separate envelope

(vii) Any other document further specified in the Bidding Document duly signed and stamped on each page.

(viii) The Bidder shall also submit Hard Copy of all the Documents as uploaded on E-Bidding Portal **except Price Bid.**

Second Envelope: (Cover-3 of the e-bidding portal)

(a) Bid Form (Second Envelope) together with Price Schedules (available in Volume-III), duly completed as uploaded on the portal https://rec.ewizard.in.

9.2 Alternative bids shall not be permitted.

9.3 Bidder is required to provide complete and precise information in the bid along with supporting documentary evidences, as applicable. The bidder should attach separate sheet(s) in case space provided is not sufficient. RECPDCL will consider the bid solely on the basis of information/details/data/documentary evidences etc. provided by the bidder in the

bid only without seeking further clarifications from the bidder in normal circumstances.

Incomplete, partially complete, not clearly filled bid giving incorrect information is liable to be rejected without any consideration.

Where the answer is a statement of fact it must be accurate and supported by documentary evidence wherever required. It is the bidder's responsibility to respond with such clarity that will ensure RECPDCL not to mis-interpret the bid.

Bidder shall submit soft copy of following documents by uploading on the portal https://rec.ewizard.in and Hard copy of documents wherever stipulated in the manner specified in ITB Clause 9.1 above along with its Techno - Commercial Part (First Envelope):

(a) Attachment 1: Bid Security (if required) or documentary evidence in support of exemption of Bid Security *(submission of Hard "Copy in Original for Bid Security" and in "Copy for documentary proof in support of exemption")*

A bid security or documentary evidence in support of exemption of Bid Security, in sealed separate envelope shall be furnished in accordance with ITB Clause 13 & ITB Clause 16.

Bidder shall submit the hard copy of the Bid Security or documentary evidence in support of exemption of Bid Security in original.

(b) Attachment 2: Power of Attorney *(submission of Hard copy in "Original and uploading of Scanned Copy")*

A power of attorney, duly notarized, indicating that the person(s) signing the bid has(ve) the authority to sign the bid and thus that the bid is binding upon the Bidder during full period of its validity, in accordance with ITB Clause 14.

Scanned copy of above documents shall be uploaded. (refer para 15.4 below)

(c) Attachment 3: Bidders Eligibility and Qualifications *(Uploading of Scanned Copies of documentary evidence in support of Bidders qualification. In case of Joint Venture bid, submission of Hard Copy in "Original of the JV Agreement and POA for JV")*

In the absence of prequalification, documentary evidence establishing that the Bidder is eligible to bid in accordance with ITB Clause 2 and is qualified to perform the contract in accordance with **Qualification Requirement Sec-III, Vol-I**, if its bid is accepted.

The documentary evidence of the Bidders eligibility to bid shall establish to the Employers satisfaction that the Bidder, at the time of submission of its bid, is eligible as defined in ITB Clause 2.

The documentary evidence of the Bidders qualifications to perform the contract, if its bid is accepted, shall establish to the Employers satisfaction that the Bidder has the financial, technical, production, procurement, shipping, installation and other capabilities necessary to perform the contract, and, in particular, meets the experience and other criteria outlined in the Qualification Requirement for the Bidders in Sec-III,

Vol-I and shall also include:

The documentary evidence defining i) the constitution or legal status; (ii) The principal place of business; (iii) The place of incorporation; or the place of registration and the nationality of the Owners (for applicants who are partnerships or individually-owned firms)

Declaration for anticipated change in legal structure/ ownership, if any.

The complete annual reports together with Audited statement of accounts of the company for last five years of its own (separate) immediately preceding the date of submission of bid. The Bidder shall also furnish documentary evidence/ declaration regarding Financial re-structuring of the company, if any.

Scanned copy of above documents shall be uploaded (refer para 15.4 below).

[**Note I**. In the event the Bidder is not able to furnish the above information of its own (i.e., separate), being a subsidiary company and its accounts are being consolidated with its Group/ Holding/ Parent company, the Bidder should submit the audited balance sheet, income statement, other information pertaining to it only (not of its Group/Holding/Parent company) duly certified by any one of the authority [(i) Statutory Auditor of the Bidder/(ii) Company Secretary of the Bidder a (iii) A certified Chartered Accountant] certifying that such information/documents are based on the audited accounts as the case may be.

Note II. Similarly, if the Bidder happens to be a Group/Holding/ Parent company, the Bidder should submit the above documents/information of its own (i.e., exclusive of its subsidiaries) duly certified by any one of the authority mentioned in Note I above certifying that these information/documents are based on audited accounts, as the case may be.]

Unless otherwise mentioned in **bidding document**, bids submitted by a joint venture of two or more firms as partners, if allowed as per stipulated Qualification Requirements in SEC-III, Vol-I, shall comply with the following requirements:

(i) The bid shall include all the information required for Attachment 3 as described above for each joint venture partner.

(ii) The bid shall be signed so as to be legally binding on all partners.

(iii) One of the partners responsible for performing a key component of the contract shall be designated as leader; this authorization shall be evidenced by submitting with the bid a power of attorney signed by legally authorized signatories as per Form-12 of Section-IX, Vol-I.

(iv) The leader shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture, and the entire execution of the contract, including payment, shall be done exclusively with the leader, provided otherwise requested by the joint venture and agreed between the Employer and the leader.

(v) All partners of the joint venture shall be liable jointly and severally for the execution of the contract in accordance with the contract terms.

(vi) A copy of the agreement entered into by the joint venture partners shall be submitted with the bid as per Form-13 of Section-IX, Vol-I, including interalia

delineation of responsibilities and obligations of each partners appended thereto, notwithstanding the joint and several liability.

(vii) The joint venture agreement should indicate precisely the responsibility of all members of JV in respect of planning, design, manufacturing, supply, installation, commissioning and training. All members of JV should have active participation in execution during the currency of the contract. This should not be varied/modified subsequently without prior approval of the Employer; and

In order for a joint venture to qualify, each of its partners or combination of partners must meet the minimum criteria listed in the Qualification Requirement for the Bidder as per Sec –III, Vol-I for an individual Bidder for the component of the contract they are designated to perform. Failure to comply with this requirement will result in rejection of the joint venture bid.

A firm can be a partner in only one joint venture; bids submitted by joint ventures or consortia including the same firm as partner will be rejected.

In the case of a Bidder who offers to supply and/or install plant and equipment under the contract that the Bidder did not manufacture or otherwise produce and/or install, the Bidder shall (i) have the financial and other capabilities necessary to perform the contract; (ii) have been duly authorized by the manufacturer or producer of the related plant and equipment or component as per proforma in attachment 8 to supply and/or install that item in the Employers country; and (iii) be responsible for ensuring that the manufacturer or producer complies with the requirements of ITB Sub-Clause 3.2 and meets the minimum criteria listed for an individual Bidder for that item.

(d) Attachment 4: Eligibility and Conformity of the Facilities *(uploading of Scanned Copy)*

Documentary evidence established in accordance with ITB Clause 3 that the facilities offered by the Bidder in its bid or in any alternative bid (if permitted pursuant to ITB Sub-Clause 9.2) are eligible and conform to the Bidding Documents.

The documentary evidence of the eligibility of the facilities shall consist of a statement on the country of origin of the plant and equipment offered, which shall be confirmed by a certificate of origin issued at the time of shipment.

The documentary evidence of the conformity of the facilities to the Bidding Documents may be in the form of literature, drawings and data, and shall furnish:

(i) a detailed description of the essential technical and performance characteristics of the facilities;

(ii) a list giving full particulars, including available sources, of all spare parts, special tools, etc., necessary for the proper and continuing functioning of the facilities for a period of Fifteen (15) years following completion of facilities in accordance with provisions of contract; and

(iii) a commentary on the Employers Technical Specifications and adequate evidence demonstrating the substantial responsiveness of the facilities to those specifications. Bidders shall note that standards for workmanship, materials and equipment designated by the Employer in the Bidding Documents are intended to be descriptive (establishing standards of quality

and performance) only and not restrictive. The Bidder may substitute alternative standards, brand names and/or catalog numbers in its bid, provided that it demonstrates to the Employers satisfaction that the substitutions are substantially equivalent or superior to the standards designated in the Technical Specifications.

(iv) All details regarding after sale service support offered.

(v) All details regarding proposed training for Employers personnel.

(vi) Detailed answers to all the Questions in the Questionnaire, if prescribed in the Bidding Document.

(vii) Details establishing the responsiveness of the offer in accordance with Technical Specification, Volume-II.

(e) Attachment 5: Subcontractors Proposed by the Bidder

The Bidder shall include in its bid details of all major items of supply or services **i.e. items, whose price is more than 10% of the Bid Price**, that it proposes to purchase or sublet, and shall give details of the name and nationality of the proposed Subcontractor, including vendors, for each of those items. Bidders are free to list more than one Subcontractor against each item of the facilities. Their participation should be confirmed with a letter of intent between the parties, as needed, in Attachment 8. Quoted rates and prices will be deemed to apply to whichever Subcontractor is appointed, and no adjustment of the rates and prices will be permitted.

(f) Attachment 5A: (Items, Components, Raw Material, Services proposed to be sourced from Micro and Small Enterprises)

The Employer encourages the Contractor to source items, components, raw material, services from Micro and Small Enterprises for development of the Micro and Small Enterprises

The bidder shall furnish the details of the items, components, raw material, services which they propose to buy/avail from Micro and Small Enterprises for the purpose of completion of works.

(g) Attachment 6: Deviations

In order to facilitate evaluation of bids, deviations, if any, from the terms and conditions or Technical Specifications shall be listed in Attachment 6 to the bid. The Bidder is required to provide the cost of withdrawal for such deviations. However, the attention of the bidders is drawn to the provisions of ITB Sub-Clause 22.3 regarding the rejection of bids that are not substantially responsive to the requirements of the Bidding Documents.

Bidders attention is also drawn to the provisions of ITB Sub- Clause 22.3.1.

(h) Attachment 7: Alternative Bids Not Applicable

(i) Attachment 8: Manufacturers Authorisation Form

Scanned copy of above documents shall be

uploaded (refer para 15.4 below)

(j) Attachment 9: Work Completion Schedule.

Attach Bar Chart for Work Completion Schedule

Scanned copy of above documents shall be uploaded (refer para 15.4 below)

(k) Attachment 10: Guarantee Declaration.

Scanned copy of above documents shall be uploaded (refer para 15.4 below) failing to which bid shall be liable for rejection.

(l) Attachment 11: Not Applicable

(m) Attachment 12: Price Adjustment Data

(n) Attachment 13: Declaration regarding Social Accountability

(o) Attachment 14: Integrity Pact *(submission of Hard Copy in Original)*

The Bidder shall complete the accompanying Integrity Pact, which shall be applicable for bidding as well as contract execution, duly signed on each page by the person signing the bid and shall be returned by the Bidder in two (2) originals alongwith the Techno - Commercial Part in a separate envelope, duly superscripted with Integrity Pact. The Bidder shall submit the Integrity Pact on a non-judicial stamp paper of Rs. 100/-.

The required Integrity Pact is automatically generated as Attachment 14-Integrity Pact in the file Attachment (in Excel format). Bidders shall take print out in two copies discussed above and as explained in the Attachment 14-Integrity Pact.

If the Bidder is a partnership firm or a consortium, the Integrity Pact shall be signed by all the partners or consortium members.

Bidders failure to submit the Integrity Pact duly signed in Original alongwith the Bid or subsequently pursuant to ITB Sub-Clause 21 .1 shall lead to outright rejection of the Bid.

(p) Attachment 15: Option for Initial Advance (either Interest Bearing Initial Advance or No Initial Advance) and Information for E-payment, PF details and declaration regarding Micro/Small & Medium Enterprises

Scanned copy of Sample Cheque (Cancelled) shall also be uploaded (refer para 15.4 below).

In this Attachment, the Bidder is required to clearly mention whether the Bidder would opt for Interest bearing initial advance in addition to providing the other information as above.

(q) Attachment 16:Additional Information *(uploading of Scanned Copy, as applicable)*

i. Certificate from their Banker(s) (as per prescribed formats in Form 14, Section-IX, Vol-I: Sample Forms and Procedures) indicating various fund based/non fund based limits sanctioned to the Bidder and the extent of utilization as on date. Such certificate should have been issued not earlier than three months prior to the date of bid opening. Wherever necessary the Employer may make queries with the Bidders Bankers.

ii. Detailed information on any litigation or arbitration arising out of contracts completed or under execution by it over the last five years. A consistent history of awards involving litigation against the Bidder or any partner of JV may result in rejection of Bid.

iii. Details of Provident Fund Code Number of the Bidder.

iv. Any other information which the Bidder intends to furnish

v. Bidder shall also furnish information/documentation in support that the Bidder have adequate sub-station design infrastructure and erection facilities and capacity and procedures including quality control.

vi. The Bidder shall furnish the CV and experience details of a project manager with 15 years' experience in executing such contract of comparable nature including not less than five years as manager.

vii. Any other information which the Bidder intends to furnish.

Scanned copy of above documents shall be uploaded (refer para 15.4 below).

(r) Attachment 17: Declaration for tax exemptions, reductions, allowances or benefits

(s) Attachment 18: Safety Pact (submission of Hard Copy in Original[h])

The Bidder shall complete the accompanying Safety Pact, which shall be applicable for bidding as well as contract execution, duly signed on each page by the person signing the bid and shall be submitted by the Bidder in two (2) originals along with the Techno - Commercial Part in a separate envelope, duly superscripted with Safety Pact. The Bidder shall submit the Safety Pact on a non-judicial stamp paper of Rs. 100/-.

Bidders shall take print out in two copies discussed above and as explained in the Attachment 18- Safety Pact.

If the Bidder is a partnership firm or a consortium, the Safety Pact shall be signed by all the partners or consortium members.

Bidders failure to submit the Safety Pact duly signed in Original along with the Bid or subsequently pursuant to ITB Sub-Clause 21.1 shall lead to outright rejection of the Bid.

(t) Attachment 19: Declaration

(u) Attachment – 20: Affidavit (submission of Hard Copy in 'Original')

signed and stamped with company seal by a full time Director/ CEO/ Chairman-cum-Managing Director and attested/ notarized by a Magistrate/ Notary for correctness of all the information/details/data/documentary evidences etc. as submitted by the bidder are correct.

10. Bid Form and Price Schedules

10.1 The Bidder shall complete the Bid Form(s) and the appropriate Price Schedules furnished in the Bidding Documents as indicated therein, following the requirements of ITB Clauses 11 and 12.

11. Bid Prices

11.1 Unless otherwise specified in the Technical Specifications, bidders shall quote for the entire facilities on a "single responsibility" basis such that the total bid price covers all the Contractors obligations mentioned in or to be reasonably inferred from the Bidding Documents in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation and completion of the facilities including supply of mandatory spares (if any). This includes all requirements under the Contractors responsibilities for testing, pre-commissioning and commissioning of the facilities and, where so required by the Bidding Documents, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as may be specified in the Bidding Documents, all in accordance with the requirements of the General Conditions of Contract. Items against which no price is entered by
the Bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the prices for other items.

11.2 Bidders are required to quote the price for the commercial, contractual and technical obligations outlined in the Bidding Documents. If a Bidder wishes to make a deviation, such deviation shall be listed in Attachment 6 of its bid. The Bidder is required to provide the cost of withdrawal for such deviations.

11.3 Bidders shall give a breakdown of the prices in the manner and detail called for in the Price Schedules. Where no Price Schedules are included in the Bidding Documents, Bidders shall present their prices in the following manner:

Separate numbered Schedules shall be used for each of the following elements. The total amount from each Schedule 1 to 5 shall be summarized in a grand summary of Price Proposal (Schedule 6) giving the total bid price(s) to be entered in the Bid Form.

Schedule 1	Plant and Equipment (including mandatory Spares) to be supplied including Type Test Charges

Schedule 2	Local Transportation, in-transit Insurance and loading and unloading
Schedule 3	Installation Services
Schedule 4	Charges for Training to be imparted
Schedule 5	Taxes and Duties not included in Schedule 1 to 4
Schedule 6	Grand Summary (Schedule Nos. 1 to 5)
Schedule 6(After Discount)	Grand Summary (AFTER DISCOUNT)
Schedule 7	Break-up of Type Test Charges

Bidders shall note that the plant and equipment included in Schedule No. 1 above exclude materials used for civil, building and other construction works. All such materials shall be included and priced under Schedule No. 3, Installation Services.

11.3.1 The bid price for the items for which quantities have been estimated by the Employer shall be governed based on the unit price quoted by the bidder. In case additional quantities, over and above the quantities indicated in the respective Price Schedules, are required for successful completion of the Scope of Work by Employer, the Bidder shall execute additional quantities of these items for which payment based on the unit prices quoted by the bidder shall be made, unless otherwise specified

11.3.2 The bid price for which the quantities are to be estimated by the Bidder shall remain constant unless there is change made in the Scope of Work by Employer. The quantities and unit prices (i) subsequently arrived while approving the Bill of Quantities (BOQ) /Billing breakup of lumpsum quantities/lot/Set and/or (ii) estimated by the bidder shall be for on account payment purpose only. In case additional quantities, over and above the quantities BOQ/billing breakup and /or estimated by the bidder, are required for successful completion of the scope of work as per Technical Specification, the Bidder shall execute additional quantities of these items for which no additional payment shall be made over and above the lumpsum bid price. In case quantities of these items supplied at site are in excess of that required for successful completion of scope of work, such additional quantities shall be the property of the bidders and they shall be allowed to take back the same from the site for which no deduction from the lumpsum bid price shall be made. Further, in case actual requirement of quantities for successful completion of scope of work is less than the quantities identified in the approved BOQ /billing breakup and/or estimated by the bidder, the lumpsum bid price shall remain unchanged and no deduction shall be made from the lumpsum price due to such reduction of quantities.

11.3.3 It shall be the responsibility of the bidders to pay all statutory taxes, duties and levies (including GST) and interest, if applicable on account of additional revised invoice issued for actual material supplied, to the concerned authorities for such return/supply of surplus material, which would otherwise have been, lawfully payable. The bidders shall submit an indemnity bond to keep Employer harmless from any liability, before release of such material to the bidder by Employer.

11.3.4 Set/Lot/Lumpsum shall be governed as per the requirement of the corresponding item description read in conjunction with relevant provisions of Technical Specifications.

11.4 In the schedules, Bidder shall give the required details and a breakdown of their price **considering and taking into account the Input Tax Credit (ITC) as may be available under the Goods and Services Tax (GST) Laws and Regulations**, in the schedules as follows:

a) Plant and equipment including mandatory spares, shall be quoted on an EXW (ex-factory, ex-works, ex-warehouse or off-the-self, as applicable) basis and Type Test Charges (including the Type Test to be conducted abroad in case of an Indian Bidder), shall also be quoted in Schedule 1.

Further, in case of imported Equipments/items offered as 'Off the Shelf' or dispatched directly from the Indian Port of disembarkation, the price of such Equipments/items shall be inclusive of all cost **as well as any duties paid/payable in relation to import of such goods (viz., customs duties, GST & levies etc.) considering and taking into account the ITC as may be available under the applicable laws including GST**.

The price quoted in respect of all items in the above schedule shall be excluding GST applicable on transaction between the Employer and the Contractor.

b) Local/inland transportation, **In-transit** insurance, **loading and unloading** of the Plant and Equipment including mandatory spares to be supplied shall be quoted separately in Schedule 2, **as composite supply of services, with local/inland transportation being the Principal Supply**. **It is the Employer's understanding that as per extant provisions, on the charges for supply of services related to Inland transportation, In-transit insurance, loading and unloading by the Bidder to the Employer, GST is not payable. The Bidder is, however, advised to check the position from their own sources. If payable, the same shall be to the Bidder's account and Employer shall not reimburse any GST on this account.**

c) Installation Charges shall be quoted separately (Schedule 3) and shall include rates and prices for all labour, Contractor's equipment, temporary works, materials, consumables and all matters and things of whatsoever nature, provision of operations and maintenance manuals, etc. wherever identified in the Bidding Documents as necessary for the proper execution of all installation services except those priced in other Schedules. **The price quoted in respect of all items in the above schedule shall be excluding GST.**

d) The Training Charges shall be furnished separately in Schedule-4 for the training. **The price quoted in respect of all items in the above schedule shall be excluding GST.**

e) The break-up of Type test charges shall be furnished separately in Schedule 7. **The price indicated in respect of all items in the above schedule shall be excluding GST. Type test shall be considered an incidental expense incurred prior to the delivery of Equipment/item and would be added to the value of goods for GST purposes and rate of GST shall be quoted accordingly.**

f) To take the confirmation of Tax Bracket (item wise), Bidder has to fill respective HSN/ SAC code and rate of GST in %ge against each item in the Price Schedule. It shall entirely be the responsibility of the bidder to check the HSN/SAC code and rate of GST given against each item. The bidders shall solely be responsible for HSN/SAC classification and the rate of GST for each item. Employer's liability for reimbursement of GST shall be lower of the GST applicable at the rate as confirmed/deemed

confirmed in the bid or actual GST paid/payable by the bidder for that item.

g) **Total GST on Supply of goods and Services shall be indicated in Schedule -5**

h) The Input Tax Credit (ITC) available, if any, under the GST law as per the relevant Government policies wherever applicable shall be taken into account by the Bidder while quoting bid price.

i) The Bidder shall include **In-transit** insurance charges in its bid prices as per insurance requirement mentioned in Section – IV: General Conditions of Contract (GCC) and Appendix-3: Insurance Requirements to Form of Contract Agreement as contained in Section IX: Sample Forms and Procedures (FORMS) of the Bidding Documents. Bidder shall further note that the Employer shall not be liable to make any payment/ reimbursement to the Contractor whatsoever for insurance of Contractor's Plant and Machinery.

j) The bidder shall fill up only the marked cell (shaded in green colour) in the work sheets of Schedule 1 to 7 and Discount, Taxes & duties. Bidder shall not carry out any modification or changes in any other cell. Required calculations will be carried out automatically in the respective work sheets of Schedule-6(Grand Summary), Schedule-6 (After Discount) (Grand Summary after discount) and Bid Form.

k) Bidders may like to ascertain availability of exemptions, reductions, allowances or benefits in case of goods and services to be supplied to the Employer. They shall solely be responsible for obtaining such benefits, and in case of failure to receive such benefits for any reasons whatsoever, the Employer will not compensate the Bidder. The Bidder shall furnish along with their bid, a declaration to this effect in Attachment 17 as per the format enclosed in the Bidding Documents.

Further, if issuance of the necessary certificate for availing such exemptions, reductions, allowances or benefits is permitted and is required to be issued by the Employer in line with the relevant policies, rules and procedures of Govt. of India in vogue, the same shall be considered for issuance by the Employer, provided the Bidder explicitly indicates in their bid that they have quoted prices after considering the applicable concessional duty/exemption. However, the Bidder alone shall be responsible for obtaining any benefits there from as may be admissible under Govt. policies/procedures and in case of their failure to receive such benefits, partly or fully, for any reason whatsoever, the Employer will neither be responsible nor be liable to compensate the Contractor, and the Employer shall have no financial liability on this account.

Where the Bidder has quoted taking into account such benefits, he must give all information required for issuance of such certificate in terms of the relevant notifications of the Govt. of India along with his bid in Attachment 17. In case bidder has not indicated such information or has indicated "to be furnished later on" in Attachment 17, the same shall be construed to mean that no benefit has been passed on by the bidder to the Employer, and the Employer shall not issue any certificate to the contractor for availing the same even if admissible.

l) **Employer shall, deduct taxes at source/cess etc. as per the applicable laws/rules, if any, and issue Tax Deduction at Source (TDS) Certificate/other necessary certificate to the Contractor.**

11.5 The prices shall be in accordance with the following:

Adjustable Price: Prices quoted by the Bidder shall be subject to adjustment during performance of the contract to reflect changes in the cost elements such as labor, material, etc. in accordance with the procedures specified in the corresponding Appendix – 2 to the Form of Contract Agreement. A bid submitted with a fixed price quotation will not be rejected, but the price adjustment will be treated as zero. The price adjustment provision will not be taken into consideration in bid evaluation. Bidders are required to indicate the source of labour & materials indices in Attachment 12.

12. Bid Currencies

12.1 Prices shall be quoted in Indian Rupees Only.

13. Bid Security

13.1 The Bidder shall furnish, except as exempted herein below, as part of its bid, a bid security in the amount and currency as stipulated in the **IFB**. The bid security must be submitted in the form provided in the Bidding Documents.

Micro and Small Enterprises (MSEs) registered with National Small Industries Corporation (NSIC) or with any other designated Authority of GoI under the Public Procurement Policy for MSEs are exempted from submission of Bid Security as per the Provisions of the Public Procurement Policy for Micro and Small Enterprises (MSEs) order 2012. This shall be subject to production of documentary evidence with regard to registration with authorities mentioned above.

13.2 The bid security shall, at the bidders option, be in the form of a crossed bank draft/pay order /banker certified cheque in favour of Employer as stipulated in **IFB** or a bank guarantee from a scheduled bank selected by the bidder. The format of the bank guarantee shall be in accordance with the form of bid security included in the Bidding Documents. Bid security shall remain valid for a period of thirty (30) days beyond the original bid validity period, and beyond any extension subsequently requested under ITB Sub-Clause 14.2.

Bid security shall remain valid for a period of thirty (30) days beyond the original bid validity period i.e., for a period of **TEN (10)** months after the last date of bid submission, and beyond any extension subsequently requested under ITB Sub-Clause 14.2.

The Bid Security shall be in favour of REC Power Development & Consultancy Limited payable at **New Delhi**.

13.3 Any bid not accompanied by an acceptable bid security, except as exempted at 13.1 above, shall be rejected by the Employer as being nonresponsive, pursuant to ITB Sub-Clause 22.4. The bid security of a joint venture must be in the name of all the partners in the joint venture submitting the bid.

13.4 The bid securities of unsuccessful bidders will be returned as promptly as possible, but not later than twenty-eight (28) days after the expiration of the bid validity period.

13.5 The successful Bidder shall be required to keep its bid security valid for a sufficient period till the performance security(ies) pursuant to ITB Clause 35 are furnished to the satisfaction of the Employer. The bid security of the successful Bidder will be returned when the Bidder

has signed the Contract Agreement, pursuant to ITB Clause 34, and has furnished the required performance security, pursuant to ITB Clause 35.

13.6 The bid security may be forfeited

(a) if the Bidder withdraws its bid during the period of bid validity specified by the Bidder in the Bid Form; or

(b) In case the Bidder does not withdraw the deviations proposed by him, if any, at the cost of withdrawal stated by him in the bid and/or accept the withdrawals/rectifications pursuant to the declaration/confirmation made by him in Attachment –
Declaration of the Bid; or

(c) If a Bidder does not accept the corrections to arithmetical errors identified during preliminary evaluation of his bid pursuant to ITB Sub-Clause 27.2; or

(d) If, as per the requirement of Qualification Requirements the Bidder is required to submit a Deed of Joint Undertaking and he fails to submit the same, duly attested by Notary Public of the place(s) of the respective executant(s) or registered with the Indian Embassy/High Commission in that Country, within ten days from the date of intimation of post – bid discussion; or

(e) in the case of a successful Bidder, if the Bidder fails within the specified time limit

(i) to sign the Contract Agreement, in accordance with ITB Clause 34, or

(ii) to furnish the required performance security(ies), in accordance with ITB Clause 35 and/or to keep the bid security valid as per the requirement of ITB Sub-Clause 13.5.

13.7 No interest shall be payable by the Employer on the above Bid Security.

14. Period of Validity of Bid

14.1 Bids shall remain valid for the period of **Nine (09)** months after the last date of bid submission. A bid valid for a shorter period shall be rejected by the Employer as being non-responsive.

14.2 In exceptional circumstance, the Employer may solicit the Bidders consent to an extension of the bid validity period. The request and responses thereto shall be made in writing or by cable. If a Bidder accepts to prolong the period of validity, the bid security shall also be suitably extended. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request will not be required or permitted to modify its bid.

15. Format and Signing of Bid

15.1 The bidder shall prepare the bid in the manner indicated in ITB Clause 9.0 and submit the bid in following manner:

First Envelope: **(Cover-1 & Cover-2 in the e-bidding portal)**

(i) The soft copy of the bid consisting of the documents listed in ITB Clause 9 including relevant scanned documents (refer ITB Clause 15.4) shall be uploaded through the portal only. Submission of Soft Copy of any documents by any other means shall not be accepted by the Employer in any circumstances.

(ii) Hard copy of followings:

a) DD towards Bidding Document fee of the amount in accordance with clause 5.4 of ITB or documentary evidence in support of exemption of Bidding Document fee as per ITB 5.5;
b) Bid Security (in Original) or documentary evidence in support of exemption of Bid Security, in separate envelope in accordance with clause 13 of ITB, Section-II;
c) Integrity Pact (in Original) in accordance with clause 9.3 (o) of ITB, Section-II in separate envelope;
d) Power of Attorney as per Clause 9.3 (b);
e) In case of Bid from Joint Venture, the Joint Venture Agreement & Power of Attorney of Joint Venture Agreement;
f) Safety Pact (in Original) in accordance with clause 9.3 (s) of ITB, Section-II in separate envelope.
g) Affidavit signed and stamped with company seal by a full time Director/ CEO/ Chairman-cum-Managing Director and attested/ notarized by a Magistrate/ Notary for correctness of all the information/details/data/documentary evidences etc. as submitted by the bidder are correct.
h) Any other document further specified in the ITB duly signed and stamped on each page

Second Envelope:

The soft copy of the price schedules as per ITB Clause 11 to be uploaded on the portal. Submission of Soft Copy of any documents by any other means shall not be accepted by the Employer in any circumstances.

15.2 The bid shall contain no alterations, omissions or additions, unless such corrections are initialed by the person or persons signing the bid.

15.3 –deleted-.

15.4 The List of following documents shall be scanned & uploaded on the portal as per table given below:

S. No.	**Description of Documents**	**Name of File to be uploaded on the portal**
1.	Power of Attorney	poa.pdf
2.	DD against Bidding Document fee	dd.pdf
3.	Constitution of legal status	legal.pdf
4.	Declaration for anticipated change in legal structure/ ownership	decl_legal.pdf

5.	The principal place of business	principal.pdf
6.	The place of Incorporation or the place of registration and the nationality of the owner	incorporation.pdf
7.	Technical Experience certificate issued by utility	techexp.pdf
8.	Financial Balance Sheets (for last five years)	balsheet.pdf
9.	Declaration in regard to Financial re-structuring	Decl_Fin_re_struc.pdf
10.	Technical GTP	gtp.pdf
11.	Type Test Report	ttreport.pdf
12.	Bank Certificate	bank.pdf
13.	Manufacturer Authorization	manuauth.pdf
14.	Work Schedule (BAR Chart)	barchart.pdf
15.	Guarantee Declaration	guarantee.pdf
16.	Documentary Evidence for Base Price Indices	pvindex.pdf
17.	Cancelled Cheque	cheque.pdf
18.	Other Documents	other.pdf

1. The various documents are to be uploaded with the help of ATTACH button provided at relevant section of Attachment-QR sheet of Volume-III, Attachment.xls.
2. Bidder may put three(03) characters suffix for each file preceded by an under score for their identification. (Example- poa_xyz.pdf)
3. In case more file are to be uploaded under the same head Numeric suffix may be put by the bidder. (Example - poa1_xyz.pdf, poa2_xyz.pdf, poa3_xyz.pdf……..).
4. For uploading any additional documents bidder may decide the name of file with prefix as „other' succeeded by „under score' and suffix as name of document in short. (Example – other_ISO certificate1_xyz.pdf, other_ISO certificate2_xyz.pdf ……..)
5. For other types of files supported on the portal, please refer the related provisions on the portal.

D. Submission of Hard Copy of Bids

16. Sealing and Marking of Bids

16.1 The Bidder shall upload the soft copy part of the bid as per the provisions of the portal (refer para 15.1& 15.4 above) and submit the hard copy of DD towards Bidding Document fee or documentary evidence in support of exemption of Document fee (as applicable), Bid Security or documentary evidence in support of exemption of Bid Security (as applicable), Integrity Pact, Safety Pact, Power of Attorney, Joint Venture Agreement (as applicable) and Power of Attorney of Joint Venture Agreement (as applicable) and Joint Deed of Undertaking (as applicable) (refer para 15.1 above), duly marked First Envelope (Techno – Commercial Part) in the following manner.

Envelope – 1: Bidding Document fee /documentary evidence in support of exemption of Bidding Document fee

Envelope – 2: Bid Security/ documentary evidence in support of exemption of Bid Security

Envelope – 3: Integrity Pact

Envelope – 4: Power of Attorney, Joint Venture Agreement (as applicable) and Power of Attorney of Joint Venture Agreement (as applicable) and Joint Deed of Undertaking (as applicable) and any other documents as required (refer para 15.1 above).

Envelope –5: Safety Pact

The Bidder shall upload the Excel files of Price Schedule and Attachments downloaded from the portal as part of the bid duly filled in the required cells. If the bid submitted by the bidder is found different from the files downloaded from the portal, as part of the bidding document or tampered/modified locked contents, the bidder may run with risk of rejection of bid.

16.2 The envelope shall

(a) be addressed to the Employer at the address given in the **IFB**, and

(b) bear the contract name & Tender Specification No. indicated in the **IFB**, and the statement "Do Not Open Before [*date*]," to be completed with the time and date specified in the **IFB**.

16.3 DD towards Bidding Document, Bid Securities, Integrity Pact and the Safety Pact in original shall be submitted in separate superscribed envelopes (one for DD towards Bidding Document, one for Bid Security, one for Integrity Pact and one for Safety Pact) alongwith First Envelope.

Bidder may upload Soft copy of the any other documents which they consider relevant along with First Envelope.

All the envelopes shall also indicate the name and address of the Bidder so that the bid can be returned unopened in case it is declared "late."

In case, pursuant to Ministry of Finance, GOIs Circular dated 17th July, 2012, the Bank Guarantee is issued using SFMS Platform by the banks located in India, the copy of such Bank Guarantee shall be submitted by the bidder along with the First Envelope.

The Account details of RECPDCL for the purpose of Bank Guarantee (towards Bid Security) to be issued using SFMS Platform are as given below:

Name of the Bank and Address	**IFSC Code**	**RECPDCL Current A/c No.**

IDFC First Bank Limited, Birla Towers, 4th Floor East Tower & LGF West Tower, Barakhamba Road, New Delhi-110001	IDFB0020101	10000697415

16.4 If the envelope is not sealed and marked as required by ITB Sub- Clause 16.2 above, the Employer will assume no responsibility for the bid's misplacement or premature opening.

17. Deadline for Submission of Bids

17.1 Soft copy of the bid shall be uploaded through the portal https://rec.ewizard.in at or before the submission time and date as stipulated in the bidding document. Demand Draft, hard copy of Bid Security in accordance with clause 13 of ITB, Section-II in separate envelope, Integrity Pact, Safety Pact, Power of Attorney, Joint Venture Agreement & Power of Attorney of Joint Venture Agreement (in case bid from Joint Venture) (as applicable), JDUs (as applicable), and Affidavit for correctness must be received by the Employer at the address specified under ITB Sub-Clause 16.2 no later than the time and date stated in the IFB. In the event of the specified date for the submission of bids being declared a holiday for the Employer, the bids will be received/uploaded upto the appointed time on the next working day.

Hard copy of Joint Deed of Undertaking must be received by the Employer at the address specified under ITB Sub-Clause 16.2 not later than the time and date stated in the IFB.

17.2 Bidding timelines will be defined as per the e-Procurement server clock only.

17.3 The Employer may, at its discretion, extend this deadline for submission of bids any time prior to opening of bids, in which case all rights and obligations of Employer and bidders will thereafter be subject to the deadline as extended.

Further the Employer also reserves the right to extend bid submission timeline or recall the tender if e- Procurement server is down (i.e. inaccessible / inoperative) for a prolonged period of time within the last 24 hours of the bid submission due date.

18. Late Bids

18.1 The bidder shall not be permitted to submit the soft copy part of the bid by any mode other than uploading on the portal within the specified deadline for submission of bids. The e-Procurement system would not allow any late submission of bids through the portal after due date & time as specified in IFB. After electronic online proposal submission, the system generates a unique identification number which is time stamped. This shall be treated as acknowledgement of the bid submission.

In case Hard copy part of the bid is received by the Employer after the deadline for submission of the same prescribed by the Employer in the IFB but the bidder has uploaded the soft copy part of the bid, the bid will be considered as late bid. Such bids will be rejected during preliminary examination.

19. Modification and Withdrawal of Bids

19.1 Bidder may modify its bids through the relevant provisions on the portal https://rec.ewizard.in .The Bidder may modify or withdraw its bid after submission, provided that modification is done on the portal as well as notice is received by the Employer prior to the deadline prescribed for bid submission.

19.2 The Bidders modifications shall be done and submitted as follows:

(i) Soft copy of the entire bid if any modification is there.

19.3 Bidder may withdraw its bid through the relevant provisions of portal only.

19.4 No bid may be withdrawn in the interval between the bid submission deadline and the expiration of the bid validity period specified in ITB Clause 14. Withdrawal of a bid during this interval may result in the Bidders forfeiture of its bid security, pursuant to ITB Sub-Clause 13.6.

E. Bid Opening and Evaluation

20. Opening of First Envelope by Employer

20.1 After receipt of Bids till last date of submission of Bids as per schedule, the First Envelope i.e., Techno – Commercial Part of Bids shall be kept unopened by the Employer.

The Employer will open the First Envelope i.e. Techno – Commercial Part in public, including withdrawals and modifications made pursuant to ITB Clause 19, in the presence of bidders designated representatives who choose to attend, at the time, date, and location stipulated in the **IFB**. The bidders representatives who are present shall sign a register evidencing their attendance. Bidder who have submitted their bid may view on line tender opening on the portal from their end. In the event of the specified date for the submission of bids being declared a holiday for the Employer, the bids will be received upto the appointed time on the next working day

20.2 During the opening of bids, Envelopes marked "Withdrawal" shall be opened first. Bids withdrawn pursuant to ITB Clause 19 shall be not be opened.

20.3 For all other Bids, the bidders names, deviation having cost of withdrawal, if any, the presence of bid security, Integrity Pact, Safety Pact and any such other details as the Employer may consider appropriate, will be get declared through the Portal by the Employer. Subsequently, all envelopes marked "Modification" shall be opened. Opening of bid, whether or not accompanied with the Tender fee and/or bid security and/ or Integrity Pact and/or Safety Pact, shall not be construed to imply its acceptability which shall be examined in detail pursuant to the provisions contained in this Section-II.

On behalf of Employer, the Integrity Pact and Safety Pact will be signed by its representative at the time of Bid Opening. One original of the Integrity Pact and Safety Pact will be retained by Employer and the other original will be returned to the representative of the bidders present during bid opening. If the Bidders representative is not present during the Bid Opening, the other original shall be sent to the bidder by post/courier.

20.4 The Employer shall prepare minutes of the bid opening in the form of Bid Opening Statement, including the information disclosed to those present in accordance with ITB Sub-Clause 20.3.

20.5 Bids not opened at bid opening shall not be considered further for evaluation, irrespective of the circumstances and shall be returned to the Bidder unopened/send to archive unopened.

21. Clarification of Bids

21.1 During bid evaluation, the Employer may, at its discretion, ask the Bidder for a clarification of its bid. In case of erroneous/non submission of documents related to/identified in ITB Sub-Clause 9.3 (b), (o), (s) and (t) or Deed of Joint Undertaking pursuant to ITB Sub- Clause 9.3 (c) & (e), 9.3 (u) required to be submitted by the Bidder as per the provisions of the Bidding Documents, the Employer may give the Bidder not more than 7 working days notice to rectify/furnish such documents, failing which the bid shall be rejected. The request for clarification and the response shall be in writing, and no change in the price or substance of the bid shall be sought, offered or permitted.

22. Preliminary Examination of <u>First Envelope</u>

22.1 The Employer will examine the bids to determine whether they are complete, whether required sureties have been furnished, whether the documents have been properly signed, and whether the bids are generally in order.

In case of non-submission of bid in the portal (soft copy part of the bid) within the stipulated deadline, then even if the bidder has submitted the specific documents in hard copy part in original within the stipulated deadline pursuant to ITB 17.1, its bid shall be considered as incomplete bid, which shall be summarily rejected.

Similarly, in case of non-submission of Hard copy part of the bid, but the bidder has uploaded the soft copy part of the bid, the bid will be considered as incomplete bid. Such bids will be rejected during preliminary examination.

22.2 The Employer may waive any minor informality, nonconformity or irregularity in a bid that does not constitute a material deviation, whether or not identified by the Bidder in Attachment 6 to its bid, and that does not prejudice or affect the relative ranking of any Bidder as a result of the technical and commercial evaluation, pursuant to ITB Clause 24.

22.3 Prior to the detailed evaluation, the Employer will determine whether each bid is of acceptable quality, is complete and is substantially responsive to the Bidding Documents. Any deviations, conditionality or reservation introduced in Attachment-6 and/or in the Bid Form, Technical Data Sheets and covering letter, or in any other part of the bid will be reviewed to conduct a determination of the substantial responsiveness of the bidder's bid. For purposes of this determination, a substantially responsive bid is one that conforms to all the terms, conditions and specifications of the Bidding Documents without material deviations, objections, conditionalities or reservations. A material deviation, objection, conditionality or reservation is one (i) that affects in any substantial way the scope, quality or performance of the contract; (ii) that limits in any substantial way, inconsistent with the Bidding Documents, the Employer's rights or the successful Bidder's obligations under the contract; or (iii) whose rectification would unfairly affect the competitive position of other bidders who are presenting substantially responsive bids.

22.3.1 Bids containing deviations from critical provisions relating to GCC & SCC Clauses i.e Clause No-5(i)(b) of GCC (Governing Law), 7(i) of GCC (Contractor's Responsibilities), 9.0 of GCC (Performance Security), 27.0 of GCC (Liquidity Damage), 31 (i) (a) of GCC (Defect Liability Period), 33.0 of GCC (Payment Terms), 39.0 of GCC (Limitations of Liability), 47.0 of GCC

(Settlement of Disputes), 48.0 of GCC (Arbitration), 14.0 of SCC (Taxes and Duties), and Appendix 2 to the Form of Contract Agreement (Price Adjustment) will be considered as non-responsive.

22.3.2 Regarding deviations, conditionality or reservations introduced in the bid, which will be reviewed to conduct a determination of substantial responsiveness of the Bidder's bid as stated in ITB Sub- Clause 22.3, the order of precedence of these documents to address contradictions, if any, in the contents of the bid, shall be as follows:

I. Bid Form
II. Attachment-6 : Deviations
III. Technical Data Sheet
IV. Any other part of the bid

Contents of the document at Sr. No. I above will have overriding precedence over other documents (Sr. No. II to IV above). Similarly, contents of document at Sr. No. II above will have overriding precedence over other documents (Sr. No. III to IV above), and so on.

22.4 If a bid is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by the Bidder by correction of the nonconformity. The Employer's determination of a bid's responsiveness is to be based on the contents of the bid itself without recourse to extrinsic evidence.

23. Qualification

23.1 The Employer will ascertain to its satisfaction whether Bidders determined having submitted substantially responsive bids are qualified, as per the Qualification Requirement specified in Section-III of Vol-I to satisfactorily perform the contract. The Employer shall be the sole judge in this regard and the Employer's interpretation of the Qualification Requirement shall be final and binding.

23.2 The determination will take into account the Bidder's financial, technical capabilities including production capabilities, in particular the Bidder's contract work in hand, future commitments & current litigation and past performance including fatal accidents during execution of contracts. It will be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder in Attachment 3 to the bid, as well as such other information as the Employer deems necessary and appropriate. This shall, however, be subject to assessment that may be carried out, if required, by the Employer as per the provisions of Qualification Requirement.

23.3 The Employer may waive any minor informality, nonconformity or irregularity in a bid that does not constitute a material deviation, affecting the capability of the Bidder to perform the Contract.

23.4 An affirmative determination will be a prerequisite for the Employer to evaluate the Techno - Commercial Part and open the Second Envelope of the Bidder. A negative determination will result in rejection of the Bidder's bid.

24. Evaluation of Techno - Commercial Part (First Envelope)

24.1 The Employer will carry out a detailed evaluation of the bids of the qualified bidders in order to determine whether the technical aspects are in accordance with the requirements

set forth in the Bidding Documents. In order to reach such a determination, the Employer will examine the information supplied by the bidders, pursuant to ITB Clause 9, and other requirements in the Bidding Documents, taking into account the following factors:

(a) overall completeness and compliance with the Technical Specifications and Drawings; deviations from the Technical Specifications as identified in Attachment 6 to the bid and those deviations not so identified; suitability of the facilities offered in relation to the environmental and climatic conditions prevailing
at the site; and quality, function and operation of any process control concept included in the bid. The bid that does not meet minimum acceptable standards of completeness, consistency and detail will be rejected for non-responsiveness.

(b) achievement of specified performance criteria by the facilities.

FOR POWER TRANSFORMER:

The criteria for acceptance of guaranteed performance or efficiency of 220/33kV Transformer, as specified in Technical Specifications, shall be "Copper Loss (Load Loss)> Iron Loss (No Load Loss)> Cooler Loss (Auxillary Loss)" failing which bid shall be considered non-responsive.

(c) compliance with the time schedule called for in the corresponding Appendix to the Form of Contract Agreement and evidenced as needed in a milestone schedule provided in the bid;

Time schedule (program of performance)

The plant and equipment covered by this bidding shall have the "Taking Over" by the Employer after successful Completion within the period specified in **IFB**. Bidders are required to base their prices on the time schedule given in Appendix 4 to the Form of Contract Agreement (Time Schedule) or, where no time schedule is given in Appendix 4, on the Completion date(s) given above. No credit will be given to earlier completion. Bids offering completion beyond the specified period are liable to be rejected.

(d) type, quantity and long-term availability of mandatory and recommended spare parts and maintenance services

(e) any other relevant technical factors that the Employer deems necessary or prudent to take into consideration.

(f) any deviations to the commercial and contractual provisions stipulated in the Bidding Documents.

(g) details furnished by the bidder in response to the requirements specified in Volume-II of the Bidding Documents.

(h) The acceptability of the vendors and subcontractors proposed in Attachment 5 to be used by the Bidder will be evaluated. Should a vendor or subcontractor, for the items other than those covered under Section-III of Vol-I, be determined to be unacceptable, the bid will not be rejected, but the Bidder will be required to substitute an acceptable vendor or subcontractor without any change to the bid price.

24.2 Where alternative technical solutions have been permitted and offered in Attachment 7 to the bid, the Employer will make a similar evaluation of the alternatives, which will be treated in the technical and commercial evaluations as if they were base bids. Where alternatives are not permitted, but have in any event been offered, they shall be ignored.

25. Opening of Second Envelope by Employer

25.1 The Second Envelope i.e., Price Part of only those Bidders shall be opened who are determined as having submitted substantially responsive bids and are ascertained to be qualified to satisfactorily perform the Contract, pursuant to ITB Clause 23 and 24. A negative determination of the bids pursuant to ITB Clause 23 and 24, shall be notified by the Employer to such Bidders and the Second Envelope submitted by them shall be sent to archive unopened and Bid Security shall be returned.

25.2 The Employer will open Second Envelope i.e., Price Part at the specified time and date in the presence Bid Opening Committee constituted by RECPDCL, at the time, date, and location stipulated in the intimation for opening of Second Envelope. Bidders who have submitted their bid and found qualified as mentioned at para 25.1 above may view online tender opening on the portal from their end.

25.3 The bidder's names, the Bid Prices, including any discounts, and any such other details as per Electronic form filled in by the bidder on the portal will become viewable at the time of opening of bids. The prices and details as filled up in Electronic Form/Template by the bidder and opened during the bid opening and recorded in the Bid Opening Statement would not be construed to determine the relative ranking amongst the Bidders, or the successful Bidder, and would not confer any right or claim whatsoever on any Bidder. The successful Bidder (also referred to as the L1 Bidder) shall be determined as per the provisions of this Section – II and considered for award of contract as provided in ITB Clause 31.

25.4 The Employer shall prepare minutes of the bid opening, including the information disclosed to those present in accordance with ITB Sub-Clause 25.3.

25.5 Bids not opened and read out at bid opening shall not be considered further for evaluation, irrespective of the circumstances.

Note:

In case Employer decides to conduct e-RA, the initial price offer of the technically qualified bidders shall be opened in the presence of Bid Evaluation Committee only. Bidders representative shall not be allowed to witness the price bid opening.

26. Conversion to Single Currency

26.1 This shall not be applicable as domestic firms are required to quote the prices in Indian Rupees only.

27. Evaluation of Second Envelope (Price Part)

27.1 The Employer will examine the Price Parts (Second Envelopes) to determine whether they are complete, whether any computational errors have been made, whether the documents have been properly signed, and whether the bids are generally in order.

The Price Part containing any deviations and omissions from the contractual and commercial conditions and the Technical Specifications which have not been identified in the First Envelope are liable to be rejected.

27.2 Arithmetical errors will be rectified on the following basis. If there is a discrepancy between the unit price and the total price, which is obtained by multiplying the unit price and quantity specified by the Employer, or between subtotals and the total price, the unit or subtotal price shall prevail, and the quantity and the total price shall be corrected. However, in case of items quoted without indicating any quantity or the items for which the quantities are to be estimated by the Bidder, the total price quoted against such items shall prevail. If there is a discrepancy between words and figures, the amount in words will prevail.

If there is a discrepancy between the quantity specified by the Employer and the quantity indicated by the bidder in any price schedules, the quantity specified by the Employer shall prevail and shall be corrected accordingly.

The prices of all such item(s) against which the Bidder has not quoted rates/amount (viz., items left blank or against which '-' is indicated) in the Price Schedules will be deemed to have been included in other item(s).

If the discount(s)/rebate(s) offered by the Bidder is a percentage discount and the price component(s) on which the said discount is not indicated in the bid, the same shall be considered on the total bid price [i.e. proportionately on each price component], in the event of award. However, if lump-sum discount is offered, the same shall be considered in full on the Ex-works price component (by proportionately reducing Ex-works price of individual items), in case of award. Further, Conditional discounts/rebates, if any, offered by the bidder shall not be taken into consideration for evaluation. It shall, however, be considered in case of award.

In respect of taxes, duties and other levies indicated by the Bidder in the Bid, which are reimbursable in line with the provisions of the Bidding Documents, the applicable rate and amount thereof shall be ascertained by the Employer based on which, if required, necessary rectification and arithmetical correction shall be carried out by the Employer. If the bidder has left the cells for confirmation of HSN/SAC code and/or corresponding rate of GST "blank", the HSN/SAC code and/or corresponding rate indicated by the Employer shall be deemed to be the one confirmed by the Bidder. The GST rate and amount so ascertained by the Employer for the said HSN/SAC code shall prevail.

The rate of GST for the purpose of evaluation shall be the rate of GST as confirmed/deemed confirmed by the bidder for each item in the bid/schedules.

If there is difference in HSN/SAC classification and corresponding rate of GST of an item as confirmed/deemed confirmed by the bidder in its bid and HSN/SAC and corresponding rate of GST as interpreted under any interpretation/ judgment/ Notification/ Circular issued under the GST law before or after the award of contract, GST reimbursable to the bidder/Contractor shall be lower of the GST applicable at the rate as confirmed/deemed confirmed in the bid or actual GST paid/payable by the bidder for that item.

The subtotal, total price or the total bid price to be identified in Bid Form for this purpose, irrespective of the discrepancy between the amount for the same indicated in words or figures shall be rectified in line with the procedure explained above.

If the Bidder does not accept the correction of errors as per this clause, its bid will be rejected and the amount of Bid Security forfeited.

27.3 The comparison shall be on the total price in Price Schedule No. 6 (After Discount) and considering applicable discount offered by the bidder in different manner at s. no. 6 of "Letter of Discount", if applicable.

The comparison shall also include the applicable taxes, duties and other levies, which are reimbursable in line with the provisions of the Bidding Documents.

The Employer's comparison will also include the costs resulting from application of the evaluation procedures described in ITB Sub-Clause 27.4 & 27.5.

27.4 The Employer's evaluation of a bid will take into account, in addition to the bid prices indicated in Price Schedule Nos. 1 through 5 (Second Envelope), the following costs and factors that will be added to each Bidder's bid price in the evaluation using pricing information available to the Employer, in the manner and to the extent indicated in ITB Sub-Clause 27.5 and in the Technical Specifications:

(a) the cost of all quantifiable deviations and omissions from the contractual and commercial conditions and the Technical Specifications as identified in the evaluation of First Envelope, and other deviations and omissions not so identified;

(b) the functional guarantees of the facilities offered (not applicable);Bidders shall state the functional guarantees (e.g., performance, efficiency, consumption) of the proposed facilities in response to the Technical Specifications. Plant and equipment offered shall have a minimum (or a maximum, as the case may be) level of functional guarantees specified in the Technical Specifications to be considered responsive. Bids offering plant and equipment with functional guarantees less (or more) than the minimum (or maximum) specified shall be rejected.

(c) the performance of the equipment offered;

APPLICABLE FOR LT TRANSFORMERS

Bidder shall confirm the guaranteed performance or efficiency of the Equipments, in response to the Technical Specifications. Equipment offered shall have a minimum 4 star rating of BEE (or a maximum, as the case may be) level of guarantees specified in the Technical Specifications to be considered responsive. Bids offering plant and equipment with guarantees less (or more) than the minimum (or maximum) specified shall be rejected.

(d) the extra cost of work, services, facilities, etc., required to be provided by the Employer or third parties;

(e) any other relevant factors listed in **bidding document**

The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the contract, shall not be taken into account in bid

evaluation.

27.5 Pursuant to ITB Sub-Clause 27.4, the following evaluation methods will be followed:

(a) Contractual and commercial deviations
The evaluation shall be based on the evaluated cost of fulfilling the contract in compliance with all commercial, contractual and technical obligations under this Bidding Documents. In arriving at the evaluated cost, towards deviations identified in the evaluation of First Envelope, the cost of withdrawal indicated by the bidder in Attachment-6 of the First Envelope will be used. If such a price is not given, the Employer will make its own assessment of the cost of such a deviation for the purpose of ensuring fair comparison of bids.

(b) Functional Guarantees of the facilities

(Not Applicable).

(c) Performance Guarantees of the Equipments

For the purposes of evaluation, the adjustment specified under this section of **ITB** will be added to the bid price is as follows.

Capitalization Cost of Transformer Losses (to be used for evaluation of Price Bid) = Capitalized cost of iron losses + Capitalized cost of copper losses + Capitalized cost of auxiliary losses.

Capitalized cost of iron losses per KW	=	**INR 4,62,777/-**
Capitalized cost of copper Losses per kW	=	**INR 1,99,920/-**
Capitalized cost of auxiliary	=	**INR 1,85,111/-**

The best parameter of loss quoted at rated voltage, rated frequency, rated current at 75˚C for each equipment/ unit of the facilities, under each Equipment Category quoted by any technically responsive bidder shall be taken as basis and the difference between this best parameter and that quoted by the particular bidder multiplied with the total no. of those items/ units of the facilities, shall be used to arrive at differential price to be applied for the bid.

For the purpose of evaluation, no adjustment to the bid price towards performance guarantees of LT Transformer is applicable.

(d) Work, services, facilities, etc., to be provided by the Employer

Where bids include the undertaking of work or the provision of services or facilities by the Employer in excess of the provisions allowed for in the Bidding Documents, the Employer shall assess the costs of such additional work, services and/or facilities during the duration of the contract. Such costs shall be added to the bid price for

evaluation.

27.6 Any adjustments in price that result from the above procedures shall be added, for purposes of comparative evaluation only, to arrive at an "Evaluated Bid Price." Bid prices quoted by bidders and rectified as per ITB Sub Clause 27.2 shall remain unaltered.

28. Purchase/ Domestic Preference

28.1 No purchase preference is presently applicable for the Plant and Equipment to be supplied under the Contract.

No margin of domestic preference will be allowed in evaluation and comparison of bids.

29. e-Reverse Auction (e-RA)

29.1. Employer reserve the right to conduct the electronic Reverse Auction (e-RA) as per the requirement and e-RA if required, shall be carried out in the manner as indicated herein below.

29.2. Based on "Evaluated Bid Price" determined pursuant to ITB Sub Clause27.6, the Bidders shall be ranked in an ascending order. Basis such ranking, the lowest ranked N/2 bidders (in case "N is even) or (N+1)/2 bidders (in case „N is odd), subject to minimum of three (03) bidders, shall be invited to participate in the e-Reverse Auction (e-RA), where „N" is the number of bidders whose bids have been found to be responsive and their "Evaluated Bid Price" has been determined in accordance with ITB Sub Clause 27.6.

29.3. However, in case only bids of two bidders are found to be responsive whose "Evaluated Bid Price" has been determined in accordance with ITB Sub Clause 27.6, the e-RA would be carried out with both the parties.

29.4. The Applicable Ceiling Price for e-RA for bidders shall be "Evaluated Bid Price" determined in accordance with ITB Sub Clause27.6. During e-RA, these Bidders shall be permitted to place their prices lower than the Applicable Celling Price.

29.5. The e-RA shall be conducted on a designated electronic platform of any Application Service Provider (hereinafter referred to as "ASP"), for and on behalf of the Employer.

29.6. The Qualified Bidders shall be permitted to place their Final Offer on the electronic bidding platform, which is lower than zero point zero five (0.25) % of the prevailing bid price.

29.7. The initial period for conducting the e-reverse bidding should be at least 30 minutes which will be extended by 10 minutes from the last received bid time, if the bid is received during the last 10 minutes of the scheduled or extended bid time. Subsequently, it will be extended again by 10 minutes from the latest received bid time.

29.8. Notwithstanding above, the bidder(s) who either do not submit the requisite compliances for e-RA do not participate in e-RA, their original price bid as opened, if valid, shall be considered for evaluation.

29.9. In the event of identical evaluated bid price from the Initial Offer having been arrived for one or

more Bidders, all such Bidders shall be assigned the same rank for the purposes of determination of Qualified Bidders.

29.10. The Employer shall be the sole judge in this regard

30. Confidentiality and Contacting the Employer

30.1 After the public opening of bids, information relating to the examination, clarification, and evaluation of bids and recommendations concerning awards shall not be disclosed to Bidders or other persons not officially concerned with this process until the publication of contract award. From the time of bid opening to the time of contract award, if any Bidder wishes to contact the Employer on any matter related to its bid, it should do so in writing.

30.2 Any effort by a Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decisions may result in rejection of the Bidder's bid. The Employer shall be the sole judge in this regard.

F. Award of Contract

31. Award Criteria

31.1 Subject to ITB Clause 32, the Employer will award the contract to the successful Bidder (also referred to as the L1 Bidder) whose bid has been determined to be substantially responsive and to be the lowest evaluated bid, further provided that the Bidder is determined to be qualified, as per the Qualification Requirement specified in Qualification Requirement, (Section-III of Vol-I) to perform the contract satisfactorily.

31.2 The Employer may request the Bidder to withdraw any of the deviations listed in the winning bid.

At the time of Award of Contract, if so desired by the Employer, the bidder shall withdraw the deviations listed in Attachment 6 to the First Envelope at the cost of withdrawal stated by him in the bid. In case the bidder does not withdraw the deviations proposed by him, if any, at the cost of withdrawal stated by him in the bid, his bid will be rejected and his bid security forfeited.

Bidder would be required to comply with all other requirements of the Bidding Documents except for those deviations which are accepted by the Employer.

31.3 The Employer reserves the right to vary the quantity of any of the spares and/or delete any items of spares altogether at the time of Award of Contract.

31.4 The mode of contracting with the successful bidder will be as per stipulation outlined in ITB Sub-Clause 31.4.1 which is briefly indicated below:

31.4.1 The Contracts to be entered into with the successful Bidder shall be as under:

(i) First Contract: For Ex works supply of all equipments and materials including mandatory spares and Type Test to be conducted (whether in India or abroad) (***Supply of Goods*** Contract)

(ii) Second Contract: For providing all services i.e. inland transportation for delivery at site, **In-transit** insurance, unloading, storage, handling at site, installation, Testing and Commissioning including performance testing in respect of all the equipments supplied under the "First Contract", Training to be imparted (whether in India or abroad) and any other services specified in the Contract Documents (***Supply of Services*** Contract).

(iii) The award of two separate Contracts shall not in any way dilute the responsibility of the Contractor for the successful completion of the facilities as per Specification and a breach in one Contract shall automatically be construed as a breach of the other Contract(s) which will confer a right on the Employer to terminate the other Contract(s) also at the risk and the cost of the Contractor.

(iv) The Contract will be signed in two originals and the Contractor shall be provided with one signed original and the rest will be retained by the Employer.

(v) The Contractor shall provide free of cost to the Employer all the engineering data, drawing and descriptive materials submitted with the bid, in at least two (2) copies to form a part of the Contract immediately after Notification of Award.

Both contracts will contain a cross fall breach clause specifying that breach of one will constitute breach of the other.

32. Employer's Right to Accept any Bid and to Reject any or all Bids

32.1 The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to award of contract, without thereby incurring any liability to the affected Bidder or bidders or any obligation to inform the affected Bidder or bidders of the grounds for the Employer's action.

33. Notification of Award

33.1 Prior to the expiration of the period of bid validity, the Employer will notify the successful Bidder in writing, that its bid has been accepted. The notification of award will constitute the formation of the contract.

33.2 The Employer shall publish the results on its website and the portal, identifying the bid and Specification numbers and the following information: (i) name of each Bidder who submitted a Bid; (ii) bid prices displayed as per e-form at bid opening; (iii) name and evaluated prices of each Bid that was evaluated; (iv) name of bidders whose bids were rejected and the reasons for their rejection; and (v) name of the winning Bidder, and the price it offered, as well as the duration and summary scope of the contract awarded.

The Employer shall promptly respond in writing to any unsuccessful Bidder who, after notification of award in accordance with above, requests in writing the grounds on which its bid was not selected.

33.3 Upon the successful Bidder's furnishing of the performance security pursuant to ITB Clause 35, the Employer will promptly discharge the bid securities, pursuant to ITB Sub-Clause 13.4 & 13.5.

34. Signing the Contract Agreement

34.1 At the same time as the Employer notifies the successful Bidder that its bid has been accepted, the Employer in consultation with the Bidder will prepare the Contract Agreement provided in the Bidding Documents, incorporating all agreements between the parties.

34.2 The Contract Agreement shall be executed within Fifteen (15) days of the Notification of Award and the successful Bidder and the Employer shall sign and date the Contract Agreement immediately thereafter.

35. Performance Security

35.1 Within Fifteen (15) days after receipt of the Notification of Award but not later than that the date of signing of Contract Agreement, the successful Bidder shall furnish the performance security for 10% (Ten percent) of the contract price plus additional performance securities, if any, in line with the requirement of Qualification Requirements, in the amount given in the **bidding document** and in the form provided in Section IX, Sample Forms and Procedures, of the Bidding Documents. The performance security of a joint venture shall be in the name of joint venture.

35.2 Failure of the successful Bidder to comply with the requirements of ITB Clause 34 or Clause 35 shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security, in which event the Employer may make the award to the next lowest evaluated Bidder or call for new bids.

36. Fraud and Corruption

It is the Employer's policy that requires the Bidders, suppliers and contractors and their subcontractors under the Monthcontracts to observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, the Employer:

(a) defines, for the purpose of this provision, the terms set forth below as follows:

(i) "corrupt practice" is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

(ii) "fraudulent practice" is any act or omission, including a misrepresentation, that knowingly or recklessly misleads or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(iii) "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

(iv) "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

(v) "obstructive practice" is

(aa) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Employer's investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation;

or

(bb) acts intended to materially impede the exercise of the Employer's inspection and audit rights.

(b) will reject a proposal for award if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for the contract in question;

(c) will sanction a firm or individual, including declaring ineligible, either indefinitely or for a stated period of time, to be awarded a contract if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for, or in executing, a contract; and

(d) will have the right to require that the provision be included in Bidding Documents and in contracts, requiring Bidders, suppliers, and contractors and their sub-contractors to permit the Employer to inspect their accounts and records and other documents relating to bid submission and contract performance and to have them audited by auditors appointed by the Employer.

End of Section-II (ITB)

Bidder Help Manual for E-Bidding

Contact Persons:

E –Wizard:

1. Help desk No – 011-49606060, eprochelpdesk.101@gmail.com
2. Sh. Birendra- 8448288988, eprochelpdesk.21@gmail.com

Step 1: Registration Process: Website address: https://rec.ewizard.in

Click on "Live Tender" to see (view and download) all the tender notifications and corrigendum"s.

Click on "Bidder Enrollment" Hyperlink and get your User Id and Password.

(Certain special chars like ~ ` ' # $ % & * ! ( ) ; \ / ? " : < > + - { } [ ] are not allowed in the companyid or any key attributes).

Once you fill all the details asked by "Bidder Enrollment" form and obtain your password, contact the Office of E-Wizard to enable your User ID. Mail Registration acknowledgement to helpdesk email **eprochelpdesk.101@gmail.com**, **eprochelpdesk.100@gmail.com.**
After this, vendor can key in their User Id and Password and get successful entry in to the application. It will take 24 working hours to activate the account.

STEP 2: Participation

Vendor should login with his USER ID and PASSWORD. After Successful entry into the application click on Tenders "Published Tender" to see the tender. By clicking on hyperlink "Published Tender" youcan see thelatest tenders which are floated and other details relevant to tender. On this screen (Published Tender) you willfind various gif"s on the left hand side. Click on  "View Tender Document" and see all the documents attached.Please download these documents and go through them. Once you have
gone through the entire tender document and you wish to participate in the tender click on "Mark as Interested" gif. And Then click on "OK". Now once you have requested for tender documents click on "Interested Tender" stage. You can see the status as "Form Received".Submit your bids.

Note: -

1. We will send you forms (Electronic Financial bid & Technical bid sheets). You will get excel file "Price Schedule Sheet.xlsx" along with other documents. Firstly, you need to download this documentby clicking on hyperlink " Click here to Download Empty Document." Then Save the file with the same file name
2. You should not change the file name of any Excel file.
3. You should only key in the values in Yellow cells only.

STEP 3: Submission

Vendor should prepare the scanned copy of DD (EMD)

EMD Declaration Submission: Click on "Click here to enter EMD Details and Attach Scanned Copy of EMD". Fill all the fields provided in that sheet and press on "Scan" button to attach the scanned copy of the EMD Declaration form.Vendor should fill values in blue cells only, provided in these sheets. Thesecan be uploaded by clicking on "Click here to Upload filled File".

Reminder:

Price Schedule Sheet should be uploaded by using "Click here to Upload filled File ". All other supporting documents could be uploaded using "Click here to Other Documents" link providedbelow. Please don"t change the name of the file as system will not accept any other file name.

Steps for uploading the additional documents (supporting documents) to your account.

1. In the left hand menu click on My Documents, general document page will appear
2. Click on upload new file Button for upload document, upload sheet will appear
3. Select the file to be uploaded, enter the description and attachment name.
4. Click on Sign & Upload
5. Repeat step 2 and 3 for uploading new files

To change the description and attachment name for the uploaded file use Update existing file button

Note: This is for altering the description and attachment name only

Section 1.03 Attachment of general document to a particular tender

Go to tender Documents screen of that particular tender

1. Go to *Click here to Other Documents* –Additional documents can be optionallyUploaded

   Other Document Summary sheet will appear.
2. In Other Document Summaryscreen select the file you want to attach and make necessary changesfor Tender Stage and click Attach file button.
3. If you need to attach any new files for the tender follow Steps for uploading the Additionaldocuments.

Other details could be scanned and uploaded but ensure that it is smaller in size (i.e. < 5 MB for Fast Uploading of Document). (only.doc, .jpg,.gif,.xls, .bmp, .pdf.)

The server time will be displayed at the right hand side of the page please follow this time, and allthe actions i.e;(Submitting, Opening etc.,) takes place according to this time only.

Note: You will see all the red colored links changing to Green color, when you have uploaded.

A) Price Schedule Sheet or price bid

B) EMD details

(i) Once you fill the above documents only then you will able to submit the tender by clicking on the "Submit t" button before the tender closing date and time.

STEP 4: Acknowledgement

Once you submit the tender you will get the submitted token number, submitted date and submittedtime. Take the print of that sheet then click on "OK". Then the status will change to

submitted.

STEP 5: OPENING

After the tender is opened at the stipulated date and time, the award details can be accessed in theOPENED/AWARDED stage.

To view the opened tenders click on the "Opened Tender" link then click on icon to view your competitors bid sheets who participated with you and who are not disqualified.

Note:

1. If you do not get the submitted status and token number, contact tendering authority well in advance. RECL is not responsible for tender‟s not submitted properly. Vendors are requested to undergo training and get their doubts clarified well in advance.

   If any queries please contact RECPDCL Office and if required, personal training would be given. Please feel free to contact if you have any clarifications regarding E-Tendering.

Bidder's guide for Bidding through excels based uploading in RECPDCL portal:

E-PROCUREMENT SYSTEM

"E-WIZARD"

Bidder Registration Manual

TABLE OF CONTENT		
S.NO	**Description**	**Page no.**
1	**Homepage**	**3**
2	**Bidder Enrolment**	**4**
3	**Terms & Conditions**	**7**
4	**Documents Upload**	**7**
5	**Registration**	**10**

(1). HOMEPAGE

Visit website https://rec.ewizard.in E-Procurement portal's home page will be opened. Bidders can view live tenders, corrigendum/addendum, and tenders closing today, opened and awarded tender information on the homepage. In addition to this helpdesk numbers are available on homepage.

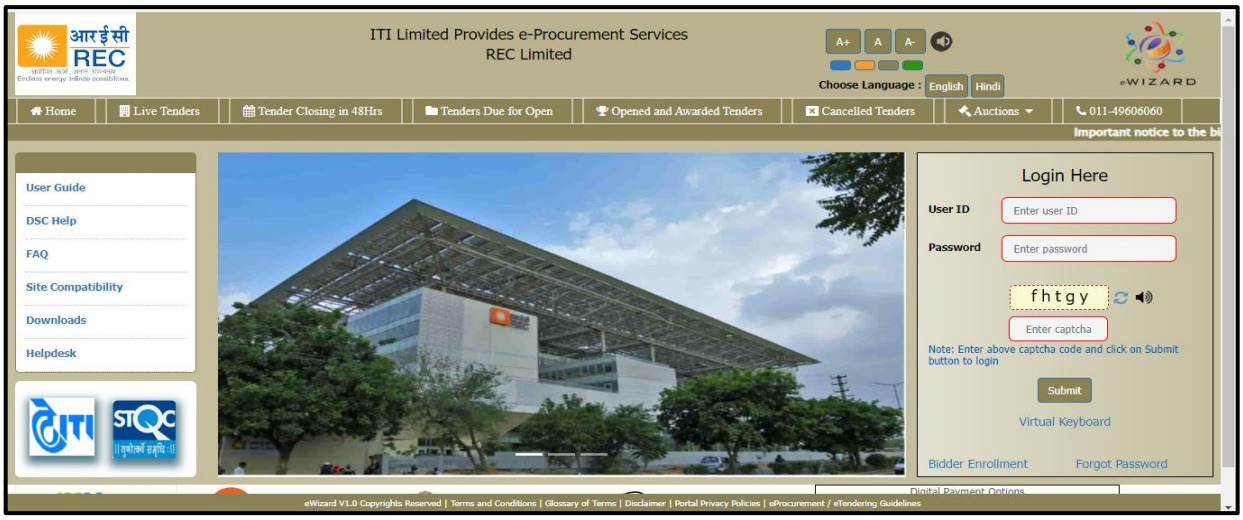

Fig. 1

(2) BIDDER ENROLMENT

Home: Home tab redirects users to the homepage of e-procurement website.From fig. 2 bidders can take view of home page. From home page bidders can enroll through Bidder Enrolment option

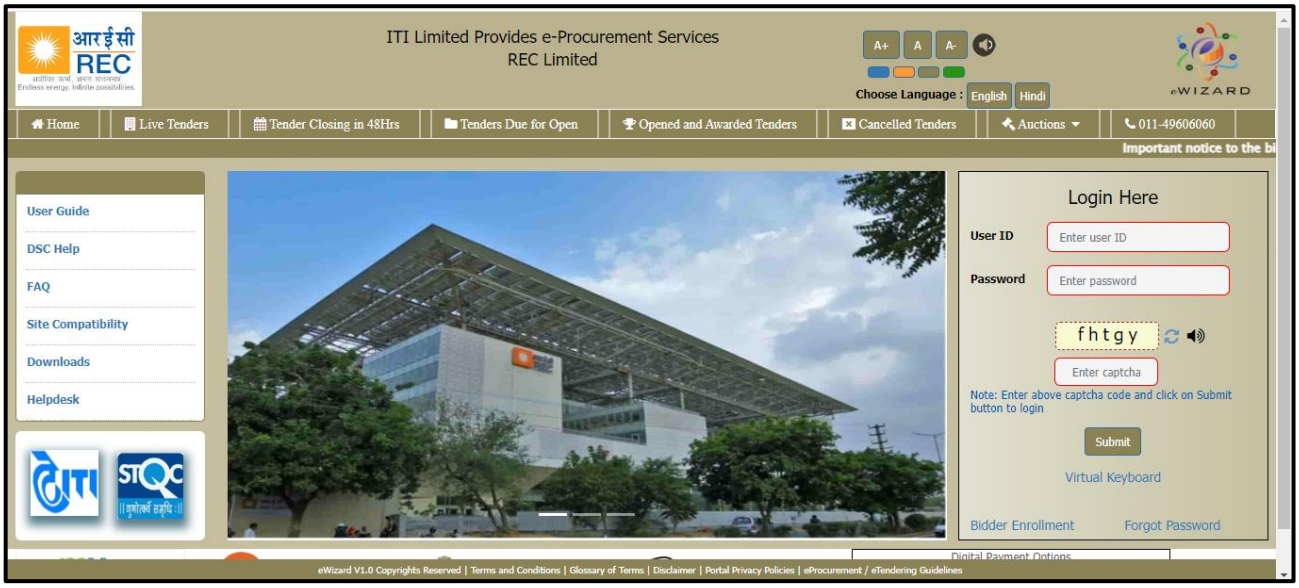

Fig. 2

a) Login Setup: Click on the Bidder Enrolment option, Login Setup page will appear. In this Page different fields are available in which bidder needs to fill the required options as per requirement.

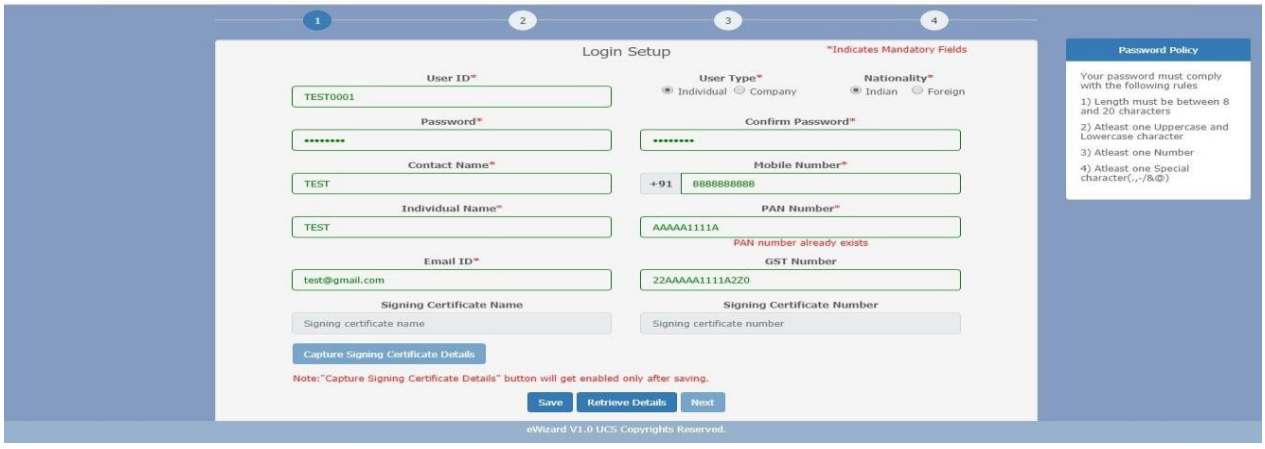

Fig. 3

b) After filling the required fields in Login Setup page, click on the "**Save"** button and later click on the "**Next"** button to go to the next page.

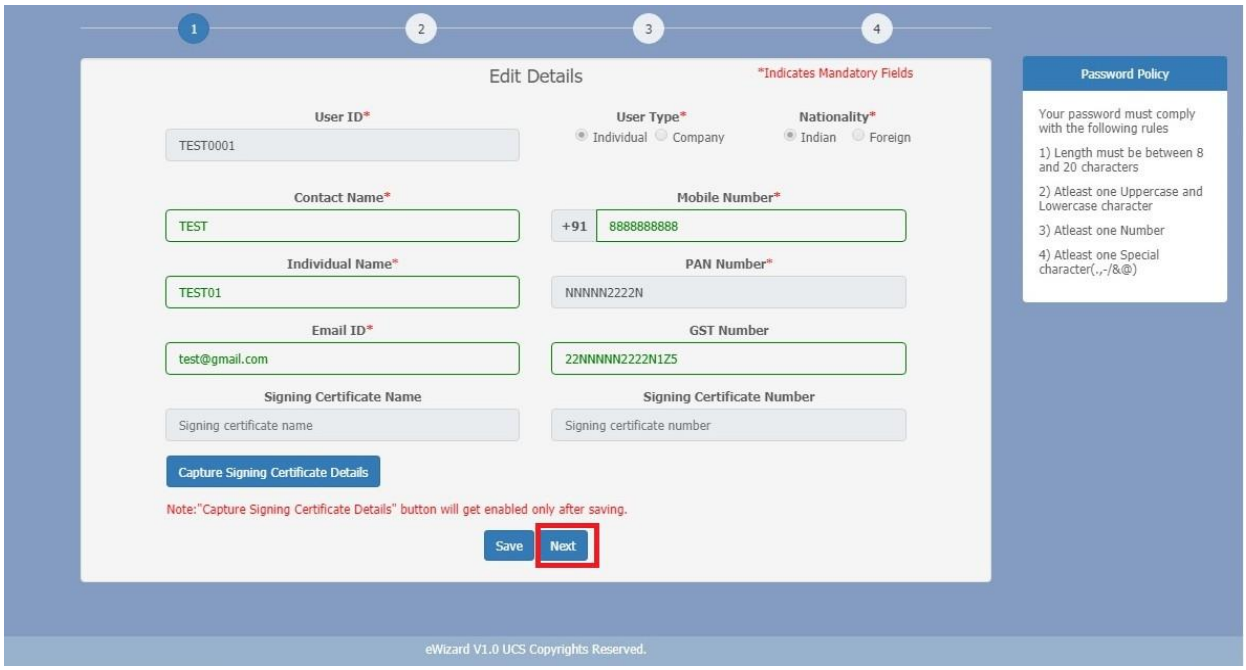

Fig. 4

c) Reservation Category: Select the Category as per requirement.

Reservation Category:

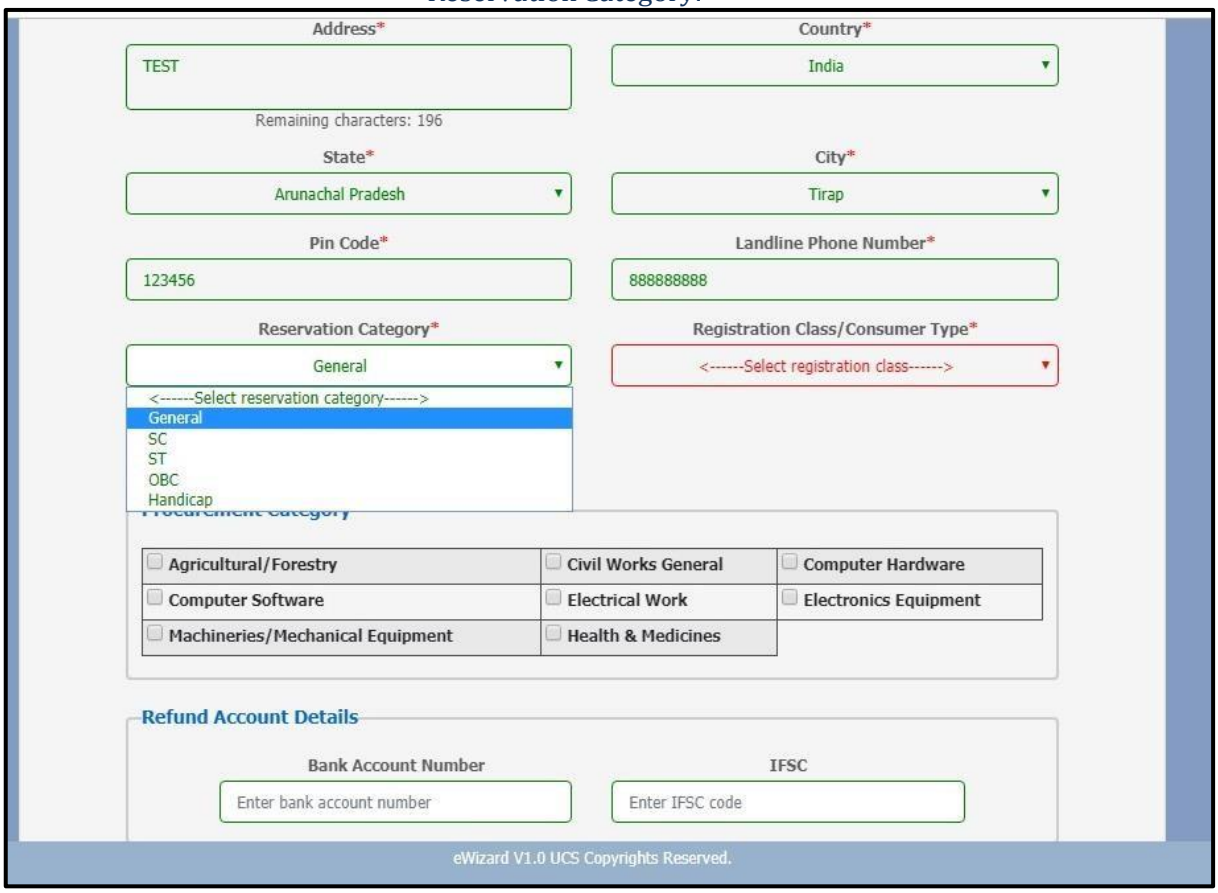

Fig. 5

d) Procurement Category: Bidder will select the Procurement Category in which He/She is interested in participating in the Tender.

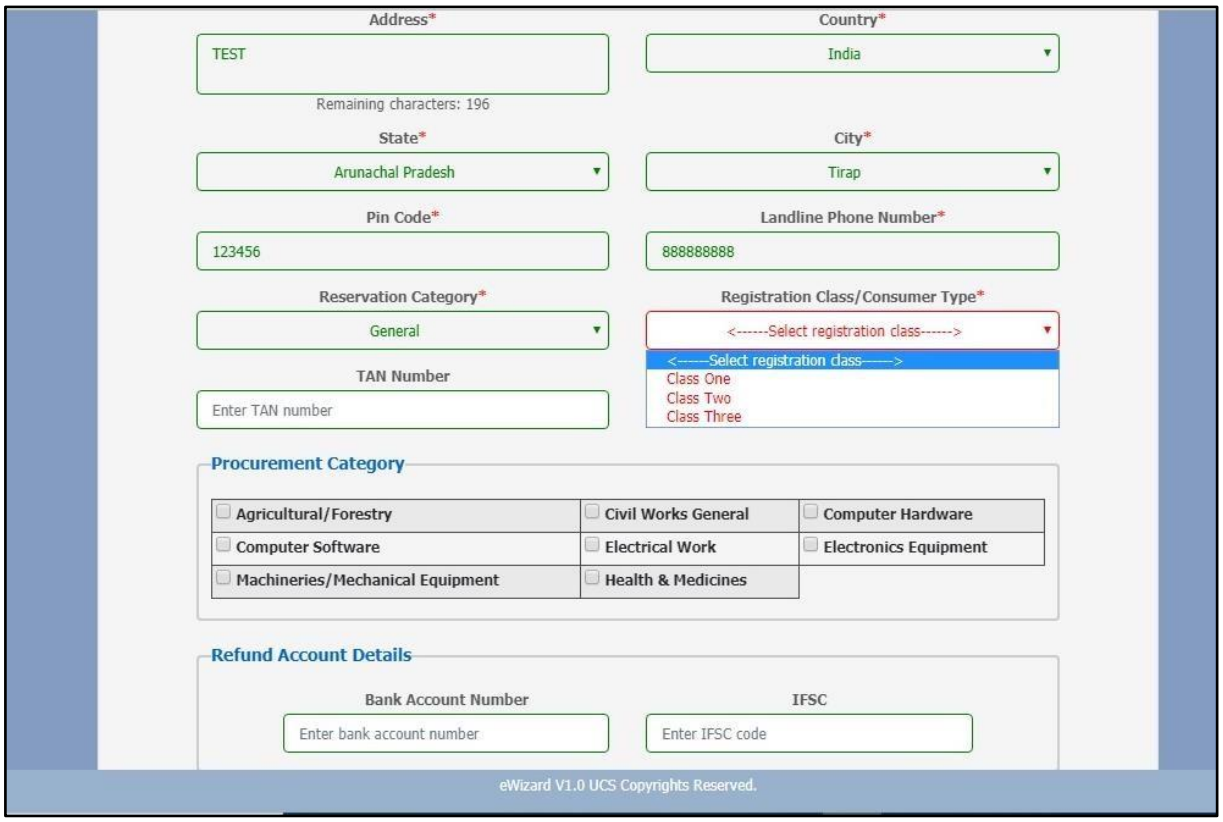

Fig. 6

(3) Terms & Conditions

After filling the form, check the Terms & Conditions carefully and click on the Accept button. After accepting the Terms & Condition option click on the **NEXT** button.

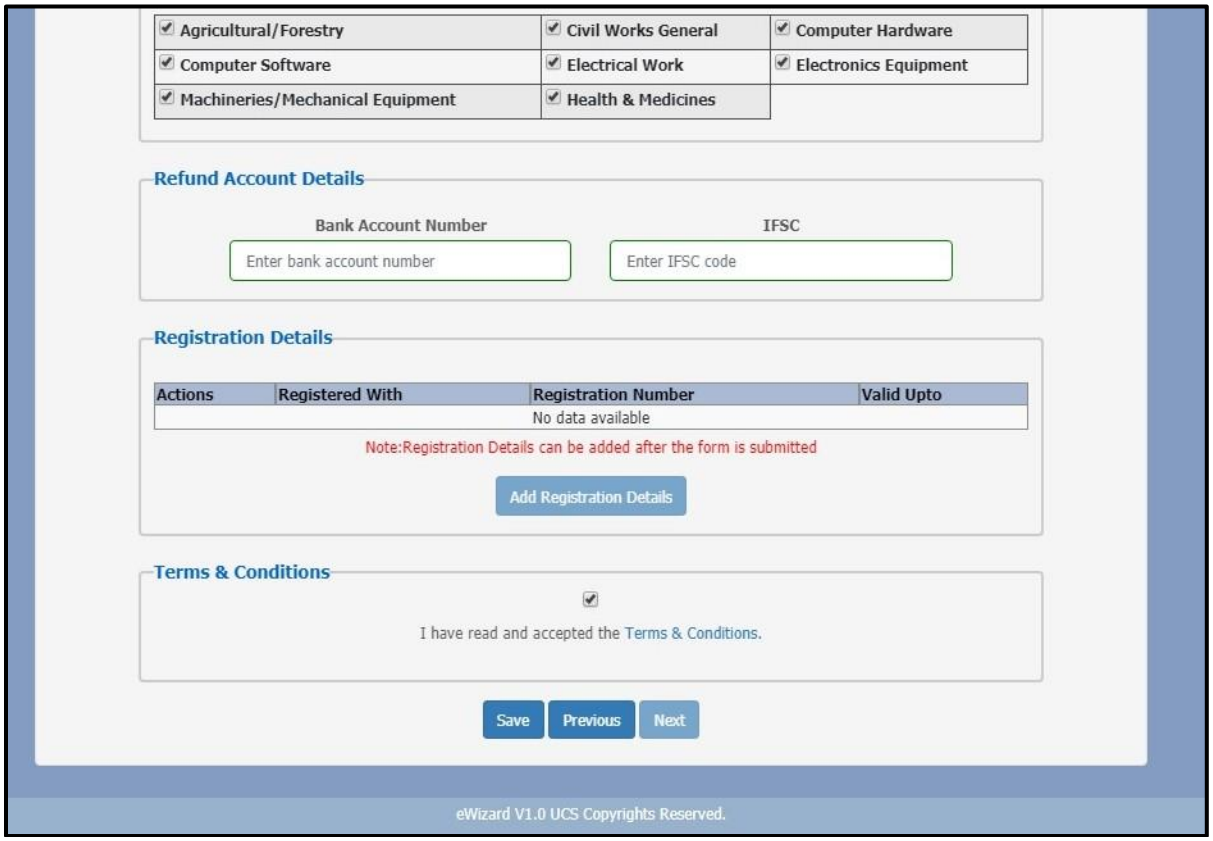

Fig. 7

(4). Documents Upload

a) After clicking on next button. Registration Document Upload dialogue box will appear. Bidder need to upload all the required documents through Upload Document tab.

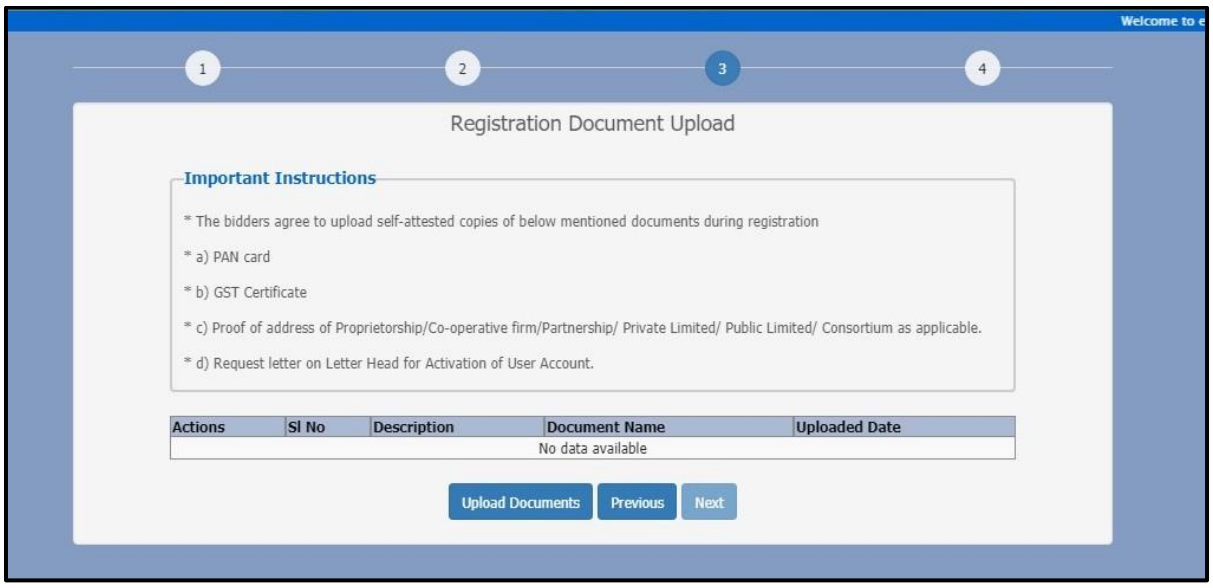

Fig. 8

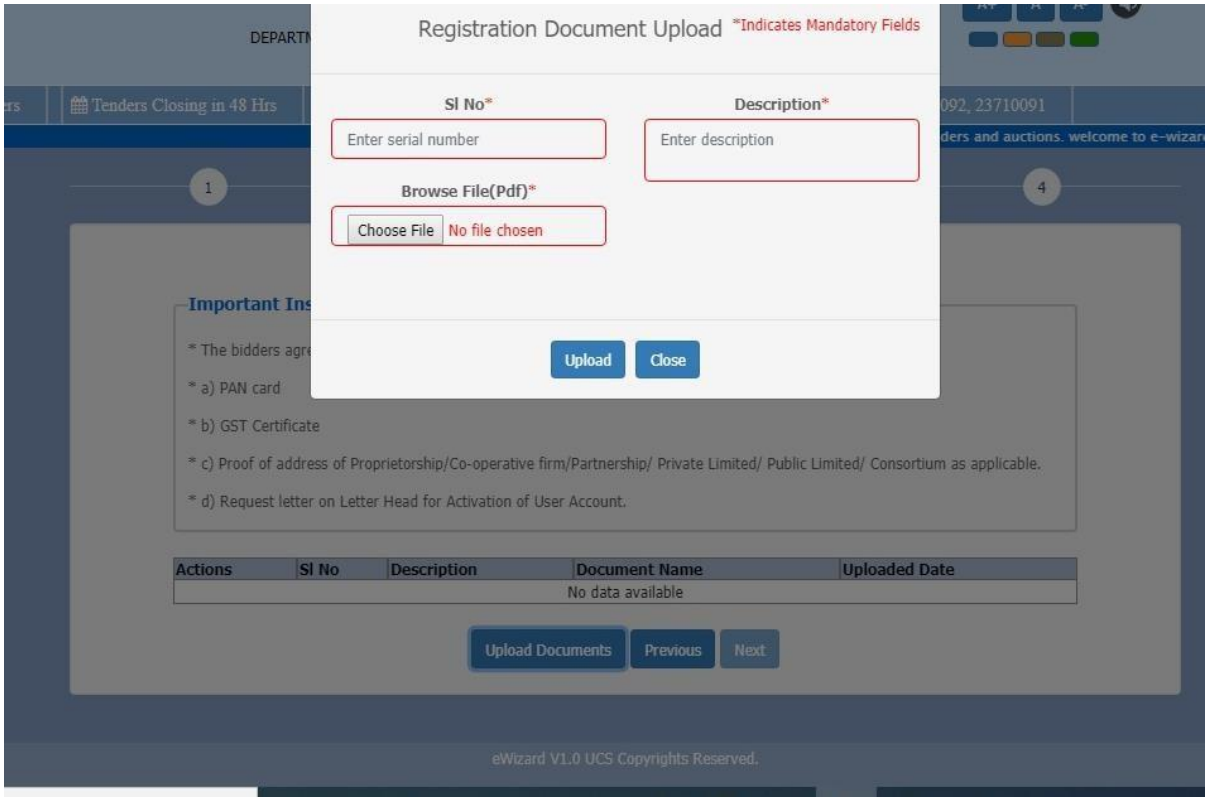

Fig. 9

b) - Upload the required documents from **"Upload Documents"** option. After clicking on **"Upload Documents"** option. Dialogue

Box will appear. Browse the file from Destination source and click on the **Upload** Button.

(4) Registration.

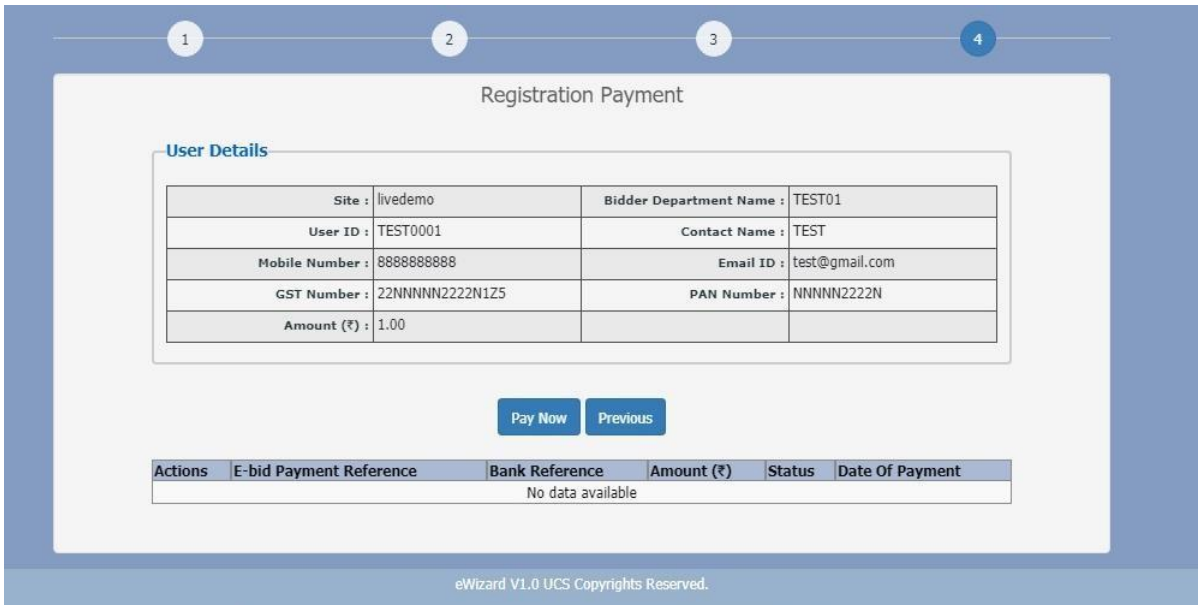

Fig. 10

Thank you

SECTION-III, VOL-I
QUALIFICATION REQUIREMENT

Qualification Requirement of the Bidder

Substation Package SS & LILO- 01 for (a) 2X 50 MVA, 220/33 kV Nagrota (New) substation including (b) LILO of 220kV Udhampur-Gladni on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation associated with Transmission System Strengthening under PMDP Sceme-15"

Qualification of bidder will be based on meeting the minimum pass/fail criteria specified below regarding the Bidder's technical experience and financial position as demonstrated by the Bidder's responses in the corresponding Bid Schedules.

Technical experience and financial resources of any proposed subcontractor shall not be taken into account in determining the Bidder's compliance with the qualifying criteria. The bid can be submitted by an individual firm or a Joint Venture of two or more firms. Specific requirements for Joint Ventures are given under Para 1.3 below.

The Employer may assess the capacity and capability of the bidder, to successfully execute the scope of work covered under the package within stipulated completion period. This assessment may inter-alia include (i) document verification; (ii) bidder's work/ manufacturing facility visit (iii) manufacturing capacity, details of works executed, works in hand, anticipated in future & the balance capacity available for present scope of works; (iv) details of plant and machinery, manufacturing and testing facilities, manpower and financial resources; (v) details of quality systems in place; (vi) past experience and performance; (vii) customer feedback; (viii) banker's feedback etc.

1.1 Technical Experience

Bidder must have constructed* as a prime contractor** under a single contract, at least one (1) new substation, having minimum of four (4) nos. AIS^ Circuit Breaker equipped bays of 132kV or above voltage level during the last seven (7) years and these bays must be in satisfactory operation# for at least two (2) years as on the originally scheduled date of bid opening.

Note-1 (*): *Construction including civil works of tower foundations, equipment foundations, control room building etc and erection, testing and commissioning of electrical equipments.*

Note-2 (**): *In case of works executed under a contract that had been awarded on a Joint Venture, the experience of individual Joint Venture partner shall be considered limited to the scope of that partner under the said contract.*

Note-3 (*#*): *Satisfactory operation means certificate issued by the Employer certifying the operation without any adverse remark.*

Note-4: *In case bidder is a holding company, the technical experience referred to in clause 1.1 shall be of that holding company only (i.e. excluding its subsidiary/group companies). In case bidder is a subsidiary of a holding company, the technical experience referred to in clause 1.1 shall be of that subsidiary company only (i.e. excluding its holding company).*

^ *AIS means Air Insulated Substation*

and

Experience of having successfully completed similar works during last 7 years ending last day of month previous to the one in which / bids are invited should be either of the following: -

(i) One similar completed work costing not less Rs. 50 Cr.

Or

(ii) Two similar completed work costing not less than Rs. 30 Cr.

Or

(iii) Three similar completed work costing not less than Rs. 25 Cr.

"Similar work" means construction of 132 kV or above substation having minimum 04 Circuit Breaker bays

1.2 Financial Position

Bidder must meet the following minimum criteria:

a) Net Worth for last 3 financial years should be **Positive**

b) Minimum Average Annual Turnover* (MAAT) of the bidder for best three years i.e. 36 months out of last five financial years as annualized, must be **Rs. 62 crore**.

*** Note**- *Annual total income as incorporated in the profit & loss account except non-recurring income e.g. sale of fixed assets*

c) Bidder must have availability of credit facilities of not less than **Rs 10.50 crore.**

Note-1: *In case bidder is a holding company, the Financial Position criteria referred to in clause 1.2 above shall be that of holding company only (i.e. excluding its subsidiary / group companies). In case bidder is a subsidiary of a holding company, the Financial Position criteria referred to in clause 1.2 above shall be that of subsidiary company only (i.e. excluding its holding company).*

Note-2: *Credit Facility shall be assessed on the basis of Form-14 i.e. "FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CREDIT/FACILITIES" of this Bid Document*

1.3 JOINT VENTURE BIDS

1.4.1 In case a bid is submitted by a Joint Venture (JV) of two or more firms as partners, joint venture must comply the following minimum criteria

i) All the partners of the JV must meet individually the Financial Position criteria given at 1.2 (a) above.

ii) The lead partner must meet, not less than 40% of the Financial Position criteria given at para 1.2 (b) & (c) above and 100% of the Technical Experience criteria given at 1.1 above.

iii) Each of the other partner (s) individually.

a) must meet not less than 25% of the criteria given at 1.2 (b) & (c) above.

b) must have erected, tested and commissioned as a prime contractor* under a single contract, at least two (2) nos. Circuit Breaker equipped bay of 220kV or above voltage level in one (1) substation or switchyard during last seven (7) years and this bay must be in satisfactory operation# as on the date of bid opening as mentioned above.

OR

must have manufactured, type tested and supplied 220kV or above class Power transformer or Circuit Breaker which must be in satisfactory operation# for at least two (2) years as on the date of bid opening as mentioned above.

iv) The joint Venture must satisfy collectively the financial position Criteria of clause 1.2 (b) & (c) above, for which the relevant figure of average annual turnover and credit facilities for each of the partners of the JV shall be added together to arrive at Joint Venture total capacity.

Note-1 (*): *In case of works executed under a contract that had been awarded on a Joint Venture, the experience of individual Joint Venture partner shall be considered limited to the scope of that partner under the said contract.*

Note-2 (#): *Satisfactory operation means certificate issued by the Employer certifying the operation without any adverse remark.*

1.5 The bidder shall furnish documentary evidence in support of the qualifying requirement stipulated as above.

SECTION-IV, VOL-I

GENERAL CONDITIONS OF CONTRACT (GCC)

SECTION - IV

GENERAL CONDITIONS OF CONTRACT

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SECTION-IV
GENERAL CONDITIONS OF CONTRACT

CLAUSE-1: DEFINITIONS:

In the Contract, as hereinafter defined, the following words and expressions shall have the meanings hereby assigned to them, except where the context otherwise requires:

i) 'RECPDCL'/ 'Purchaser'/'Implementing Agency' means the REC Power Development and Consulting Ltd. and the legal successor in title to the RECPDCL, who will employ the contractor. 'Owner' means the State Government of concerned state where the works are to be executed.

ii) 'Contractor/Supplier' means the person or persons, firm or company, group of firms or joint venture entity, who has been awarded the work by the RECPDCL and includes the Contractor's personnel, representatives, successors and permitted assigns.

iii) 'Engineer-in-Charge' means the HoD Transmission of RECPDCL.

(a) 'Engineer-in-Charge's Representative' means the project engineers of the project as employed by the Employer. The Site in-charge will assist the Engineer-in-charge's representatives to perform the duties set forth in Clause-2 hereof, whose authority shall be notified in writing to the Contractor by the Engineer-in-Charge.

(b) The responsibilities assigned herewith as above in iii (a) to various officers does not absolve them from taking the approval from the competent authority under various state laws/rules/regulations and book of financial powers.

iv) "Works" shall include both permanent Works and Temporary Works or either of them as appropriate and shall mean supply of Goods and Services.

v) "Temporary Works" means all temporary Works of every kind other than Contractor's plant, equipment and machinery required in or about the execution and completion of the Works and remedying of any defects --therein.

vi) "Permanent Works" means the permanent Works to be executed in accordance with the Contract.

vii) The 'Goods' means all the equipment, machinery and/or other materials which the Contractor is required to supply to RECPDCL under the Contract.

viii) 'Services' means services ancillary to the supply of Goods such as but not limited to transportation and insurance from ex-works till defect liability period, handling, storage and preservation at store/site, erection, testing, painting, commissioning of goods, training and other such obligations of the Contractor covered under the Contract.

ix) 'Contract' or 'Contract Document' means the agreement entered into between RECPDCL and the Contractor as recorded in the Form of Agreement, signed by both the parties including all attachments and appendices thereto and all documents incorporated by reference there in.

x) 'Contract Price' means the sum as stated in the Notification of Award payable to the Contractor under the Contract for full and proper performance of his contractual obligations i.e. providing goods and services and remedying any defects therein in accordance with the provisions of the Contract.

xi) 'Plant' and 'Equipment' or 'Machinery' means and include plant, equipment, machinery, tools, appliances, other implements of all description or things of whatsoever nature other than the Temporary Works required in or about the execution and completion of the Works and remedying of any defects therein but does not include materials or other things intended to form or forming part of the Permanent Works.

xii) 'Specifications' means the specifications of Works included in the Contract and any modification thereof or addition thereto or deduction there from as may, from time to time, decided by RECPDCL and/or submitted by the Contractor and approved in writing by the HoD Transmission, RECPDCL**.**

xiii) 'Drawings' means the drawings referred to in the Contract and any modification of such drawings approved in writing by the Engineer-in-Charge and such drawings, as may , from time to time, be furnished by RECPDCL and/or the Contractor and approved in writing by the HoD Transmission , RECPDCL.

xiv) 'Site' means the places where the Works are to be executed and any other places as may be specifically designated in the Contract as forming part of Site.

xv) 'Store' means the place where the goods supplied under this Contract are stored by the Contractor near to the Project site. Such place will be treated as forming part of site.

xvi) 'Approved' means approved in writing, including subsequent written confirmation of previous verbal approval and 'approval' means approval in writing, including as aforesaid.

xvii) 'Consultant' means company/individual as appointed by owner/employer.

xviii) Chief Engineer means HoD-Transmission, RECPDCL.

xix) Chief Engineer-JKPTCL means Representative of the Owner of the Project.

xx) 'GoI' means The Government of India.

xxi) 'Sub-Contractor' means the party or parties having direct contract with the Contractor and to whom any part of the Works has been sublet by the Contractor with the consent, in writing, of the Engineer-in-Charge and the legal successors in title to such person, but not any assignee of any such person.

xxii) 'Manufacturer' means the party proposing to design and/or manufacture the Goods as specified, complete or in part.

xxiii) 'Notification of Award' means the letter from RECPDCL conveying award of Works subject to such reservations as may have been stated therein.

xxiv) 'Tests on Completion' means the tests specified in the Contract or otherwise agreed to by RECPDCL and the Contractor to be performed before the Works are taken over by RECPDCL.

xxv) 'Day' means a day from midnight to midnight.

xxvi) 'Month' means from the beginning of a given date of a calendar month to the end of the preceding date of the next calendar month.

xxvii) 'Week' means seven consecutive days.

xxviii) 'Quarter' means a period of three consecutive months starting from January, April, July and October i.e. January to March, April to June, July to September and October to December.

xxix) 'C.E.A.' means Central Electricity Authority.

xxx) 'Near Relative' means wife/husband, parents and grandparents, children, first cousins, brothers-in-law, sisters-in-law and parents-in-law.

xxxi) 'Rupees' means Rupees in Indian Currency.

xxxii) Words in singular number shall include the plural number and vice-versa where the context so requires. 'He' shall include 'She' and vice – versa.

xxxiii) 'IS' Means Indian Standard specifications with latest amendments or revision as currently in force at the time of execution of the Works.

xxxiv) 'Bill of Quantities'/ 'Price Schedule' means the priced and completed bill of quantities.

xxxv) 'Project Manager' means the person appointed from time to time by the Contractor and notified in writing to the RECPDCL to act as the in-charge for the purpose of the Contract. The Project Manager shall have a minimum of 12 years' experience in the related field, out of which at least 5 years' experience shall be at executive level in "transmission works at 220 KV level"

xxxvi) "Facilities" mean the Plant and Equipment to be supplied and installed, as well as all the installation services to be carried out by the Contractor under the Contract.

xxxvii) "Package" means the Construction of Balance works of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Sceme-15 on Turn Key Basis

CLAUSE-2 DUTIES AND POWERS OF ENGINEER-IN-CHARGE AND ENGINEER-IN-CHARGE'S REPRESENTATIVE:

i) The Engineer-in-Charge shall carry out the duties specified in the Contract.

ii) The Engineer-in-Charge may exercise the authority specified in or necessarily to be implied from the Contract, provided however, that if the Engineer-in-Charge is required to obtain the specific approval from a competent authority before

exercising any such authority, he will do so and convey the decision to the Contractor.

iii) The Engineer-in-Charge's Representative will be appointed by and be responsible to the Engineer-in-Charge and will carry out such duties and exercise such authority as may be delegated to him by the Engineer-in-Charge under Sub Clause (iv) of this Clause. He shall have no authority to relieve the Contractor of any of his duties or obligations under the Contract nor, except as expressly provided hereunder or elsewhere in the Contract, to order any work involving delay or any extra payment by the RECPDCL, nor to make any variation in the Works.

iv) The Engineer-in-Charge may, from time to time delegate to the Engineer-in-Charge's Representative any of the powers and authorities vested in the Engineer-in-Charge and he may at any time revoke such delegation. Any communication issued by the Engineer-in-Charge's Representative to the Contractor in accordance with such delegation shall have the same effect as though it had been issued by the Engineer-in-Charge. Provided that:

a. any failure of the Engineer-in-Charge's Representative to disapprove any work or materials shall not prejudice the authority of the Engineer-in-Charge thereafter to disapprove such work or materials and to give instructions for the removal or for the rectification thereof.

b. If the Contractor questions any communication of the Engineer-in-Charge's Representative, he may refer the matter to the Engineer-in-Charge who will confirm, reverse or vary the contents of such communication.

v) The Engineer-in-Charge may have any number of persons to assist the Engineer-in-Charge's Representative in carrying out of his duties. Such assistants shall have no authority to issue any instructions to the Contractor, except in so far as such instructions may be necessary to enable them to carry out their duties and to secure their acceptance of materials, plant, equipment and machinery or workmanship as being in accordance with the Contract, and any instructions given by any of them for those purposes shall be deemed to have been given by the Engineer-in-Charge's Representative.

vi) Instructions given by the Engineer-in-charge shall be in writing, provided that if for any reason the Engineer-in-charge considers it necessary to give any such instruction orally, the contractor shall comply with such instruction. Confirmation in writing of such oral instruction given by the Engineer-in-Charge, whether before or after carrying out of the instruction, shall be deemed to be an instruction within the meaning of this sub-clause. Provided further that if the Contractor, within seven days, confirms in writing to the Engineer-in-Charge any oral instructions of the Engineer-in-Charge and such confirmation is not contradicted in writing within seven days by the Engineer-in-Charge, it shall be deemed to be an instruction of the Engineer-in-Charge. The provisions of this sub-Clause shall equally apply to instructions given by the Engineer-in-Charge's Representative and any assistants of the Engineer-in-Charge or the Engineer-in-Charge's Representative pursuant to Sub-Clause (v).

CLAUSE-3 ASSIGNMENT OF CONTRACT

The Contractor shall not, without the prior consent of the RECPDCL, assign the Contract or any part thereof, or any benefit or interest therein or there under, otherwise than by:

(i) A charge in favour of the Contractor's bankers of any monies due or to become due under the Contract, or

(ii) Assignment to the Contractor's insurers (in cases where the insurers have discharged the Contractor's loss or liability) of the Contractor's right to obtain relief against any other party liable.

CLAUSE-4 SUBLETTING:

(i) The Contractor shall not sublet the whole of the Works except where otherwise provided by the Contract, the Contractor shall not sublet any part of the Works without the prior written consent of the Engineer-in-charge. However, any such consent shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of any sub-contractor, his agents, servants or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his own agents, servants or workmen. Provided that the Contractor shall not be required to obtain such consent for:

a) The provision of labour, or
b) The purchase of materials which are in accordance with the standards specified in the Contract, or
c) The subletting of any part of the Works for which the sub-contractor is named in the Contract.

(ii) The Contractor shall furnish un-priced copies of the major sub-contracts (costing more than Rs. 5.0 million) to RECPDCL wherever these are executed. This action would, however, not involve RECPDCL in any complications arising between the Contractor and his sub-contractor(s) or any other liabilities. This action would also be without prejudice to the provision under this Clause.

(iii) In the event of a sub-contractor having under taken the Contract in respect of the work executed or the goods, materials, plant, equipment and machinery or services supplied by such sub-contractor, any continuing obligation extending for a period exceeding that of the Defects Liability Period or its extension under the Contract, the Contractor shall at any time, after the expiration of such period, assign to the RECPDCL, the benefit of such obligation for the unexpired duration thereof.

CLAUSE-5: LANGUAGE(S) AND LAW:

i a) The Contract Documents shall be drawn up in English. All correspondence and documents relating to the Contract, exchanged by the Contractor and RECPDCL shall be submitted in the prescribed form in English. All supporting documents and printed literature in connection with the Contract shall be in English. In case the supporting documents and printed literature are in any other language, these shall be accompanied by an appropriate translation in English and in that case, for the purpose of interpretation, the English translation shall govern.

b) **<u>Governing Law & its Jurisdiction:</u>**

The Contract shall be governed by and interpreted in accordance with laws of Union of India and the Courts of New Delhi shall have exclusive jurisdiction in all maters arising under this Contract.

ii Documents Mutually Explanatory

Several documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies, the documents shall take precedence in the order in which they are set out in the proforma of Contract Agreement (attached in Sample Forms & Procedures, Section-IX, Vol-I).

CLAUSE-6: DRAWINGS:

i) After the award of Contract, the supplier & purchaser will hold design co-ordination meetings to finalize steps to be taken to implement the Contract including procedure for submission of drawings, design details & approval thereof in such a manner & procedures which would bring out workable solution to step by step process. At least seven print copies of all the drawings for any part of the Work and seven copies of complete design calculations shall be submitted by the Contractor for approval, at least ninety days prior to the date on which such drawings are required to ensure that the work is carried out in accordance with the approved program Work. The Engineer-in-charge shall accord and convey the approval to the design calculation and drawings, if found in order, within 30(thirty) days from the receipt of the drawings from the Contractor. Otherwise he shall apprise the Contractor of his comments on such design calculations and drawings within the above mentioned period.

ii) Where such comments are communicated to the Contractor, the Contractor shall be bound to ensure that 7 print copies of all the revised drawings and 7 copies of revised design calculations, in view of these comments, are submitted to the **HoD Transmission , RECPDCL, Gurugram.** (Engineer-in-charge) within fifteen days of receipt of these comments. Similar course of action, as aforesaid, shall be taken by the **HoD Transmission , RECPDCL, Gurugram** on the revised designs calculation and drawings. On receipt of approval of drawings/design processes/design calculation etc. The Contractor shall furnish seven print copies (Five copies of A1 or higher size and 2 copies of A3 size) and two (2) nos. paper type reproducible copies of approved drawings and ten copies of approved design calculation to **HoD Transmission , RECPDCL, Gurugram** within 30 days of such approval. In addition, 2 sets of CDs of computer/AutoCAD drawings of such approved drawings shall also be supplied.

iii) Notwithstanding the approval of the **HoD Transmission , RECPDCL, Gurugram** to the Contractor's design and drawings, the Contractor shall be responsible for the stability of Works in accordance with the provisions of the Contract and the approval accorded shall not absolve him of his responsibility for meeting all requirements of specifications.

iv) One copy of the approved drawings shall be kept by the Contractor on the site and the same shall, at all reasonable times, be available for inspection and use by the Engineer-in-Charge and the Engineer-in-Charge's Representative and by any other person authorized by the Engineer-in-Charge.

v) **HoD Transmission , RECPDCL, Gurugram** shall, however, have full power and authority to modify, from time to time, during the progress of Works, the

drawings approved previously in consultation with the contractor, as shall be necessary for the purpose of proper and adequate execution and completion of Works. The Contractor, shall carry out and be bound by such modification.

vi) Final Drawings

After completion of the erection work the Contractor shall furnish 5 copies (3 copies of A1 or higher size and 2 copies of A3 size duly bound in folder) and one copy on reproducible tracing cloth or velograph of final as built drawings of work. For computer/AutoCAD drawn drawings, two sets of CDs containing such drawings shall be supplied. Each set shall include an index showing the drawing number, Revision No. & titles.

vii) Record Drawings

Prior to shipment of the equipment, the Contractor shall furnish to Purchaser one complete set of full size permanent reproducible cloth or film copies of approved quality and type and one full size set of prints of all supplier's drawings of structures, foundations, material etc. as finally built, including any suggested modification. In addition, five (5) bound sets of half-size prints of all Contractor's drawings shall be furnished. Each set shall include an index showing the drawing numbers and titles and shall be bound for permanent reference.

viii) Instructions/ Procedures for Storage & Preservation, Installation/Erection, Testing & Commissioning at Site and Operation & Maintenance of Goods.

The Contractor shall submit 7 sets of written detailed Instructions/Procedures in English language, for Storage & Preservation, Installation/Erection, Testing & Commissioning at site and Operation and Maintenance manual for each component of Transmission Line. The instructions/procedures shall be submitted as early as possible so that final reviewed copies can be made available to the field for use in planning the work well in advance of actual installation and operation. After review, seven (7) durable bound copies of the final instructions shall be furnished. Each of these copies shall have a presentation similar to a hard-bound book resistant to wear and tear and firmly holding each of the pages. A book shall contain a maximum of approximately 240 pages to offer easy handling; if the material requires more space, the manual shall be divided into two (2) or more volumes. Each volume shall have its title, printed on the front of the binding and on the back of the book. The paper used, the reproduction technique, the binding, and the presentation shall be of an approved quality and type. 2 sets of CDs containing final Instructions/Procedures shall also be furnished.

ix) The RECPDCL specification drawings, specifications and other information to the Contractor shall remain the property of the RECPDCL. They shall not, without the consent of the RECPDCL, be used, copied or communicated to a third party by the Contractor unless necessary for the purposes of this Contract.

x) The Contractor shall be responsible for any errors or omissions in the Contractor's drawings unless they are due to incorrect RECPDCL specification drawings or other written information supplied by the RECPDCL. Errors, if any, noticed by the Contractor in the RECPDCL drawings, specification and other information shall, however, be promptly pointed out by the Contractor to the RECPDCL. Approval by the HoD Transmission , RECPDCL, Gurugram of the

Contractor's drawings shall not relieve the Contractor from any responsibility under this Sub-Clause.

xi) The Contractor shall bear all costs which he may incur as a result of delay in providing drawings and other information or as a result of errors or omissions therein, for which he is responsible.

xii) The Contractor shall, at his own cost, carry out any alterations or remedial work necessitated by such errors or omissions for which he is responsible and modify the drawings and such other information accordingly.

CLAUSE-7: CONTRACTOR'S GENERAL RESPONSIBILITIES:

(i) Contractor to carry out Work with care and diligence.

The Contractor shall, in accordance with the Contract and with due care and diligence, design, manufacture, assemble, test at manufacturer's Works before dispatch, transport to site, store and preserve, assemble and erect, test and commission the Goods and carry out the Works within the Time for Completion. The Contractor shall also provide all necessary plant, equipment and machinery, superintendence, labor and all necessary facilities required for completion of works thereof.

(ii) Contractor Responsible for Stability and Safety of Site Operations.

The Contractor shall take full responsibility for the adequacy, stability and safety of all site operations and methods of execution, notwithstanding any approval by the Engineer-in-Charge. The Contractor shall provide, at his cost sufficient illumination, firefighting equipment in and around the place of work to the satisfaction of Engineer-in-Charge. Further, Contractor shall follow the safety precautions as covered in Section-7 of this Document.

(iii) Instructions and Orders in Site Order Book.

All instructions and orders given by the Engineer-in-Charge or his Representative at site are to be maintained in the Site Order Book and shall be taken to have been conveyed to the Contractor for his compliance.

(iv) Contractor's Site Office.

The Contractor must have a site office to receive normal correspondence between 10 AM and 5 PM on working days and urgent correspondence at any time on all days.

(v) Shift Works

To achieve the required progress, the Work, may be required to be carried out round the clock. The time for completion and number of working days shall not be affected by the number of shifts each day. No extra amount on account of any shift work is payable to the Contractor.
Whenever the work is carried out in shifts, notice to this effect shall be given by the Contractor to the Engineer-in-Charge regarding the details of Works he intends to carry out in shifts so that necessary supervision arrangements can be made.

(vi) Contractor to keep Site Clean

a) During the progress of the Works, the Contractor shall keep the site reasonably free from all unnecessary obstructions and shall remove from site any of his plant, equipment and machinery, surplus material or temporary works, no longer required. The Contractor shall also keep the site clean, tidy and orderly at all times and remove from site any wreckage, rubbish, scrap, packing material etc. promptly.

b) In case the Contractor does not keep the area clean and if found necessary to get the area cleaned, the Engineer-in-Charge shall issue a notice of forty-eight hours to the Contractor. In the event of non-compliance by the Contractor, the Engineer-in-charge shall get the area cleaned by some other agency. The cost of such cleaning shall be borne by the Contractor. In case of rubbish, accumulating due to deposition by more than one Contractor, the share of charges to be borne by the Contractors as indicated by the Engineer-in-Charge shall be final.

(vii) Clearance of Site on Completion

On the completion of the Works, the contractor shall clear away and remove from the Site all his plant, equipment and machinery, surplus materials, rubbish and Temporary Works of every kind, and leave the whole of the Site and Works clean and in a workman like condition to the satisfaction of the Engineer-in-Charge

(viii) Giving of Notices, Payment of Fees and Compliance with Statutes and Regulations etc.

a) Giving of Notices and Payment of Fees

The Contractor shall give all notices and pay all fees required to be given or paid under any National or State Statute, Ordinance, or other Law, or any regulation, or bye-law of any local or other duly constituted authority in relation to the execution of Works and by the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works.

b) Compliance with Statutes, Regulations etc.

The Contractor shall conform, in all respects, with the provisions of any such Statute, Ordinance or Law as aforesaid and the regulation or bye-law of any local or other duly constituted authority which may be applicable to the Works and with such rules and regulations of public bodies and companies as aforesaid and shall keep the RECPDCL indemnified against all penalties and liability of every kind for breach of any such Statute, Ordinance or Law, regulation or bye-law.

c) Statutory Obligations

If the cost to Contractor in the performance of the Contract shall be increased or reduced by reasons of the making, passing or promulgation of any law after 30 days prior to the latest date of submission of bids, any order, regulation or by-law having the force of the law, the amount of such an increase or reduction shall be added to or deducted from the Contract Price as the case may be.

(ix) Opportunities for Other Contractors

(a) The Contractor shall, in accordance with the requirements of the Engineer-in-Charge, afford all reasonable opportunities for carrying out their Works to:

- any other Contractors employed by the RECPDCL, and workmen, and
- the workmen of the RECPDCL, and
- the workmen of any duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any Contract which the RECPDCL may enter into in connection with or ancillary to the Works.

(b) The Contractor shall jointly use with other Contractors and the RECPDCL, approach roads, access roads and adits, drainage and other facilities. The use of other Contractor's facilities shall be coordinated by the Engineer-in-Charge between the Contractors, if required, for execution of the Works connected with the project. (Cost, if any, on this account shall be settled between the Contractors concerned).

The use of common facilities shall be coordinated by the Engineer-in-Charge through meetings of various parties. In case of any conflict, the decision of the Engineer-in-Charge in the matter shall be binding on all the parties.

(c) If any part of the Contractor's work depends, for proper execution or results, upon the work of any other Contractor, the Contractor shall inspect and promptly report in writing to the Engineer-in-Charge, any defects in such work that render it unsuitable for such proper execution and results. His failure to inspect and report shall constitute an acceptance of other Contractor's work as fit and proper for the reception of his own work, except as to defects, which may develop in the other Contractor's work after the proper execution of his own work.

(x) Patent Rights and Royalties.

(a) The Contractor shall indemnify the RECPDCL from and against all claims, proceedings, damages, costs, charges and expenses, whatsoever as may be incurred by RECPDCL on account of infringement of any patent rights, designs, trademark or name or other protected rights in respect of any of his plant, equipment and machinery or materials used for or in connection with the Works.

Except where otherwise specified, the Contractor shall pay all royalties, rent and other payments or compensation, if any, for getting any materials required for the Works.

(b) In the event of any claims made under or action brought against RECPDCL in respect of any such matters, as aforesaid, the Contractor shall be immediately, notified thereof and the Contractor shall be at liberty, at his own expense, to settle any disputes or to conduct any litigation that may arise there from, provided that the Contractor shall not be liable to indemnify the RECPDCL if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Engineer-in-Charge in this behalf.

(xi) Packing

a) The Contractor shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to the final destination as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, humid and salt laden climate (where applicable) and precipitation during transit and open storage. Packing case size and weights shall take into consideration, the remoteness of the Goods' final destination, the existing road condition and the absence of heavy handling facilities at all points in transit.

b) **Project storage site**

The Contractor shall submit instructions for packing, handling, marking, storage code and documentation within and outside the package for approval by the Engineer-in-Charge. The packing, handling, marking, storage code and documentation within and outside the package shall comply strictly with such instructions. These instructions can be modified/changed at any time during the execution of works by the Engineer-in-Charge and Contractor shall comply with such instructions.

(xii) Delivery and Documents

a) Delivery of the Goods shall be made by the Contractor in accordance with the terms specified in the Contract. The Contractor shall warrant that the goods supplied under the Contract are new, unused, of most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the Contract. The Contractor further warrants that the goods supplied under this Contract shall have no defect arising from design, materials workmanship, installation or erection or from any act of omission of the supplier that may develop under normal use of supplied goods in conditions available at site.

b) The Contractor shall carryout all the required tests at his works as per approved Quality Assurance Plan. No material/goods shall be dispatched unless required shop tests have been performed and Material Dispatch Clearance Certificate (MDCC) has been issued by the Engineer-in-Charge after witnessing the tests.

c) The Contractor shall request the Engineer-in-Charge for issue of MDCC as under:

i) In case tests at works are not to be witnessed by RECPDCL, Contractor shall carryout these tests through reputed and recognized test houses of India and submit the test certificates to Engineer-in-Charge along with request for issue of MDDC for that component.

ii) In case test at works are to be witnessed by RECPDCL, Contractor shall submit test certificates to the Engineer-in-Charge after such inspection along with a request for issue of MDCC for that component.

iii) MDCC shall be issued within 15 (fifteen) days after the approval of test certificates.

The Contractor shall be responsible for arranging Import License and Customs clearance (wherever required). The RECPDCL will assist the Contractor where required, in arranging Import License and Import Duty exemption certificate and obtaining clearance through the Customs. Any assistance that the RECPDCL can give to the Contractor shall be provided on a "no responsibility basis".

(xiii) Communication and Transport

Jammu Tawi is the largest railway station in Jammu and Kashmir state. It is a major railhead for other places in the state and for tourists heading towards the Kashmir Valley. Jammu–Baramulla line project starts northwards from here. Administratively, it is in the Firozpur division of Northern Railways.

Jammu Tawi is well connected to major Indian cities by Indian railways trains.

With the commencement of the Jammu–Baramulla line, all trains to the Kashmir Valley will pass through Jammu Tawi. A part of the Jammu–Baramulla project has been executed and the track has been extended to Katra. Jalandhar - Pathankot - Jammu Tawi section has been doubled and electrified.

National Highway 1A which passes through Jammu connects it to the Kashmir valley. National Highway 1B connects Jammu with Poonch town. Jammu is just 80 kilometres (50 mi) from Kathua town, while it is 68 kilometres (42 mi) from Udhampur city. Katra is also 49 kilometres (30 mi) away.

Jammu Airport is in the middle of Jammu. It has direct flights to Srinagar, Delhi, Amritsar, Chandigarh, Leh and Mumbai and Bengaluru. Jammu Airport operate daily 30 arrival and departure flights which is Goair, Air India, Spicejet and Indigo running daily flights.

The city has JKSRTC city buses under and mini buses for local transport which run on some defined routes. These mini buses are called "Matadors". Besides this auto-rickshaw and cycle-rickshaw service is also available. Local taxis are also available.

Bidder may visit the site prior to bidding and make sure about Transportation of Material to site.

(xiv) Transportation and Storage/Preservation

(a) The Contractor is required under the Contract to undertake transportation of goods from Ex-works to Project Site including clearing, forwarding and handling, storage and preservation at site, intermediate location (if any) and further transportation to work site, including handling wherever required. All necessary transportation equipment including lifting and handling equipment shall be provided and/or hired by the Contractor at his own cost.

(b) Where the Contractor is required to effect delivery under any other terms, for example, by post or to another address, the Contractor shall be required to meet all the expenses until delivery on the site.

(xv) Spares

(a) The Contractor shall carry sufficient inventories to assure ex-stock supply of spares and same shall be supplied as promptly as possible but in any case within six months of placement of order.

(b) It shall be mandatory for the Contractor to specify the unit rates and prices for the spares as specified in the Schedule of Prices. The RECPDCL, however, reserve the right, during the execution of Contract, to vary the quantity of spares specified in the Schedule of Prices.

(xvi) Quality Assurance

In order to ensure that the Goods to be supplied under this Contract and the civil works to be executed meet the specification requirements, the Contractor shall prepare a comprehensive quality assurance plan and submit the same within 30 days after commencement date of the Contract to the Engineer-in-charge (**HoD Transmission , RECPDCL, Gurugram**) for approval. Any national or International quality assurance certificates such as IS: 14000 series/ISO 9000 series obtained by the Contractor along with its validity period shall be stated.

CLAUSE-8: CONTRACT AGREEMENT:

The Contractor shall, when called upon to do so, enter into and execute a Contract Agreement in the Proforma (attached in Section-IX, VOL-I) of Bidding Document, with such modification as may be necessary.

CLAUSE-9: PERFORMANCE SECURITY:

(i) For the due performance of the Contract, the Contractor shall, within 15 (fifteen) days of receipt of notification of award but not later than the date of signing of the Contract Agreement, furnish to the RECPDCL, a performance security for an amount equivalent to 10 (ten) percent of the Contract Price. The cost of complying with the requirements of this Clause shall be borne by the Contractor, unless the Contract otherwise provides.

(ii) The performance security shall be in the form of an irrevocable Bank Guarantee on the Proforma (attached in Section-IX, VOL-I). The Bank Guarantee shall be in favour of the Accounts Officer with **HoD Transmission , RECPDCL, Gurugram,** issued by any Nationalized /Scheduled Indian Bank.

(iii) The proceeds of the performance security shall be payable to RECPDCL as compensation for any loss, resulting from Contractor's failure to complete his obligation under the Contract.

(iv) If the Contractors fails to furnish the performance security within the specified period, RECPDCL may annul the award and revoke the bid security at its discretion.

(v) If the contractor during the currency of the Contract fails to maintain the requisite Performance Security, it shall be lawful for the RECPDCL at its discretion at its discretion

a) to terminate the Contract for default besides availing any or all contractual remedies provided for breaches/ default, or

b) without terminating the Contract:

1) recover from the contractor the amount of such security deposit by deducting the amount from the pending bills of the contractor under the contract or

2) treat it as a breach of contract and avail any or all availing any or all contractual remedies provided for breaches/ default.

(vi) In the event of any amendment issued to the contract, the contractor shall furnish suitably amended value and validity of the Performance Security in terms of the amended contract within fourteen days of issue of the amendment.

(vii) The performance security shall be valid until 30 days after the date of issue of Defects Liability Certificate. No claim shall be made against the performance security after the issue of the Defects Liability Certificate and the performance security will be discharged and returned to the Contractor thirty days after the Defects Liability Period.

(viii) If the completion of last Defects Liability Period is extended due to the delays attributable to the Contractor, he shall, at his own cost, get the validity period of Bank Guarantee extended. The Contractor shall furnish the extended revised Bank Guarantee one month before the expiry date of the Original Bank Guarantee or any extension thereof. In case the extended/revised Bank Guarantee is not received by RECPDCL within the specified period, the RECPDCL, entirely at its discretion, shall be at liberty to encash the aforesaid Bank Guarantee.

(ix) RECPDCL shall be entitled to:

a) to deduct from the performance securities or to forfeit the said security in whole or in part in the event of:

1) any default, or failure or neglect on the part of the contractor in the fulfilment or performance in all respect of the contract under reference or any part thereof

2) for any loss or damage recoverable from the contractor which RECPDCL may suffer or be put to for reasons of or due to above defaults/ failures/ neglect

b) and in either of the events aforesaid to call upon the contractor to maintain the said performance security at its original limit by making further deposits, provided further that RECPDCL shall be entitled, and it shall be lawful on his

part, to recover any such claim from any sum then due or which at any time after that may become due to the contractor for similar reasons.

(x) Subject to the sub-clause above, the RECPDCL shall release the performance security without any interest to the contractor on completing all contractual obligations, including the warranty obligations, if any.

(xi) No claim shall lie against RECPDCL regarding interest on submitted performance securities or depreciation thereof.

CLAUSE 10: INSPECTION OF SITE:

(i) The Contractor shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself, as to

(a) the form and nature thereof

(b) the hydrological and climatic conditions

(c) the extent and nature of work, materials and water for construction necessary for the execution and completion of the Works and remedying of any defects therein, and

(d) the means of access to the Site and the accommodation he may require and, in general, shall be deemed to have obtained all necessary information as to risks, contingencies and all other circumstances.

CLAUSE-11: SUFFICIENCY OF BID:

The Contractor shall be deemed to have satisfied himself as to the correctness of the rates and prices stated in the Schedule of Prices, all of which shall, except in so far as it is otherwise provided in the Contract, cover all his obligations under the Contract and all matters and things necessary for the proper execution and completion of the Works and remedying of any defects therein.

CLAUSE-12: WORK TO BE IN ACCORDANCE WITH THE CONTRACT:

The Contractor shall execute and complete the Works and remedy any defects therein in strict accordance with the Contract to the satisfaction of the Engineer-in-Charge and shall comply with and adhere strictly to the Engineer-in-Charge's instructions and directions on any matter whether mentioned in the Contract or not, touching or concerning the Works. The Contractor shall take instructions and directions only from the Engineer-in-Charge, or, subject to the limitations referred to in Clause-2 hereof, from the Engineer-in-charge's Representative.

CLAUSE-13: PROGRAMME TO BE FURNISHED:

(i) The Contractor shall within 30 days after the Commencement Date, submit to the Engineer-in-Charge, for his approval a detailed work programme in Primavera along with 2 sets of CDs of same indicating the following:

(a) The order in which the Contractor proposes to carry-out the Works (including design, manufacture, supply, erection, testing and commissioning) so as to complete the works within specified time schedule.

(b) The times when submission and approval of the Contractor's drawings are required (time frame for this shall conform to that set out under Clause-6 hereof).

(c) The times by which the Contractor requires the RECPDCL

- to furnish data/specification drawings, if any
- to have completed any other associated Works

The approval by the Engineer-in-charge of the programme shall not relieve the Contractor from any of his obligations under the Contract.

(ii) The programme shall cover activities on the site and procurement and delivery activities and no material alteration to such programme shall be made without prior approval of HoD Transmission , RECPDCL, Gurugram

(iii) The programme shall be in the form of a network diagram which shall show in detail and in orderly sequence all activities, their descriptions, duration, and dependencies or precedencies, necessary to the completion of the Works.

(iv) The Contractor shall base his programme on the completion times and periods and other relevant Contract requirements and shall co-ordinate his programme with information given to him by the Engineer-in-Charge concerning the project programme and programme of other Contractors to be engaged on the site to the extent that this can be done within the framework of the periods and information available at the time.

(v) The Contractor shall, supply to the Engineer-in-Charge, at such times as he may direct during the progress of the Works, such written particulars, photographs and information as are reasonably required by the Engineer-in Charge to enable a progress record to be maintained in respect of the Works.

(vi) The Contractor shall also submit a narrative report periodically with updated analysis which shall include but not be limited to the description of the problem areas, current and anticipated, delaying factors and their impact and an explanation of the corrective actions taken or proposed.

CLAUSE-14: CONTRACTOR'S SUPERINTENDENCE:

The Contractor shall provide all necessary superintendence during the execution of the Works and as long thereafter as the Engineer-in-Charge may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. The Contractor, or a competent and authorized representative approved of in writing by the Engineer-in-Charge, which approval may at any time be withdrawn, shall give his whole time to the superintendence of the Works. Such authorized representative shall receive on behalf of the Contractor, instructions from the Engineer-in-Charge or subject to the provisions of Clause-2 hereof the Engineer-in-Charge's Representative. If approval of the representative is withdrawn by the Engineer-in-Charge, the Contractor shall, as

soon as is practicable, having regard to the requirement of replacing him as herein after mentioned, after receiving notice of such withdrawal, remove the representative from the Works and shall not thereafter employ him again on the Works in any capacity and shall replace him by another representative approved by the Engineer-in-Charge.

CLAUSE-15: CONTRACTOR'S EMPLOYEES:

(i) The Contractor shall provide on the Site in connection with the execution and the completion of the Works and the remedying of any defects therein;

(a) only such technical assistants as are skilled and experienced in their respective trades and such foremen and leading hands as are competent to give proper superintendence of the Works; and

(b) such skilled, semi-skilled and unskilled labour as is necessary for the proper and timely fulfilling of the Contractor's obligations under the Contract.

(ii) The Engineer-in-Charge shall be at liberty to object to and require the Contractor to remove forthwith from the Works any person provided by the Contractor who in the opinion of the Engineer-in- Charge, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose presence on the site is otherwise considered by the Engineer-in-Charge to be undesirable and such persons shall not be again allowed upon the Works without the written consent of the Engineer-in-Charge. Any person so removed from the Works shall be replaced as soon as possible by a competent substitute approved by the Engineer-in-Charge.

CLAUSE-16: EXTRAORDINARY TRAFFIC:

Protection of Highways and Bridges

The Contractor shall use every reasonable means to prevent any of the highways or bridges communicating with or on the routes to the site from being damaged by any traffic of the Contractor or any of his subcontractors and, in particular, shall select routes, choose and use vehicles and restrict and distribute loads so that any such extraordinary traffic, as will inevitably arise from the moving of Goods or his plant, equipment and machinery and materials from and to the site, shall be limited, as far as reasonably possible, and so that no unnecessary damage may be occasioned to such highways and bridges. In case, however, highways and bridges are damaged on account of movement of any traffic of the Contractor, he shall be liable to restore the highways and bridges to their original condition at his expense.

CLAUSE-17: SAFETY, SECURITY AND PROTECTION OF THE ENVIRONMENT:

The Contractor shall, throughout the execution and completion of the Works and the remedying of any defects therein;

(i) have all the regard for the safety of all persons entitled to be on the site and keep the site (so far as the same is under his control) and the Works (so far as the same are not completed or taken over by the RECPDCL) in an orderly state appropriate to the avoidance of danger to such persons, and

(ii) provide and maintain, at his own cost all lights, guards, fencing, warning signs and watching, when and where necessary or required by the Engineer-in-Charge or his representative or by any duly constituted authority, for the protection of the machines, equipment, Works or for the safety and convenience of the public or others, and

(iii) take all reasonable steps to protect the environment on and off the site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation, and shall preserve and protect all existing vegetation such as trees on or adjacent to the site which do not unreasonably interfere with the execution of the Works. The Contractor shall be held responsible for all unauthorized cutting of and damage to trees, by careless operation of his plant, equipment and machinery and stockpiling of materials etc. and the RECPDCL shall have no responsibility on this account.

CLAUSE-18: OBLIGATIONS OF THE RECPDCL:

Access to and Possession of the Site

The RECPDCL shall, in reasonable time grant the Contractor access to and possession of the site, which may, however, not be exclusive to the Contractor.

CLAUSE-19: LABOUR:

(i) Engagement of Labour

The Contractor shall make his own arrangements for the engagement of all labour, local or otherwise, for the transport, housing, food, medical care etc. at his own expenses. The contractor shall not employ in connection with the Works any person who has not completed 18 years of age. No female labour shall be employed in the night shift. The Contractor shall not recruit or attempt to recruit his staff and labour from amongst persons in the service of RECPDCL.

The labour force, technical, administrative and other personnel engaged by the Contractor shall be confined to the nationals of India.

(ii) Supply of Water

The Contractor shall, so far as is reasonably practicable, provide on the site, to the satisfaction of the Engineer-in-charge or Engineer-in-Charge's Representative, an adequate supply of drinking and other water for the use of his staff and workmen.

The contractor shall arrange, at his cost, water for construction purposes at site.

(iii) Alcohol Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Statutes, Ordinances and Govt. Regulations or Orders for the time being in force, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his subcontractors, agents or staff or labour.

(iv) Epidemics

In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulation, orders and requirements as may be made by the Government, or the local medical or sanitary authorities for the purpose of dealing with and overcoming the same.

(v) Disorderly Conduct etc.

The Contractor shall, at all times, take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his staff and labour and for the preservation of peace and protection, of persons and property in the neighborhood of the Works.

(vi) Contractor to follow Labour Laws

The Contractor shall, in respect of labour employed by him, comply with the provision of the various Labour Laws, Minimum Wages Act as per Rules and Regulation as applicable and shall indemnify the RECPDCL in respect of all claims that may be made against the RECPDCL for non-compliance thereof by the Contractor. In case of noncompliance by the contractor, the Engineer-in-Charge may take such actions as may be necessary for compliance of the various Labour Laws and recover the costs thereof from the Contractor.

(vii) Housing for Labour

So far as the Contract otherwise provides, the Contractor shall provide and maintain such accommodation and amenities as he may consider necessary for all his staff and labour, employed for the purpose of or in connection with the Contract, including all fencing, water supply (both for drinking and other purposes), electricity supply, sanitation, cook houses, fire prevention and firefighting equipment, and other requirements in connection with such accommodation or amenities. On completion of the Contract, unless otherwise agreed with the RECPDCL, the temporary camps/housing provided by the Contractor shall be removed and the Site reinstated to its original condition, to the satisfaction of the Engineer-in-Charge.

(viii) Accident Prevention Officer

The Contractor shall have on his staff on Site an officer dealing only with questions regarding the safety and protection against accidents of all staff and labour. This officer shall be qualified for this work and shall have the authority to issue instructions and shall take protective measures to prevent accidents.

(ix) Health and Safety

Due precautions shall be taken by the Contractor, and at his own cost, to ensure the safety of his staff and labour and, in collaboration with and to the requirements of the local health authorities, to ensure that medical staff, first aid equipment and stores, sick bay and suitable ambulance service are available at the camps, housing and on the Site at all times throughout the period of the Contract and that suitable arrangements are made for the prevention of epidemics and for all necessary welfare and hygiene requirements.

(x) Observance by Sub-Contractors

The Contractor shall be responsible for observance by his sub-contractors of the aforesaid provisions.

CLAUSE-20: RETURNS OF LABOUR:

The Contractor shall, deliver to the Engineer-in-Charge or Engineer-in-Charge's Representative or at his office, a return in detail in such form and at such intervals as the Engineer-in-Charge may prescribe showing the supervisory staff and the number of the several classes of labour from time to time employed by the Contractor on the site and such information in respect of the Contractor's plant, equipment and machinery as the Engineer-in-Charge may require.

CLAUSE-21: WORKMANSHIP AND MATERIALS:

(i) Manner of execution

The goods to be supplied shall be manufactured and all Works to be done shall be executed in the manner set out in the Contract.

Where the manner of manufacture and execution is not set out in the Contract, the Work shall be executed in a proper and workman like manner in accordance with recognised good practice and relevant standards.

(ii) Covering up work

The Contractor shall give the Engineer-in-Charge full opportunity to examine, measure and test any work on site which is about to be covered up or put out of view.

The Contractor shall give due notice to the Engineer-in-Charge whenever such work is ready for examination, measurement or testing.

The Engineer-in-Charge shall then, unless otherwise, notifies the Contractor that he considers it unnecessary, without unreasonable delay carry out the examination, measurement or testing

(iii) Uncovering work

If so instructed by the Engineer-in-Charge, the Contractor shall expose any parts of the works. The Contractor shall reinstate and make good such works to the satisfaction of the Engineer-in-Charge.

CLAUSE-22: INSPECTION AND TESTING:

(i) Independent Inspection

The Engineer-in-Charge shall have the right to inspect and/or to test the goods to confirm their conformity to the Contract specifications at no extra cost to the Purchaser. The Technical Specifications shall specify the inspection and tests required by Engineer-in-Charge. The Engineer-in-Charge may, delegate inspection and testing of contracted equipment or a part thereof to an independent Inspector and such independent Inspector shall be considered as

the Engineer-in-Charge's Representative. Notice of such appointment shall be given by the Engineer-in-Charge to the Contractor.

(ii) Inspection and Testing During Fabrication/Manufacture

Any departmental representative or independent inspector nominated by Engineer-in-charge shall be entitled during fabrication/manufacture to inspect, examine and test the materials and workmanship and check the progress of fabrication/manufacture of the Goods to be supplied under the Contract. This shall take place on the Contractor's premises. If the Goods are being fabricated/manufactured on other premises, the Contractor shall obtain permission for the Engineer-in-charge to carry out such inspection, examination and testing on those premises.

The contractor shall certify that his persons conducting the tests are qualified specialist on the subject matter of relevant tests.

No such inspection, examination or testing shall release the Contractor from any obligation under the Contract.

(iii) Dates for Inspection and Testing

The Contractor shall give at least 15 days' notice to the HoD Transmission , RECPDCL, Gurugram regarding his intention to carry out the tests. The Contractor shall agree with the HoD Transmission , RECPDCL, Gurugram about the time and place for the testing of the Goods as provided in the Contract. The inspector nominated by HoD Transmission , RECPDCL, Gurugram shall give the Contractor at least 24 hours' notice of his intention to attend the tests.

(iv) Facilities for Testing

Where the Contract provides for tests on the premises of the Contractor or of any sub-contractor, the Contractor shall provide such assistance, documents, labour, materials, electricity, fuel, apparatus and instruments as may be necessary to carry out the tests efficiently.

(v) Certificate of Testing

When the Goods have passed the tests referred to in this Contract, the HoD Transmission , RECPDCL, Gurugram shall furnish to the Contractor a certificate within 15 days.

(vi) Rejection

If, as a result of the inspection, examination or testing, the Engineer–in-Charge decides that any work is defective or otherwise not in accordance with the Contract, he may reject such work and shall notify the Contractor thereof immediately. The notice shall state the Engineer-in-Charge's objections with reasons.

The Contractor shall then, with all speed, make good the defect or ensure that any rejected work complies with the Contract.

If the Engineer-in-Charge requires such Works to be re-tested, the tests shall be repeated under the same terms and conditions. All costs incurred for the repetition of the tests shall be borne by the Contractor.

CLAUSE-23: SUSPENSION OF WORKS, TRANSPORTATION OR ERECTION:

(i) Order to Suspend

The Engineer-in-Charge or his representative may, at any time instruct the Contractor to:

(a) Suspend progress of the Works, or

(b) Suspend transportation of the Goods, if fabricated/ manufactured at a place other than on the site, which are ready for transportation to the site at the time specified in the programme, or if no time is specified, at the time appropriate for it to be transported, or

(c) Suspend the erection of the Goods which have been delivered to the site

The Contractor shall, during suspension, protect and secure the Works or Goods affected at the Contractor's Works or elsewhere or on the site, as the case may be, against any deterioration, loss or damage.

(ii) Cost of Suspension

The additional cost, if any, incurred by the Contractor in protecting, securing and insuring the Works or the Goods in following the Engineer-in-Charge or his representative's instructions under Sub-clause (i) of this Clause and in resumption of the Work, shall be added to the Contract Price.

The Contractor shall not be entitled to be paid any additional costs if such suspension is necessary by reason of some default on the part of Contractor.

The Contractor shall not be entitled to additional costs unless he notifies the Engineer-in-Charge or his representative of his intention to make such claim, within 30 days after receipt of the order to suspend progress or transportation or erection.

(iii) Suspension Lasting more than 90 days

If suspension under Sub-Clause (i) of this clause has continued for more than 90 days, and the suspension is not due to Contractor's default, the Contractor may, by written notice to the Engineer- in-Charge, request for permission within 30 days after the expiry of the above period to proceed with the Works.

If permission is not granted within that time, the Contractor may treat the suspension as an omission under Clause-32 hereof, of the section it affects or if the suspension affects the whole of the Works, as an abandonment of the Contract by the RECPDCL.

CLAUSE-24: TIME FOR COMPLETION, EFFECTIVE DATE AND COMMENCEMENT DATE:

The Contract shall become effective on the date of signing of Contract Agreement between RECPDCL & successful bidder. The effective date shall be considered as commencement date.

The time for completion shall be reckoned from Commencement Date i.e. the date of signing of Contract Agreement between RECPDCL & successful bidder. The work i.e. **""Construction of 2x50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni on D/C Tower at Nagrota Substation along with Staff Quarters under PMDP Sceme-15"** on Turnkey basis is to be completed within **15 months** of date of Award of Contract. The bidder shall submit a bar chart along with the bid giving schedule for completion of entire works covering supply as well as services indicating commencement and completion of each activity and foundation work considering zero date as the date of signing of Contract Agreement between RECPDCL & successful bidder.

The Works shall be completed and shall have passed the tests as per the prevalent Regulations/Act on completion within the time indicated above.

CLAUSE-25: EXTENSION OF TIME FOR COMPLETION:

The Contractor may claim an extension of the Time for Completion, if the completion of the Works is delayed by any of the following causes:

(i) Extra or additional work ordered in writing under Clause-32 hereof.
(ii) Delay by any other Contractor engaged by the RECPDCL, which affects this contract materially.
(iii) Any suspension of the works under Clause-23 hereof except when due to the Contractor's default.
(iv) Any force majeure conditions.

The Contractor shall give to the Engineer-in-charge**,** notice of his intention to make a claim for an extension of time within 14 days of the circumstances for becoming known to the Contractor for such an extension. The notice shall be followed as soon as possible with full supporting details.

The Engineer-in-charge will evaluate such details and grant the Contractor from time to time, either prospectively or retrospectively; such extension of Time for Completion as may be justified provided always that, the circumstances leading to the extension of Time for completion are other than through a default of the Contractor. The Engineer-in-charge shall notify the Contractor accordingly.

CLAUSE-26: RATE OF PROGRESS:

If for any reason, which does not entitle the Contractor to an extension of Time for Completion, the rate of progress of the Works or any section at any time is not commensurate with the time for completion set out under clause 24 here of and in the opinion of the Engineer-in-Charge does not ensure completion by the prescribed Time or extended Time for Completion, the Engineer-in-Charge shall so notify the Contractor in writing and the Contractor shall thereupon take such steps as are necessary and the Engineer-in-Charge may approve to expedite progress so as to complete the Works or such section by the prescribed time or extended time. The Contractor shall not be entitled to any additional payment for taking such steps.

CLAUSE-27: LIQUIDATED DAMAGES FOR DELAY:

If the Contractor fails to complete the Work as specified in Clause 24 hereof, the purchaser shall, without prejudice to its other remedies under the Contract, deduct the amount from any monies in its hands, due or which may become due to the Contractor, as liquidated damages (which is a genuine pre-estimate agreed by the parties hereto of the loss or damage which the purchaser would have suffered on account of delay without giving any proof of the loss or damages) a sum equivalent to 1.0% of the Contract price plus GST payable thereon per week of delay or part thereof subject to a maximum of 10% of the Contract price plus GST payable thereon.

The payment or deduction of such damages shall not relieve the Contractor from his obligations to complete the works or from any of his obligations and liabilities under the Contract.

CLAUSE-28: PROLONGED DELAY:

If at any time it appears to the Engineer-in-Charge that the Contractor is unable to adhere to the prescribed time schedule and the delay is not due to a cause for which the RECPDCL or some other Contractor employed by it is responsible or if the aggregate of the liquidated damages levied in terms of the provisions under Clause-27 hereof has reached a maximum of ten percent of the Contract Price, then the RECPDCL may at its discretion, by further notice to the Contractor either:

i) require the Contractor to complete, or
ii) may itself complete at the Contractor's risk and cost, provided that it does so in a reasonable manner, or
iii) terminate the Contract.

If the RECPDCL terminates the Contract, it shall be entitled to recover from the Contractor any loss it has suffered.

CLAUSE-29: TESTS ON COMPLETION:

(i) Notice of Tests

The Contractor shall give to the Engineer-in-Charge, fifteen days' notice of the date after which he will be ready to make the Tests on completion hereinafter called the Tests. Unless otherwise agreed, the Tests shall take place within fifteen days after the said date, on such day or days as the Engineer-in-Charge notifies the Contractor.

(ii) Time for Tests

If the Engineer-in-Charge fails to notify a time after having been asked to do so, or does not attend at the time and place notified, the Contractor shall be entitled to proceed with the Test in his absence and such tests shall be deemed to have been carried out in the presence of Engineer-in-charge.

(iii) Delayed Tests

If the Tests are being unduly delayed by Contractor, the Engineer-in-Charge may, by a notice, require the Contractor to make the Tests within twenty-one days

after the receipt of such notice. The Contractor shall make the Tests on such days within that period as the Contractor may fix and of which he shall give notice to the Engineer-in-charge.

If the Contractor fails to make the Tests within twenty-one days, the Engineer-in-Charge may himself proceed with the Tests. All Tests so made by the Engineer-in-Charge shall be at the risk and cost of the Contractor and the cost thereof shall be deducted from the Contract Price. The Tests shall then be deemed to have been made in the presence of the Contractor and the results of the Tests shall be accepted as accurate.

(iv) Facilities for Tests on Completion

Except where otherwise specified, the Contractor shall provide, at his cost, such labour, materials, electricity, fuel, apparatus, and other necessary equipment as may be required to carry out the Tests.

(v) Re-Testing

If the Works or any section fails to pass the Tests, the Engineer-in-Charge may require such Tests to be repeated on the same terms and conditions. The costs on account of repetition of the Tests under this Sub-Clause or under Sub-Clause-31 (vii) hereof shall be borne by the Contractor.

(vi) Disagreement as to Results of Tests

If the Engineer-in-Charge and the Contractor disagree on the interpretation of the Test results, each shall give a statement of his views to the other within fourteen days after such disagreement arises. The statement shall be accompanied by all relevant evidence. In case of such disagreement, the decision of HoD Transmission , RECPDCL, Gurugram shall be final.

(vii) Consequences of Failure to Pass Tests on Completion

If the Works or any section fails to pass the Tests on the repetition thereof under Sub-Clause (v) of this Clause, the Engineer-in-Charge Shall be entitled to:

(a) order one further repetition of the Tests under the conditions of Sub-Clause (v) of this Clause, or

(b) reject the Works or section in which event the contractor shall replace that part of work or section without any cost to the purchaser within reasonable time without affecting the completion schedule. Testing on this part of work or section shall be performed in the presence of Engineer-in charge or his representative as per procedure specified above.

(viii) Test Certificate

As soon as the Works or any section thereof has passed the Tests, a joint protocol shall be signed based upon which the Engineer-in-Charge shall issue a Certificate to the Contractor to that effect within seven days of signing the protocol and submission of all relevant documents.

CLAUSE-30: TAKING OVER:

(i) Taking over

The Works shall be taken over by the RECPDCL when they have been completed in accordance with the Contract and duly inspected & cleared for energisation by **Electrical Inspection Agency of the employer/Owner**, except in minor respects that do not affect the use of the Works for their intended purpose, have passed the Tests on Completion and a Taking Over Certificate has been issued in accordance with Sub-Clause (ii) of this Clause.

(ii) Taking Over Certificate

The Contractor may apply to the Engineer-in-Charge for issue of a Taking Over Certificate not earlier than fourteen days before he proposes to carry out commissioning and acceptance tests on each equipment of the substation.

The Engineer-in-Charge shall, within thirty days after the receipt of the Contractor's application either:

(a) Issue the Taking Over Certificate to the Contractor stating the date on which the Works were complete and ready for taking over, or

(b) Reject the application giving his reasons and specifying the work required to be done by the Contractor to enable the Taking Over Certificate to be issued.

(iii) Use before Taking Over

The RECPDCL shall not use any part of the Works unless a Taking Over Certificate has been issued in respect thereof.

If nevertheless, the RECPDCL uses any part of the Works, that part which is used shall be deemed to have been taken over at the date of such use. The Engineer-in-Charge shall, on request of the Contractor, issue a Taking Over Certificate accordingly. If the RECPDCL uses any part of the Works before taking over, the Contractor shall be given the earliest opportunity of taking such steps as may be necessary to carry out the Test on Completion.

The Works shall not be deemed to have been taken over if they are not substantially in accordance with the Contract.

The provisions set out under Clauses-29 and 31 hereof shall apply as if the part had been taken over on the date it was taken into use.

(iv) Interference with Tests on Completion

If the Contractor is prevented from carrying out the tests on completion by a cause for which the Engineer-in-charge or other Contractors employed by the RECPDCL are responsible, the RECPDCL shall be deemed to have taken over the Works on the date when the Tests on Completion would have been completed but for such prevention, the Engineer-in-Charge shall issue a Taking Over Certificate accordingly.

The Works shall not be deemed to have been taken over if they are not substantially in accordance with the Contract.

If the Works are taken over under this Clause, the Contractor shall, nevertheless, carry out the Tests on Completion during the Defects Liability Period. The Engineer-in-Charge shall require the Tests on Completion to be carried out by fourteen days' notice and in accordance with the relevant provisions of Clause-29 hereof.

CLAUSE -31: DEFECTS AFTER TAKING OVER:

(i) Defects Liability Period

The expression "Defects Liability Period" shall mean a period of Twelve months from the date the Works are taken over under Clause-30 (i) hereof and the Taking Over Certificate is issued in accordance with Clause-30 (ii) hereof or 36 months from the date of delivery of each unit described under Clause 24 hereof, whichever is earlier.

Where any part of the Works is taken over separately, the Defects Liability Period for that part shall commence on the date it was taken over.

(ii) Notice of Defects

If any defect appears or damage occurs during the defect liability period, the Engineer-in-Charge shall forthwith notify the Contractor thereof. However, delay or failure of the Engineer-in-Charge in notifying shall not relieve the Contractor from his liability for remedying the defects at his own cost.

(iii) Making Good Defects

Upon the receipt of such notice the Contractor shall be responsible for making good any defect in or damage to any part of the Works which may appear or occur during the Defects Liability Period and which arises from either;

(a) any defective materials, workmanship or design, or

(b) any act or omission of the Contractor during the Defects Liability Period.

The Contractor shall make good the defect or damage as soon as practicable and at his own cost.

(iv) Extension of Defects Liability Period

The provisions of this Clause shall apply to all replacements or renewals carried out by the Contractor as if the replacement and renewals had been taken over on the date they were completed.

The Defects Liability Period for the Works shall be extended by a period equal to the period during which the Works cannot be used by reasons of a defect or damage. If only a part of the Works is affected, the Defect Liability Period shall be extended only for that part.

In neither case shall the Defects Liability Period be extended by more than twelve months.

(v) Failure to Remedy Defects

If the Contractor fails to remedy a defect or damage within a reasonable time, the Engineer-in-Charge may fix a final time for remedying the defect or damage.

(a) If the Contractor fails to do so, the Engineer-in-Charge may carry out the work himself or by others at the Contractor's risk and cost. The costs actually incurred by the Engineer-in-Charge in remedying the defect or damage shall be recovered from any payments due or which may become due to the Contractor.

(vi) Removal of Defective Work

If the defect or damage is such that repairs cannot be expeditiously carried out on the site, the Contractor may, with the consent of the Engineer-in-Charge and after furnishing a proper security acceptable to the RECPDCL in case the item is paid for, remove from the site, for the purposes of repair, any part of the Works which is defective or damaged.

(vii) Further Tests on Completion

If the replacements or renewals are such that they may affect the performance of the Works, the Engineer-in-Charge may request that the Tests on Completion be repeated to the extent necessary. The request shall be made by notice **within thirty days** after the replacement of renewal. The Tests shall be carried out in accordance with Clause-29 hereof.

(viii) Right of Access

Until the Final Certificate of Payment has been issued, the Contractor shall have the right of access to all parts of the Works and to records of the working and performance of the Works.

Such right of access shall be during the RECPDCL normal working hours at the Contractor's risk and cost. Access shall also be granted to any duly authorised representative of the Contractor, whose name has been communicated in writing to the Engineer-in-Charge.

Subject to the Engineer-in-Charge's approval, the Contractor may also, at his own risk and cost, make any tests which he considers desirable.

(ix) Defects Liability Certificate

When the Defect, Liability Period for the Works or any part thereof has expired and the Contractor has fulfilled all his obligations under the Contract for defects in the Works or that part, the Engineer-in-Charge shall issue, within thirty days**,** to the Contractor, a Defects Liability Certificate to that effect.

No certificate other than the Defects Liability Certificate referred to herein above shall be deemed to constitute approval of the Works.

(x) Exclusive Remedies

The RECPDCL remedies under this Clause shall be in place of and to the exclusion of any other remedy in relation to defects whatsoever.

CLAUSE-32: VARIATIONS:

(i) The RECPDCL may make any variation in the form, quality or quantity of the Works or any part thereof or substitution for original specifications, design, drawings and instructions that may, in his opinion be necessary and for that purpose, or if for any other reason it shall, in his opinion be desirable, he shall have power to order the Contractor to do the following and the Contractor shall do the same;

a) increase or decrease the quantity of any work included in the Contract,

b) omit or substitute any such work,

c) change the drawings, designs specifications, character or quality or kind of any such work,

d) change the levels, lines, positions and dimensions of any part of the Works,

e) execute additional work of any kind necessary for the completion of the Works,

f) change any specified sequence, method or timing of construction of any part of the Works,

g) change method of dispatch or packing, and

h) change the place of delivery.

No such variations shall in any way vitiate or invalidate the Contract. Any altered, additional or substituted work which the Contractor may be directed to do in the manner above specified as part of the Work, shall be carried out by the Contractor on the same conditions in all respects on which he agreed to do the main Work.

The contractor may also at any time propose variations of the Works to the Engineer-in-Charge.

(ii) Procedure to order variation

The Engineer-in-Charge shall notify the Contractor of the nature and form of the variation considered necessary. After having received such notice, the Contractor shall submit to the Engineer-in-Charge.

a) a description of work, if any, to be performed and a programme for its execution, and

b) the Contractor's proposal for any modifications to the programme, if considered necessary, according to Clause-25 hereof or to any of the Contractor's obligations under the Contract, and

c) the Contractor's proposals for adjustment to the Contract Price.

Following the receipt of the Contractor's submission, the Engineer-in-Charge shall, decide as soon as possible whether or not the variation shall be carried out.

If the Engineer-in-Charge decides that the variation shall be carried out, he shall notify the Contractor to proceed with the variations. If the Engineer-in-Charge and the Contractor are unable to agree the adjustment of the Contract Price, the provisions of Sub-Clause (iii) of this Clause shall apply.

d) The pricing of any Change shall, as far as practicable, be calculated in accordance with the rates and prices included in the Contract. If such rates and prices are inequitable, the parties thereto shall agree on specific rates for the valuation of the Change.

e) The Contract Price for (i) the items for which quantities have been indicated as lumpsum or lot or set and/or (ii) where the quantities are to be estimated by the Contractor shall remain constant unless there is change made in the Scope of Work by Employer. The quantities and unit prices (i) subsequently arrived while approving the Bill of Quantities (BOQ)/Billing breakup of lumpsum quantities/lot/Set and/or (ii) estimated by the Contractor shall be for on account payment purpose only. In case additional quantities, over and above the quantities in BOQ/billing breakup and /or estimated by the Contractor, are required for successful completion of the scope of work as per Technical Specification, the Contractor shall execute additional quantities of these items for which no additional payment shall be made over and above the lumpsum Contract Price. In case quantities of these items supplied at site are in excess of that required for successful completion of scope of work, such additional quantities shall be the property of the Contractor and they shall be allowed to take back the same from the site for which no deduction from the lumpsum Contract Price shall be made. Further, in case actual requirement of quantities for successful completion of scope of work is less than the quantities identified in the approved BOQ /billing breakup and/or estimated by the Contractor, the lumpsum contract price shall remain unchanged and no deduction shall be made from the lumpsum price due to such reduction of quantities.

It shall be the responsibility of the Contractor to pay all statutory taxes, duties and levies to the concerned authorities for such surplus material which would otherwise have been, lawfully payable in case of non-deemed export contracts. The Contractor shall submit an indemnity bond to keep Employer harmless from any liability, before release of such material to the Contractor by Employer.

Set/Lot/Lumpsum shall be governed as per the requirement of the corresponding item description read in conjunction with relevant provisions of Technical Specifications and the Billing breakup

referred to above shall be issued by the Employer based on Contractor's request, if and as may be required during the currency of the Contract.

f) If rates and prices of any change are not available in the Contract, the parties thereto shall agree on specific rates for the valuation of the change and all matters therein related to the change. Based on the same, the Employer shall, if it intends to proceed with the Change, issue the Contractor with a Change Order.

g) The Employer shall issue the Contractor with a Change Order by way of amendment to the Contract or in any other manner deemed appropriate. Even if the Employer and the Contractor cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Completion, or any other matters related to the Change Proposal, the Employer may nevertheless instruct the Contractor to proceed with the Change by issue of a "Pending Agreement Change Order" ("Pending Agreement Amendment").

Upon receipt of a Pending Agreement Change Order, the Contractor shall immediately proceed with effecting the Changes covered by such Order. The parties shall thereafter attempt to reach agreement on the outstanding issues under the Change Proposal. If the parties cannot reach agreement within sixty (60) days from the date of issue of the Pending Agreement Change Order, then the matter may be referred to the Arbitrator in accordance with the provisions of GCC Clause 48.

If the Engineer-in-Charge decides that the variation shall be carried out, he shall notify the Contractor to proceed with the variations. If the Engineer-in-Charge and the Contractor are unable to agree the adjustment of the Contract Price, the provisions of Sub-Clause (iii) of this Clause shall apply.

(iii) Disagreement on Adjustment of the Contract Price

If the Contractor and the Engineer-in-Charge are unable to agree on the adjustment of the Contract Price, the adjustment shall be determined in accordance with the rates specified in the Schedule of Prices.

No payment shall be made for the items of Work ordered to be omitted.

Varied items and additional items of Work which are not provided in the Schedule of Prices, shall be paid on the basis of actual expenditure relating to that item including cost of materials, fabrication/machinery handling and installation at site plus 15% (Fifteen percent) towards overheads including profits.

The price of varied items determined by the Engineer-in-Charge and approved by HoD Transmission, RECPDCL, Gurugram shall be final and binding on the Contractor. No claim of the Contractor shall be entertained by RECPDCL in this regard.

(iv) Contractor to Proceed

On receipt of the notification to proceed with the variations, the Contractor shall forthwith proceed to carry out the variation and be bound to these conditions in doing so as if such variation was stated in the Contract.

The work shall not be delayed pending the granting of an extension of the time for completion or an adjustment to the Contract Price under Sub-Clause (iii) of this Clause and the Contractor shall execute the varied work at the same terms and conditions provided in the Contract.

(v) Records of costs

In any case where the Contractor is instructed to proceed with a variation prior to the determination of the adjustment to the Contract Price in respect thereof, the Contractor shall keep records of the cost of undertaking the variation and of time expended thereon. Such records shall be open to inspection by the Engineer-in-Charge at all reasonable times.

(vi) **Valuation of Changes:**

Unless otherwise stipulated, the accepted variation in the quantity of each contract item would be up to +25% of the quantity initially contracted. The contractor shall be bound to carry out the service at the agreed rates in the price schedules and shall not be entitled to any claim or compensation whatsoever up to the limit of +25% variation in the quantity of the individual item of services. No compensation shall be payable for any negative variation in the quantity.

If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 32 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement by more than the percentage specified in **SCC**, the Employer and the Contractor shall agree on the rates for valuation of the Change beyond the specified percentage as per the procedure defined in **SCC**.

~~If rates and prices of any change are not available in the Contract, the parties thereto shall agree on specific rates for the valuation of the change and all matters therein related to the change.~~

CLAUSE-33: TERMS OF PAYMENT

a. The Contract Price shall be paid as specified in the corresponding **Appendix - 1** (Terms and Procedures of Payment) to the Contract Agreement. The procedures to be followed in making application for and processing payments shall be those outlined in the same Appendix.

b. Except otherwise stated in **Appendix-1** (Terms and Procedure of Payment) to the Contract Agreement, the payments under the Contract shall be made in the currency or currencies in which the Contract Price has been stated in Contract Agreement, subject to the general principle that payments will be made in the currency or currencies in which the Contract Price has been stated in the Contractor‟s bid.

33.1 Securities

33.1.1 Issuance of Securities

The Contractor shall provide the securities specified below in favor of the Employer at the times, and in the amount, manner and form specified below.

33.1.2 Advance Payment Security

The Contractor shall, within fifteen (15) days of the notification of contract award, provide a security in an amount equal to 110% (one hundred ten percent) of the advance payment calculated in accordance with the corresponding **Appendix - 1** (Terms and Procedures of Payment) to the Contract Agreement, and in the same currency(ies) with initial validity of up to ninety (90) days beyond the date of Completion of the Facilities in accordance with GCC Clause 30. The same shall be extended by the Contractor time to time till ninety (90) days beyond the actual date of Completion of the Facilities, as may be required under the Contract.

33.1.2.1 The security shall be in the Form of unconditional Bank Guarantee attached hereto in Section IX - Sample Forms and Procedures. The security shall be discharged after completion of the facilities or relevant part thereof.

- Procedure for effective reduction in the Advance Payment Security

  The Advance Payment Security shall be allowed to be reduced every six (06) months after First Running Account Bill/Stage payment under the Contract if the validity of the Bank Guarantee is more than one year. The cumulative amount of reduction at any point of time shall not exceed seventy five percent (75%) of the advance corresponding to cumulative value of the Facilities completed as per a certificate to be issued by the Project Manager. It should be clearly understood that reduction in the value of advance Bank Guarantee shall not in any way dilute the Contractor's responsibility and liabilities under the Contract including in respect of the Facilities for which reduction in the value of security is allowed.

CLAUSE-34: CLAIMS

i) Pursuant to the provisions under the Contract, the procedure for submitting claims by the Contractor shall be as under;

   a) the Contractor shall give to the Engineer-in-Charge a notice of his intention to make such claim within thirty days after such claim arises stating the reasons for his claim and

   b) as soon as reasonably practical after the date of such notice, submit to the Engineer-in-Charge full and detailed particulars of his claim, but not later than 90 days after such notice, unless otherwise agreed by the Engineer-in-Charge . The Contractor shall thereafter promptly submit such further particulars as the Engineer-in-Charge may require assessing the validity of the claim.

ii) Assessment

When the Engineer-in-Charge of project has received full and detailed particulars of the Contractor's claim in accordance with Sub-Clause (i) of this Clause and such further particulars as he may have required, he shall determine whether the Contractor is entitled to additional payment and notify him accordingly.

The Engineer-in-Charge project may reject any claim for additional payment which does not comply with the requirements of Sub-Clause (i) of this clause and the decision of the said Engineer-in-charge shall be final and binding on the Contractor.

CLAUSE-35: CURRENCIES FOR PAYMENTS:

The Payments shall be made in Indian Rupees.

CLAUSE-36: INTENTIONALLY LEFT BLANK

CLAUSE-37: CARE OF THE WORKS AND PASSING OF RISK:

(i) Contractor's Responsibility for the Care of the Works.

The Contractor shall be responsible for the care of the Works or any section thereof from the Commencement Date until the Risk Transfer Date applicable thereto under Sub-Clause (ii) of this Clause.

The Contractor shall also be responsible for the care of any part of the Works upon which any outstanding work is being performed by the Contractor during the Defects Liability Period until completion of such outstanding work.

(ii) Risk Transfer Date

The Risk Transfer Date in relation to the Works or a section thereof is the earliest of either:

(a) the date of issue of the Taking Over Certificate, or

(b) the date when the Works are deemed to have been taken over in accordance with **Clause-30** hereof, or

(c) the date of expiry of the notice of termination when the Contract is terminated by the RECPDCL in accordance with these Conditions.

(iii) Passing of Risk of Loss or of Damage to the Works

The risk of loss or of damage to the Works or any section thereof shall pass from the Contractor to the RECPDCL on the Risk Transfer Date applicable thereto.

(iv) Loss or Damage Before Risk Transfer Date

Loss of or damage to the Works or any section thereof occurring before the Risk Transfer Date shall:

(a) to the extent caused by any of the Contractor's risks, be made good forthwith by the Contractor at his own cost, and

(b) to the extent caused by any of the RECPDCL's Risks, be made good by the Contractor at the RECPDCL's expense if so required by the Engineer-in-Charge within thirty days of the occurrence of the loss or damage. The price for making good such loss and damage shall be in all circumstances reasonable and shall be agreed by the RECPDCL

and the Contractor, or in the absence of agreement, the RECPDCL shall fix a reasonable price which shall be final and binding.

(v) Loss or Damage after Risk Transfer Date

After the Risk Transfer Date, the Contractor's liability in respect of loss of or damage to any part of the Works shall, except in the case of gross misconduct, be limited:

(a) to the fulfillment of the Contractor's obligations under **Clause-31** hereof in respect of defects therein, and
(b) to making good forthwith loss or damage caused by the Contractor during the Defects Liability Period.

CLAUSE-38: DAMAGE TO PROPERTY AND INJURY TO PERSONS:

(i) Contractor's Liability

Except as provided under Sub-Clause (iii) of this Clause, the Contractor shall be liable for and shall indemnify the RECPDCL against all losses, expenses and claims in respect of any loss of or damage to physical property, death or personal injury occurring before the issue of the last Defects Liability Certificate to the extent caused by;

(a) defective design, material or workmanship of the Contractor.
(b) negligence or breach of statutory duty of the Contractor, his sub-contractors or their respective employees and agents.

(ii) INTENTIONALLY LEFT BLANK

(iii) Accidents

The Contractor shall be liable for and shall indemnify the RECPDCL against all losses, expenses or claims arising in connection with the death of or injury to any person employed by the Contractor or his sub-contractors for the purposes of the Works, unless caused by any defaults of the Engineer-in-Charge or other Contractors engaged by the RECPDCL or by their respective employees or agents and in such cases the RECPDCL shall be liable for and shall indemnify the Contractor against all losses, expenses and claims arising in connection therewith.

CLAUSE-39: LIMITATIONS OF LIABILITY:

(i) Except in cases of gross negligence or willful misconduct

(a) The Contractor and the Employer shall not be liable to the other party for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to the Employer and

(b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to the

cost of repairing or replacing defective equipment, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.

(ii) Liability after expiration of Defects Liability Period

The Contractor shall have no liability to the RECPDCL for any loss of or damage to the RECPDCL's physical property which occurs after the expiration of the Defects Liability Period unless caused by gross misconduct of the Contractor.

(iii) INTENTIONALLY LEFT BLANK

(iv) Mitigation of Loss or Damage

In all cases the party claiming a breach of Contract or a right to be indemnified in accordance with the Contract shall be obliged to take all reasonable measures to mitigate the loss or damage.

CLAUSE-40: INSURANCE

Refer Appendix-III, Insurance Requirement, Section-IX, Vol-I,

CLAUSE-41: FORCE MAJEURE:

(i) Definition of Force Majeure

Force Majeure means any circumstances beyond the control of the parties, including but not limited to:

a) war and other hostilities, (whether war be declared or not), invasion, act of foreign enemies, requisition or embargo;

b) rebellion, revolution, insurrection, military or usurped power and civil war;

c) ionising radiation or contamination by radio activity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosives, or other hazardous properties of any explosive nuclear assembly or nuclear components thereof;

d) riot, commotion or disorder, except where solely restricted to employees of the Contractor or of his sub-contractors.

e) Earthquake affecting Contractor's work.

(ii) Effect of Force Majeure

Neither party shall be considered to be in default or in breach of his obligations under the Contract to the extent that performance of such obligations is prevented by any circumstances of Force Majeure which arise after the date of the Notification of Award or the date when the Contract becomes effective, whichever is the earlier.

(iii) Notice of Occurrence

If either party considers that any circumstances of Force Majeure have occurred which may affect performance of his obligations, he shall promptly notify the other party.

(iv) Performance to Continue

Upon the occurrence of any situation of Force Majeure, the Contractor shall endeavor to continue to perform his obligations under the Contract so far as reasonably practicable. The Contractor shall notify the Engineer-in-Charge of the steps he proposes to take including any reasonable alternative means for performance which is not prevented by Force Majeure. The Contractor shall not take any such steps unless directed so to do by the Engineer-in-Charge.

(v) Additional Costs caused by Force Majeure

If the Force Majeure events exceed a period of six months and if the Contractor incurs additional costs in complying with the Engineer-in-Charge's directions under Sub-Clause (iv) of this Clause then, the Contractor shall be compensated for the additional costs and expenses during the period of Force Majeure exceeding six months and for the costs and expenses to be incurred for the continuation of execution of the Contract.

(vi) Termination in Consequence of Force Majeure

If circumstances of Forces Majeure have occurred and shall continue for a **period of twelve months** then, notwithstanding that the Contractor may by reason thereof has been granted an extension of Time for Completion of the Works, either party shall be entitled to serve upon the other 30 days' notice to terminate the Contract. If at the expiry of the period of 30 days, Force Majeure shall still continue, the Contract shall be terminated.

(vii) Payment on Termination for Force Majeure

If the Contract is terminated under Sub-Clause (vi) of this Clause, the Contractor shall be paid the value of the work done.

The Contractor shall also be entitled to receive;

a) the amounts payable in respect of any preliminary items so far as the work or service comprised therein has been carried out and a proper proportion, as certified by the Engineer-in-Charge, of any such item in which the work or service comprised has only been partially carried out,

b) the cost of materials or goods reasonably ordered for the Works or for use in connection with the Works which have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery. Such materials or goods shall become the property of RECPDCL when paid for by it and the Contractor shall place the same at the RECPDCL's disposal,

c) the amount certified by the Engineer-in-Charge, being the amount of any expenditures which in the circumstances was reasonably incurred by the Contractor in the expectation of completing the

whole of the Works insofar as such expenditure shall not have been covered by any other payments referred to in this Sub-Clause.

CLAUSE-42: DEFAULT:

(i) Notice of Default

If the Contractor is not executing the Works in accordance with the Contract or is neglecting to perform his obligations there under so as to seriously affect the carrying out of the Works, the Engineer-in-Charge or his representative may give notice to the Contractor requiring him to make good such failure or neglect.

(ii) Contractor's Default

If the Contractor;

(a) has failed to comply, within a reasonable time, with a notice under Sub-Clause (i) of this Clause, or

(b) assigns the Contract or subcontracts the whole or part of the Works without the RECPDCL's written consent, or

(c) becomes bankrupt or insolvent, has a receiving order made against him or compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors or goes into liquidation.

The RECPDCL may, after having given seven days' notice to the Contractor, terminate the Contract and expel the Contractor form the site. Any such expulsion and termination shall be without prejudice to any other rights or powers of the RECPDCL under the Contract. The RECPDCL may upon such termination, complete the Works itself or by any other Contractor.

(iii) Valuation at Date of Termination

The Engineer-in-Charge shall, as soon as possible after such termination, certify the value of the Works and all sums then due to the Contractor as at the date of termination in accordance with Clause-33 hereof.

(iv) Payment after Termination

The RECPDCL shall not be liable to make any further payments to the Contractor until the Works have been completed and the Defects Liability Period is over. The RECPDCL shall be entitled to recover from the Contractor the extra costs, if any, of completing the Works after allowing for any sum due to the Contractor under Sub-Clause (iii) of this Clause. If there is no such extra cost, the RECPDCL shall pay any balance due to the Contractor.

(v) Effect on Liability for Delay

The Contractor's liability under Clauses-27 and 28 hereof shall immediately cease when the RECPDCL expels him from the site without prejudice to any liability thereunder that may have already occurred.

CLAUSE 43- INCREASE OR DECREASE OF COSTS

This is a fixed price Contract. No Price Adjustment will be applicable.

CLAUSE-44: TAXES AND DUTIES:

(i) For Supply of Goods:

The prices shall include all duties, levies and taxes in India that may be levied according to the Laws and regulation, save, as provided under para 11.3 and 11.4 of 'ITB' and clause 33 of the General Conditions of the Contract. Nothing in the contract shall relieve the contractor from his responsibility to pay any tax that may be levied in India on profits made by him in respect of the Contract.

(ii) INTENTIONALLY LEFT BLANK

CLAUSE-45: OWNERSHIP:

Ownership of goods shall pass from the Contractor to the RECPDCL on arrival of the goods at site. However, such passing of ownership shall not in any way dilute the responsibility of the Contractor to insure the goods as per Clause-40 hereof and shall not absolve the Contractor of his obligations and liabilities under the Contract. The goods shall be handed over back to the Contractor for performance of services under the Contract for which Contractor shall submit an Indemnity Bond to the purchaser as per proforma attached at SECTION-IX, VOLUME-I.

CLAUSE-46: NOTICES:

(i) Service of Notices on Contractor

All notices or written orders to be given by the RECPDCL or by the Engineer-in-Charge or his representative to the Contractor under the terms of the Contract shall be served either by sending by post to or delivering the same to the Contractor's office on site or his principal place of business, or such other address as the Contractor shall nominate for this purpose.

(ii) Service of Notices

All notices to be given to the Engineer-in-Charge under the terms of Contract shall be served by sending by post or delivering the same to the respective address given below.

HoD Transmission
RECPDCL, D-Block, REC Corporate Headquarter, Plot No. I-4, Sector-29,
Gurugram, Haryana– 122 001
1

(iii) Change of Address

Either party may change a nominated address to another address by prior written notice to the other party.

CLAUSE-47: SETTLEMENT OF DISPUTE:

i. If any dispute of any kind whatsoever shall arise between the Employer and the Contractor in connection with or arising out of the Contract, including without prejudice to the generality of the foregoing, any question regarding its existence, validity or

termination, or the execution of the Packages/Facilities, whether during the progress of the Packages/Facilities or after their completion and whether before or after the termination, abandonment or breach of the Contract, the parties shall seek to resolve any such dispute or difference, to the extent possible, amicably by mutual consultation.

ii. If the parties fail to resolve such a dispute or difference by mutual consultation at the execution site level, then the dispute shall be referred by the Contractor to the Engineer-in Charge , who, within a period of thirty (30) days after being requested by Contractor to do so, shall give written notice of his decision.

   a. The decision/instruction of the Engineer-in Charge shall be deemed to have been accepted by the Contractor unless notified by the Contractor of his intention to refer the matter for Arbitration within thirty (30) days of such decision/instruction.
   b. In the event the Engineer-in-Charge fails to notify his decision as aforesaid within thirty (30) days, the Contractor, if he intends to go for Arbitration, shall notify his intention to the Engineer-in Charge within 30 days of expiry of the first mentioned period of thirty days failing which it shall be deemed that there are no dispute or difference between the Employer and the Contractor.

iii. In case of dispute or difference between the Employer and the Contractor, if the Employer intends to go for Arbitration, he shall notify such intention to the Contractor.

CLAUSE-48: ARBITRATION:

i. All disputes or differences remaining unresolved between the parties under Clause 47 above shall be settled by arbitration in the manner provided herein below:
ii. The arbitration shall be conducted by three arbitrators, one each to be nominated by the Contractor and the Employer and the third to be appointed by both the arbitrators in accordance with 'The Arbitration and Conciliation Act, 1996 as amended, replaced/modified, from time to time' . If either of the parties fails to appoint its arbitrator within sixty (60) days after receipt of a notice from the other party invoking the Arbitration clause, the arbitrator appointed by the party invoking the arbitration clause shall become the sole arbitrator to conduct the arbitration.
iii. The language of the arbitration proceedings and that of the documents and communications between the parties shall be English. The arbitration shall be conducted in accordance with the provisions of the Indian Arbitration and Conciliation Act, 1996 or any statutory modification thereof. The venue and seat of arbitration shall be New Delhi.
iv. The decision of the majority of the arbitrators shall be final and binding upon the parties. In the event of any of the aforesaid arbitrators dying, neglecting, resigning or being unable to act for any reason, it will be lawful for the party concerned to nominate another arbitrator in place of the outgoing arbitrator.
v. During settlement of disputes and arbitration proceedings, both parties shall be obliged to carry out their respective obligations under the Contract. The Contractor shall not be entitled to any interest pendente-lite.
vi. Notwithstanding anything in this clause 48, in case the Contractor is government department/entity, central public sector enterprise or state public sector enterprise, then all such disputes shall be resolved in terms of the Government of India Office Memorandum No. 05/0003/2019-FTS-10937 dated 14 th December, 2022 pertaining to 'Administrative Mechanism for resolution of CPSEs Disputes (AMRCD).

CLAUSE-49: TERMINATION OF CONTRACT FOR RECPDCL's CONVENIENCE:

(i) The Engineer-in-Charge of RECPDCL shall be entitled to terminate this Contract at any time for the RECPDCL's convenience after recording sufficient reasons and getting approval from the relevant contract committee after providing the contractor an opportunity of being heard for which 30 days' prior notice shall be given to the contractor by the Executive Engineer, in-charge project with a copy to the Engineer, in-charge.

(ii) In the event of such termination, the Contractor shall be paid by the RECPDCL as provided in Sub-Clause – 41 (vii) hereof.

CLAUSE-50: JOINT VENTURES:

If the Contractor is a joint venture or consortium, all partners of the joint venture shall be jointly and severally liable to the RECPDCL for the execution of the entire Contract in accordance with its terms.

SECTION-V, VOL-I

SPECIAL CONDITIONS OF CONTRACT (SCC)

SPECIAL CONDTIONS OF CONTRACT

Preamble

This Section of the Bidding Documents shall be named as Special Conditions of Contract (SCC). If there is a conflict between the Section of the bid document namely General Terms & Conditions for Supply and works, the provisions of this section shall prevail.

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
1	**New Clause**	**Addition of New Clause :** **Severability:** If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.
2	**New Clause**	**Addition of New Clause :** **Country of Origin** "Origin" means the place where the materials, equipment and other supplies for the Facilities are mined, grown, produced or manufactured, and from which the services are provided. Plant and equipment are produced when, through manufacturing, processing or substantial and major assembling of components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.
3	**Clause no. 31 (i) (a)**	**Replacing sub-clause no. 31 (i) (a)** The expression " Defects Liability Period" shall mean a period of as provided below from the date the Works are taken over under Clause-30 (i) hereof and the Taking Over Certificate is issued in accordance with Clause-30 (ii) hereof . "The Defect Liability Period: (i) Sixty (60) months for (132kV/220kV/400kV Class) Transformer from the date of Taking Over/Completion of Facilities (or part thereof). For the purpose of this clause, the Measurable Defects as per the Technical Specifications shall also be considered for Transformer. (ii) Twelve (12) months from the date of Taking Over/Completion of Facilities for all equipment/materials other than those specified above". Where any part of the Works is taken over separately, the Defects Liability Period for that part shall commence on the date it was taken over.
4	**New Clause**	**Addition of New Clause :** **Indemnity:** ● For the equipment/material to be provided by the Contractor, it will be the responsibility of the Contractor to take delivery, unload and store the materials at Site and execute an Indemnity Bond and obtain authorisation letter from Employer as per proforma enclosed at Section-IX of Vol-I (Sample Forms and Procedures), in favour of the

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		Employer against loss, damage and any risks involved for the full value of the materials. This Indemnity Bond shall be furnished by the Contractor before commencement of the supplies and shall be valid till the scheduled date of Taking Over of the equipment by the Employer. • In case of divisible Contracts, where the Employer hands over his equipment to the Contractor for executing the Contract, then the Contractor shall, at the time of taking delivery of the equipment through Bill of Lading or other despatch documents, furnish trust Receipt for Plant, Equipment and Materials and also execute an Indemnity Bond in favour of the Employer in the form acceptable to the Employer for keeping the equipment in safe custody and to utilize the same exclusively for the purpose of the said Contract. Samples of proforma for the Trust receipt and Indemnity Bond are enclosed under Section-IX of Vol-I (Sample Forms and Procedures). The Employer shall also issue a separate Authorization Letter to the Contractor to enable him to take physical delivery of plant, equipment and materials from the Employer as per proforma enclosed under Section IX of Vol-I (Sample Forms and Procedures).
5	**New Clause**	**Addition of New Clause :** **Intellectual Property** **Copy Right** • The copyright in all drawings, documents and other materials containing data and information furnished to the Employer by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the Employer directly or through the Contractor by any third party, including supplies of materials, the copyright in such materials shall remain vested in such third party. The Employer shall however be free to reproduce all drawings, documents and other material furnished to the Employer for the purpose of the Contract including, if required, for operation and maintenance. • The copyright in all drawings, documents and other materials containing data and information furnished to the Contractor by the Employer herein shall remain vested in the Employer. **Confidential Information** • The Employer and the Contractor shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data and other information it receives from the Employer to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this Clause.

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		• The Employer shall not use such documents, data and other information received from the Contractor for any purpose other than the operation and maintenance of the Facilities. Similarly, the Contractor shall not use such documents, data and other information received from the Employer for any purpose other than the design, procurement of Plant and Equipment, construction or such other work and services as are required for the performance of the Contract. • The above provisions of this Clause shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Facilities or any part thereof. • The provisions of this Clause shall survive termination, for whatever reason, of the Contract.
6	**New Clause**	**Addition of New Clause :** **Contractor's Organization Chart:** • The Contractor shall supply to the Employer and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities. The chart shall include the identities of the key personnel together with the curricular vitae of such key personnel to be employed within twenty-one (21) days of the Effective Date. The Contractor shall promptly inform the Employer and the Project Manager in writing of any revision or alteration of such an organization chart. In case of RECPDCL Project Manager is Engineer –in- Charge
7	**Clause Ref No-17**	**Supplementary Clauses may be read out with GCC Clause no-17 for SAFETY, SECURITY and PROTECTION OF THE ENVIRONMENT:** The Employer and the Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Contractor shall prepare and submit to the Employer, with a copy to the Project Manager, proposed Site regulations for the Employers approval, which approval shall not be unreasonably withheld. Such Site regulations shall include, but shall not be limited to, rules in respect of security, safety of the Facilities, gate control, sanitation, medical care, and fire prevention. **Compliance with Labour Regulations:** • During continuance of the contract, the Contractor and his sub-contractors shall abide at all times by all applicable existing labour enactments and rules made there under, regulations notifications and byelaws of the State or Central Government or local authority and any other labour law (including rules), regulations bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. The employees of the Contractor and the Sub-contractor in no case shall be treated as the employees of the Employer at any point of time. • The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. • If the Employer is caused to pay under any law as principal employer such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/ byelaws/Acts/ Rules/regulations including amendments, if any, on the part of the Contractor, the Employer shall have the right to deduct any money due to the Contractor under this contract or any other contract with the employer including his amount of performance security for adjusting the aforesaid payment. The Employer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer. Notwithstanding the above, the Contractor shall furnish to the Employer the details/documents evidencing the Contractors compliance to the laws applicable to establishments engaged in building and other construction works, as may be sought by the Employer. In particular the Contractor shall submit quarterly certificate regarding compliance in respect of provisions of Employees" Provident Fund and Misc. Provisions Act 1952 to the Employer. For this purpose, the Contractor as well as its Sub-Contractor(s) should have Provident Fund Code Number and all the workers deployed by the Contractor or Sub-Contractor must be enrolled as members of Provident Fund having an Universal Account Number (UAN). **Salient features of some major laws applicable to establishments engaged in building and other construction works:** • Workmen Compensation Act 1923: The Act provides for compensation in case of injury by accident arising out of and during the course of employment. • Payment of Gratuity Act 1972: Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees. • Employee P.F. and Miscellaneous Provision Act 1952: The Act provides for monthly contribution by the employer plus workers @10% or 8.33%. The benefits under the Act are: ✓ Pension or family pension on retirement or death, as the case may be. ✓ Deposit linked insurance on death in harness of the worker. ✓ Payment of P.F. accumulation on retirement/death etc. • **Maternity Benefit Act 1951:** The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc. • **Contract Labour (Regulation & Abolition) Act 1970:** The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor fails to

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		provide, the same are required to be provided, by the Principal Employer by law. The Principal Employer is required to take Certification of Registration and the Contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Employer if they employ 20 or more labour contract labour. • Minimum Wages Act 1948: The Employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provision of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employments. • Payment of Wages Act 1936: It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers. • Equal Remuneration Act 1979: The Act provides for payment of equal wages for work of equal nature to Male and Female workers and for not making discrimination against Female employees in the matters of transfers, training and promotions etc. • Payment of Bonus Act 1965: The Act is applicable to all establishments employing 20 or more employees. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages to employees drawing Rs. 3500/- per month or less. The bonus is to be paid to employees getting Rs. 2500/- per month or above upto Rs. 3500/- per month shall be worked out by taking wages as Rs. 2500/- per month only. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20to 10 for the purpose of applicability of this Act. • Industrial Dispute Act 1947: the Act lays down the machinery the procedure for resolution of Industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment. • Industrial Employment (Standing Orders) Act 1946: It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority. • Trade Unions Act 1926: The Act lays down the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have been given certain immunities from civil and criminal liabilities. • Child Labour (Prohibition & Regulation) Act 1986: The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of Child Labour is prohibited in Building and Construction Industry.

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		• Inter-State Migrant workmen's (Regulation of Employment & Conditions of Service Act 1979: The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The Inter-State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home upto the establishment and back, etc. • The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and the Cess Act of 1996 : All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay cess at the rate not exceeding 2% of the cost of construction as may be modified by the Government. The Employer of the establishment is required to provide safety measures at the Building or construction work and other welfare measures, such as Canteens, First-Aid facilities, Ambulance, Housing accommodations for workers near the work place etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the government. • **Factories Act 1948:** The Act lays down the procedure for approval at plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power engaged in manufacturing process. **Following law be added against Environment Protection:** Salient features of some of the major laws that are applicable are given below: • The Water (Prevention and Control of Pollution) Act, 1974, this provides for the prevention and control of water pollution and the maintaining and restoring of wholesomeness of water. „Pollution" means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms. • The Air (Prevention and Control of Pollution) Act, 1981, This provides for prevention, control and abatement of air pollution. „Air Pollution" means the presence in the atmosphere of any „air pollutant", which means any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		• The Environment (Protection) Act, 1986, This provides for the protection and improvement of environment and for matters connected therewith, and the prevention of hazards to human beings, other living creatures, plants and property. „Environment" includes water, air and land and the inter-relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property. • The Public Liability Insurance Act, 1991, This provides for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling hazardous substances and for matters connected herewith or incidental thereto. Hazardous substance means any substance or preparation which is defined as hazardous substance under Environment (Protection) Act, 1986, and exceeding such quantity as may be specified by notification by the Central Government. **Safety Precautions** • The Contractor shall observe all applicable regulations regarding safety on the Site. Unless otherwise agreed, the Contractor shall, from the commencement of work on Site until Taking Over, provide: • fencing, lighting, guarding and watching of the Works, and • Temporary roadways, footways, guards and fences which may be necessary for the accommodation and protection of Employer / his representatives and occupiers of adjacent property, the public and others. • The Contractor shall ensure proper safety of all the workmen, materials, plant and equipment belonging to him or to Employer or to others, working at the Site. The Contractor shall also be responsible for provision of all safety notices and safety equipment required both by the relevant legislations and the Project Manager, as he may deem necessary. • The Contractor will notify well in advance to the Project Manager of his intention to bring to the Site any container filled with liquid or gaseous fuel or explosive or petroleum substance or such chemicals which may involve hazards. The Project Manager shall have the right to prescribe the conditions, under which such container is to be stored, handled and used during the performance of the works and the Contractor shall strictly adhere to and comply with such instructions. The Project Manager shall have the right at his sole discretion to inspect any such container or such construction plant/equipment for which material in the container is required to be used and if in his opinion, its use is not safe, he may forbid its use. No claim due to such prohibition shall be entertained by the Employer and the Employer shall not entertain any claim of the Contractor towards additional safety provisions/conditions to be provided for/constructed as per the Project Manager's instructions. Further, any such decision of the Project Manager shall not, in any way, absolve the Contractor of his responsibilities and in case, use of such a container or entry thereof into the Site area is forbidden by the Project Manager, the Contractor shall use alternative methods with

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		the approval of the Project Manager without any cost implication to the Employer or extension of work schedule. • Where it is necessary to provide and/or store petroleum products or petroleum mixtures and explosives, the Contractor shall be responsible for carrying-out such provision and/or storage in accordance with the rules and regulations laid down in Petroleum Act 1934, Explosives Act, 1948 and Petroleum and Carbide of Calcium Manual published by the Chief Inspector of Explosives of India. All such storage shall have prior approval of the Project Manager. In case, any approvals are necessary from the Chief Inspector (Explosives) or any statutory authorities, the Contractor shall be responsible for obtaining the same. • All equipment used in construction and erection by Contractor shall meet Indian/International Standards and where such standards do not exist, the Contractor shall ensure these to be absolutely safe. All equipment shall be strictly operated and maintained by the Contractor in accordance with manufacturer's Operation Manual and safety instructions and as per Guidelines/rules of Employer in this regard. • Periodical examinations and all tests for all lifting/hoisting equipment & tackles shall be carried-out in accordance with the relevant provisions of Factories Act 1948, Indian Electricity Act 1910 and associated Laws/Rules in force from time to time. A register of such examinations and tests shall be properly maintained by the Contractor and will be promptly produced as and when desired by the Project Manager or by the person authorised by him. • The Contractor shall be fully responsible for the safe storage of his and his Sub-Contractors radioactive sources in accordance with BARC/DAE Rules and other applicable provisions. All precautionary measures stipulated by BARC/DAE in connection with use, storage and handling of such material will be taken by the Contractor. • The Contractor shall provide suitable safety equipment of prescribed standard to all employees and workmen according to the need, as may be directed by the Project Manager who will also have right to examine these safety equipment to determine their suitability, reliability, acceptability and adaptability. The Contractor shall also provide Reflective Jackets to all workmen working on the site including different coloured such Jackets to the persons working at height. • Where explosives are to be used, the same shall be used under the direct control and supervision of an expert, experienced, qualified and competent person strictly in accordance with the Code of Practice/Rules framed under Indian Explosives Act pertaining to handling, storage and use of explosives. • The Contractor shall provide safe working conditions to all workmen and employees at the Site including safe means of access, railings, stairs, ladders, scaffoldings etc. The scaffoldings shall be erected under the control and supervision of an experienced and competent person. For erection, good and standard quality of material only shall be used by the Contractor.

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		• The Contractor shall not interfere or disturb electric fuses, wiring and other electrical equipment belonging to the Employer or other Contractors under any circumstances, whatsoever, unless expressly permitted in writing by Employer to handle such fuses, wiring or electrical equipment • Before the Contractor connects any electrical appliances to any plug or socket belonging to the other Contractor or Employer, he shall: a. Satisfy the Project Manager that the appliance is in good working condition; b. Inform the Project Manager of the maximum current rating, voltage and phases of the appliances; c. Obtain permission of the Project Manager detailing the sockets to which the appliances may be connected. The Project Manager will not grant permission to connect until he is satisfied that; a. The appliance is in good condition and is fitted with suitable plug; b. The appliance is fitted with a suitable cable having two earth conductors, one of which shall be an earthed metal sheath surrounding the cores. • No electric cable in use by the Contractor/Employer will be disturbed without prior permission. No weight of any description will be imposed on any cable and no ladder or similar equipment will rest against or attached to it. • No repair work shall be carried out on any live equipment. The equipment must be declared safe by the Project Manager and a permit to work shall be issued by the Project Manager before any repair work is carried out by the Contractor. While working on electric lines/equipment, whether live or dead, suitable type and sufficient quantity of tools will have to he provided by the Contractor to electricians/workmen/officers. • The Contractors shall employ necessary number of qualified, full time electricians/electrical supervisors to maintain his temporary electrical installation. • The Contractor employing more than 250 workmen whether temporary, casual, probationer, regular or permanent or on contract, shall employ at least one full time officer exclusively as safety officer to supervise safety aspects of the equipment and workmen, who will coordinate with the Project Safety Officer. In case of work being carried out through Sub-Contractors, the Sub-Contractor's workmen/employees will also be considered as the Contractor's employees/workmen for the above purpose. The Contractor shall deploy one dedicated Safety Staff(s) for every 200 kms of a Transmission Line Project. In case, the Contractor fails to deploy Qualified Safety Officer(s)/Safety Staff(s) under each Contract, as specified, then the Contractor shall be responsible for payment of a sum of Rs. 15,00,000/- per quarter till the Safety Officer(s)/Safety Staff(s) is deployed, to be deposited with the Employer, which will be retained in the Safety Corpus Fund.

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		• The name and address of such Safety Officers of the Contractor will be promptly informed in writing to Project Manager with a copy to Safety Officer-In charge before he starts work or immediately after any change of the incumbent is made during currency of the Contract. In case any accident occurs during the construction/ erection or other associated activities undertaken by the Contractor thereby causing any minor or major or fatal injury to his employees due to any reason, whatsoever, it shall be the responsibility of the Contractor to promptly inform but no later than 24 hrs. of the occurrence of the same, to the Project Manager in prescribed form and also to all the authorities envisaged under the applicable laws. Notwithstanding above, in case of any fatal accident, the Board of Directors of Contractor shall review the incidence and a copy of Board's resolution signed by the Director/Company Secretary of the firm along with action plan for avoidance of such incidences in future shall be furnished promptly but no later than 60 days, to the Employer. Besides above, the CEO of the Contractor shall meet and apprise RECPDCL along with the Board's resolution of the cause of the fatal accident occurred and their future action plan/safety preparedness to prevent recurrence of such accidents in future within 60 days of the occurrence of the fatal accident. • The Project Manager shall have the right at his sole discretion to stop the work, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and/or property, and/or equipment. In such cases, the Contractor shall be informed in writing about the nature of hazards and possible injury/accident and he shall comply to remove shortcomings promptly. The Contractor after stopping the specific work can, if felt necessary, appeal against the order of stoppage of work to the Project Manager within 3 days of such stoppage of work and decision of the Project Manager in this respect shall be conclusive and binding on the Contractor. • The Contractor shall not be entitled for any damages/compensation for stoppage of work due to safety reasons as provided above and the period of such stoppage of work will not be taken as an extension of time for completion of work and will not be the ground for waiver of levy of liquidated damages. • It is mandatory for the Contractor to observe during the execution of the works, requirements of Safety Rules which would generally include but not limited to following: • Safety Rules a. Each employee shall be provided with initial indoctrination regarding safety by the Contractor, so as to enable him to conduct his work in a safe manner. b. No employee shall be given a new assignment of work unfamiliar to him without proper introduction as to the hazards incident thereto, both to himself and his fellow employees. c. Under no circumstances shall an employee hurry or take unnecessary chance when working under hazardous conditions.

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<tr><th>SCC Clause No</th><th>GCC Clause Ref No</th><th>Additional Point in RECPDCL GCC</th></tr>
<tr><td></td><td></td><td>
d. Employees must not leave naked fires unattended. Smoking shall not be permitted around fire prone areas and adequate fire fighting equipment shall be provided at crucial location.
e. Employees under the influence of any intoxicating beverage, even to the slightest degree shall not be permitted to remain at work.
f. There shall be a suitable arrangement at every work site for rendering prompt and sufficient first aid to the injured.
g. The staircases and passageways shall be adequately lighted.
h. The employees when working around moving machinery, must not be permitted to wear loose garments. Safety shoes are recommended when working in shops or places where materials or tools are likely to fall. Only experienced workers shall be permitted to go behind guard rails or to clean around energized or moving equipment.
i. The employees must use the standard protection equipment intended for each job. Each piece of equipment shall be inspected before and after it is used.
j. Requirements of ventilation in underwater working to licensed and experienced divers, use of gum boots for working in slushy or in inundated conditions are essential requirements to be fulfilled.
k. In case of rock excavation, blasting shall invariably be done through licensed blasters and other precautions during blasting and storage/transport of charge material shall be observed strictly.
• The Contractor shall follow and comply with all Employer Safety Rules, relevant provisions of applicable laws pertaining to the safety of workmen, employees, plant and equipment as may be prescribed from time to time without any demur, protest or contest or reservations. In case of any discrepancy between statutory requirement and Employer Safety Rules referred above, the latter shall be binding on the Contractor unless the statutory provisions are more stringent.
• If the Contractor fails in providing safe working environment as per Employer Safety Rules or continues the work even after being instructed to stop work by the Project Manager as provided above, the Contractor shall promptly pay to Employer, on demand by the Employer, compensation at the rate of Rs. 10,000/- per day or part thereof to be deposited in Safety Corpus Fund pursuant to clause below, till the instructions are complied with and so certified by the Project Manager. However, in case of accident taking place causing injury to any individual, the provisions contained in Clause below shall also apply in addition to compensation mentioned in this Clause.
• If the Contractor does not take adequate safety precautions and/or fails to comply with the Safety Rules as prescribed by the Employer or under the applicable law for the safety of the equipment and plant
<table>
<tr><td>a</td><td>Fatal injury or accident causing death</td><td>Rs. 15,00,000/- per person</td></tr>
<tr><td>b</td><td>Major injuries or accident causing 25% or more permanent disablement</td><td>Rs. 5,00,000/- per person</td></tr>
</table>
</td></tr>
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SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		• The amount paid/ recovered from the Contractor on account of non-compliance to Safety measures shall be deposited in the „Safety Corpus Fund", if not specified otherwise, established by the Employer. The „Safety Corpus Fund" shall be used for augmentation of Safety measures in construction works, capacity building of workers, development of working conditions of workers like providing tents/ mobile toilets/ caravans, safety tools & plants etc. and undertaking such other activities which will facilitate in reducing the accidents. However, the Contractor shall have no claim in this regard and the Employer shall be sole judge in this regard. • If the Contractor observes all the Safety Rules and Codes, Statutory Laws and Rules during the currency of Contract awarded by the Employer and no accident occurs then Employer may consider the performance of the Contractor and award suitable "ACCIDENT FREE SAFETY MERITORIOUS AWARD" as per scheme as may be announced separately from time to time. • The Contractor shall also submit "Safety Plan" as per proforma specified in Section-IX (Sample Forms and Procedures) of the Bidding Documents alongwith all the requisite documents mentioned therein and as per check-list contained therein to the Engineer In-Charge for its approval within 60 days of award of Contract. Further, one of the conditions for release of first progressive payment / subsequent payment towards Services Contract shall be submission of "Safety Plan" alongwith all requisite documents and approval of the same by the Engineer In-Charge.
8	**New Clause**	**Addition of New Clause :** **Emergency Work** • If, by reason of an emergency arising in connection with and during the execution of the Contract, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Facilities, the Contractor shall immediately carry out such work. • If the Contractor is unable or unwilling to do such work immediately, the Employer may do or cause such work to be done as the Employer may determine is necessary in order to prevent damage to the Facilities. In such event the Employer shall, as soon as practicable after the occurrence of any such emergency, notify the Contractor in writing of such emergency, the work done and the reasons therefor. If the work done or caused to be done by the Employer is work that the Contractor was liable to do at its own expense under the Contract, the reasonable costs incurred by the Employer in connection therewith shall be paid by the Contractor to the Employer. In case such work is not in the scope of the Contractor, the cost of such remedial work shall be borne by the Employer.
9	New Clause	**Addition of New Clause :** **Equipment Performance Guarantees:** • The Contractor guarantees that the Equipments, named in the Bid document, shall attain the rating and performance requirements specified in this document, subject to and upon the conditions therein specified.

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		• If the guarantees specified are not established, then the Employer shall, at the Employer's discretion either (a) reject the equipment, or (b) accept the equipment after assessing liquidated damages in accordance with the provision in the bidding document against the Contractor and such amounts shall be deducted from the Contract Price or otherwise recovered from the Contractor. • In case the Employer exercises its option to reject the equipment, the Contractor shall at its cost and expense make such changes, modifications and/or additions to the equipment or any part thereof as may be necessary to meet the specified guarantees. The Contractor shall notify the Employer upon completion of the necessary changes, modifications and/or additions, and shall request the Employer to repeat the Test until the level of the specified guarantee has been met.
10	**New Clause**	**Addition of New Clause :** **Termination** **Termination for Employer's Convenience** • The Employer may at any time terminate the Contract for any reason by giving the Contractor a notice of termination that refers herein below. • Upon receipt of the notice of termination, the Contractor shall either immediately or upon the date specified in the notice of termination (a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) (ii) below (c) remove all Contractor's Equipment from the Site, repatriate the Contractor's and its Subcontractor personnel from the Site, remove from the Site any wreckage, rubbish and debris of any kind, and leave the whole of the Site in a clean and safe condition (d) In addition, the Contractor, subject to the payment specified below, shall (i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination (ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant and Equipment as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors (iii) deliver to the Employer all non-proprietary drawings, specifications and other documents prepared by the Contractor or its Subcontractors as at the date of termination in connection with the Facilities. • In the event of termination of the Contract as specified above, the Employer shall pay to the Contractor the following amounts:

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		(a) the Contract Price, properly attributable to the parts of the Facilities executed by the Contractor as of the date of termination (b) the costs reasonably incurred by the Contractor in the removal of the Contractor's Equipment from the Site and in the repatriation of the Contractor's and its Subcontractors personnel (c) any amounts to be paid by the Contractor to its Subcontractors in connection with the termination of any subcontracts, including any cancellation charges (d) costs incurred by the Contractor in protecting the Facilities and leaving the Site in a clean and safe condition (e) the cost of satisfying all other obligations, commitments and claims that the Contractor may in good faith have undertaken with third parties in connection with the Contract and that are not covered by paragraphs (a) through (d) above. **Termination for Contractor's Default** ● The Employer, without prejudice to any other rights or remedies it may possess, may terminate the Contract forthwith in the following circumstances by giving a notice of termination and its reasons therefore to the Contractor: (a) if the Contractor becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Contractor takes or suffers any other analogous action in consequence of debt (b) if the Contractor assigns or transfers the Contract or any right or interest. (c) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract. **For the purpose of this Sub-Clause:** **"corrupt practice"** is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party; **"fraudulent practice"** is any act or omission, including a misrepresentation, that knowingly or recklessly misleads or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation; **"collusive practice"** is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party; **"coercive practice"** is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party; **"obstructive practice"** is

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		(a) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Employer's investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; (b) acts intended to materially impede the exercise of the Employer's inspection and audit rights. In persuasions of its policy, the Employer will sanction a firm or individual, including declaring ineligible, either indefinitely or for a stated period of time, to be awarded a contract if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for, or in executing, a contract. • If the Contractor (a) has abandoned or repudiated the Contract (b) has without valid reason failed to commence work on the Facilities promptly or has suspended the progress of Contract performance for more than twenty-eight (28) days after receiving a written instruction from the Employer to proceed. (c) persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause (d) refuses or is unable to provide sufficient materials, services or labor to execute and complete the Facilities in the manner specified in the program furnished at rates of progress that give reasonable assurance to the Employer that the Contractor can attain Completion of the Facilities by the Time for Completion as extended, then the Employer may, without prejudice to any other rights it may possess under the Contract, give a notice to the Contractor stating the nature of the default and requiring the Contractor to remedy the same. If the Contractor fails to remedy or to take steps to remedy the same within fourteen (14) days of its receipt of such notice, then the Employer may terminate the Contract forthwith by giving a notice of termination to the Contractor. • Upon receipt of the notice of termination, the Contractor shall, either immediately or upon such date as is specified in the notice of termination, (a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) below

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		(c) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination (d) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant and Equipment as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors (e) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities. • The Employer may enter upon the Site, expel the Contractor, and complete the Facilities itself or by employing any third party. The Employer may, to the exclusion of any right of the Contractor over the same, take over and use with the payment of a fair rental rate to the Contractor, with all the maintenance costs to the account of the Employer and with an indemnification by the Employer for all liability including damage or injury to persons arising out of the Employer's use of such equipment, any Contractor's Equipment owned by the Contractor and on the Site in connection with the Facilities for such reasonable period as the Employer considers expedient for the supply and installation of the Facilities. Upon completion of the Facilities or at such earlier date as the Employer thinks appropriate, the Employer shall give notice to the Contractor that such Contractor's Equipment will be returned to the Contractor at or near the Site and shall return such Contractor's Equipment to the Contractor in accordance with such notice. The Contractor shall thereafter without delay and at its cost remove or arrange removal of the same from the Site. • Subject to provision provide below, the Contractor shall be entitled to be paid the Contract Price attributable to the Facilities executed as of the date of termination, the value of any unused or partially used Plant and Equipment on the Site, and the costs, if any, incurred in protecting the Facilities and in leaving the Site in a clean and safe condition pursuant to paragraph (a) above. Any sums due to the Employer from the Contractor accruing prior to the date of termination shall be deducted from the amount to be paid to the Contractor under this Contract. • If the Employer completes the Facilities, the cost of completing the Facilities by the Employer shall be determined. If the sum that the Contractor is entitled to be paid, pursuant to above, plus the reasonable costs incurred by the Employer in completing the Facilities, exceeds the Contract Price or the entire Facilities if entire Facilities have been completed or the price for part of the Facilities if part of the Facilities have been completed, the Contractor shall be liable for such excess. If such excess is greater than the sums due the Contractor, the Contractor shall pay the balance to the Employer, and if such excess is less than the sums due, the Employer shall pay the balance to the Contractor. For facilitating such payment the Employer shall encash the Bank Guarantees of the Contractor

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<tr><th>SCC Clause No</th><th>GCC Clause Ref No</th><th>Additional Point in RECPDCL GCC</th></tr>
<tr><td></td><td></td><td>available with the Employer and retain such other payments due to the Contractor under the Contract in question or any other Contract that the Employer may have with the Contractor. The Employer and the Contractor shall agree, in writing, on the computation described above and the manner in which any sums shall be paid.
• In this clause , the expression “Facilities executed” shall include all work executed, Installation Services provided, and all Plant and Equipment acquired (or subject to a legally binding obligation to purchase) by the Contractor and used or intended to be used for the purpose of the Facilities, up to and including the date of termination.</td></tr>
<tr><td>11</td><td>New Clause</td><td>Time for completion of project:
<table>
<tr><th rowspan="2">Sl. No.</th><th>Activities</th><th rowspan="2">Duration in months from the effective date of contract</th></tr>
<tr><th>Taking over by the Employer upon successful completion of:</th></tr>
<tr><td>01</td><td>Turnkey project including Supply, Transportation, Erection, Testing and Commissioning of following work in Jammu & Kashmir :-

“Construction of
a. 2x50 MVA, 220/33 kV Nagrota (New) substation including
b. LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation under PMDP Sceme-15”
c. Staff Quarters at proposed Nagrota Subststion</td><td>15 (Fifteen) Months</td></tr>
</table></td></tr>
<tr><td>12</td><td>Clause no. 44</td><td>Supplementary Clauses may be read out with GCC Clause no-44 for Taxes and Duties or any other clause of the document as applicable

TAXES & DUTIES:
• The Contractor shall be entirely responsible for payment of all taxes, duties, licence fees and other such levies legally payable/incurred until delivery of the contracted supplies to the Employer.
• If it is statutory requirement to make deductions towards such taxes and duties or any other applicable taxes and duties, the same shall be made by the Employer and a certificate for the same shall be issued to the Contractor.
• The Contractor shall be solely responsible for the taxes that may be levied on the Contractor's persons or on earnings of any of his employees and shall hold the Employer indemnified and harmless against any claims that may be made against the Employer. The Employer does not take any responsibility whatsoever regarding taxes under Indian Income Tax Act, for the Contractor or his personnel. If it is obligatory under the</td></tr>
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SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		provisions of the Indian Income Tax Act, deduction of Income Tax at source shall be made by the Employer. • In respect of **supply of goods to** the Employer **by** the Contractor, the EXW price is inclusive of all cost as well as duties and tax (viz., custom duties & levies, duties, **GST** etc.) paid or payable on components, raw materials and any other items used for their consumption incorporated or to be incorporated in the Plant & Equipment. Further, the EXW price of (i) imported Equipments/items offered as 'Off the Shelf' or dispatched directly from the Indian Port of disembarkation are inclusive of all cost **as well as any duties paid/payable in relation to import of such goods (viz., Customs duties, GST & levies etc.)** and no separate claim on this behalf will be entertained by the Employer. If any tax exemptions, reductions, allowances or privileges may be available to the Contractor in the Country where the site is located and the Contractor has declared the same in its bid, the Employer shall use its best endeavors to enable the Contractor to benefit from such tax savings to the maximum allowable extent. **The Input Tax Credit (ITC) available, if any, under GST as per the relevant Government laws wherever applicable has been taken into account by the Contractor.** • **Ex-works price for the supply of goods viz. Equipment/items by the Contractor is excluding GST, if any, payable. The GST will be reimbursable (along with subsequent variation if any), by the Employer on the supplies made by the Contractor but limited to the tax liability on the transaction between the Employer and the Contractor.** **Type test charges, if applicable, are excluding GST, if any, payable. Type test shall be considered an incidental expense incurred prior to the supply of goods viz. Equipment/items and would be added to the value of goods viz. Equipment/items for GST purposes and GST for Type Test shall be reimbursed at the rate applicable for such Equipment/items.** **Further the price for supply of services viz. Installation and training are excluding GST, if any, payable. The GST will be reimbursable (along with subsequent variation if any), by the Employer on the supplies made by the Contractor but limited to the tax liability on the transaction between the Employer and the Contractor.** **It is the Employer's understanding that as per extant provisions, on the charges for supply of services related to Inland transportation, In-transit insurance, loading and unloading by the Contractor to the Employer, GST is not payable. The Contractor is, however, advised to check the position from their own sources. If payable, the same shall**

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		be to the Contractor's account and Employer shall not reimburse any GST on this account. • **Employer would not bear any liability on account of any other taxes, duties, levies applicable locally.** • **Employer shall, deduct taxes at source as per the applicable laws/rules, if any, and issue Tax Deduction at Source (TDS) Certificate to the Contractor.** • **Reimbursement of GST by the Employer shall be at the rate applicable on the HSN/SAC of the goods/ services supplied by the Contractor to the Employer. The reimbursement of GST shall be against Invoice/Debit Note containing particulars specified under the GST Act and related Rules, Notifications, etc as notified by the Government in this regard. In the event that the Contractor fails to provide the invoice in the form and manner prescribed under the GST Act and Rules, the Employer shall not be liable to make any payment against such invoice.** **If there is difference in HSN/SAC classification and corresponding rate of GST of an item as confirmed/deemed confirmed by the bidder in its bid and HSN/SAC and corresponding rate of GST as interpreted under any interpretation/ judgment/ Notification/ Circular issued under the GST law before or after the award of contract, GST reimbursable to the bidder/Contractor shall be lower of the GST applicable at the rate as confirmed/deemed confirmed in the bid or actual GST paid/payable by the bidder for that item.** • **The Contractor shall comply with all tax laws in force in India. The Contractor shall indemnify and hold harmless the Employer from and against any and all liabilities, interest, damages, claims, fines, penalties and expenses of whatever nature arising or resulting from the violation of such tax laws by the Contractor or its personnel, including the Subcontractors and their personnel.** • **Owner's GSTIN number will be provided to bidder on request. While raising invoice/proforma invoice for Supply of Goods, Contactor shall bill to and ship to the address of the Owner in the State/UT where the Goods or part thereof is to be Supplied and mention GSTIN of Owner in of the same state/UT. #In case of Supply of Services, the Contractor shall invoice the Owner using the GSTIN of Owner in the state/UT in which the service or part thereof is to be rendered.**

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		• **Notwithstanding anything above or elsewhere in the Contract, in the event that the input tax credit of the GST charged by the Contractor is denied by the tax authorities to the Employer for reasons associated with non-compliance/ incorrect compliance by the Contractor, the Employer shall be entitled to recover such amount from the Contractor by way of adjustment from any of the subsequent invoices submitted by the Contractor to the Employer. In addition to the amount of GST, the Employer shall also be entitled to recover interest and penalty, in case any interest and/or penalty are imposed by the tax authorities on the Employer for incorrect/wrong availment of Input Tax Credit. The Employer shall determine whether the denial of credit is linked to the non-compliance/ incorrect compliance of the Contractor and the said determination shall be binding on the Contractor** For the purpose of the Contract, it is agreed that the Contract Price specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement is based on the taxes, duties, levies and charges prevailing at the date seven (07) days prior to the last date of bid submission (hereinafter called "Tax"). If any rates of Tax are increased or decreased, a new Tax is introduced, an existing Tax is abolished, or any change in interpretation **except for classification related purpose,** or application of any Tax occurs in the course of the performance of the Contract, which was or will be assessed on the Contractor in connection with performance of the Contract, an equitable adjustment of the Contract price shall be made to fully take into account any such change by addition to the Contract price or deduction therefrom, as the case may be, in accordance with GCC Clause 31 (Changes in Laws and Regulations) hereof. **These adjustments shall be applicable for all transactions between the Employer and the Contractor for supply of goods and services under the Contract but shall not be applicable on procurement of raw materials, intermediary components etc. by the Contractor and on account of variation in taxes, duties & levies applicable locally.** **In respect of raw materials, intermediary components etc and the taxes, duties & levies applicable locally, neither the Employer nor the Contractor shall be entitled to any claim arising due to increase or decrease in the rate of Tax, introduction of a new Tax or abolition of an existing Tax in the course of the performance of the Contract**.
13	**New Clause**	**Addition of New Clause :** **Approach Roads**

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		Access to the Site of Works shall be available before commencement of works. While efforts will be made to keep the approach roads open through-out the year, REC Power Development & Consultancy Limited (RECPDCL) shall not be responsible for any damage or loss suffered by the Contractor due to closure of the road(s) on account of landslides, weather conditions or any other reasons whatsoever
14	**New Clause**	**Addition of New Clause :** **LAND** The purchaser shall acquire only such piece of land as is actually required for each type of tower foundation. Any extra land required by the contractor for storage of tower material, conductor, line material etc. shall be the responsibility of the contractor.
15	**New Clause**	**Addition of New Clause :** **Training of the RECPDCL's & Consultant's Personnel** The Contractor shall in pursuance of provisions of technical specification or as specified elsewhere, provide free of charge adequate facilities for training any of employees of RECPDCL in the manufacturing works / at site.
16	**New Clause**	**Addition of New Clause :** **SITE ORDER BOOK** The Engineer-in-Charge shall maintain the site order book systematically and securely till completion of the Works. The site order book shall be available at the site during working hours. Orders regarding the Work as and when necessary shall be entered in this book by the Engineer-in-Charge or his representative with dated signatures in exercise of the powers vested in him, which orders shall be duly noted by the Contractor or his authorized agent with his dated signature. Order entered in this book and noted by the Contractor's agent shall be considered to have been duly given to the Contractor.
17	**New Clause**	**Addition of New Clause :** **FLOODS** • In case of floods resulting in flooding of the work areas, the Contractor shall make his own arrangements, at his own cost, to shift goods, all his plant, equipment and machinery, materials including if any, supplied / issued by the RECPDCL and labour to safe place. The work shall be resumed after receding of floods and dewatering the area. • The RECPDCL shall not be liable for any loss of or damage to the men, Contractor's plant, equipment, machinery works or materials on account of these floods and no compensation whatsoever, in this regard shall be paid to the Contractor.
18	**New Clause**	**Change in Laws and Regulations** If, after the date seven (07) days prior to the date of Bid Opening, any law, regulation, ordinance, order or by-law having the force of law is

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		enacted, promulgated, abrogated or changed in India (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently affects the costs and expenses of the Contractor and/or the Time for Completion, the Contract Price shall be correspondingly increased or decreased, and/or the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been affected in the performance of any of its obligations under the Contract. These adjustments shall be applicable for all transactions between the employer and contractor for supply of goods & services under the contract but shall not be applicable on procurement of raw material, intermediary component etc. by the contractor for which employer shall be the sole judge. . Notwithstanding the foregoing, such additional or reduced costs shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable.
19	**New Clause**	**PREFERENCE TO MAKE IN INDIA** The Bidders must conform to all the requirements under all applicable laws including any order issued by the central government including Order No No.9/16/2016-Trans-Part (2) dated 18 November 2020, Order No. F/No.6/18/2019-PPD by Ministry of Finance, Department of Expenditure, Public Procurement Division dated 23 July 2020, latest Government of India Guidelines for Make in India, Domestically manufactured products, Atmanirbhar Bharat and circulars DIPP Office Memorandum No. P-45021/2/2017-PP (BE-II) date:16th Sept. 2020, MeitY Circular No.1(10)/2017-CLES dated 06.12.2019 and Order No. 11/05/2018-Coord. by the Ministry of Power dated 17 September 2020 including any amendments or modifications to the same from time to time. Bidders will submit an notified undertaking signed by its authorised representative in the format provided with the bid document.
20	**GCC Clause 32. (vi)**	Supplementing GCC Clause 32. (vi) Percentage for the Change Proposal under this Clause shall be limited to Fifteen (15) percent.
21	**GCC Clause 32. (vi)**	Procedures for calculation of new rates • If the variation is beyond 125% of Contracted quantity of each contract item, the rates of deviated quantity beyond +25% shall be calculated as per market rate. Extra item • The contractor may within fifteen days of receipt of order claim rates, supported by proper analysis, for the work and the engineer-in-charge shall within one month of the receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and agree with the

SCC Clause No	GCC Clause Ref No	Additional Point in RECPDCL GCC
		contractor that extra items shall be paid in accordance with the rates so determined & mutually agreed. Substituted Items • In the case of substituted items (items that are taken up with partial substitution or in lieu of items of work in the contract), the rate for the agreement item (to be substituted) and substituted item shall also be determined in the manner as mentioned in the following Para: (a) If the market rate for the substituted item so determined is more than the market rate of agreement item (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted). (b) If the market rate for the substituted item so determined is less than the market rate of the agreement (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted). • Market Rates to be determined shall be on the basis of prevailing rates of Material excluding GST (unless mentioned otherwise), Relevant Labour authority rate for Labour, market rates of T&P etc. plus 15% towards Contractors' Profits and Overheads. The following factors may be considered in the justification of rates on which Contractor's overhead & profit shall not be applicable: Buildings and Other Construction Worker Cess as applicable in the state of workplace GST. • For rate analysis the factors in an item shall be considered as per rate analysis tables of CPWD (as and where applicable). The overall deviation including all the deviations shall be within the limit so specified in the special clause of the contract.

SECTION-VI, VOL-I
MODEL RULE FOR HEALTH & SANITARY ARRANGEMENTS FOR CONTRACTOR'S WORKMEN

SECTION - VI
MODEL RULES FOR HEALTH AND SANITARY ARRANGEMENTS FOR
CONTRACTOR'S WORKMEN

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SECTION-VI

MODEL RULES FOR HEALTH AND SANITARY ARRANGEMENTS FOR CONTRACTOR'S WORKMEN

1 APPLICATION

These rules shall apply to all buildings and erection works of REC Power Development and Consultancy Limited (RECPDCL).

2 DEFINITIONS

(i) "Work place"/or work site means a place at which, at an average 50 or more workers are employed, in connection with construction work.

(ii)"Large work place" or large work site means a place at which at an average 500 or more workers are employed in connection with construction work.

3 FIRST AID

(i) At every work place, there shall be maintained in a readily accessible place first aid appliance including an adequate supply of sterilized dressings and sterilized cotton wool. The appliances shall be placed in good order and in a large work place. They shall be placed under the charge of a responsible person who shall be readily available during working hours.

(ii) At large work places, where hospital facilities are not available within easy distance of the work, First Aid posts shall be established and run by trained compounders.

(iii) Where large work places are remote from regular hospitals, an indoor ward shall be provided with one bed for every 250 employees.

(iv) Where large work places are situated in cities/towns or in their suburbs and no beds are considered necessary owing to the proximity of city or town hospitals, suitable transport will be provided to facilitate removal of emergent cases to the hospitals. At other work places, some conveyance facilities such as car shall be kept readily available to take injured person(s) or person(s) suddenly taken seriously ill, to the nearest hospital.

4 DRINKING WATER

(i) In every work place, there shall be provided and maintained at suitable places, easily accessible to labour, a sufficient supply of cold water fit for drinking.

(ii) Where drinking water is obtained from an intermittent public water supply, each work place shall be provided with storage where such drinking water shall be stored.

(iii) Every water supply storage shall be at distance of not less than 15 metres from latrine, drain or any other source of pollution. Where water has to be drawn from an existing

well which is within such proximity of latrine, drain or any other source of pollution, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with trap door which shall be dust and water proof.

(iv) A reliable pump shall be fitted to each covered well, the trap door shall be kept locked and opened only for cleaning or inspection which shall be done at least once in a month.

5 WASHING AND BATHING PLACES

i) Adequate washing and bathing places shall be provided, separately for men & women.

ii) Such places shall be kept in a clean and drained condition.

6 LATRINES AND URINALS

There shall be provided within the precincts of every work place adequate number of latrines and urinals in an accessible place. If women are employed, separate urinals and latrines shall be provided for them. All these shall be cleaned regularly and kept in a sanitary condition.

7 DISPOSAL OF EXCRETA

Unless otherwise arranged for by the local sanitary authority, arrangements for proper disposal of excreta by incineration at the work place shall be made by means of a suitable incinerator approved by the local health officer or Engineer-in-Charge. Alternatively, excreta may be disposed of by putting a layer of night soil at the bottom of pucca tank prepared for the purpose and covering it with a 150mm layer of waste or refuse and then covering it up with a layer of earth for a fortnight (when it will turn into manure).

8 PROVISION OF SHELTER DURING REST

At every work place there shall be provided free of cost for the use of labour, two suitable sheds, one for meals and the other for rest.

9 CRECHES

At every work place, at which 50 or more women workers are ordinarily employed, there shall be provided a crèche for the use of children, belonging to such women.

10 CANTEEN

A cooked food canteen on a moderate scale shall be provided for the benefit of workers wherever it is considered expedient.

The above rules shall form an integral part of the contract.

SECTION-VII, VOL-I

CONTRACTOR'S LABOUR REGULATION

SECTION –VII

CONTRACTOR'S LABOUR REGULATIONS

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SECTION - V

CONTRACTOR'S LABOUR REGULATIONS

1 SHORT TITLE

These regulations may be called the "REC Power Development & Consultancy Limited", Contractor's Labour Regulations".

2 DEFINITIONS

In these regulations, unless otherwise expressed or indicated, the following words and expressions shall have the meaning hereby assigned to them respectively, that is to say:-

(i) "Labour" means workers employed by RECPDCL Contractor directly or indirectly through a sub-contractor or other persons or by an agent on his behalf but will not include supervisory staff like section officers, etc.

(ii) "Fair Wage" means wage whether for time or piece work notified at the time of inviting tenders for the work and where such wages have not been so notified, the wages prescribed by the RECPDCL for the area in which the work is done. Such wages will not be less than the minimum wages fixed by the Government of India for that class of employee engaged on the same type of work in the same area.

(iii) "Contractor" shall include every person whether a sub-contractor or head-man or agent, employing labour on the work taken on contract.

Normally working hours of a worker should not exceed 9 (Nine) hours a day. The working day shall be so arranged that inclusive of interval for rest, if any, it shall not spread over more than 12 (twelve)hours on any day.

3 DISPLAY OF NOTICE REGARDING WAGES, ETC.

The Contractor shall

(i) before he commences his work on Contract, display and correctly maintain and continue to display and correctly maintain in a clean and legible condition in conspicuous place on the work, notices in English and in Hindi and local language spoken by the majority of the workers, giving the rate of wages which have been certified by the Engineer-in-Charge as fair wage and the hours of work for which such wage are earned, and

(ii) Send a copy of such notices to the certifying office.

4 PAYMENT OF WAGES

(i) Wages due to every worker shall be paid to him direct.

(ii) Arrears claimed after 3 months after the completion of the Work shall not be entertained.

(iii) All wages shall be paid in current coin or currency or in both.

5 FIXATION OF WAGE PERIODS

(i) The Contractor shall fix the wage periods in respect of which the wages shall be payable.

(ii) No wage period shall exceed one month.

(iii) Wages of every worker employed on the contract shall be paid; (a) in the case of establishment in which wage period is one week within 3 days from the end of the wage period and (b) in the case of other establishments before the expiry of the 7th day or 10th day from the end of the wage period for the number of workers employed in such establishment not exceeding 1000 and exceeding 1000 respectively.

(iv) When the employment to any worker is terminated by or on behalf of the Contractor, the wages earned by him shall be paid before the expiry of the day succeeding the one on which his employment is terminated.

(v) All payments of wages shall be made on a working day except when the work is completed before the expiry of the wage period in which case final payment shall be made within 48 hours of the last working day at work site and during the working time.

6 WAGE BOOK AND WAGE SLIPS ETC

(i) The Contractor shall maintain a Wage Book of each worker in such forms as may be convenient at the place of works, but the same shall include the following particulars:

a Name of the worker.
b Rate of daily or monthly wages.
c Nature of work on which employed.
d Total number of days worked during each wage period.
e Dates and periods for which worked overtime.
f Gross wages payable for the work during each wage period.
g All deductions made from the wage with an indication in each case of the ground on account of which the deduction is made.
h Wages actually paid for each wage period
i Signature or thumb impression of the worker.

(ii) The Contractor shall also issue a wage slip containing the aforesaid particulars to each worker employed by him on the work at least a day prior to the day of disbursement of wages.

(iii) The Contractor shall also issue an "Employment Card" in the prescribed 'Form I' (attached) to each worker on the day of work or entry into his employment.

(iv) The Contractor shall issue an 'Attendance cum Wage Card' as per 'Form II' to each worker on the day of entry into his employment.

7 REGISTER OF UNPAID WAGES

The Contractor shall maintain a register of unpaid wages in such form as may be convenient at the place of work but the same shall include the following particulars.

i) Full particulars of the labourers whose wages have not been paid.
ii) Reference number of the muster roll and wage register.
iii) Rate of Wages.
iv) Wage period.
v) Total amount not paid.
vi) Reasons for not making payment.
vii) How the amount of unpaid wages was utilised.
viii) Acquaintance with dates.

8 REGISTER OF ACCIDENTS

The Contractor shall maintain a register of accidents in such form as may be convenient at the work place, but the same should include the following particulars.

i) Full particulars of the Worker(s) who met with accident.
ii) Rate of wages.
iii) Sex.
iv) Age.
v) Nature of accident and cause of accident.
vi) Time and date of accident.
vii) Date and time when admitted in hospital.
viii) Date of discharge from the hospital.
ix) Period of treatment and result of treatment.
x) Percentage of loss of earning capacity and disability assessed by medical officer.
xi) Compensation required to be paid.
xii) Date of payment of compensation.
xiii) Amount paid with details of the person to whom the same was paid.
xiv) Authority by whom the compensation was assessed.
xv) Remarks.

9 FINES AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES

i) The wages of a worker shall be paid to him without any deductions of any kind except the following:
   a) Fines
   b) Deductions for absence from duty i.e. from the place or the places where by the terms of his employment he is required to work. The amount of deduction shall be in proportion to the period for which he was absent.
   c) Deduction for damage to or loss of goods expressly entrusted to the employed person for custody, or for loss of money or any other deduction which he is required to account, where such damage or loss is directly attributable to his neglect or default.
   d) Deduction for recovery of advance or for adjustment of over payment of wages, advances granted shall be entered in a register.
   e) Any other deduction which the Jammu & Kashmir Power Development Department may from time to time allow.

ii) No fine shall be imposed on any worker except in respect of such acts and omissions on his part as have been approved of by the Engineer-in-Charge.

iii) No fine should be imposed on a worker and no deduction for damage or loss shall be made good from his wages until the worker has been given an opportunity of showing cause against such fines or deductions.

10 REGISTER OF FINES

i) The Contractor shall maintain a 'Register of Fines' and a 'Register of Deductions for Damages or Loss' in 'Form Nos. III & IV' respectively which should be kept at the places of work.

ii) The Contractor shall maintain both English and in the local language, a list approved by the Engineer-in-Charge clearly stating the acts and omissions for which penalty or fine may be imposed on a workman and display it in a good condition in a conspicuous place on the work.

11 PRESERVATION OF REGISTER

The wage book, the wage slips, register of unpaid wages, the register of accidents, the register of fines, deduction required to be maintained under these regulations shall be preserved for 12 months after the date of last entry made in them and shall be made available for

inspection by the Engineer-in-Charge, labour officer or any other officer authorised by the RECPDCL on their behalf.

12 POWERS OF LABOUR WELFARE OFFICERS TO MAKE INVESTIGATION OR ENQUIRY

The Labour Welfare Officer or any other person authorised by the Indian ***Govt.*** on their behalf shall have power to make enquiries with a view to ascertaining and enforcing due and proper observance of the fair wage clause and the provisions of these regulations. He shall investigate into any complaint regarding the default made by the contractor or sub-contractor in regard to such provision.

13 REPORT OF LABOUR WELFARE OFFICER

The labour welfare officer or other persons authorised as aforesaid shall submit a report of result of his investigation or enquiry to the Engineer-in-Charge concerned indicating the extent, if any, to which the default has been committed, with a note that necessary deductions from the contractor's bill be made and the wages and other dues be paid to the labourers concerned. In case an appeal is made by the contractor under **para 14** of these regulations actual payment to labourers will be made by the Engineer-in-charge or authorised agent after RECPDCL has given its decision on such appeal.
The Engineer-in-Charge shall arrange payments to the labourers concerned within 45 days from the receipt of the report form the labour welfare officer.

14 APPEAL AGAINST THE DECISION OF LABOUR WELFARE OFFICER

Any person aggrieved by the decision and recommendations of the Labour Welfare Officer or other person so authorised may appeal such decision to the labour court, within 30 days from the date of decision. The decision of the labour cour***t*** shall be final and binding upon the Contractor and RECPDCL as the case may be.

15 INSPECTION OF BOOKS AND SLIPS

The Contractor shall allow inspection of the wage books and the wage slips, register of unpaid wages, register of accidents, the register of fines and deductions to any of his workers or to his agent at convenient time and place after due notice is received or to the Labour Welfare Officer or any other persons, authorised by Engineer-in-Charge on his behalf.

16 SUBMISSION OF RETURNS

The Contractor shall submit periodical returns as may be specified from time to time.

17 AMENDMENTS

RECPDCL may from time to time add to or amend the regulations and on any question as to the application, interpretation or affect of those regulations, the decision of the Engineer-in-Charge or of his authorized representative shall be final.

FORM – I
EMPLOYMENT CARD REGULATION

Name & Sex of the worker.

Age or date of birth.

Father's name

Identification marks

.(Particulars of next of kin ,wife and children, if any or of dependent next to kin in case the worker has no wife or child)

Name ……..

Full address of dependents

(Specify village, district and state).

Sl.No	Name and address of employer (Specify whether a contractor or Sub-contractor).	Particulars of location work site and description of work done	Total period for which the worker is employed (From……..to……)	Actual number of days worked	Leave taken (Number of days Should be Specified)
1	2	3	4	5	6

(BACK SIDE OF THE CARD)

Nature of work done by the workers	Wage period	Wage rate (with particulars of unit in case of piece work)	Total wage earned by the worker during the period Shown under column(5)	Remarks	Signature of the employer
7	8	9	10	11	12

FORM – II

ATTENDANCE –CUM-WAGE CARD

Card No. ……..

Name of Contractor……..

Name of work……...

Name of worker……

Address……

Designation……...

Rates of wages ……

Dates	Attendance	Signature of person marking attendance	REMARKS
1. 2. 3. 4. 5. etc.			

(ON THE BACK SIDE OF CARD)

Wage period	Date on which overtime Worked	Gross wage payable	Deductions if any.	Actual Wages paid	Date of payment	Signature of the Worker

FORM – III
REGISTER OF FINES

Sl. No.	Name	Father' s/ Husband' s Name	Sex	Department	Nature and Date of the offence for which fine imposed	Whether worker showed cause against Fine or not, if so, enter date.	Rate of Wages	Date and amount of fine Imposed	Date on which Fine Realised	Remarks
1	2	3	4	5	6	7	8	9	10	11

FORM – IV

REGISTER OF DEDUCTIONS FOR DAMAGES OR LOSS

Sl. No.	Name	Father' s/ Husband' s Name	Sex	Department	Damage or loss caused with date	Whether worker showed cause against deduction if so, enter date.	Date and amount of deduction Imposed	Number of install-ment, if any	Date on which total amount Realised	Remarks
1	2	3	4	5	6	7	8	9	10	11

SECTION-VIII, VOL-I

SAFETY REGULATIONS

SECTION - VIII

SAFETY PRECAUTIONS

1 Suitable scaffolds shall be provided for workmen for all Works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used, an extra workman shall be engaged for holding the ladder. If the ladder is used for carrying materials as well, suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than 0.25 to 1 (0.25 horizontal and 1 vertical).

2 Scaffolding or staging more than 3.6 m above the ground or erected floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise secured at least 0.9 m high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such opening as may be necessary for the delivery of the materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying f**ro**m the structure.

3 Working platform, gangways and stairways shall be so constructed that they do not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.6 m above ground level or floor level, they shall be closely boarded, and shall have adequate width and shall be suitably fastened.

4 Every opening in the floor of a structure or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 0.9 m. Employees working on steep slopes or otherwise subject to possible falls from levels not protected by guardrails or safety nets, shall be secured by safety belts.

5 Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9.0 m in length while the width between side rails in hung ladder shall, in no case, be less than 28 cm. for ladder upto and including 3.0 m in length. For longer ladders, this width shall be increased at least by 6 mm for each additional 30 cm of length. Uniform step spacing shall not exceed 30 cm. Adequate precautions shall be taken to

prevent danger f***ro***m electrical equipment. No materials on any of the Sites of Work shall be so stacked or placed as to cause danger or inconvenience to any person or the public.

6 EXCAVATION AND TRENCHING

All trenches, 1.2 m or more in depth, shall, at all times, be supplied with at least one ladder for each 30 metres length or fraction thereof. Ladder shall be extended form bottom of the trench to at least 0.9 m above the surface of the ground. The side of the trenches which are 1.5 m or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides to collapse. The excavated materials shall not be placed within 1.5 m of the edges of the trench or half of the depth by the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.

7 DEMOLITION

Before any demolition work is commenced and also during the process of the work:

(i) All roads and open areas adjacent to the site shall either be closed or suitably protected.

(ii) No electric cable or apparatus which is liable to be a source of danger over a cable or apparatus used by the operator shall remain electrically charged.

(iii) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the structure shall be overloaded with debris or materials as to render it unsafe.

8 All necessary personal safety equipment as considered adequate by the Engineer-in-Charge shall be kept available for the use of the persons employed on the Site and maintained in condition suitable for immediate use, and the Contractor shall take adequate steps to ensure proper use of equipment by those concerned.

(i) The Contractor shall provide rubber gauntlets, gloves, mats, boots and galoshes, insulated platform and stools, safety belts, hand lamps, tower

wagons and other special insulated devices as required for working on electrical equipment and apparatus.

(ii) Workers employed on mixing asphaltic materials, cement mortar and cement concrete shall be provided with protective footwear and protective goggles.

(iii) Those engaged in mixing or stacking of cement bags or any materials which is injurious to eyes shall be provided with protective goggles.

(iv) Those engaged in welding Works shall be provided with welder's protective eye shields.

(v) Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

(vi) The Contractor shall not employ any person **below the age of 18 years**. Whenever a person above the age of 18 years is employed on the work of lead painting, the following precautions shall be taken:-

(a) No paint containing lead, sulphate of lead or product containing their pigments shall be used except in the form of paste or readymade paint.

(b) Suitable face masks shall be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.

(c) Overalls shall be supplied by the Contractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of Work.

(d) Measures shall be taken, whenever required, in order to prevent danger arising from the application of a paint in the form of spray.

(e) Measures shall be taken, whenever practicable, to prevent danger arising out from dust caused by dry rubbing down and scrapping.

(f) Suitable arrangements shall be made to prevent clothing put off during working hours, being spoiled by painting materials.

(g) Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by a medical officer appointed by the competent authority.

(h) The contractor, when necessary, shall arrange for medical examination of workers and same shall be monitored by medical officer appointed by competent authority.

(i) Instructions with regard to special hygienic precautions to be taken in the painting trade shall be distributed to working painters.

(vii) The Contractor shall observe all safety precautions to control the noise on all Sites and also provide all workmen deployed in the affected areas with the necessary equipment for safety against noise.

9 When the Work is done near any place where there is risk of drowning, all necessary equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision shall be made for prompt first aid treatment of all injuries likely to be sustained during the course of the Work.

10 Use of hoisting machines and shackle including their attachments, anchorage and supports shall conform to the following standards or conditions:

(i) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defect and shall be kept in good working order.

(ii) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength and free from patent defects.

(iii) Every crane driver or hoisting appliance operator shall be properly qualified for his job.

(iv) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gears referred to above shall be plainly marked with the safe working load.

In case of hoisting machine having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing. The capacity of the hoisting machines shall be periodically checked.

(v) The Contractor shall notify the safe working load of the machines to the Engineer-in-Charge whenever he brings any machinery to Site of work and gets it verified by the Engineer-in-Charge or his representative.

11 Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguards.

Hoisting appliances shall be provided with such means as shall reduce to the minimum, the risk of any part of a suspended load becoming accidentally displaced. When workmen are employed on or near electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boot, as may be necessary, shall be provided. The workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

12 All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe conditions and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities shall be provided at or near places of Work.

13 These safety provision***s*** shall be brought to the notice of all concerned by display on a notice board at a prominent place on the Site. The person responsible for compliance of the safety code shall be named therein by the Contractor.

14 To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangements made by Contractor shall be open to inspection by the Labour officer /or the Engineer-in-Charge.

15 In addition to above, the Contractor shall take the following specific precautions for the Underground Works.

(i) All precautions regarding safety of personnel working in tunnels/caverns/shafts, in connection with the handling of electrical installations, loading, blasting and seepage water etc. as specified in the relevant stipulations of IS codes shall be taken by the Contractor in order to ensure safe underground working. He shall also provide adequate medical, drinking water, sanitation, lighting and ventilation facilities.

(ii) Emergency material shall be provided at each underground excavation heading

This equipment shall include, but not be limited to the following:

- 3 stretchers
- 3 woolen blankets
- 2 appliances for artificial breathing
- 1 oxygen flask
- 3 explosion-proof lamps
- wound dressing and disinfection material
- anti-pain injections
- gas masks

(iii) At least two members of the Rescue Team as described hereinafter, properly instructed and trained in the rescue procedures, shall be in each crew working underground.

(iv) Prior to the commencement of construction, the Contractor shall organize and train a Rescue Team composed of his employees. This Rescue Team shall be capable to render help after accidents caused by fire, gas explosion and avalanche etc.

(v) The Rescue Team shall be organized in such a way that sufficient numbers of members are ready for action at any time until the Completion of Work.

(vi) The Rescue Team members shall be instructed and trained for their task by a qualified and experience person. If required, the Contractor shall hire an outside specialist to perform such training. A refresher training for all members of the Rescue Team shall be conducted at least every six months.

(vii) Each Rescue Team member shall be skilled in giving the first aid, dealing with the appliances for artificial respiration and fire fighting equipment and shall possess a good local knowledge. Adequate equipment for reaching even the remotest working area shall be at their disposal.

(viii) The Contractor shall submit the details of the proposed Rescue Team organization to the Engineer-in-Charge for approval.

16 The Contractor shall at all times exercise reasonable and proper precautions for the safety of the people on the Works and shall comply with the provisions of current safety law and building and construction codes as may be applicable. All machinery and equipment and other sources of physical hazards shall be properly guarded. The Contractor shall have a full time staff exclusively in charge of securing the safety of the Work ensuring that all safety regulations are followed and in charge of indoctrination and teaching course on safety to the work force.

17 The Contractor shall provided all necessary fencing and lights to protect the public from accidents and shall be bound to bear all the expenses of defence of every suit, action and other proceedings at Law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any such suit, action and proceedings to any such persons or which may, with the consent of the Contractor, be paid to compromise any claim by any person.

18 About his employees, the Contractor shall ensure as follows:

(i) Each employee shall be provided initial indoctrination regarding safety by the Contractor so as to enable him to conduct his Work in a safe manner.

(ii) No employee shall be given a new assignment of work unfamiliar to him without proper introduction as to the hazardous incident thereto, both to himself and his fellow employees.

(iii) Under no circumstances shall an employee hurry or take unnecessary chances when working under hazardous conditions.

(iv) Employees shall not leave naked fires unattended. Adequate fire fighting equipment shall be provided at crucial locations.

(v) Employees under the influence of any intoxicating beverage, even to the slightest degree, shall not be permitted to remain on Work.

(vi) There shall be suitable arrangement on every site for rendering prompt and sufficient first aid to the injured.

(vii) The stair cases and passage ways shall be adequately lighted.

(viii) The employees, when working around moving machinery, shall not be permitted to wear loose garments. Safety shoes are recommended when working in shops or places where materials or tools are likely to fall.

Only experienced workers shall be permitted to go behind guard rails or to clean around energized or moving equipment.

(ix) The employees shall use the standard protection equipment intended before and after it is used.

19 The following precautions shall be taken for fire prevention:

(i) All construction areas and storage yards shall be kept clean and well arranged.

(ii) A clear space of 15 metres around the outer boundary of saw mill and lumber storage area may be provided. All lumber shall be stored in sections with fire breaks with a distance of 15 metres between consecutive section.

(iii) All combustible waste material, wood scalings and soiled rags etc shall be removed daily and burnt in suitable burning area. The saw mill and lumber yard shall be kept free form accumulation of combustible debris.

(iv) Fires, welding, flame cutting shall in general not be permitted in combustible area. Fires and open flame devices shall not be left unattended.

(v) Smoking shall be prohibited in all fire prone areas, flammable material storages viz. Carpentry, paint shops, garrages, service stations etc. "No smoking" signs shall be pasted on all such areas.

(vi) Accumulations of flammable liquids on floors, walkways etc. should be prohibited. All spills of flammable liquids shall be cleaned up immediately.

(vii) Smoke pipes from Diesel Engines passing through roof of combustible material e.g. in compressor stations on various Sites shall be insulated by asbestos. All joints of smoke pipe shall be riveted, welded or otherwise securely fastened together and supported to prevent accidental displacement or separation. The joints shall not be leaky.

(viii) Flammable liquids, lubricants etc. shall be handled and transported in safety containers and drums which can be kept tightly capped.

(ix) Storage of fuels and other flammable materials and liquids shall be set not less than 100 m away from the Works and permanent installations. All storage installations and tanks shall conform to the regulations set out in relevant Indian Standards.

(x) Petrol or other flammable liquids with a flash point below 100 degrees Centigrade shall not be used for cleaning purpose.

(xi) Oxygen cylinders shall not be stored with combustible materials.

(xii) All electric installation shall be properly earthed. Repairs shall not be made on electrical circuits until the circuit has been de-energized.

20 THE FOLLOWING FIRE FIGHTING ARRANGEMENTS SHALL BE MADE BY THE CONTRACTOR:

(i) Fire extinguishers and fire buckets filled with clean dry sand, painted red, shall be provided at all fire hazardous locations viz. Bathing and Mixing Plant, Winch houses, Workshops, store yards, Saw-mill, Switch Gear Room, Compressor Stations, Office establishments etc. The extinguishers shall be inspected, serviced and maintained in accordance with manufacturer's instructions. The inspection shall be evidenced by notations on tag attached to the extinguisher.

(ii) Full reliance shall never be placed on portable hand extinguishers as all of these have a very limited capacity. Water, in ample quantity and under adequate pressure, shall always be available for fire fighting.

(iii) Where a group of work points are located beyond the range of protection from a public water supply, the installation of a water system for private fire protection shall be warranted.

(iv) Evacuation facilities and fire exit shall be provided at all locations featuring fire hazards.

(v) Siren or other suitable fire alarm arrangement shall be made on all Sites. Warning signs shall be pasted at all locations having fire hazards.

(vi) All staff shall be conversant with the use of all type of fire extinguishing apparatus.

(vii) In the event of fire on electrical mains or apparatus, the effected part shall immediately be completely isolated from its source of supply of electrical energy.

(viii) Demonstrations and training in fire fighting shall be conducted at sufficient intervals to ensure that sufficient personnel are familiar with and are capable of operating fire fighting equipment.

21 When any work is carried on, which is likely to affect the security or stability of an installation or structure or any part thereof and endanger any person employed, all practicable precautions shall be taken by shoring or otherwise to prevent collapse of

structure or fall of any part thereof and thus remove the cause of danger to such structures and the persons employed.

22 For persons engaged in handling of corrosive materials, adequate equipment shall be provided.

23 Where, in connection with any grinding, cleaning, spraying or manipulation of any material, there is emission of dust or fume of such character and to such extent as is likely to be injurious to the health of persons employed, all practical measures shall be taken by securing adequate ventilation or by the provision and use of suitable respirators or otherwise to prevent inhalation of such dust and fume.

24 The Contractor shall strictly follow the safety procedures & practices as mentioned in Indian standard IS5216-1982 "Guide for Safety Procedure & Practices in Electrical Work" during the execution of this Contract. In this regard the under J&K Electricity rules 1978 shall also be applicable to the Contractor to fulfill the safety precaution for workmen and Plant.

25 In addition to instructions contained here-in-above the safety regulations contained in the following IS Codes shall also apply wherever the provisions in the codes are exhaustive in nature.

i)	IS:4756-1978 (Reaffirmed 1991)	Safety Code for Tunneling Work
ii)	IS: 3696-1987 (Part-I) (Reaffirmed 1991)	Safety Code of Scaffolds & Ladders (Pt. I Scaffolds)
iii)	IS: 3696-1991 (Part-II)	Safety Code of Scaffolds & Ladders (Pt. II Ladders)
iv)	IS: 3016-1982 (Reaffirmed 1990)	Fire precaution in welding and cutting operations
v)	IS - 5216-1982 Part 1 & 2 (Reaffirmed 1990)	Guide for Safety procedures and Practices in Electrical work Part 1 – General Part-2 – Life saving techniques

26 Notwithstanding the above provisions, the Engineer-in-Charge may require the Contractor to follow any other Act or Rules in force in J&K in respect of Safety Precautions so as to ensure the safety of the Workmen and the Plant and the Contractor shall promptly comply with such requirements.

SECTION – IX

SAMPLE FORMS AND PROCEDURES (FORMS)

SAMPLE FORMS AND PROCEDURES (FORMS)

Preamble

This Section (Section –IX) of the Bidding Documents [named as Sample Forms and Procedures (FORMS)] provides proforma to be used by the bidders at the time of their bid preparation and by the Contractor subsequent to the award of Contract.

The Bidder shall complete, sign and submit with its bid the relevant FORMS to be used unamended, in accordance with the requirements included in the Bidding Documents.

The Bidder shall provide the Bid Security, either in the form included hereafter or in another form acceptable to the Employer, pursuant to the provisions in the instructions to Bidders.

The Form of Contract Agreement shall be used unamended, except for the need to complete Article 1.1 (Contract Documents), as appropriate and as may be required to suit the specific requirement of the Contract. The form shall also include the Appendices listed, as required, which should be completed according to the instructions for their completion provided at the beginning of each Appendix. The Price Schedule deemed to form part of the contract shall be modified according to any corrections or modifications to the accepted bid resulting from price corrections, pursuant to the provisions of the Instructions to Bidders.

The Performance Security (ies) and Bank Guarantee for Advance Payment forms should not be completed by the bidders at the time of their bid preparation. Only the successful Bidder will be required to provide the Performance Security(ies) and Bank Guarantee for Advance Payment, according to one of the forms indicated herein or in another form acceptable to the Employer and pursuant to the provisions of the General and Special Conditions of Contract, respectively.

Depending on specific facts and circumstances related to the Bid, other specific agreement, if any, and the contract, the text of the Forms herein may need to be modified to some extent. The Employer reserves the right to make such modifications in conformity with such specific facts and circumstances and rectify and consequent discrepancies, if any. However, modifications, if any, to the text of the Forms that may be required in the opinion of the Bidder/Contractor shall be effected only if the same is approved by the Employer. The Employer's decision in this regard shall be final and binding.

1. BID FORMS AND PRICE SCHEDULES

1.1 Bid Form

Please see Volume – III.

1.2 Price Schedule

Please see Volume - III

2. BID SECURITY FORM

((To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper should be in the name of the issuing Bank. ***For the purpose of verification/confirmation of this Bank Guarantee by the Employer, the Bank shall indicate 2 official email ids of the authorized signatories from Issuing Branch and also of the designated higher office (Corporate Office, Zonal Office etc)in the covering letter of the Bank forwarding the Bank Guarantee.****)*

Bank Guarantee No.: .....
Date: .....

To: *(insert Name and Address of Employer)*

WHEREAS M/s. .... *(Insert name of Bidder)……* having its Registered/Head Office at ….. *(Insert address of the Bidder)* ……. (Hereinafter called "the Bidder") has submitted its Bid for the performance **of the Contract for ……..(*** ***insert name of the Package*** **) …….. under ……..(*** ***insert Specification No*** **)…….** (Hereinafter called "the Bid")

KNOW ALL PERSONS by these present that WE …….. *(insert name & address of the issuing bank)* ……. having its Registered/Head Office at …….*(insert address of registered office of the bank)*…….. (hereinafter called "the Bank"), are bound unto ……*(insert name of Employer)…..* (hereinafter called "the Employer") in the sum of .....*(insert amount of Bid Security in figures & words)*..... ..... for which payment well and truly to be made to the said Employer, the Bank binds itself, its successors and assigns by these presents.

Sealed with the Common Seal of the said Bank this ..... day of ..... 20....

THE CONDITIONS of this obligation are:

(1) If the Bidder withdraws its bid during the period of bid validity specified by the Bidder in the Bid Form; or

(2) In case the Bidder does not withdraw the deviations proposed by him, if any, at the cost of withdrawal stated by him in the bid and/or accept the withdrawals/rectifications pursuant to the declaration/confirmation made by him in Attachment – Declaration of the Bid; or

(3) If the Bidder does not accept the corrections to arithmetical errors identified during preliminary evaluation of his bid pursuant to ITB Clause 27.2; or

(4) If, as per the requirement of Qualification Requirements the Bidder is required to submit a Deed of Joint Undertaking and he fails to submit the same, duly attested by Notary Public of the place(s) of the respective executants (s) or registered with the Indian Embassy/High Commission in that Country, within ten days from the date of intimation of post – bid discussion; or

(5) In the case of a successful Bidder, if the Bidder fails within the specified time limit

(i) To sign the Contract Agreement, in accordance with ITB Clause 34, or

(ii) To furnish the required performance security, in accordance with ITB Clause 35.
or

(6) In any other case specifically provided for in ITB.

WE undertake to pay to the Employer up to the above amount upon receipt of its first written demand, without the Employer having to substantiate its demand, provided that in its demand the Employer will note that the amount claimed by it is due to it, owing to the occurrence of any of the above-named CONDITIONS or their combination, and specifying the occurred condition or conditions.

This guarantee will remain in full force up to and including ……. *(insert date, which shall be the date 30 days after the period of bid validity)……..*, and any demand in respect thereof must reach the Bank not later than the above date.

Notwithstanding anything contained herein:

1. **Our liability under this Bank Guarantee shall not exceed _____ (*value in figures*)_____ [_____ (*value in words*)_____].**

2. **This Bank Guarantee shall be valid upto _____*(validity date)*_____.**

3. **We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only & only if we receive a written claim or demand on or before _____ (*validity date*) _____**

For and on behalf of the Bank

[*Signature of the authorised signatory(ies)*]

Signature_____

Name_____

Designation_____

POA Number_____

Contact Number(s): Tel._____Mobile_____

Fax Number_____

email _____

Common Seal of the Bank_____

Witness:

Signature_____

Name_____

Address_____

Contact Number(s): Tel._____Mobile_____

email _____

Note:

1. Normally EMD shall be submitted only in the name of the JV and not in the name of constituent member. However, in exceptional cases, EMD in the name of lead partner can be accepted subject to submission of specific request letter from lead partner stating the reasons for not submitting the EMD in the name of JV and giving written confirmation from the JV partners to the effect that the EMD submitted by the lead partner may be deemed as EMD submitted by JV firm.

2. The Bank Guarantee should be in accordance with the proforma as provided. However, in case the issuing bank insists for additional paragraph regarding applicability of ICC publication No: 758, the following may be added at the end of the proforma of the Bank Guarantee [*i.e., end paragraph of the Bank Guarantee preceding the signature(s) of the issuing authority(ies) of the Bank Guarantee*]:

   "This Guarantee is subject to Uniform Rules for Demand Guarantee, ICC publication No. 758."

3a. FORM OF NOTIFICATION BY THE EMPLOYER TO THE BANK
(Applicable for Forfeiture of Bank Guarantee)

To: *(insert Name and Address of the issuing Bank)*

Ref..: Forfeiture of Bid Security Amount against Bank Guarantee No. …… ……. dated …… for ……., issued by you on behalf of M/s. ……*(insert name of the Bidder)* ……..

Dear Sirs,

Please refer to the subject Bank Guarantee executed by you in our favour for …….. as Bid Security for the bid submitted by M/s. ……*(insert name of the Bidder)* …….. against ….. *(insert name of the Package)* ……. ; Specification No. ……..

As per the terms of the said guarantee, the bank has guaranteed and undertaken to pay immediately on demand by the Employer the amount of …….. without any reservation, protest, demur and recourse. Further, any demand made by the Employer shall be conclusive and binding on the Bank irrespective of any dispute or difference raised by the Bidder.

In terms of the said guarantee, we hereby submit our claim/demand through this letter for remittance of Bid Security amount to …. *(insert name of the Employer)* …….. owing to the occurrence of the condition referred to at Sl. No. …….. The Bank is requested to remit the full guaranteed sum …….. towards proceeds of the bid security in the form of Demand Draft in favour of '…. *(insert name of the Employer)* ……..', payable at ….*(insert place of the Employer)*….'.

Thanking you,

For.....(Name of the Employer)

(AUTHORISED SIGNATORY)

Copy to:
…..(Registered Office of the Bank)….

3b. FORM OF NOTIFICATION BY THE EMPLOYER TO THE BANK
(Applicable for conditional claim pending extension of Bank Guarantee by the Bidder)

To: *(insert Name and Address of the issuing Bank)*

Ref..: Conditional Claim against Bank Guarantee No. …… …….. dated ……. for …….. valid up to ……. issued by you on behalf of M/s. ……*(insert name of the Bidder)* ……..

Dear Sirs,

Please refer to the subject Bank Guarantee executed by you in our favour on behalf of M/s. ……*(insert name of the Bidder)* ……., who have submitted this Bank Guarantee to us towards Bid Security against ….. *(insert name of the Package)* ……. ; Specification No. ……..

We, ……. *(insert name of the Employer)* ……. do hereby request you to lodge our claim/demand against the subject Bank Guarantee for full guaranteed sum. Kindly note that this claim/demand against the subject Bank Guarantee is without any further notice in case the amendment to Bank Guarantee No. …….. dated ……. extending its validity upto …….. is not got arranged by ……*(insert name of the Bidder)* ……. in our favour and are not received by us upto ……. In such an event you are requested to remit the full guaranteed amount in terms of the subject guarantee in its letter and spirit and proceeds of this Bank Guarantee shall be forwarded to us in form of demand draft in favour of '…. *(insert name of the Employer)* ……., payable at ….*(insert place of the Employer)*….'.

This is without prejudice to our right under this guarantee and under the law.

Thanking you,

For.....(Name of the Employer)

(AUTHORISED SIGNATORY)

Copy to:
(insert Name and Address of the Bidder)

- You are requested to do the needful so that the amendment to the subject Bank Guarantee extending the validity up to …….. is received by us by ……..

4. FORM OF CONTRACT AGREEMENT
(On non-judicial stamp paper of appropriate value)

THIS AGREEMENT MADE the……day of……2020, AMONG, Chief Engineer, JKPTCL, (herein after called "the owner") and HoD Transmission, RECPDCL, (herein after called "the Employer") and …… having its registered office at…… (hereinafter called "the Contractor") of the other part.

WHEREAS the JKPTCL is desirous that certain goods and services contained in the Package designated as Turnkey Contract Package No CE/S&J/J……in the bidding document viz. **"**Turnkey project including **"_____(Name of the Works)** at Jammu province should be provided and has by a letter of Award no. ……dated……..accepted the offer Submitted by the Contractor for the Supply of Goods and Carrying out the services.

NOW THIS AGREEMENT WITHNESSETH as follows;

In this agreement words and expressions shall have the same meanings as are respectively assigned to them in conditions of Contract hereinafter referred to.

1. The following documents shall be deemed to form and be read and construed as part of this Agreement viz.
    a. The Contract Agreement No. CE/C&S/J
    b. The Letter of Award issued under RECPDCL letter no……..dated……..
    c. Document No. 1 containing price schedule for supply and erection of material.
    d. Document No.2 contain the General technical specification and the specific technical requirements of the project.
    e. Document No. 3 containing invitation for bids, Instruction to Bidders, Introduction and Background, General Terms and Conditions of Contract, Technical Specifications.
    f. Document No. 4 contain forms and schedules

2. The aforesaid documents shall be taken as complementary and mutually explanatory of one another, but in case of ambiguities or discrepancies, shall be take precedence in the order set out above.
3. In consideration of the payments to be made by the RECPDCL to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the RECPDCL to provide goods and services and remedy defects therein conformity, in all respects, with the provisions of the Contract.
4. The RECPDCL hereby covenants to pay the Contractor, in consideration of the provisions of goods and services and remedying defects therein and completion of the Works, the Contract Price at the times and in the manner prescribed by the Contract.
5. The contract price in respect of this contract shall be Rs……..(Rupees……) as detailed in Letter of Award dated……

6. The RECPDCL hereby covenants to pay the contractor, in consideration of the execution and completion of the works, the contract price at the times and in the manner prescribed by the contract.
7. The assets created shall be handed over to the owner after successful completion of the project and all the obligation of the contractor, not only limited to defect and liability shall be transferred to the owner of the project.

IN WITNESS whereof the parties hereto have caused their respective common seals to be hereunto affixed (or have hereunto set their respective hands and seals) the day and the year first above written.

SIGNED, SEALED AND DELIEVERED

By the said……..	**By the said……..**	**By the said……..**
NAME……..	**NAME……..**	**NAME……..**
On behalf of the Owner	**On behalf of the Employer**	**On behalf of the Contractor**
In the presence of:	**In the presence of:**	**In the presence of:**
NAME……..	**NAME……..**	**NAME……..**
ADDRESS	**ADDRESS**	**ADDRESS**

4.1 PROCEDURES OF PAYMENT

In accordance with the provision of GCC clause 33 (Terms of Payment), the Employer shall pay the Contractor in the following manner and at the following times, on the basis of the Price Breakdown given in the section on price schedules. Payments will be made in the currencies quoted by the Bidder unless otherwise agreed between the parties. The Contractor may make applications for payment in respect of part deliveries as work proceeds.

1. TERMS OF PAYMENT

In addition to the condition stipulated under GCC clause 33, the following terms & Conditions will apply

1.1 Supply Portion

A. Interest Bearing Advance (Optional*): Ten percent (10%) of the Ex-works price component of Main Equipment/Materials (including Mandatory Spares) shall be paid as an interest bearing initial advance after signing the Contract Agreement and on submission of (a) **Proforma** invoice(**s**), (b) **Advance Bank Guarantee for [{110% (one hundred ten percent) of the amount of Advance} Plus {amount of GST reimbursable on Advance as per the Proforma invoice(s)}]**, in line with GCC Clause 33.1.2 Performance Securities in line with GCC Clause 9 and (d) Detailed PERT Network/Bar chart and its approval by the Employer. **Provided further that the Proforma Invoice(s) for advance payment along with all supporting documents is submitted by the Contractor to the Employer within 3 months from the date of Notification of Award. In case the Contractor does not submit the requisite documents including applicable Bank Guarantee(s)/Security(ies) within the aforesaid period, the advance shall not be payable. The Contractor shall, within 7 days from the date of receipt of Advance, furnish an Advance Receipt Voucher to the Employer, as prescribed under the GST Law.**

Note: * This payment is an optional payment. The Contractor has the option of taking the interest bearing initial advance or otherwise.

Interest rate applicable on advance payment to the Contractor shall be 200 Basis Points (BPS) above the MCLR [One Year Tenor rate p.a.] published by State Bank of India prevailing as on the date of drawal of advance. The said interest rate shall remain fixed and shall be applicable till the advance amount is fully repaid. The interest will be charged considering proportionate adjustment of advance against progressive payment as per 1.1 (B.1) below. The interest shall be calculated on daily progressive balances outstanding as on the date of recovery/adjustment. It is the Employer's understanding that as per extant provisions, GST is not payable on interest paid on the amount of Advance. The Contractor is, however, advised to check the position from their own sources. If payable, the same shall be to the Contractor's account and Employer shall not reimburse any GST on this account.

Further, the Contractor shall submit the certificate of Tax Deduction at Source (TDS) on interest within 3 months from the end of the quarter in which adjustment of advance has been made for claiming refund from Employer. No claim for refund will be entertained after end of the aforesaid period of 3 months. Further, while submitting the TDS Certificate the details of Contract No, Project, Region, Quarter etc to which the TDS certificate pertains, shall also be submitted tallying the amount with the TDS Certificate.

In case, the Contractor opts not to take interest bearing advance as above, it would be mandatory for him to submit the documents listed at Sl. No. (c), and (d) above within twenty eight (28) days of issuance of NOA.

(The above is to be incorporated in case the Contractor has opted for the interest bearing initial advance, as declared by it in its bid in the relevant Attachment to Bid Form).

B. It would be mandatory for contractor to fulfill the following conditions mentioned at as per terms & conditions of Contract and agreed work schedule:

a) Approval of all designs, drawings & guaranteed technical particulars as identified in Technical Specifications, Volume-II of the Bidding Documents.
b) Approval of all quality plans and sub-vendor list.
c) Approval of type test reports in case type tests are not required to be repeated.

C Progressive Payment

Payment of the Ex-works price of Main Equipment/ materials (including Mandatory Spares) for each consignment shall be made progressively on certification of the Employer and on the basis of work performed using the following guidelines:

C.1 **Sixty percent (60%)^** payment of the: (i) Ex-works price of Main Equipment/ materials (*including Mandatory Spares*) for **each consignment for substation portion**; (ii) Ex-Works price component ***for the fabricated tower parts/tower (for transmission line portion)***
And

Eighty percent (80%)^ payment of the Ex-works price component of all items of transmission line portion excluding that of fabricated tower parts/ towers, shall be made progressively;

On successful completion of inspection and testing of the materials/items, as applicable, dispatch of the same and on submission of documents indicated hereinunder:

(a) Evidence of dispatch (R/R or receipted L/R)
(b) Contractor's **GST invoice**, **claim** & packing list identifying contents of each shipment.
(c) Insurance policy/certificate
(d) Manufacturer's/Contractor's guarantee certificate of Quality.
(e) Material Inspection Clearance Certificate (MICC) for dispatch issued by the Employer's representative.
(f) Test certificate
(g) the details of items, components, raw materials, services etc. procured/availed from MSEs, if any, for the preceding 6 months, in respect of all the contracts in the respective executing Region of RECPDCL as per format enclosed at Section IX, Forms, Volume-I of the bidding documents.

The payment of fabricated tower parts/towers shall, however, be made on completed tower basis on certification by the Employer.

^ In case, the Contractor opts not to take interest bearing initial advance **or has opted to take interest bearing initial advance but the advance payment has become inadmissible for the reason specified in 1.1(A) above**, then this payment shall be 70% instead of 60% for substation portion & transmission line tower & tower parts portion and 90% instead of 80% for all items of transmission line portion excluding that of fabricated tower parts/ towers.

C.2 Twenty percent (20%) payment of the;

(i) Ex-works price of Main Equipment/ materials (*excluding Mandatory Spares*) for **each consignment for substation portion** shall be paid on receipt and storage at site and

on physical verification and furnishing of necessary certificate by Employer's representative.

However, for Mandatory Spares, balance thirty percent (30%) payment of the Ex-works price component shall be released on receipt & storage of the same at site, physical verification and taking over by the Employer's representative.

(ii) Ex-works price component for the fabricated tower parts/tower (for transmission line portion***)*** shall be paid on completion of erection of complete tower and furnishing of necessary certificate by Employer's representative.

D **Final Payment**

Balance 10% (ten percent) payment of the:

(i) Ex-works price component of Main Equipment / materials for substation portion shall be paid as per the following:

a) 5% (Five percent) on Successful completion of erection, testing and commissioning of individual bays.
b) 5% (Five percent) on proof of submission of required number of reproducibles, O&M Manuals, approved drawings, data sheets, test report, pamphlets and manuals of mandatory spares, maintenance & testing equipment and on successful completion of erection, testing and commissioning of Substation and issuance of Taking Over Certificate.

(ii) Ex-works price component of transmission line portion shall be paid on ***completion of erection of all the towers of the transmission line*** and on submission of an unconditional & irrevocable Bank Guarantee for full 10% amount initially valid till scheduled date of completion of testing & commissioning of the transmission line and its taking over by the Employer and shall be extended from time to time till the actual date of successful completion of testing & commissioning of line and its taking over by the Employer.

The payment for bolts and nuts shall be subject to a ceiling of approved weight of bolts and nuts for the respective type of towers as per the Bill of Material to be furnished by the Employer.

However, in case of delay in testing and commissioning & issuance of taking over certificate by Employer beyond six (6) months from the date of receipt of equipment at site, the last 10% of Ex-Works price of respective equipment shall be paid after issuance of a certificate by Employer's representative that the equipment have been received in good condition and on submission of a bank guarantee of equivalent amount, which shall be kept valid initially for a period of twelve (12) months or until three (3) months after the expected date of commissioning (in case it is possible to anticipate the same), whichever is earlier, provided all other conditions as per above are complied with by the Contractor. If the commissioning does not take place within the validity period of BG, the validity of BG shall be extended from time to time. The bank guarantee shall, however, be released within one month of successful commissioning of the respective equipment by the Employer.

1.2 **Type Test Charges**: Not Applicable

1.3 **Supply of Services Portion:**

Inland Transportation, In-transit insurance, loading & unloading Charges

Inland transportation and In-transit insurance charges shall be paid to the Contractor on pro-rata basis, as per the unit rates indicated in the Contract Agreement, after receipt of materials/items at site and on presentation of the **Bill of supply or any other documents**

prescribed under GST Law alongwith supporting documents by the Contractor. However, these charges will be subject to a limitation that the aggregate of all invoices does not exceed the total amount indicated in the Contract Agreement. **It is the Employer's understanding that as per extant provisions, on the charges for supply of services related to Inland transportation, In-transit insurance, loading and unloading by the Contractor to the Employer, GST is not payable**. **The Contractor is, however, advised to check the position from their own sources. If payable, the same shall be to the Contractor's account and Employer shall not reimburse any GST on this account.**.

1.4 **Supply of Services Portion**: Price Component for Installation (including Civil Works)

A. Survey **(*covered in Transmission Line Portion*)**

Payment for survey shall be paid on pro-rata basis on completion of survey and approval of the same by the Employer.

B. **Interest Bearing Initial Advance (Optional ^^) Ten percent (10%)**:

B.1 1st Installment: 5% (five percent) of the total Installation price component shall be paid as an interest bearing advance on submission of (a) **Proforma invoic**e(s), (b) Establishment of Contractor's site offices for preparatory to mobilisation for Installation establishment, (c) Advance Bank Guarantee for **[{110% (one hundred ten percent) of the amount of Advance} Plus {amount of GST reimbursable on Advance as per the Proforma invoice}]** in line with GCC Clause 33.1.2 and (d) Performance Securities in line with GCC Clause 9.

B.2 2nd Installment: 5% (five percent) of the total Installation price component shall be paid as an interest bearing advance on submission of (a) **Proforma invoice(s)**, (b) On start of equipment erection*, (c) Advance Bank Guarantee for **[{110% (one hundred ten percent) of the amount of Advance} Plus {amount of GST reimbursable on Advance as per the Proforma invoice}]** in line with GCC Clause 33.1.2.

*After the release of 2nd Installment, the rate of recovery of the advance shall be re-adjusted.

Provided further that the **Proforma** Invoice(s) for advance payment along with all supporting documents is submitted by the Contractor to the Employer within 3 months from the date of fulfillment of the requisite activities, as per the L2 network. In case the Contractor does not submit the requisite documents including applicable Bank Guarantee(s)/ Security(ies) within the aforesaid period, the advance shall not be payable.

The Contractor, shall, within 7 days from the date of receipt of Advance, furnish an Advance Receipt Voucher to the Employer, as prescribed under the GST Law.

Note: ^^: This payment is an optional payment. The Contractor has the option of taking the interest bearing advance or otherwise.

Interest rate applicable on advance payment to the Contractor shall be 200 Basis Points(BPS) above the MCLR[One year Tenor rate p.a.] published by State Bank of India prevailing as on the date of drawl of advance. The said interest rate shall remain fixed and shall be applicable till the advance amount is fully repaid. The interest will be charged considering proportionate adjustment of advance against progressive payment for the work done as per 1.4(B). The interest shall be calculated on the daily progressive balances outstanding as on the date of recovery/adjustment. **It is the Employer's understanding that as per extant provisions, GST is not payable on Interest paid on the amount of Advance**. **The Contractor may, however, advised to check the position from their own sources. If payable, the same shall be to the Contractor's account and Employer shall not reimburse any GST on this account.**

(The above is to be incorporated in case the Contractor has opted for the interest bearing initial advance, as declared by it in its bid in the relevant Attachment to Bid Form).

Further, the Contractor shall submit the certificate of Tax Deduction at Source (TDS) on interest within 3 months from the end of the quarter in which adjustment of advance has been made for claiming refund from Employer. No claim for refund will be entertained after end of the aforesaid period of 3 months. Further, while submitting the TDS Certificate the details of Contract No, Project, Region, Quarter etc to which the TDS certificate pertains, shall also be submitted tallying the amount with the TDS Certificate.

In case, the Contractor opts not to take interest bearing advance as above, it would be mandatory for him to submit the document listed at Sl. No. (d) above within twenty eight (28) days of issuance of NOA**.**

(The above is to be incorporated in case the Contractor has opted for the interest bearing initial advance, as declared by it in its bid in the relevant Attachment to Bid Form).

C Progressive Payment

Eighty percent (80%)*^^(excluding Survey) shall be paid on completion the each of the items of Erection activity and on successful completion of quality check point involved in Installation, submission of the details of items, components, raw materials, services etc. procured/availed from MSEs, if any, for the preceding 6 months, in respect of all the contracts in the respective executing Region of RECPDCL as per format enclosed at Section IX, Forms, Volume-I of the bidding documents and certification by Employer's representative **and on submission of GST invoice.**

***** This payment shall be 85% instead of 80% in the following cases:

(i) the Contractor opts not to take 1st Installment **interest bearing initial advance or has opted to take 1st Installment interest bearing initial advance but the advance payment has become inadmissible for the reason specified in 1.4 (B) above**

(ii) the Contractor opts not to take 2nd Installment **interest bearing initial advance or has opted to take 2nd Installment interest bearing initial advance but the 2nd Installment advance payment has become inadmissible for the reason specified in 1.4 (B) above**, and 1st Installment **interest bearing initial advance** has been paid to the Contractor.

^^ This payment shall be 90% instead of 80% in case, the Contractor opts not to take **interest bearing initial advance or has opted to take interest bearing initial advance but the advance payment has become inadmissible for the reason specified in 1.4 (B) above.**

Further, one of the conditions for release of first progressive payment / subsequent payment shall be submission of 'Safety Plan' alongwith all requisite documents in line with tender document on Safety Precaution and proforma provided in this Section – Sample Forms and Procedure and approval of the same by the Engineer In-Charge.

D. **Final Payment**

Final 10% payment shall be made as follow:

(1) <u>Substation Portion</u>

a) 5% (five percent) of the Installation price component shall be paid on Successful completion of erection, testing and commissioning of individual bay.
b) balance 5% (five percent) of the Installation price component shall be paid on Successful completion of erection, testing and commissioning of Substation and issuance of Taking Over Certificate.

(2) <u>Transmission Line Portion</u>

The balance 10% (ten percent) of the erection price component (excluding price component for survey) shall be paid after successful commissioning of the transmission line and issuance of Taking Over Certificate. However, in case, for any reason solely attributable to the Employer, the commissioning of line is delayed beyond 120 days of successful completion of final checking and testing of line for the purpose of commissioning as defined in Technical Specification, Volume-II of the Bidding Documents, the balance 10% payment shall be released against an unconditional & irrevocable bank guarantee of equivalent amount initially valid till 6 months from the readiness of transmission line for commissioning and charging at rated voltage, to be extended till 90 days beyond actual commissioning & taking over.

1.4.1 'Commissioning' for the purpose of payments shall mean satisfactory completion of all supplies, erection, commissioning checks and successful completion of all site tests and charging of the transmission line at rated voltage as per the Contract and to the satisfaction/approval of the Employer.

1.5 **Training Charges**: Training Charges shall be paid on successful completion of training and on approval of the same by the Employer.

1.6 **Payment towards Price Adjustment**

This is a Fixed Price Contract. Price Adjustment is not applicable. ~~Any variation in Contract price due to price adjustment provision of Appendix-2 shall be effected on presentation of **debit note/credit note, as prescribed under the GST law,** supported by calculations as per formulae specified therein along with documentary evidence for different indices applicable for Price Adjustment.~~

~~1.6.1 Any increase in Contract price due to price adjustment provision shall be payable as follows:~~

~~**Supply of Goods Portion**:~~

~~90% (ninety percent) of the price adjustment amount for the respective shipment shall be paid on receipt of said shipment at site **and issuance of Debit Note, as prescribed under the GST law, by the Contractor.** Balance 10% (ten percent) of the price adjustment amount shall be paid alongwith the final payment.~~

~~**Any interest on GST payable due to increase in Contract price due to price adjustment shall be to the Contractor's account and Employer shall not reimburse any amount on this account.**~~

~~**Supply of Services Portion**:~~

~~90% (ninety percent) of the price adjustment amount for the respective billing period shall be paid after certification by Employer's representative for quantum of work done in the said billing period **and issuance of Debit Note, as prescribed under the GST law, by the Contractor.** Balance 10% (ten percent) of the price adjustment amount shall be paid alongwith the final payment.~~

Any interest on GST payable due to increase in Contract price due to price adjustment shall be to the Contractor's account and Employer shall not reimburse any amount on this account.

1.6.2 **For** any reduction in Contract Price due to price adjustment provisions the **Contractor shall issue 'Credit note', as prescribed under the GST law. Further, the reduction in Contract Price shall be effected by recovering 100% of the reduction amount along with applicable GST, if any charged earlier, from Contractor's invoices falling immediately due for payment or any other payments**.

1.7 **Payment towards Taxes & Duties**

Taxes and duties applicable as per Indian Tax laws, **concerning Supply of Goods and Services** in respect of transaction between the Employer and the Contractor, **shall be reimbursed by the Employer as follows:**

(a) GST on Advance payment shall be reimbursed along with the Advance payment.

(b) In case of Ex-works supply of goods, remaining GST (GST charged on invoice less GST on advance) shall be reimbursed along with progressive payment on dispatch.

(c) In case of Installation, the remaining GST(GST charged on invoice less GST on advance) shall be reimbursed along with Progressive payment on completion of Erection activity.

(d) GST on type test shall be reimbursed after successful completion of the Type test and along with the progressive payment on dispatch for the first consignment of Equipment for which the type test has been conducted.

(e) GST on Training charges shall be reimbursed on successful completion of Training.

(f) 100% GST reimbursable on account of increase in Contract price due to price adjustment shall be reimbursed along with the 90% payment of the Price adjustment amount.

All GST payment except GST applicable on Advance shall be against GST invoices/debit notes raised by the Contractor as specified under the GST Act and related Rules, Notifications, etc as notified by the Government in this regard. In the event that the Contractor fails to provide the invoice/debit note in the form and manner prescribed under the GST Act and Rules, the Employer shall not be liable to make any payment against such invoice/debit note. Reimbursement of GST payment against Advance payment shall be against proforma invoice(s). Further, the Contractor shall, within 7 days from the date of receipt of Advance, furnish an Advance Receipt Voucher to the Employer, as prescribed under the GST Law. Payment towards taxes & duties shall be released by the Employer directly to the Contractor.

2. PAYMENT PROCEDURES

2.1 Method of Payment

The Employer shall make payments promptly within thirty (30) days of submission of an invoice/claim by the Contractor, complete in all respects and supported by the requisite documents and fulfillment of stipulated conditions, if any. **All invoices/claims shall be raised by the Contractors in the name of Owner acting through RECPDCL.**

All payments to be made directly to the Contractor shall be made by the Employer though electronic payment mechanism (e-payment) for which necessary details shall be tied up during execution of the Contract. However, a request for payment to be released through cheque shall be considered on case to case basis and merit of the same.

Note: Pro-rata shall refer to functionally complete part(s) of the facilities, for which unit rates are identified in the contract

1.2 **Payment Tracking**

(Payment Tracking method will be intimated to the contractor in due course of time.)

4.2 PRICE ADJUSTMENT

THIS IS A FIXED PRICE CONTRACT. PRICE ADJUSTMENT IS NOT APPLICABLE.

1.0 General

1.1 Prices for work and materials covered under the scope of this Specification shall be furnished by the bidder in the manner specified in the Bid Form & Price Schedules. The bidder shall quote base prices for the Ex-Works price component of the equipment/materials, the complete equipment procured as spares (Transformers, CB, ISO, CT, CVT & SA only) and installation (including civil works) price component of the equipment/materials. These price components for certain equipment/ materials, as specified, shall be subject to price adjustment to reflect changes in the cost of labour and material components as per the provisions given below:

1.2 All Ex-Works Price Components for Installation Hardware, Control and Relay Panels, PLCC Equipment, Wave Traps, Bus Post Insulators, Fire Protection Systems, Illumination System, L.T. Switchgear, IPS Aluminium Tube, Spares etc. and other items not specifically mentioned below shall remain firm and no price adjustment shall be applicable for the price components of these items.

1.3 The Ex-Works Price Components for tower accessories such as danger plate, phase plate, circuit plates, number plate, anti-climbing device, span marker, bird guards, pipe, counterpoise earthing, obstruction lights, Flexible Copper Bond, Insulators etc. shall remain firm and no price adjustment shall be applicable for the price components of these items. Ex-Works Price Components for OPGW shall also remain firm and no price adjustment shall be applicable for this item.

1.4 Other Charges viz. inland transportation, inland insurance, type test charges, survey, soil investigation & painting of towers computer studies (if any) & training charges etc. shall be firm and no price variation shall be payable for these components.

2.0 Ex-works Price Component

The formulae for calculating the price adjustment to be applied to the Ex-works price component of the equipment/material will be as follows:

A. Fabricated Tower Parts (including Bolts & Nuts)

$EC_1 = EC_0 [0.15 + a \times (A_1/A_0) + b \times B_1/B_0) + l \times (L_1/L_0)] - EC_0$

Where, EC_1 is the price adjustment amount payable on ex-works prices of fabricated tower parts (including Bolts & Nuts), shipment-wise.

EC_0 = Ex-works price component of fabricated tower parts (including ex-works price of Bolts & Nuts) shipment-wise.

A = Price of Steel Blooms of size 150 mm x 150 mm, as published by IEEMA.

B = Price for Electrolytic High Grade Zinc, as published by IEEMA.

~~L = Indian field labour index – namely All India average consumer price index for Industrial Workers (monthly) (Base: 2001= 100), as published by Labour Bureau, Shimla, Government of India (www.labourbureau.nic.in).~~

~~a = Co-efficient of Steel Blooms, Value of which shall be between 0.51 & 0.57.~~

~~b = Co-efficient of Zinc, Value of which shall be between 0.08 & 0.10~~

~~l = Co-efficient of labour, Value of which shall be between 0.20 & 0.24.~~

~~and the sum of a, b & l shall be 0.85.~~

~~B. Line Materials~~

~~B.1 Earthwire~~

~~$EC_{EW1} = EC_{EW} [0.20 + a \times (A_1/A_0) + l \times (L_1/L_0)] - EC_{EW}$~~

~~Where,~~

~~EC_{EW1} = Price adjustment amount payable on Ex-works price of Earthwire, shipment-wise.~~

~~EC_{EW} = Ex-works price for Earthwire, shipment-wise.~~

~~A = Published price indices for high tensile steel galvanized wire, as published by CACMAI/Nationally recognized published index acceptable to Employer.~~

~~L = Indian field labour index – namely All India average consumer price index for Industrial Workers (monthly) (Base: 2001= 100), as published by Labour Bureau, Shimla, Government of India (www.labourbureau.nic.in).~~

~~a = Co-efficient of High Tensile Steel Galvanized Wire, Value of which shall be between 0.69 & 0.71.~~

~~l = Co-efficient of labour, Value of which shall be between 0.09 & 0.11.~~

~~and the sum of a & l shall be 0.80.~~

~~B.2 Hardware Fittings~~

~~$EC_{HW1} = EC_{HW} [0.20 + a \times (A_1/A_0) + b \times (B_1/B_0) + c \times (C_1/C_0) + l \times (L_1/L_0)] - EC_{HW}$~~

~~EC_{HW1} = Price adjustment amount payable on Ex-works price of Hardware Fittings, shipment-wise.~~

~~EC_{HW} = Ex-works price for Hardware fittings, shipment-wise.~~

~~A = Price indices for EC Grade Aluminium Ingots, as published by IEEMA.~~

B = Price indices for Electrolytic High Grade Zinc, as published by IEEMA.

C = Wholesale Price Index Number for `Ferrous Metals'(Group Item) (monthly) (Base: 2004-05=100), as published by Office of Economic Advisor, Ministry of Commerce & Industry(www.eaindustry.nic.in).

L =Indian field labour index – namely All India average consumer price index for Industrial Workers (monthly) (Base: 2001= 100), as published by Labour Bureau, Shimla, Government of India (www.labourbureau.nic.in).

a = Co-efficient of EC Grade Aluminum Ingots, Value of which shall be between 0.35 & 0.45.

b = Co-efficient of Electrolytic High Grade Zinc, Value of which shall be between 0.04 & 0.06.

c = Co-efficient of Ferrous Metal, Value of which shall be between 0.18 & 0.22.

l = Co-efficient of labour, Value of which shall be between 0.13 & 0.17.

and the sum of a, b, c & l shall be 0.80.

B.3 **Conductor and Earthwire Accessories:**

(i) Mid Span Compression Joint for Earthwire

$EC_1 = EC_0 [0.20 + a \times (A_1/A_0) + b \times (B_1/B_0) + c \times (C_1/C_0) + l \times (L_1/L_0)] - EC_0$

Where,

a = Co-efficient of EC Grade Aluminum Ingots, Value of which shall be between 0.35 & 0.45.

b = Co-efficient of Electrolytic High Grade Zinc, Value of which shall be between 0.04 & 0.06.

c = Co-efficient of Ferrous Metal, Value of which shall be between 0.18 & 0.22.

l = Co-efficient of labour, Value of which shall be between 0.13 &

0.17. and the sum of a, b, c & l shall be 0.80.

(ii) Mid Span Compression Joint, Repair Sleeve, Spacer Damper, Bundle Spacer & Rigid Spacer for Conductor and Rigid Spacer for Jumper.

$EC_1 = EC_0 [0.20 + a \times (A_1/A_0) + l \times (L_1/L_0)] - EC_0$

Where,

a = Co-efficient of EC Grade Aluminum Ingots, Value of which shall be between 0.63 & 0.67.

l = Co-efficient of labour, Value of which shall be between 0.13 & 0.17. and the sum of a & l shall be 0.80.

(iii) Vibration Damper for Earthwire, Suspension Clamp for Earthwire, Tension Clamp for Earthwire and Vibration Damper for Conductor

$EC_1 = EC_0 [0.20 + b \times (B_1/B_0) + c \times (C_1/C_0) + l \times (L_1/L_0)] - EC_0$

Where,

b = Co-efficient of Electrolytic High Grade Zinc, Value of which shall be between 0.06 & 0.08.

c = Co-efficient of Ferrous Metal, Value of which shall be between 0.55 & 0.61.

l = Co-efficient of labour, Value of which shall be between 0.13 & 0.17. and the sum of b, c & l shall be 0.80.

(iv) Flexible Aluminium Bond shall be on Firm price basis.

In the above formulae,

EC_1 = Price adjustment amount of respective items, shipment-wise.

EC_0 = Ex-works price for Conductor & Earthwire Accessories, shipment-wise.

A = Price indices for EC Grade Aluminium Ingots, as published by IEEMA.

B = Price indices for Electrolytic High Grade Zinc, as published by IEEMA.

C = Wholesale Price Index Number for `Ferrous Metals'(Group Item) (monthly) (Base: 2004-05=100), as published by Office of Economic Advisor, Ministry of Commerce & Industry(www.eaindustry.nic.in).

L = Indian field labour index – namely All India average consumer price index for Industrial Workers (monthly) (Base: 2001= 100), as published by Labour Bureau, Shimla, Government of India (www.labourbureau.nic.in).

i) Subscript '0' refers to indices for material & labour as on thirty (30) days & three (3) months prior to date of opening of Bids respectively.

ii) Subscript '1' refers to indices for material & labour as on 60 (sixty) days & four months prior to the date of shipment respectively.

C. Conductor

$P_1 = P_0 \times \{0.15 + a \times (A_1/A_0) + b \times (B_1/B_0) + c \times (C_1/C_0) + l \times (L_1/L_0)\} - P_0$

Where,

P_1 = Price adjustment amount, shipment-wise (if it works out negative, that would mean the amount to be recovered by the Purchaser from the Supplier).

P_0 = Ex-works price of Conductor.

A, B & L are the indices for materials and labour as below:

A = Monthly Average of "Aluminum LME SELLER Settlement Price including Premium of AL Ingots and Customs duty converted in Rs./MT" as published by IEEMA/ Nationally recognized published Price Index for EC Grade Aluminum Ingots acceptable to the Purchaser, in case index is not published by IEEMA.

B = Nationally recognized published Price Index for High Carbon Steel, acceptable to the Purchaser.

C = Nationally recognized published Price Index for High Grade Electrolytic Zinc acceptable to the Purchaser.

L = Indian field labour index – namely All India average consumer price index for Industrial Workers (monthly) (Base: 2001= 100), as published by Labour Bureau, Shimla, Government of India (www.labourbureau.nic.in).

a = Co-efficient for EC Grade Aluminium Ingots, which shall be 0.65.
b* = Co-efficient for High Carbon Steel, which shall be 0.13.
c* = Co-efficient for High Grade Electrolytic Zinc, which shall be 0.02.
l = Co-efficient for labour component, which shall be 0.05.

(*) For bidders who intend to quote their prices based on High Tensile Galvanised Steel wire, the coefficient for the same (i.e. coefficient 'b' for High Tensile Galvanised Steel wire) shall be 0.15 and coefficient 'c' shall not be applicable. In such a case,

B= Monthly Price exclusive of all duties of "High Tensile Galvanized Steel Wire (FE)"in Rs./MT as published by IEEMA/ Nationally recognized published Price index for High Tensile Galvanized Steel Wire acceptable to the Purchaser, in case index is not published by IEEMA

i) Subscript '0' refers to indices as on Calendar month preceding the month of opening of Bids, for materials & Labour.

ii) Subscript '1' refers to indices as applicable on Calendar month preceding the month of shipment, for materials & Labour.

2.0 The total adjustment for Earthwire, Hardware Fittings and Conductor & Earthwire Accessories shall be subject to a ceiling of ± 20% of respective Ex- Works price component of Earthwire, Hardware Fittings and Conductor & Earthwire Accessories.

However, the total price adjustment of fabricated tower parts (including Bolts & Nuts) and Conductor shall not be subject to any ceiling whatsoever.

a i) Auto Transformer/Reactor

The formula for calculating the price adjustment to be applied to the Ex-works price component of the main equipment for Auto Transformer/Reactor (excluding Insulating Oil) will be as follows:

$$P_1 = P_0 \times \{0.15 + a \times (A_1/A_0) + b \times (B_1/B_0) + c \times (C_1/C_0) + d \times (D_1/D_0) + l \times (L_1/L_0)\} - P_0$$

Where,

P1 = Price adjustment amount, expressed in currency of bid, payable to Contractor, for each shipment (if it works out negative, that would mean the amount to be recovered by the Employer from the Contractor).

P0 = Ex-works price component of main equipment for Auto Transformer/Reactor (excluding Insulating Oil) in the currency of bid, shipment-wise.

A, B, C, D & L = Corresponding Published recognized price indices for various materials used in the equipment (except insulating oil) and Labour respectively.

a, b, c & d = Coefficients for copper, electrical lamination steel, construction steel & insulating material respectively for Reactor. The coefficients are estimated percentage of major raw material component involved in the Price of the equipment such that the sum of these coefficients shall be between 0.65 and 0.73

l = Coefficient of labour, value of which shall be between 0.12 and 0.20

Further the coefficient a, b, c, d & l should be so selected that their summation shall be equal to 0.85

a)(ii) Insulating Oil for Auto Transformer/Reactor:

$P2 = P0 \times \{0.15 + 0.85 \times (E1/E0)\} - P0$

P2 = Price adjustment amount for insulating oil for Auto Transformer/Reactor, expressed in currency of bid, payable to Contractor, for each shipment (if it works out negative, that would mean the amount to be recovered by the Employer from the Contractor).

P0 = Ex-works price component of insulating oil for Auto Transformer/Reactor in the currency of bid, shipment-wise.

E = Published recognized price indices for Insulating oil.

b. Circuit Breaker, Current Transformer, Capacitance Voltage Transformer, Isolator and Surge Arrestor (AIS) as applicable

$P_1 = P_0 \times \{0.15 + a \times (A_1/A_0) + b \times (B_1/B_0) + c \times (C_1/C_0) + d \times (D_1/D_0) + l \times (L_1/L_0)\} - P_0$

Where,

P_1 = Price adjustment amount expressed in currency of Bid, for each shipment.

P_0 = CIF/Ex-works price of the respective equipment, in currency of Bid.

A, B, C, D & L = Published recognized price indices of raw materials used in the equipment and labour.

a, b, c & d = Value of corresponding coefficients of raw materials used and the sum of which should be between 0.55 to 0.65.

l = Coefficient for labour component.

These coefficients are estimated percentage of major raw material/labour component involved in the Ex-works price of equipment such that their summation shall be equal to 0.85.

c. **PVC/XLPE Insulated Power and Control Cables**

$P_1 = P_0 \times \{0.85 + 0.15 \times (A_1/A_0)\} - P_0 + (M_1 - M_0)$

Where,

P_1 = Price adjustment amount per Km. of cable.
P_0 = Ex-works price per Km. of cable.
A = Price index for PVC/XLPE as published by IEEMA.

M1 – M0 = Change in metal component of the Ex-Works Price of particular type & size of cable.

Where,

M = Weight in MT of metal per Km. of Cable x Price index of metal per MT as published by IEEMA.

The Bidder has to specify in his Bid metal component per Km. for each type and size of cable.

d. Sub Station Structures (including Bolts & Nuts)

For Lattice & Pipe Structures (including washers, foundation bolts and Bolts & Nuts).

$$P_1 = P_0 \times \{0.15 + 0.58 \times (A_1/A_0) + 0.16 \times (B_1/B_0) + 0.11 \times (L_1/L_0)\} - P_0$$

Where,

P_1 = Price adjustment amount expressed in currency of Bid, for each shipment.

P_0 = Ex-works price, in currency of Bid.

A= Average Indicative market price of steel angles of size 50x50x6 mm of all cities in Rs/MT as published by joint plant committee (JPC), excluding applicable excise duty component.

B = Price indices of electrolytic zinc as published by IEEMA.

L = Indian field labour index- namely all india average consumer price index for industrial workers (monthly) (base: 2001=100), as published by labour bureau, Shimla, Government of India (www.labourbureau.nic.in)

These coefficients are estimated percentage of major raw material/labour component involved in the Ex-works price such that their summation shall be equal to 0.85.

e. L.T. Transformer

$$P_1 = P_0 \times \{0.15 + a \times (A_1/A_0) + b \times (B_1/B_0) + c \times (C_1/C_0) + d \times (D_1/D_0) + e \times (E_1/E_0) + l \times (L_1/L_0)\} - P_0$$

Where,

P_1 = Price adjustment amount expressed in currency of Bid, for each shipment.

P_0 = Ex-works price of L.T. Transformer, in currency of Bid, shipment wise.

A, B, C, D, E & L = Published recognized price indices for the materials identified as below and Labour respectively.

a, b, c, d, e = Value of corresponding co-efficients for Copper, Electrical lamination Steel, Construction Steel, Insulating Material and Oil respectively. The sum of these coefficients shall be between 0.65 and 0.73.

l = The coefficient of labour, which shall be between 0.12 and 0.20.

Further the coefficient a, b, c, d, e & l should be so selected so that their summation shall be equal to 0.85.

2.1 i) Subscript '0' refers to indices as on thirty (30) days prior to date of opening of Bids, for materials & labour.

ii) Subscript '1' refers to indices and exchange rate as applicable on:

a) Sixty (60) days prior to the date of shipment for Labour.

b) At the expiry of two third (2/3) period from the date of base index to the shipment of material in case of CVT and SA.

c) Sixty (60) days prior to the date of shipment for materials in case of LT Transformer/Auto Transformer/Reactor, Cable and substation structure.

2.2 The total adjustment for CVT, SA, PVC/XLPE insulated Power & Control Cables and Sub-Station Structures (including bolts & nuts) shall be subject to a ceiling of ± 20% individually of respective Ex-Works price of CVT, SA, PVC/XLPE insulated Power & Control Cables and Sub-Station Structures (including bolts & nuts).

The price adjustment for the Ex-Works price component for LT Transformer/ Auto Transformer/Reactor for each shipment will not be subject to any ceiling.

3. **Installation (including Civil Works) Price Component**

The formula for calculation of the monthly price adjustments for Installation (including civil works) price component shall be as under:

A. **Installation price component (including Civil Works but excluding 'Supply & Placement of Reinforcement Steel' and 'Concreting')**

$ER_1 = ER_0 [0.20 + b \times (B_1/B_0) + c \times (EC_1/EC_0)] - ER_0$

Where,

ER_1 = Price adjustment amount for the Installation price component (excluding supply & placement of steel and concreting) for each billing

ER_0 = Price for Installation (excluding supply & placement of steel and concreting and including civil works), done in billing period as established by the Contract.

B = Indian field labour index – namely All India average consumer price index for Industrial Workers (monthly) (Base: 2001= 100), as published by Labour Bureau, Shimla, Government of India (www.labourbureau.nic.in).

EC = Expatriate field Labour index for the foreign bidder. In case of Indian bidder, this shall be same as 'B' above.

b = Value of Co-efficient of Indian field labour component of the Erection value as indicated by Bidder in his proposal.

c = Value of Co-efficient of Expatriate field labour component of the Erection value as indicated by Foreign Bidder in his proposal.

These coefficients are estimated percentage of Indian field and Expatriate labour component involved in the Installation such that their summation shall be equal to 0.80. In case of Indian Bidder, 'c' shall be equal to zero.

B. **Supply and Placement of Reinforcement Steel:**

$ER_1 = ER_0 [0.20 + 0.10 \times (A_1/A_0) + 0.05 \times (L_1/L_0) + 0.65 \times (B_1/B_0)] - ER_0$

Where,

ER_1 = Price adjustment amount payable on price components of Supply and Placement of Steel.

ER_0 = Value of supply & placement of steel in billing period as established by Contract.

A = Wholesale Price Index Number for `High Speed Diesel' (Individual Commodity) (monthly) (Base: 2004-05=100), as published by Office of Economic Advisor, Ministry of Commerce & Industry(www.eaindustry.nic.in).

L = Indian field labour index – namely All India average consumer price index for Industrial Workers (monthly) (Base: 2001= 100), as published by Labour Bureau, Shimla, Government of India (www.labourbureau.nic.in).

B = Wholesale Price Index Number for `Ferrous Metals'(Group Item) (monthly) (Base: 2004-05=100), as published by Office of Economic Advisor, Ministry of Commerce & Industry(www.eaindustry.nic.in).

C. **Concreting**

ER_1 = ER_0 [0.20 + 0.20 x (A_1/A_0) + 0.10 x (L_1/L_0) + 0.30 x (B_1/B_0) + 0.20 x (C_1/C_0)] – ER_0

Where,

ER_1 = Price adjustment amount payable on price components of concreting.

ER_0 = Value of concreting in billing period as established by Contract.

A = Wholesale Price Index Number for `High Speed Diesel'(Individual Commodity) (monthly) (Base: 2004-05=100), as published by Office of Economic Advisor, Ministry of Commerce & Industry(www.eaindustry.nic.in).

L = Indian field labour index – namely All India average consumer price index for Industrial Workers (monthly) (Base: 2001= 100), as published by Labour Bureau, Shimla, Government of India (www.labourbureau.nic.in).

B = Wholesale Price Index Number for `Cement & Lime'(Group Item) (monthly) (Base: 2004-05=100), as published by Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in).

C = Wholesale Price Index Number for `Structural Clay Products'(Group Item) (monthly) (Base: 2004-05=100), as published by Office of Economic Advisor, Ministry of Commerce & Industry(www.eaindustry.nic.in).

3.1 i) Subscript '0' will correspond to thirty (30) days prior to date of opening of Bids.

ii) Subscript '1' will correspond to the month of billing.

3.2 The total price adjustment amount for Installation (including civil works) price component shall not be subject to any ceiling whatsoever.

4. The bidder shall indicate in his bid the actual values of the coefficients a, b, c, d etc. to be adopted, keeping in view the range/total values given in para 2 & 3 above.

5. The above price adjustment provision shall be invoked by either party subject to the following further conditions:

a) For the purpose of Price Adjustment on ex-works price components of the equipment, the date of shipment for Goods shall mean scheduled date of shipment or actual date of shipment, whichever is earlier. Scheduled date of shipment will be ex-works date of despatch, governed by the accepted PERT Network/Bar Chart. Similarly, for the purpose of Price Adjustment on Installation price component, the Billing period shall mean the billing period as per Contract time schedule i.e., the agreed Bar Chart or actual period, whichever is earlier. The Billing period for various Installation activities will be as per agreed Installation Bar Chart indicating monthly schedule of Installation activities for completion of works. However, when the Employer's specific approval for advancement of shipment/installation activities has been obtained

in such case the said advanced date shall be treated as the schedule date of shipment/installation activities for the purpose of working out the price adjustment payable.

No price increase shall be allowed beyond the original delivery/ Installation dates unless specifically stated in the Time Extension Letter, if any, issued by the Employer. The Employer will, however, be entitled to any decrease in the Contract Price which may be caused due to lower price adjustment amount in case of delivery of Goods/ Installation beyond the original delivery/Installation dates. Therefore, in case of delivery of Goods/ Installation beyond the original delivery/ Installation dates, the liability of the Employer shall be limited to the lower of the price adjustment amount which may work out either on schedule date or actual date of despatch of Goods/ Installation.

b) For the purpose of price adjustment, the bidder shall indicate in his proposal as to whether the Bid is based on the use of raw materials such as copper, electrical lamination steel, construction steel, insulating material, Aluminium, Structural Steel, zinc etc. and insulating oil at local or international prices. The bidder shall indicate the indices for such raw materials and insulating oil (transformer oil) which are recognized published indices in the Country of origin form where these materials are proposed to be procured or any other Internationally recognized indices in case recognized indices are not available in the Country of Origin.

c) In case of non-publication of applicable indices on a particular date, which happens to be the applicable date for Price Adjustment purposes, the published indices prevailing immediately prior to the particular date shall be applicable.

d) If the Price Adjustment amount works out to be positive, the same is payable to the Contractor by the Employer and if it works out to be negative, the same is to be recovered by the Employer from the Contractor.

e) The Contractor shall promptly submit price adjustment invoices for the supplies made/work done, positively within 3 months of the dispatch or within ten(10) days of publication of all relevant indices, whichever is earlier, whether it is positive or negative.

Appendix-3

4.3 INSURANCE REQUIREMENTS

A) Insurances to be taken out by the Contractor

In accordance with the provisions of GCC Clause 40, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, such approval not to be unreasonably withheld. The inability of the insurers to provide insurance cover in the sums and with the deductibles and other conditions as set forth below, shall not absolve the Contractor of his risks and liabilities under the provisions of GCC Clause 40. However, in such a case the Contractor shall be required to furnish to the Employer documentary evidence from the insurer in support of the insurer's inability as aforesaid.

(a) **Marine Cargo Policy/Transit Insurance Policy**:

(I)(i) Marine Cargo policy for imported equipment

The Contractor shall take the Marine Cargo Policy for Plant and Equipment including mandatory Spares to be supplied from abroad wherein export/import including inland transit is involved for the movement of the Plant and Equipment including mandatory Spares. The policy shall cover movement of Plant and Equipment including mandatory Spares from the manufacturer's works to the project's warehouse at final destination site. The policy shall cover all risk for loss or damage that may occur during transit of Plant and Equipment including mandatory Spares from the Contractor/sub-Contractor's works or stores until arrival at project's warehouse/ store at final destination. Institute Cargo Clause (ICC) 'A' along with war & Strike Riots & Civil Commotion (SRCC) cover shall be taken.

(I)(ii) Transit Insurance Policy for indigenous equipment

Similarly, Transit Insurance Policy shall be taken wherein only inland transit is involved for the movement of Plant and Equipment including mandatory Spares supplied from within India. The policy shall cover movement of Plant and Equipment including mandatory Spares from the manufacturer's works to the project's warehouse at final destination site. Inland Transit Clause (ITC) 'A' along with war & Strike Riots & Civil Commotion (SRCC) extension cover shall be taken.

Amount	Deduc-tible Limits	Parties insured	From	To
120% of CIP Entry Border Point Price /CIF Indian Port of Entry Price of all the Plant and Equipment including mandatory Spares to be supplied from abroad plus customs duties (**including BCD, GST, Cess etc**.) on merit rate and 120% of Ex-work Price of all the Plant and Equipment including mandatory Spares to be supplied from within India plus **GST,** if additionally payable.	Nil	Contractor & Employer	Mfrs ware-house	Project's ware-house store at final destination

(II) If during the execution of Contract, the Employer requests the Contractor to take any other add-on cover(s)/ supplementary cover(s) in aforesaid insurance, in such a case, the Contractor shall promptly take such add-on cover(s)/ supplementary cover(s) and the charges towards such premium for such add-on cover(s)/ supplementary cover(s) shall be reimbursed to the Contractor on submission documentary evidence of payment to the Insurance company. Therefore, charges towards premium for such add-on cover(s)/ supplementary cover(s) are not included in the Contract Price.

(III) The Contractor shall take the policy in the joint names of Employer and the Contractor. The policy shall indicate the Employer as the beneficiary. However, if the Contractor is having an open policy for its line of business, it should obtain an endorsement of the open cover policy from the insurance company indicating that the dispatches against this Contract are duly covered under its open policy and include the name of the Employer as jointly Insured in the endorsements to the open policy.

(b) **Erection All Risk Policy/Contractor All Risk Policy**:

(I) The policy should cover all physical loss or damage to the facility at site during storage, erection and commissioning covering all the perils as provided in the policy as a basic cover and the add on covers as mentioned at Sl. No. (III) below.

Amount	Deductible limits	Parties insured	From	To
105% of CIP Entry Border Point Price /CIF Indian Port of Entry	Nil	Contractor & Employer	Receipt at site of first lot of the Plant and	Up to Operational Acceptance

Price of all the Plant and Equipment including mandatory Spares to be supplied from abroad plus customs duties **(including BCD, GST, Cess etc**.) on merit rate and 105% of Ex-work Price of all the Plant and Equipment including mandatory Spares to be supplied from within India plus **GST**., if additionally payable. and 100% of erection price component			Equipment including mandatory Spares	

(II) The Contractor shall take the policy in the joint name of Employer and the Contractor. All these policies shall indicate Employer as the beneficiary. The policy shall be kept valid till the date of the Operational Acceptance of the project and the period of the coverage shall be determined with the approval of the Employer.

If the work is completed earlier than the period of policy considered, the Contractor shall obtain the refund as per provisions of the policy and pass on the benefit to Employer. In case no refund is payable by the insurance company then the certificate to that effect shall be submitted to Employer at the completion of the project.

(III) The following add-on covers shall also be taken by the Contractor:

i) Earthquake
ii) Terrorism
iii) Escalation cost (approximately @10% of sum insured on annual basis)
iv) Extended Maintenance cover for Defect Liability Period
v) Design Defect
vi) Other add-on covers viz., 50-50 clause, 72 hours clause, loss minimization clause, waiver of subrogation clause (for projects of more than Rs.100 crores, cover for offsite storage/fabrication (over Rs.100 crores).

(IV) ***Third Party Liability cover with cross Liability within Geographical limits of India as on ADD-on cover to the basic EAR cover***:

The third party liability add-on cover shall cover bodily injury or death suffered by third parties (including the Employer's personnel) and loss of

or damage to property (including the Employer's property and any parts of the Facilities which have been accepted by the Employer) occurring in connection with supply and installation of the Facilities.

Amount	Deductible limits	Parties insured	From	To
• For projects upto Rs. 100 crores, the third party liability limit shall be 10% of the project value for single occurrence/ multiple occurrences in aggregate during the entire policy period. • For projects from Rs. 100 crores to Rs. 500 crores, the third party liability limit shall be Rs. 10 crores for single occurrence/multiple occurrences in aggregate during entire policy period. For projects of more than Rs.500 crores, the third party liability limit shall be Rs. 25 crores for single occurrence/ multiple occurrences in aggregate during entire policy period.	Nil	Contractor/ Sub-contractor	Receipt at site	Upto Defect Liability Period.

(V) Contractor shall take consolidated insurance which includes warrantee for Defect Liability Period on all supply items including Owner Supplied Material also mentioned in the Supply Contract.

(c) **Automobile Liability Insurance**

The Contractor shall ensure that all the vehicles deployed by the Contractor or its Subcontractors (whether or not owned by them) in connection with the supply and installation of the Facilities in the project are duly insured as per RTA act. Further the Contractor or its Subcontractors may also take comprehensive policy(own damage plus third party liability) of each individual vehicles deployed in the project on their own discretion in their own name to protect their own interest.

(d) **Workmen Compensation Policy**:

(I) Workmen Compensation Policy shall be taken by the Contractor in accordance with the statutory requirement applicable in India. The Contractor shall ensure that all the workmen employed by the Contractor

or its Subcontractors for the project are adequately covered under the policy.

(II) The policy may either be project specific covering all men of the Contractor and its Subcontractors. The policy shall be kept valid till the date of Operational Acceptance of the project.

Alternatively, if the Contractor has an existing 'Workmen Compensation Policy' for all its employees including that of the Subcontractor(s), the Contractor must include the interest of the Employer for this specific Project in its existing 'Workmen Compensation Policy'.

(III) Without relieving the Contractor of its obligations and responsibilities under this Contract, before commencing work the Contractor shall insure against liability for death of or injury to persons employed by the Contractor including liability by statute and at common law. The insurance cover shall be maintained until all work including remedial work is completed including the Defect Liability Period. The insurance shall be extended to indemnify the Principal for the Principal's statutory liability to persons employed by the Contractor.

The Contractor shall also ensure that each of its Subcontractors shall effect and maintain insurance on the same basis as the 'Workmen Compensation Policy' effected by the Contractor.

(e) **Contractor's Plant and Machinery (CPM) Insurance**

The Employer (including without limitation any consultant, servant, agent or employee of the Employer) shall not in any circumstances be liable to the Contractor for any loss of or damage to any of the Contractor's Equipment or for any losses, liabilities, costs, claims, actions or demands which the Contractor may incur or which may be made against it as a result of or in connection with any such loss or damage.

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor except for the Third Party Liability, Workmen Compensation Policy Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor except for the Cargo Insurance During Transport, Workmen Compensation Policy Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

B) Insurances to be taken out by the Employer

The Employer shall at its expense take out and maintain in effect during the performance of the Contract the following insurances.

Amount	Deductible limits	Parties Insured	From	To
_____ NIL _____				

-- End –

Appendix-4

4.4 TIME SCHEDULE

1. The Project Completion Schedule shall be as follows:

Description	Duration in Months from the date of Notification of Award
Taking Over by the Employer upon successful Completion of:	
A. 2X50MVA, 220/33kV Nagrota (New) S/S	15 Months
B. LILO of 220kV Udhampur-Gladni on D/C Tower at Nagrota Substation	
C. Staff Quarters at proposed Nagrota Substation	

1.1 The activity(ies) under the Contractor's programme for Project Completion shall be in the form of a master network (MNW) and shall identify the various activities like design, engineering, manufacturing, supply, installation, factory testing, transportation to site, site testing and commissioning, trial operation and Taking Over etc. of the Facilities or specific part thereof (where specific parts are specified in GCC). The network shall conform to the above Project Completion Schedule.

This master network will be discussed and agreed before Award in line with above, engineering drawing and data submission schedule shall also be discussed and finalised before Award. Liquidated damages for delay in successful Completion of the Facilities or specific part thereof (where specific parts are specified in GCC) and Operational Acceptance at rates specified in Tender document shall be applicable beyond the date specified above.

1.2 The Employer reserves the right to request minor changes in the work schedule at the time of Award of Contract to the successful Bidder.

1.3 The successful Bidder shall be required to prepare detailed Network(s) and project implementation plans & programmes and finalise the same with the Employer as per the requirement specified in Technical Specifications, which shall from a part of the Contract.

Appendix-5

4.5 LIST OF APPROVED SUBCONTRACTORS

Prior to award of Contract, the following details shall be completed indicating those sub-contractors proposed by the Bidder by Attachment to its bid that are approved by the Employer for engagement by the Contractor during the performance of the contract.

The following Subcontractors are approved by RECPDCL for carrying out the item of the facilities indicated. Where more than one Subcontractor is listed, the Contractor is free to choose between them, but it must notify the Employer of its choice in good time prior to appointing any selected Subcontractor. In accordance with tender document, the Contractor is free to submit proposals for Subcontractors for additional items from time to time. No Subcontracts shall be placed with any such Subcontractors for additional items until the Subcontractors have been approved in writing by the ~~OWNER/~~RECPDCL and their names have been added to this list of Approved Subcontractors.

Item of Facilities	Approved Subcontractors	Nationality

Further, erection portion of the contract shall not be subcontracted without the prior approval of the Employer. However, such approval shall not be necessary for engaging labour.

Appendix-6

4.6 LIST OF DOCUMENTS FOR APPROVAL OR REVIEW

Pursuant to tender document, the Contractor shall prepare, or cause its Subcontractor to prepare, and present to the Project Manager (EMPLOYER) in accordance with the requirements of contract (Program of Performance), the following documents for:

A. Approval

1.

2.

3.

B. Review

1.

2.

3.

Note:

Bidder shall furnish the exhaustive list, which shall be discussed and finalised for incorporation into the Contract Agreement.

Appendix-7

4.7 GUARANTEES, LIQUIDATED DAMAGES FOR NON – PERFORMANCE

1. The equipment offered shall meet the rating and performance requirements stipulated in Technical Specification for various equipment or indicated in Data requirement.

2. The ratings and performance figures of the below mentioned equipments are guaranteed by you.

Sl. No.	Equipment	Parameter to be taken for applying differential price factor (F)
1.	50 MVA, 220/33 kV, Three Phase Power Transformer	Differential Copper loss (KW)
		Differential Iron loss (KW)
		Auxiliary Losses (KW)

3. If the aforementioned guarantees are not established at factory tests, then the Employer at his discretion may reject or accept the equipment after assessing the liquidated damages as per table above against the Contract and such amounts plus GST payable thereon shall be deducted from the Contract Price or otherwise recovered from the Contractor. However, the equipment under no circumstances shall be accepted if the measured losses are meeting the clauses mentioned under clause 4 (f) of this appendix.

4. GUARANTEE, EVALUATION OF LOSSES & PENALTIES

The bidder shall indicate the Guaranteed values of No load losses, load losses and auxiliary losses in his bid.

a. Capitalization Formula for Transformer Losses

The rate of Capitalization of transformer losses depends upon the rate of interest, rate of electrical energy per kWh, life of transformer and average annual loss factor.

Capitalized Cost of Transformer = Initial cost + Capitalized cost of annual iron losses + Capitalized cost of annual copper losses + Capitalized cost of annual auxiliary losses.

Capitalized cost of iron losses per KW = **INR 4,62,777/-**

Capitalized cost of copper Losses per kW = **INR 1,99,920/-**

Capitalized cost of auxiliary Losses per kW = **INR 1,85,111/-**

b. The measured losses of each transformer shall not exceed the value in the tender, by more than the tolerance admissible as per **IS: 2026**. The losses need to be very low.

c. The No load loss in Kilo watts at rated voltage and rated frequency shall be guaranteed. The excess of difference between test values of total losses and No load losses in 'Kilo-watt' over corresponding guaranteed losses shall be recovered. In case of fraction of KW, the penalties shall be applied for full KW.

d. **Liquidated Damage for Excessive Losses:** On testing, if it is found that actual losses are more than the values quoted including maximum tolerance, the undisputed liquidate damages shall be recovered from the bidder at the rates double of that calculated from above.

e. **Guarantee, Evaluation of Auxiliary Power Consumption and Penalties**

i. The power consumed at full load by the fans, oil pumps and any other auxiliary apparatus shall be stated in the offer which shall be guaranteed. Tolerance, if any on this figure shall also be indicated failing which a tolerance of 10% shall be assumed. For the purpose of evaluation of tenders and imposition of penalty the guaranteed figure after taking in account the maximum tolerance if any, shall be assumed.

ii. For the purpose of evaluation of tenders, the power consumption of the auxiliaries shall be considered for 20% of the capacity and shall be capitalized to arrive at the final evaluated price for comparison. For the purpose of evaluation, the rates as given in para above shall be taken.

f. REJECTION

The Employer may reject any transformer if during tests or service any of the following conditions arise:

i) No load loss exceeds the guaranteed value by 15% or more.
ii) Load loss exceeds the guaranteed value by 15% or more.
iii) Total losses exceed the guaranteed value by 10% or more.
iv) Impedance value exceeds the guaranteed value by + 10% or more.
v) Transformer fails on impulse test.
vi) Transformer fails on power frequency voltage withstand test.
vii) Transformer provided to have been manufactured not in accordance with the specification.

Appendix-8

4.8 AGREEMENT

UNDER INTEGRITY PACT

No.
Dated

To,
REC Power Development & Consultancy Limited,
New Delhi

Sub : Procurement of Bidding Documents

Ref. Tender no.

RECPDCL and the Bidder agree that the Notice Inviting Tender (NIT) is an offer made on the condition that the bidder will sign the Integrity Pact and the Bid would be kept open in its original form without variation or modification for a period of (state the number of days from the last date for the receipt of tenders stated in the NIT) ……. days and the making of the bid shall be regarded as an unconditional and absolute acceptance of this condition of the NIT.

We confirm acceptance and compliance with the Integrity Pact in letter and spirit. We further agree that the contract consisting of the above conditions of NIT as the offer and the submission of Bid as the Acceptance shall be separate and distinct from the contract which will come into existence when bid is finally accepted by RECPDCL.

The consideration for this separate initial contract preceding the main contract is that RECPDCL is not agreeable to sell the NIT to the Bidder and to consider the bid to be made except on the condition that the bid shall be kept open for …… days after the last date fixed for the receipt of the bids and the Bidder desires to make a bid on this condition and after entering into this separate initial contract with RECPDCL.

RECPDCL promises to consider the bid on this condition and the Bidder agrees to keep the bid open for the required period. These reciprocal promises form the consideration for this separate initial contract between the parties.

If Bidder fails to honour the above terms and conditions, RECPDCL shall have unqualified, absolute and unfettered right to encash / forfeit the bid security submitted in this behalf.

Yours faithfully,

(BIDDER)

Yours faithfully

(PURCHASER)

INTEGRITY PACT

PRE-CONTRACT INTEGRITY PACT

General

This pre-bid contract Agreement (hereinafter called the Integrity Pact) is made on_____ day of the month of __ 20_____, between, on one hand, the HoD-Transmission of REC Power Development & Consultancy Limited through Shri._____ Designation of the officer, Ministry, Department, Government of India (hereinafter called the "BUYER", which expression shall mean and include, unless the context otherwise requires, his successors in the office and assigns) of the First Part and M/s._____ represented by Shri _____,Authorized Signatory (hereinafter called the "BIDDER/Seller" which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns) of the Second Part.

WHEREAS the BUYER proposes to procure_____ (Name of the stores/equipment/items) and the BIDDER/Seller is willing to offer/has offered the stores and

WHEREAS the BIDDER is a private company/ public company/Government undertaking / partnership / registered export agency, constituted in accordance with the relevant law in the matter and the BUYER is a Ministry/Department of the Government of Indian/PSU performing its functions on behalf of the President of India.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:-

Enabling the BUYER to obtain the desired stores/equipment at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and

Enabling BIDDER to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other practices and the BUYER will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:

Commitments of the Buyer

1.1 The Buyer undertakes that no official of the BUYER, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries,

any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the Contract.

1.2 The Buyer will, during the pre-contract stage, treat all Bidders alike, and will provide to all Bidders the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to other BIDDERs.

1.3 All the officials of the Buyer will report to the appropriate Govt. Office for any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

2. In case of any such preceding misconduct on the part of such official(s) is reported by the BIDDER to the BUYER with full and verifiable facts and the same is *prima facie* found to be correct by the Buyer, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the BUYER and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the Buyer the proceedings under the contract would not be stalled.

Commitments of Bidders

3. The BIDDER commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commits itself to the following:-

3.1 The will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the Buyer, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the Contract.

3.2 The BIDDER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the Buyer or otherwise in procuring the Contract or for bearing to do or having done any act in relation to the obtaining or execution of the Contract or any other Contract with the Govt for showing or for bearing to show favour or dis-favour to any person in relation to the Contract or any other Contract with the Govt..

3.3 The BIDDERs shall disclose the name and address of agents and representatives and Indian BIDDERs shall disclose their foreign principals or associates.

3.4 The BIDDERs shall disclose the payments to be made by them to agents/brokers or any other intermediary, in connection with this bid/contract.

3.5 The BIDDER further confirms and declares to the BUYER that the BIDDER is the original manufacturer/integrator/authorized govt. sponsored export entity of the defense stores and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the BUYER or any of its functionaries, whether officially or unofficially to the award of the contract to the BIDDER, nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.

3.6 The Bidder, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of the Buyer or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.

3.7 The BIDDER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

3.8 The BIDDER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

3.9 The BIDDER shall not use improperly, for purposes of competition or personal gain, or pass on to others, any information provided by the BUYER as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The BIDDER also undertakes to exercise due and adequate care lest any such information is divulged.

3.10 The BIDDER commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.

3.11 The BIDDER shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.

3.12 The BIDDER shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the BUYER.

4. Previous Transgression

4.1 The BIDDER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify BIDDER exclusion from the tender process.

4.2 The BIDDER agrees that if it makes incorrect statement on this subject, BIDDER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

5. Earnest Money (Security Deposit)

5.1 While submitting commercial bid, the BIDDER deposit an amount_____ (to be specified in the RFP (Request for Proposal) as Earnest Money/Security Deposit, with the BUYER through any of the following instruments :-

(i) Bank Draft or a Pay Order in favour of _____

(ii) A confirmed guarantee by an Indian Nationalized Bank, promising payment of the guaranteed sum to the BUYER, on demand within three working days without any demur whatsoever and without seeking any reasons whatsoever. The demand for payment by the BUYER shall be treated as conclusive proof of payment.

(iii) Any other mode or through any other instrument (to be specified in RFP).

5.2 The Earnest Money/Security Deposit shall be valid & retained by the buyer for such period as specified in the RFP/GTC.

5.3 In the case of successful BIDDER, a clause would also be incorporated in the Article pertaining to Performance Bond in the Purchase Contract that the provisions of Sanctions for Violation shall be applicable for forfeiture of Performance Bond in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this pact.

5.4 No interest shall be payable by the BUYER to the BIDDER/SELLER on Earnest Money/Security Deposit for the period of its currency.

6. <u>Sanctions for Violation</u>

6.1 Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER/SELLER) shall entitle the BUYER to take all or anyone of the following actions, wherever required:-

(i) To immediately call off the pre-contract negotiations without assigning any reason or giving any compensation to the BIDDER. However, the proceedings with the other BIDDER(s) would continue.

(ii) The Earnest Money Deposit (in pre-contract stage) and/or Security Deposit /Performance Bond (after the contract is signed) shall stand forfeited either fully or partially, as decided by the BUYER and the BUYER shall not be required to assign any reason therefore.

(iii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.

(iv) To recover all sums already paid by the BUYER, and in case of an Indian BIDDER with interest thereon at 2% higher than the prevailing Prime Lending Rate of State Bank of India, while in case of a BIDDER from a country other than India with interest thereon at 2% higher than the LIBOR. If any outstanding payment is due to the BIDDER from the BUYER in connection with any other contract for any other stores, such outstanding payment could also be utilized to recover the aforesaid sum and interest.

(v) To encash the advance bank guarantee and performance bond/warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the BUYER, along with interest.

(vi) To cancel all or any other Contracts with the BIDDER. The BIDDER shall be liable to pay compensation for any loss or damage to the BUYER resulting from such cancellation/rescission and the BUYER/principal shall be entitled to deduct the amount so payable from the money(s) due the BIDDER

(vii) To debar the BIDDER from participating in future bidding processes of the Government of India BUYER/Principal for a minimum period of five years, which may be further extended at the discretion of the BUYER.

(viii) To recover all sums paid in violation of this Pact by BIDDER to any middleman or agent or broker with a view to securing the contract.

(ix) In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the BUYER with the BIDDER, the same shall not be opened.

(x) Forfeiture of Performance Bond in case a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

6.2 The BUYER will be entitled to take all or any of the actions mentioned at para 6.1 (i) to (x) of this Pact also on the Commission by the BIDDER or anyone employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER), of an offence as defined in Chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.

6.3 The decision of the BUYER to the effect that a breach of the provisions of this Pact has been committed by the BIDDER shall be final and conclusive on the BIDDER. However, the BIDDER can approach the Independent monitor(s) appointed for the purposes of this Pact.

7. **Independent Monitors**

7.1 The BUYER has appointed Independent Monitors (hereinafter referred to as Monitors) for this Pact in consultation with the Central Vigilance Commission .

Shri Sudhir Bhargava, IAS (Retd.)
Procurement and Contract Management (PCM) Division,
REC Limited,
I-4, Sector-29, Gurugram, Haryana, INDIA

Dr. Varesh Sinha, IAS (Retd.)
Procurement and Contract Management (PCM) Division,
REC Limited,
I-4, Sector-29, Gurugram, Haryana,

mail:
officesudhirbhargava[at]gmail[dot]com

INDIA
mail: vareshsinha[at]gmail[dot]com

7.2 The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact.

7.3 The Monitors shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently.

7.4 Both the parties accept that the Monitors have the right to access all the documents relating to the project/procurement, including minutes of meetings.

7.5 As soon as the Monitors notice, or has reason to believe, a violation of this Pact, he will so inform the authority designated by the BUYER.

7.6 The BIDDER(s) accepts that the Monitors has the right to access without restriction to all Project documentation of the BUYER including that provided by the BIDDER. The BIDDER will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to Subcontractors. The Monitor shall be under contractual obligation to treat the information and documents of the BIDDER/Subcontractor(s) with the confidentiality.

7.7 The BUYER will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitor the option to participate in such meetings.

7.8 The Monitors will submit a written report to the Designated Authority of the BUYER/Secretary in the Department/within 8 to 10 weeks from the date of reference or intimation to him by the BUYER / BIDDER and, should the occasion arise, submit proposals for correcting problematic situations.

8. **Facilitation of Investigation**

In case of any allegation of violation of any provisions of this Pact or payment of commission, the BUYER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER and the BIDDER shall provide necessary information and documents in English and shall extend all possible help for the purpose of such examination.

9. **Law and Place of Jurisdiction**

This Pact is subject to Indian Law. The place of performance and jurisdiction is the seat of the BUYER.

10. **Other Legal Actions**

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the any extent law in force relating to any civil or criminal proceedings.

11. **Validity**

11.1 The validity of this Integrity Pact shall be from date of its signing and extend up to 5 years or the complete execution of the contract to the satisfaction of both the BUYER and the BIDDER/SELLER, including warranty period, whichever is later. In case BIDDER/SELLER is unsuccessful, this Integrity Pact shall expire after six months from the date of the Signing of the contract.

11.2 Should one or several provisions of this Pact turn out to be invalid, the remainder of this Pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

12. The Parties hereby sign this Integrity Pact at _____ on _____

BUYER	BIDDER
Name of the Officer Designation /Dept/Ministry/PSU	Name of the Officer Authorized Signatory
Witness	Witness
1._____	1. _____
2. _____	2. _____

Provision of these clauses would need to be amended/deleted in line with the policy of the BUYER in regard to involvement of Indian Agents of foreign Supplies.

Instruction for printing & submitting Safety Pact

1. The requisite format of Safety Pact is getting generated automatically and displayed here below.

2. Take print out of first page on a non-judicial stamp paper of Rs. 100/- /Company's Letterhead, as applicable, and other pages on plain A4 size paper. Such two sets shall be prepared by the bidder.

3. All the pages of both the copies of the Safety Pact shall be signed by the authorised representative of the bidder and duly stamped.

4. Both the original copies shall be submitted by the bidder in the form of Hard Copy as part of the first envelope before due date & time of submission of the bid.

Appendix-9

4.9 SAFETY PACT

Between

REC Power Development & Consultancy Ltd.,
(A 100% subsidiary of REC Ltd, Government of India Enterprise), a company incorporated in India having their Registered Office at Core-4, SCOPE Complex, 7, Lodhi Road, New Delhi-110003,, India

hereinafter referred to as "RECPDCL"

and

insert name of bidder

having its Registered Office at

and

insert name of partner(s) in case of JV …… …… …… …….. having its Registered Office at

Hereinafter referred to as "The Bidder/Contractor"

Preamble

RECPDCL intends to award, under laid-down organisational procedures, contract(s) for Cable Package of **"Balance Works for Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni on D/C Tower at Nagrota Substation along with Staff Quarters at proposed Nagrota Substation under PMDP Sceme-15"**and Specification Number: **xxxxxxxxxxxxxxx**

RECPDCL values full compliance with all relevant laws and regulations and the principles of Safety, Health & Environment in its relations with its Bidders/ Contractors.

In order to achieve these goals, RECPDCL and the above named Bidder / Contractor enter into this agreement called "Safety Pact" which will form part of the Bid.

It is hereby agreed by and between the parties as under:

Section I - Commitments of RECPDCL:

RECPDCL commits itself to take all measures necessary to prevent accidents during Construction and Operation of the Transmission Assets and to observe the following:

1 RECPDCL recognizes and accepts its statutory responsibilities for ensuring construction, operation and maintenance of equipments and for the provision of safe methods of work and safe working conditions.

2 RECPDCL recognizes and accepts its statutory responsibilities for ensuring safety of not only its employees but also that of the Contracting Agencies as Principal Employer.

3 RECPDCL shall review the accidents in a structured manner and take necessary actions to ensure that the safety criteria are strengthened for safe construction as well as Operation & Maintenance of the Transmission Assets.

4 RECPDCL shall conduct necessary awareness and training programmes to its Employees to augment the various safety requirements to be followed during Construction and Operation & Maintenance of the Transmission Assets from time to time.

5 RECPDCL shall, from time to time, issue necessary guidelines, instructions and deterrents to its employees as well as to the Contracting Agencies, to update them to take necessary preventive measures to avoid repetition of similar accident attributes.

6 RECPDCL shall review and provide necessary guidance to the Contracting Agencies, as and when, any abnormality / special situations are brought to its notice by the Contracting Agencies during execution of the Transmission Projects being executed by them.

7 RECPDCL shall conduct periodical surveillance site inspections / audits to identify the unsafe conditions and unsafe actions, and bring them to the knowledge of the Contracting Agencies for taking timely corrective actions.

8 RECPDCL shall investigate all accidents, fatal as well as non-fatal, to identify the lapses, the reason for the accident / incident and suggest measures for prevention of recurrence of such accidents, and fix responsibility for the lapses leading to the accident.

9 RECPDCL shall augment the training to the workers and supervising personnel of the Contracting Agencies, as per schedules, upon nomination by the Contracting Agencies in reasonable time frame.

10 RECPDCL shall exercise the right to claim and recover compensation from the Contracting Agencies in case of any violation of the safety requirements / provisions during execution of the Transmission Projects, as built in the applicable Laws and contractual specifications / guidelines in vogue / issued by RECPDCL from time to time.

11 **Section II - Commitments of the Bidder / Contractor:**

The Bidder / Contractor commits himself to take all measures necessary to prevent / minimise accidents at their construction / erection sites and to observe the following:

1 The Bidder / Contractor recognizes and accepts the statutory and comprehensive responsibility for ensuring safe construction and Testing & Commissioning in the Transmission Projects being executed by them by providing safe methods of work, working conditions and Tools & Plants for human safety.

2 The Bidder / Contractor recognizes and accepts the responsibilities for ensuring safety of not only their employees but also that of the Sub-contractors, Principal Employer and the general public during execution of the Transmission Projects / works.

3 The Bidder / Contractor shall review the accidents in a structured manner and take necessary actions to ensure that the safety criteria are strengthened for safe construction of the Transmission Assets.

4 The Bidder / Contractor shall endeavour continuous development of safe methods of work to ensure that the effect of risks and perils are minimised to the extent possible and implement the same at their work sites.

5 The Bidder / Contractor shall conduct periodical Training to their Employees as well as to that of their Sub-contractors for safety awareness during construction works being executed by them.

6 The Bidder / Contractor shall provide all requisite Tools & Plants required for the work and ensure their healthiness by periodical inspections / testing as required. Unhealthy and sub-standard Tools & Plants will be immediately removed from site as and when they are identified.

7 The Bidder / Contractor shall, at their cost, provide all necessary Personal Protective Equipments such as Double Lanyard Safety Belts, Appropriate Fall Arrest Systems, Safety Helmets, Foot Wear, Hand Gloves, etc., as required for various activities pertaining to execution of the Projects / works, confirming to relevant Indian Standards.

8	The Bidder / Contractor shall ensure that dedicated qualified Safety Officers are posted in the construction projects being executed by them and ensure that the Safety Officer visits each and every gang periodically and conducts audits / inspections to identify the unsafe conditions and unsafe actions, to be rectified by the site supervising personnel promptly.
9	The Bidder / Contractor shall conduct appropriate medical checks-up for the workers before deploying them at their construction sites to ensure that only those who are medically fit are deployed in the Projects / works to be executed by them. The copy of the Medical Reports shall be provided by the Bidder / Contractor to RECPDCL, whenever requested by RECPDCL.
10	The Bidder / Contractor shall screen the workers before deploying them at their construction sites to ensure that only those with the skills, experience and competence to work at height and also medically fit for work at height are deployed for work at height in the Projects executed by them.
11	The Bidder / Contractor shall ensure daily before starting the work that their site Supervising Personnel / Safety Officer briefs the workers about the work for the day and the safety measures / precautions required to be taken by them.
12	The Bidder / Contractor shall investigate all the accidents at their working sites to ascertain the lapses leading to the incident and the precautionary / corrective measures required to be taken to avoid recurrence of such accidents. These accidents will be reviewed at the Board Management level of the Agencies and the findings / recommendations will be put up to RECPDCL Apex Safety Board within the stipulated period.
13	The Bidder / Contractor shall ensure that all accidents, whether fatal or non-fatal in nature, will be informed to RECPDCL, in writing, immediately on the occurrence of the same and in any case, within not more than 24 hours of occurrence of the same.
14	The Bidder / Contractor shall ensure that in case of any accident, all necessary medical help / support shall be provided to the victims / injured till they are completely fit to return to work.
15	The Bidder / Contractor shall ensure that in case of fatal accidents, all statutory Authorities, including Police, concerned Labour Dept. Officials, concerned Workmen Compensation Commissioner, etc., will be intimated in writing as required by the statutory Law, and followed up for compliance of all statutory obligations. The Bidder / Contractor shall own full responsibility of timely accident reporting to various authorities, including RECPDCL.

16 The Bidder / Contractor shall ensure that in case of fatality or serious injury leading to permanent disablement of the victims, the compensation amount will be deposited with the concerned authorities, as required by the Laws, and followed up for early disbursement to the beneficiaries of the victims.

17 The Bidder / Contractor assures that they shall co-operate to the fullest extent for carrying out any investigation of the accidents at their work sites by RECPDCL to identify the lapses, the reason for the accident / incident and suggest measures for prevention of recurrence of such accidents. All factual details of the occurrence of the accident will be provided to RECPDCL, as and when required.

18 The Bidder / Contractor assures that they take full responsibility of meeting the statutory obligations in case of accidents, and in case of any reference by any Statutory Body at a later date also, they shall provide all information to RECPDCL and meet all the statutory obligations, including payment of additional compensation, if any.

19 The Bidder / Contractor assures that in case of any inspection of their work site or Notice by any Statutory Authority, they shall comply promptly and inform RECPDCL Site Officials of the same, and also provide all necessary information and assistance for smooth compliance of the observations / instructions of such Authorities.

20 The Bidder / Contractor accepts the provisions regarding safety, including payment of compensation to RECPDCL, in case of any violation of the safety requirements / provisions during execution of the Transmission Projects, as built in the Contractual Conditions, Safety Plan and the Safety Pact, and confirm to abide by the same.

Section III - Equal treatment to all Bidders / Contractors:

1 RECPDCL will enter into agreements with identical conditions as this one with all Bidders.

2 RECPDCL will disqualify, from the tender process, any bidder/ take punitive actions on the bidder, who does not sign this Pact or violate its provisions.

Section IV - Pact Duration:

This Pact begins when both parties have legally signed it. It expires for the successful Bidder / Contractor after closure of the contract and, for all other Bidders, after the contract has been awarded.

Section V - Other Provisions:

1 This agreement is subject to Indian Law. Place of performance and jurisdiction is the establishment of RECPDCL. The Arbitration clause provided in the main tender document / contract shall not be applicable for any issue / dispute arising under the Safety Pact.

2 Changes and supplements need to be made in writing, which shall come into force only upon mutual agreement / acceptance.

3 If the Contractor is a partnership firm or consortium of Joint Venture, this agreement must be signed by all partners, consortium members and Joint Venue partners, as applicable as per the Tender Specifications.

4 Nothing in this agreement shall affect the rights of the parties available under General Conditions of Contract (GCC) and Special Conditions of Contract (SCC).

5 Should one or several provisions of this agreement turn out to be invalid, the reminder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

(Signature)_____
(For & on behalf of RECPDCL)
(Office Seal)

Name:_____
Designation:_____

(Signature)_____
(For & on behalf of Bidder / Partner(s) of Joint Venture/ Consortium partner (s))
(Office Seal)

Name:_____
Designation:_____

Witness 1:_____

(Name & Address)_____

Witness 2:_____

(Name & Address)_____

Witness 1:_____

(Name & Address)_____

Witness 2:_____

(Name & Address)_____

5. PERFORMANCE SECURITY FORM

(*TO BE SUBMITTED BY THE CONTRACTOR OPTING FOR SUBMISSION OF PERFORMANCE SECURITY IN ACCORDANCE WITH CLAUSE GCC 9)*

(For the purpose of verification/confirmation of this Bank Guarantee by the Employer, the Bank shall indicate 2 official email ids of the authorized signatories from Issuing Branch and also of the designated higher office (Corporate Office, Zonal Office etc)in the covering letter of the Bank forwarding the Bank Guarantee.)

Bank Guarantee No. …… Date.....

NOA/Contract No.....

……..*[Name of Contract]*……..

To: *[Name and address of the **Owner**]*

Dear Ladies and/or Gentlemen,

We refer to the Contract ("the Contract")

vide notification of award issued on *..... (insert date of the notification of award)*....by M/s. REC Power Development and Consultancy Ltd., having its Registered Office at D-Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram, Haryana– 122 001 ("the Employer"/"RECPDCL") on behalf of ..... Name of OWNER…..... (hereinafter referred to as 'Owner') to M/s ..... *(Name of Contractor)* .....,

(or)

signed on .....*(insert date of the Contract)*..... between M/s. REC Power Development and Consultancy Ltd., having its Registered Office at D-Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram, Haryana– 122 0013 ("the Employer"/"RECPDCL") on behalf of ..... Name of OWNER…..... (hereinafter referred to as 'Owner'), and M/s ..... *(Name of Contractor)* .....,having its Principal place of business at ……*(Address of Contractor)* ..... and Registered Office at ……*(Registered address of Contractor)* ..... ("the Contractor") and the Contract ("the Contract") signed on .....*(insert date of the Contract)*..... between you and M/s ..... *(Name of Associate)* ....., having its Principal place of business at ……*(Address of Associate)* ..... and Registered Office at ……*(Registered address of Associate)* ....., the Associate of the Contractor for executing the Facilities concerning ……..... *(Indicate brief scope of*

work) ..... for the complete execution of the …… *(insert name of Package alongwith name of the Project)…….. [Applicable for Bank Guarantees to be issued by Contractor against those Contracts awarded to their Associate]*

By this letter we, the undersigned, ……..*(insert name & address of the issuing bank)* ……., a Bank (which expression shall include its successors, administrators, executors and assigns) organized under the laws of ..... and having its Registered/Head Office at ……..*(insert address of registered office of the bank)*……. do hereby irrevocably guarantee payment to you up to …… i.e., ten percent (10%) of the Contract Price until 60 months i.e., upto and inclusive of …….. *(dd/mm/yy)*.

We undertake to make payment under this Letter of Guarantee upon receipt by us of your first written demand signed by the Employer's duly authorized officer or the authorized officer of Owner declaring the Contractor to be in default under the Contract and without cavil or argument any sum or sums within the above named limits, without your need to prove or show grounds or reasons for your demand and without the right of the Contractor to dispute or question such demand.

Our liability under this Letter of Guarantee shall be to pay to you whichever is the lesser of the sum so requested or the amount then guaranteed hereunder in respect of any demand duly made hereunder prior to expiry of the Letter of Guarantee, without being entitled to inquire whether or not this payment is lawfully demanded.

This letter of Guarantee shall remain in full force and shall be valid from the date of issue until 60 months i.e. upto and inclusive of …….. *(dd/mm/yy)* and shall be extended from time to time for such period, as may be desired by M/s. …… on whose behalf this Letter of Guarantee has been given.

Except for the documents herein specified, no other documents or other action shall be required, notwithstanding any applicable law or regulation.

Our liability under this Letter of Guarantee shall become null and void immediately upon its expiry, whether it is returned or not, and no claim may be made hereunder after such expiry or after the aggregate of the sums paid by us to you shall equal the sums guaranteed hereunder, whichever is the earlier.

All notices to be given under shall be given by registered (airmail) posts to the addressee at the address herein set out or as otherwise advised by and between the parties hereto.

We hereby agree that any part of the Contract may be amended, renewed, extended, modified, compromised, released or discharged by mutual agreement between you and the Contractor, and this security may be exchanged or surrendered without in any way impairing or affecting our liabilities hereunder without notices to us and without the necessity for any additional endorsement, consent or guarantee by us, provided, however, that the sum guaranteed shall not be increased or decreased.

No action, event or condition which by any applicable law should operate to discharge us from liability hereunder shall have any effect and we hereby waive any right we may have to apply such law so that in all respects our liability hereunder shall be irrevocable and, except as stated herein, unconditional in all respects.

Notwithstanding anything contained herein:

1. Our liability under this Bank Guarantee shall not exceed _____ (*value in figures*)_____ [_____ (*value in words*)_____].

2. This Bank Guarantee shall be valid upto _____*(validity date)*_____.

3. We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only & only if we receive a written claim or demand on or before _____ (*validity date*) _____."

For and on behalf of the Bank

[*Signature of the authorised signatory(ies)*]

Signature_____

Name_____

Designation_____

POA Number_____

Contact Number(s): Tel._____Mobile_____

Fax Number_____

email _____

Common Seal of the Bank_____

Witness:

Signature_____

Name_____

Address_____

Contact Number(s): Tel._____Mobile_____

email _____

Note :

1. For the purpose of executing the Bank Guarantee, the non-judicial stamp papers of appropriate value shall be purchased in the name of Bank who issues the 'Bank Guarantee'.

2. The Bank Guarantee shall be signed on all the pages by the Bank Authorities indicating their POA nos. and should invariably be witnessed.

3. The Bank Guarantee should be in accordance with the proforma as provided. However, in case the issuing bank insists for additional paragraph regarding applicability of ICC publication No: 758, the following may be added at the end of the proforma of the Bank Guarantee [*i.e., end paragraph of the Bank Guarantee preceding the signature(s) of the issuing authority(ies) of the Bank Guarantee*]:
"This Guarantee is subject to Uniform Rules for Demand Guarantee, ICC publication No. 758 except that article 15(a) is hereby excluded."

6. FORM OF TAKING OVER CERTIFICATE

Date.....

Name of Contract.....

Contract No.....

To :

(Name and address of the Contractor)

Dear Ladies and/or Gentlemen,

Pursuant to GCC 30 (Taking Over) of the General Conditions of the Contract entered into between yourselves and the Employer dated …… relating to the ..... *(insert brief description of the Facilities)*..... we hereby notify you that the following part(s) of the Facilities was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Employer hereby takes over the said part(s) of the Facilities, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below :

1. Description of the Facilities or part thereof .....
   ….....

2. Date of Completion :.....

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defects Liability Period.

Very truly yours,

Title
(Project Manager)

7. FORM OF INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE EQUIPMENT HANDED OVER IN ONE LOT BY .....*(abbreviated name of the Employer)*..... FOR PERFORMANCE OF ITS CONTRACT

INDEMNITY BOND

THIS INDEMNITY BOND is made this..... day of ..... 20..... by ..... a Company registered under the Companies Act, 1956/Partnership firm/ proprietary concern having its Registered Office at.....(hereinafter called as 'Contractor' or "Obligor" which expression shall include its successors and permitted assigns) in favour of ..... *(insert name of the Employer)*....., a Company incorporated under the Companies Act, 1956 having its Registered Office at .....*(insert registered address of the Employer)* and its project at ..... (hereinafter called ".....*(abbreviated name of the Employer)*....." which expression shall include its successors and assigns):

WHEREAS .....*(abbreviated name of the Employer)*..... has awarded to the Contractor a Contract for..... .....vide its Notification of Award/Contract No..... dated..... and its Amendment No. ..... (applicable when amendments have been issued) (hereinafter called the "Contract") in terms of which .....*(abbreviated name of the Employer)*..... is required to hand over various Equipment to the Contractor for execution of the Contract.

And WHEREAS by virtue of Clause No.....of the said Contract, the Contractor is required to execute an Indemnity Bond in favour of .....*(abbreviated name of the Employer)*..... for the Equipment handed over to it by .....*(abbreviated name of the Employer)*..... for the purpose of performance of the Contract/Erection portion of the contract (hereinafter called the "Equipment").

AND THEREFORE, This Indemnity Bond witnesseth as follows:

1. That in consideration of various Equipment as mentioned in the Contract, valued at (amount in words.....) handed over to the Contractor for the purpose of performance of the Contract, the Contractor hereby undertakes to indemnify and shall keep .....*(abbreviated name of the Employer)*..... indemnified, for the full value of the Equipment. The Contractor hereby acknowledges receipt of the Equipment as per despatch title documents handed over to the Contractor duly endorsed in their favour and detailed in the Schedule appended hereto. It is expressly understood by the Contractor that handing over of the despatch title documents in respect of the said Equipments duly endorsed by .....*(abbreviated name of the Employer)*..... in favour of the Contractor shall be construed as handing over of the Equipment purported to be covered by such title documents and the Contractor shall hold such Equipment in trust as a Trustee for and on behalf of .....*(abbreviated name of the Employer)*.....

2. That the Contractor is obliged and shall remain absolutely responsible for the safe transit/protection and custody of the Equipment at .....*(abbreviated name of*

the Employer)..... project Site against all risks whatsoever till the Equipment are duly used/erected in accordance with the terms of the Contract and the Plant/Package duly erected and commissioned in accordance with the terms of the Contract, is taken over by .....*(abbreviated name of the Employer)*..... The Contractor undertakes to keep .....*(abbreviated name of the Employer)*..... harmless against any loss or damage that may be caused to the Equipment.

3. The Contractor undertakes that the Equipment shall be used exclusively for the performance/execution of the Contract strictly in accordance with its terms and conditions and no part of the equipment shall be utilised for any other work of purpose whatsoever. It is clearly understood by the Contractor that non-observance of the obligations under this Indemnity Bond by the Contractor shall inter-alia constitute a criminal breach of trust on the part of the Contractor for all intents and purpose including legal/penal consequences.

4. That .....*(abbreviated name of the Employer)*..... is and shall remain the exclusive Employer of the Equipment free from all encumbrances, charges or liens of any kind, whatsoever. The equipment shall at all times be open to inspection and checking by the Employee or Employer's Representative in this regard. Further, ...*(abbreviated name of the Employer)*..... shall always be free at all times to take possession of the Equipment in whatever form the equipment may be, if in its opinion, the Equipment are likely to be endangered, misutilised or converted to uses other than those specified in the Contract, by any acts of omission or commission on the part of the Contractor or any other person or on account of any reason whatsoever and the Contractor binds himself and undertakes to comply with the directions of demand of .....*(abbreviated name of the Employer)*..... to return the equipment without any demur or reservation.

5. That this indemnity Bond is irrevocable. If at any time any loss or damage occurs to the Equipment or the same or any part thereof is misutilised in any manner whatsoever, then the Contractor hereby agrees that the decision of the Employer's Representative as to assessment of loss or damage to the Equipment shall be final and binding on the Contractor. The Contractor binds itself and undertakes to replace the lost and/or damaged Equipment at his own cost and/or shall pay the amount of loss to .....*(abbreviated name of the Employer)*..... without any demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to .....*(abbreviated name of the Employer)*..... against the Contractor under the Contract and under this Indemnity Bond.

6. NOW THE CONDITION of this Bond is that if the Contractor shall duly and punctually comply with the terms and conditions of this Bond to the satisfaction of .....*(abbreviated name of the Employer)*....., THEN, the above Bond shall be void, but otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorised representative under the common seal of the Company, the day, month and year first above mentioned.

SCHEDULE

Particulars of the Equipment handed over	Quantity	Particulars of Despatch title Documents		Value of the Equipment	Signature of the Attorney in token of receipt
		RR/GR No. date of lading	Carrier		

For and on behalf of
M/s.....

WITNESS

1. Signature..... Signature.....

   Name..... Name.....

   Address..... Address.....

2. Signature..... Authorised representative

   Name..... (Common Seal)

   Address..... (In case of Company)

Indemnity Bonds are to be executed by the authorised person and (i) in case of contracting Company under common seal of the Company or (ii) having the power of attorney issued under common seal of the company with authority to execute Indemnity Bonds, (iii) In case of (ii), the original Power of Attorney if it is specifically for this Contract or a Photostat copy of the Power of Attorney if it is General Power of Attorney and such documents should be attached to Indemnity Bond.

8. FORM OF INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE EQUIPMENT HANDED OVER IN INSTALLMENTS BY .....*(abbreviated name of the Employer)*..... FOR PERFORMANCE OF ITS CONTRACT

INDEMNITY BOND

THIS INDEMNITY BOND is made this ……..... day of ……..... 20..... by …….. a Company registered under the Companies Act, 1956/Partnership firm/proprietary concern having its Registered Office at ……..…..(hereinafter called as 'Contractor' or 'Obligor' which expression shall include its successors and permitted assigns) in favour of .....*(insert name of the Employer)*....., a company incorporated under the Companies Act, 1956 having its Registered Office at .....*(insert registered address of the Employer)*..... and its project at ……..... (hereinafter called ".....*(abbreviated name of the Employer)*....." which expression shall include its successors and assigns):

WHEREAS .....*(abbreviated name of the Employer)*..... has awarded to the Contractor a Contract for .....vide its Notification of Award/Contract No. ……..... dated ….……..…..and Amendment No. ..... (applicable when amendments have been issued) (hereinafter called the "Contract") in terms of which .....*(abbreviated name of the Employer)*..... is required to handover various Equipment to the Contractor for execution of the Contract.

AND WHEREAS by virtue of Clause No.....of the said Contract, the Contractor is required to execute an Indemnity Bond in favour of .....*(abbreviated name of the Employer)*..... for the Equipment handed over to it by .....*(abbreviated name of the Employer)*..... for the purpose of performance of the contract/Erection portion of the Contract (hereinafter called the "Equipment".)

NOW THEREFORE, This Indemnity Bond witnesseth as follows:

1. That in consideration of various Equipments as mentioned in the Contract, valued at (amount in words _____) to be handed over to the Contractor in installments from time to time for the purpose of performance of the contract, the Contractor hereby undertakes to indemnify and shall keep .....*(abbreviated name of the Employer)*..... indemnified, for the full value of Equipment. The Contractor hereby acknowledges receipt of the initial installment of the equipment per details in the schedule appended hereto. Further, the Contractor agrees to acknowledge receipt of the subsequent installments of the Equipment as required by .....*(abbreviated name of the Employer)*..... in the form of Schedules consecutively numbered which shall be attached to this Indemnity bond so as to form integral parts of this Bond. It is expressly understood by the Contractor that handing over the despatch title documents in respect of the said Equipments duly endorsed by .....*(abbreviated name of the Employer)*..... in favour of the Contractor shall be construed as handing over the Equipment purported to be covered by such title documents

and the Contractor shall hold such Equipments in trust as a Trustee for and on behalf of .....*(abbreviated name of the Employer)*.....

2. That the Contractor is obliged and shall remain absolutely responsible for the safe transit/protection and custody of the Equipment at .....*(abbreviated name of the Employer)*..... project Site against all risks whatsoever till the Equipment are duly used/erected in accordance with the terms of the Contract and the Plant/Package duly erected and commissioned in accordance with the terms of the Contract, is taken over by .....*(abbreviated name of the Employer)*..... The Contractor undertakes to keep .....*(abbreviated name of the Employer)*..... harmless against any loss or damage that may be caused to the Equipment.

3. The Contractor undertakes that the Equipment shall be used exclusively for the performance/execution of the Contract strictly in accordance with its terms and conditions and no part of the equipment shall be utilised for any other work or purpose whatsoever. It is clearly understood by the Contractor that non-observance of the obligations under this Indemnity Bond by the Contractor shall inter-alia constitute a criminal breach of trust on the part of the Contractor for all intents and purpose including legal/penal consequences.

4. That .....*(abbreviated name of the Employer)*..... is and shall remain the exclusive Employer of the Equipment free from all encumbrances, charges or liens of any kind, whatsoever. The equipment shall at all times be open to inspection and checking by the Employer or Employer's Representative in this regard. Further, ...*(abbreviated name of the Employer)*..... shall always be free at all times to take possession of the Equipment in whatever form the Equipment may be, if in its opinion, the Equipment are likely to be endangered, misutilised or converted to uses other than those specified in the Contract, by any acts of omission or commission on the part of the Contractor or any other person or on account of any reason whatsoever and the Contractor binds himself and undertakes to comply with the directions of demand of .....*(abbreviated name of the Employer)*..... to return the equipment without any demur or reservation.

5. That this indemnity Bond is irrevocable. If at any time any loss or damage occurs to the Equipment or the same or any part thereof is misutilised in any manner whatsoever, then the Contractor hereby agrees that the decision of the Employer's Representative as to assessment of loss or damage to the Equipment shall be final and binding on the Contractor. The Contractor binds itself and undertakes to replace the lost and/or damaged Equipment at its own cost and/or shall pay the amount of loss to .....*(abbreviated name of the Employer)*..... without any demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to .....*(abbreviated name of the Employer)*..... against the Contractor under the Contract and under this Indemnity Bond.

6. NOW THE CONDITION of this Bond is that if the Contractor shall duly and punctually comply with the terms and conditions of this Bond to the satisfaction

of .....*(abbreviated name of the Employer)*....., THEN, the above Bond shall be void, but otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorised representative under the common seal of the Company, the day, month and year first above mentioned.

SCHEDULE No. 1

Particulars of the Equipment handed over	Quantity	Particulars of Despatch title Documents		Value of the Equipment	Signature of the Attorney in token of receipt
		RR/GR No. date of lading	Carrier		

For and on behalf of
M/s.....

WITNESS

1. Signature..... Signature.....

   Name..... Name.....

   Address..... Address.....

2. Signature..... Authorised representative

   Name..... (Common Seal)

   Address..... (In case of Company)

Indemnity Bonds are to be executed by the authorised person and (i) in case of contracting Company under common seal of the Company or (ii) having the power of attorney issued under common seal of the company with authority to execute Indemnity Bonds, (iii) In case of (ii), the original Power of Attorney if it is specifically for this Contract or a photostat copy of the Power of Attorney if it is General Power of Attorney and such documents should be attached to Indemnity Bond.

9. FORM OF AUTHORISATION LETTER

Ref. No:

Date :

To

M/s.....
.....
.....

REF.: Contract No. …….. dated ..... for ..... awarded by ....*(insert name of the Employer)*.....

Dear Sir,

Kindly refer to Contract No. …….. dated …..... for .....
You are hereby authorised on behalf of ..... *(Name of Employer)*..... a company incorporated under the laws of Companies Act 1956 and having its Registered Office at ……*(registered address of the Employer)* ……. and its Project at ..... to take physical delivery of materials/equipments covered under Despatch Document/Consignment Note No. ……..*..... dated .....and as detailed in the enclosed schedule for the sole purpose of successful performance of the aforesaid contract and for no other purpose, whatsoever.

(Signature of Project Authority)**

Designation.....

Date.....

Encl: As Above.

** To be signed not below the rank of Manager.

* Mention LR/RR No.

Schedule of Material/Equipment covered under Despatch Title Document (RR No./LR No. .....)

Sl. No.	Contract Name	NOA No./ CA No.	Description of Materials/ Equipments	Spec. No.	Qty.	Value	Remarks

(Signature of the Project Authority)

(Designation) .....

(Date) .....

10. FORM OF TRUST RECEIPT FOR PLANT, EQUIPMENT AND MATERIALS RECEIVED

We M/s. ……..*(insert name of the Contractor)* ..... having our Principal place of business at ..... having been awarded a Contract No. ..... dated ..... for ……. *(insert Package name alongwith name of the Project)*..... by ……*(insert name of the Employer)* .....

We do hereby acknowledge the receipt of the Plant, Equipment and Materials as are fully described and mentioned under Documents of Title/RR/LR etc. and in the schedule annexed hereto, which shall form an integral part of this receipt as "Trustee" of ..... *(insert name of the Employer)*……. The aforesaid materials etc. so received by us shall be exclusively used in the successful performance of the aforesaid Contract and for no other purpose whatsoever. We undertake not to create any charge, lien or encumbrance over the aforesaid materials etc, in favour of any other person/institution(s)/Banks.

For M/s .....
(Contractor's Name)

Dated : .....

(AUTHORISED SIGNATORY)

Place : .....

SEAL OF COMPANY

11. FORM OF EXTENSION OF BANK GUARANTEE

Ref. No..... Dated:.....

To: *[Name and address of the Employer]*

Dear Sirs,

Sub.: Extension of Bank Guarantee No. …… …… dated …… for ……., issued to you on behalf of M/s. ……*(insert name of the Contractor)* ……. in respect of Contract No. ……. dated ……. for …….. *(insert name of the Package alongwith the Project name)* ……. (hereinafter called original Bank Guarantee).

At the request of M/s…… *(insert name of the Contractor)* ……., We ……*(insert name & address of the issuing bank)* ……., a Bank organized under the laws of ..... and having its Registered/Head Office at ……*(insert address of registered office of the bank)*…… do hereby extend our liability under the above-mentioned Guarantee No. ……..... Dated ……..... for a further period of ..... Years/Months from ..... to expire on ..... Except as provided above, all other terms and conditions of the original Bank Guarantee No. ……..... dated ..... shall remain unaltered and binding.

Please treat this as an integral part of the original Guarantee to which it would be attached.

For and on behalf of the Bank

[*Signature of the authorised signatory(ies)*]

Signature_____

Name_____

Designation_____

POA Number_____

Contact Number(s): Tel._____Mobile_____

Fax Number_____

email _____

Common Seal of the Bank_____

Witness:

Signature_____

Name_____

Address_____

Contact Number(s): Tel._____Mobile_____

email _____

Note:

1. For the purpose of executing the Bank Guarantee, the non-judicial stamp papers of appropriate value shall be purchased in the name of Bank who issues the 'Bank Guarantee'.

2. The Bank Guarantee shall be signed on all the pages by the Bank Authorities indicating their POA nos. and should invariably be witnessed.

12A. POWER OF ATTORNEY

To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution.

Know all men by these presents, We ……..(name and address of the registered office of the Bidder) do hereby constitute, appoint and authorize Mr./Ms……(name and residential address) who is presently employed with us and holding the position of …….. as our attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to our Response against Tender No..... Name of work ..... the bids for which have been invited by …… (insert name of the Employer alongwith address) ……. (hereinafter called the 'Employer') to undertake the following acts :

a. To submit proposal and participate in the aforesaid Bid Specification of the Employer.

b. To negotiate with the Employer the terms and conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with the Employer.

c. To do any other act or submit any document related to the above.

d. To receive, accept and execute the Contract.

e. To ensure performance of the Contract(s)

f. It is expressly understood that this Power of Attorney shall remain valid binding and irrevocable till completion of the Defect Liability Period in terms of the Contract.

We hereby agree to ratify all acts, deeds and things lawfully done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall and shall always be deemed to have been done by us.

for and on behalf of the bidder

.....

.....

.....

Seal and Signature

in the presence of:

WITNESS

Signature..... Name ..... Designation ..... Occupation……	Signature..... Name ..... Designation ..... Occupation……

Note :

1. For the purpose of executing the Agreement, the non-judicial stamp papers of appropriate value.
2. The Agreement shall be signed on all the pages by the authorized representatives

12B. FORM OF POWER OF ATTORNEY FOR JOINT VENTURE

KNOW ALL MEN BY THESE PRESENTS THAT WE , the Partners whose details are given hereunder ..... have formed a Joint Venture under the laws of ..... and having our Registered Office(s)/Head Office(s) at ..... (hereinafter called the 'Joint Venture' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) acting through M/s ..... being the Partner in-charge do hereby constitute, nominate and appoint M/s..... a Company incorporated under the laws of ..... and having its Registered/Head Office at ..... as our duly constituted lawful Attorney (hereinafter called "Attorney" or "Authorised Representative" or "Partner In-charge") to exercise all or any of the powers for and on behalf of the Joint Venture in regard to Specification No..... Package ..... the bids for which have been invited by ..... (insert name of the Employer alongwith address) ..... (hereinafter called the 'Employer') to undertake the following acts :

i) To submit proposal and participate in the aforesaid Bid Specification of the Employer on behalf of the "Joint Venture".

ii) To negotiate with the Employer the terms and conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with the Employer for and on behalf of the "Joint Venture".

iii) To do any other act or submit any document related to the above.

iv) To receive, accept and execute the Contract for and on behalf of the "Joint Venture".

It is clearly understood that the Partner In-charge (Lead Partner) shall ensure performance of the Contract(s) and if one or more Partner fail to perform their respective portions of the Contract(s), the same shall be deemed to be a default by all the Partners.

It is expressly understood that this Power of Attorney shall remain valid binding and irrevocable till completion of the Defect Liability Period in terms of the Contract.

The Joint Venture hereby agrees and undertakes to ratify and confirm all the whatsoever the said Attorney/Authorised Representatives/Partner in-charge quotes in the bid, negotiates and signs the Contract with the Employer and/or proposes to act on behalf of the Joint Venture by virtue of this Power of Attorney and the same shall bind the Joint Venture as if done by itself.

IN WITNESS THEREOF the Partners Constituting the Joint Venture as aforesaid have executed these presents on this ..... day of ……..... under the Common Seal(s) of their Companies.

for and on behalf of the
Partners of Joint Venture

.....

.....

.....

The Common Seal of the above Partners of the Joint Venture:

The Common Seal has been affixed there unto in the presence of:

WITNESS

1. Signature.....

   Name .....

   Designation .....

   Occupation .....

2. Signature.....

   Name .....

   Designation .....

   Occupation .....

Note:

1. For the purpose of executing the Agreement, the non-judicial stamp papers of appropriate value shall be purchased in the name of Joint Venture.
2. The Agreement shall be signed on all the pages by the authorised representatives of each of the partners and should invariably be witnessed.

13. FORM OF UNDERTAKING BY THE JOINT VENTURE PARTNERS

THIS JOINT DEED OF UNDERTAKING executed on this……. day of……... Two Thousand and……..... by …….. a company incorporated under the laws of …….. and having its Registered Office at .....(hereinafter called the "Party No.1" which expression shall include its successors, executors and permitted assigns) and M/s……a company incorporated under the laws of ……..…… and having its Registered Office at ……..…… (hereinafter called the "Party No.2" which expression shall include its successors, executors and permitted assigns) and M/s.. .. .. a Company incorporated under the laws of …….. and having its Registered Office at …….. (hereinafter called the "Party No.3" which expression shall include its successors, executors and permitted assigns) for the purpose of making a bid and entering into a contract [hereinafter called the "Contract" {in case of award)] against the Specification No…….…….. for …… *(insert name of the package alongwith project name)* …….. of …….. *(insert names of the Employer)* ……., a Company incorporated under the Companies Act of 1956 having its registered office at ……..*(insert registered address of the Employer)*…….. (hereinafter called the "Employer").

WHEREAS the Party No.1, Party No.2 and Party No.3 have entered into an Agreement dated.....

AND WHEREAS the Employer invited bids as per the above mentioned Specification for the design, manufacture, supply, erection, testing and commissioning of Equipment/ Materials stipulated in the Bidding Documents under …… *(insert name of the package alongwith project name)* ……

AND WHEREAS Clause 9.3, Section-ITB and Section-III, VOl-I., Qualification Requirement forming part of the Bidding Documents, inter-alia stipulates that an Undertaking of two or more qualified manufacturers as partners, meeting the requirements of Qualification Criteria, as applicable may bid, provided, the Joint Venture fulfills all other requirements under Clause 9.3 (c) of ITB and Section-III, VOl-I., Qualification Requirement and in such a case, the Bid Forms shall be signed by all the partners so as to legally bind all the Partners of the Joint Venture, who will be jointly and severally liable to perform the Contract and all obligations hereunder.

The above clause further states that this Undertaking shall be attached to the bid and the Contract performance guarantee will be as per the format enclosed with the Bidding Documents without any restrictions or liability for either party.

AND WHEREAS the bid is being submitted to the Employer vide proposal No……..dated ……... by Party No.1 based on this Undertaking between all the parties; under these presents and the bid in accordance with the requirements of Clause 9.3, Section-ITB and Section-III, VOl-I., Qualification Requirement , has been signed by all the parties.

NOW THIS UNDERTAKING WITNESSETH AS UNDER:

In consideration of the above premises and agreements all the parties of this Deed of Undertaking do hereby declare and undertake:

1. In requirement of the award of the Contract by the Employer to the Joint Venture Partners, we, the Parties do hereby undertake that M/s…… the Party No.1, shall act as Lead Partner and further declare and confirm that we the parties to the Joint Venture shall jointly and severally be bound unto the Employer for the successful performance of the Contract and shall be fully responsible for the design, manufacture, supply and successful performance of the equipment in accordance with the Contract:

2. In case of any breach or default of the said Contract by any of the parties to the Joint Venture, the party(s) do hereby undertake to be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.

3. Further, if the Employer suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performances guaranteed as per the specification in terms of the Contract, the Party(s) of these presents undertake to promptly make good such loss or damages caused to the Employer, on its demand without any demur. It shall not be necessary or obligatory for the Employer to proceed against Lead Partner to these presents before proceeding against or dealing with the other Party(s), the Employer can proceed against any of the parties who shall be jointly and severally liable for the performance and all other liabilities/obligations under the Contract to the Employer.

4. The financial liability of the Parties of this Deed of Undertaking to the Employer, with respect to any of the claims rising out of the performance or non-performance of the obligations set forth in this Deed of Undertaking, read in conjunction with the relevant conditions of the Contract shall, however not be limited in any way so as to restrict or limit the liabilities or obligations of any of the Parties of this Deed of Undertaking.

5. It is expressly understood and agreed between the Parties to this Undertaking that the responsibilities and obligations of each of the Parties shall be as delineated in Appendix – I *(to be suitably appended by the Parties alongwith this Undertaking in its bid)* to this Deed of Undertaking. It is further undertaken by the parties that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Parties under the Contract.

6. It is also understood that this Undertaking is provided for the purposes of undertaking joint and several liabilities of the partners to the Joint Venture for

submission of the bid and performance of the Contract and that this Undertaking shall not be deemed to give rise to any additional liabilities or obligations, in any manner or any law, on any of the Parties to this Undertaking or on the Joint Venture, other than the express provisions of the Contract.

7. This Undertaking shall be construed and interpreted in accordance with the provisions of the Contract.

8. In case of an award of a Contract, we the parties to this Deed of Undertaking do hereby agree that we shall be jointly and severally responsible for furnishing a Contract performance security from a bank in favour of the Employer in the currency/currencies of the Contract.

9. It is further agreed that this Deed of Undertaking shall be irrevocable and shall form an integral part of the bid and shall continue to be enforceable till the Employer discharges the same or upon the completion of the Contract in accordance with its provisions, whichever is earlier. It shall be effective from the date first mentioned above for all purposes and intents.

IN WITNESS WHEREOF, the Parties to this Deed of Undertaking have through their authorised representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of ……..
has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated ……..

Name ……..

Designation ……..

Signature ……..

For Lead Partner (Party No.-1)
For and on behalf of M/s
……..

(Signature of the authorized representative)

WITNESS :

I. ……

II. ……

Common Seal of ……..
has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated ……..

For Party No.-2
For and on behalf of M/s……..

Name ……..

Designation ……..

Signature ……..

(Signature of the authorized representative)

WITNESS :

I. ……

II. ……

Common Seal of …….. has been affixed in my/ our presence pursuant to Board of Director's Resolution dated ……..

For Party No.-3
For and on behalf of M/s. ……..

Name ……..

Designation ……..

Signature ……..

(Signature of the authorized representative)

WITNESS :

I. ……

II. ……

Note:

1. For the purpose of executing the Joint Deed of Undertaking, the non-judicial stamp papers of appropriate value shall be purchased in the name of Joint Venture.

2. The Undertaking shall be signed on all the pages by the authorised representatives of each of the partners and should invariably be witnessed.

14. FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CREDIT/FACILITIES

BANK CERTIFICATE

This is to certify that M/s. _____ *(insert Name & Address of the Contractor)* _____ who have submitted their bid to ……..*(insert name of the Employer)*……. against their tender specification Vide ref. No. ……. for ……. *(insert name of the package alongwith the project name)* …….. is our customer for the past …… years.

Their financial transaction with our Bank have been satisfactory. They enjoy the following fund based and non fund based limits including for guarantees, L/C and other credit facilities with us against which the extent of utilization as on date is also indicated below:

Sl. No.	**Type of Facility**	**Sanctioned Limit as on Date**	**Utilisation as on Date**

This letter is issued at the request of M/s. _____.

Signature _____

Name of Bank _____

Name of Authorised Signatory _____

Designation _____

Phone No. _____

Address _____

SEAL OF THE BANK

15. FORM OF OPERATIONAL ACCEPTANCE

Date.....

Name of Contract.....

Contract No.....

To :

(Name and address of the Contractor)

Dear Ladies and/or Gentlemen,

Pursuant to GCC 29, 30 of the General Conditions of the Contract entered into between yourselves and the Employer dated …….. relating to the ..... *(insert brief description of the Facilities)*..... we hereby notify you that the we System tests and Acceptance tests of the following part(s) of the Facilities were satisfactorily completed on the date specified below :

1. Description of the Facilities or part thereof .....
   ……

2. Date of Operational Acceptance:.....

This letter does not relieve you of your obligation during the Defects Liability Period and Latent Defect warranty.

Very truly yours,

Title
(Project Manager)

FORM No. 16

FORM OF SAFETY PLAN TO BE SUBMITTED BY THE CONTRACTOR WITHIN SIXTY DAYS OF AWARD OF CONTRACT

[TO BE EXECUTED ON A NON JUDICIAL STAMP PAPER WORTH RS. TWENTY ONLY]

SAFETY PLAN

THIS SAFETY PLAN is made this ……..... day of ……..... 20..... by …… a Company registered under the Companies Act, 1956 or 2013, as the case may be/Partnership firm/proprietary concern having its Registered Office at …….....[*to be modified suitably for JV Contractor*] (hereinafter called as 'Contractor' which expression shall include its successors and permitted assigns) for approval of .....*(insert name of the Employer)*....., a company incorporated under the Companies Act, 1956 having its Registered Office at .....*(insert registered address of the Employer)*..... for its Contract for ……..... .....*(insert package name, project name alongwith Specification number of the Contract)*.....

WHEREAS .....*(abbreviated name of the Employer)*..... has awarded to the Contractor the aforesaid Contract vide its Notification of Award/Contract No. ……..... dated ....……..and Amendment No. ..... (applicable when amendments have been issued) (hereinafter called the "Contract") in terms of which the Contractor is required to submit 'Safety Plan' alongwith certain documents to the Engineer In-Charge/Project Manager of the Employer within Sixty (60) days of Notification of Award for its approval.

NOW THEREFORE, the Contractor undertakes to execute the Contract as per the safety plan as follows:

1. THAT the Contractor shall execute the works as per provisions of Bidding Documents including those in regard to Safety Precautions / provisions as per statutory requirements.

2. THAT the Contractor shall execute the works in a well planned manner from the commencement of Contract as per agreed mile stones of work completion schedule so that planning and execution of construction works goes smoothly and consistently through out the contract duration without handling pressure in last quarter of the financial year/last months of the Contract and the shall be finalized in association with RECPDCL Engineer In-charge/Project Manager from time to time as required.

3. THAT the Contractor has prepared the safe work procedure for each activity i.e. foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal of materials at site / store etc. to be executed at site, which is enclosed at **Annexure – 1A (SP)** for acceptance and approval of Engineer

In-charge/Project Manager. The Contractor shall ensure that on approval of the same from Engineer In-charge/Project Manager , the approved copies will be circulated to Employer's personnel at site [Supervisor(s)/Executive(s)] and Contractor's personnel at site [Gang leader, supervisor(s) etc.] in their local language / language understood by gang.

THAT the Contractor has prepared minimum manpower deployment plan, activity wise as stated above, which is enclosed at **Annexure – 1B (SP)** for approval of Engineer In-charge/Project Manager.

4. THAT the Contractor shall ensure while executing works that they will deploy minimum 25% of their own experienced work force who are on the permanent roll of the company and balance 75% can be a suitable mixed with the hired gangs / local workers / casual workers if required. The above balance 75% work force should be provided with at least 10 days training by the construction agencies at sites and shall be issued with a certificate. No worker shall be engaged without a valid certificate. Hired gang workers shall also follow safe working procedures and safety norms as is being followed by company's workmen. It should also be ensured by the contractor that certified fitters who are climbing towers / doing stringing operations can be easily identifiable with a system like issue of Badge / Identification cards (ID cards) etc. Colour identification batches should be worn by the workers. Contractor has to ensure that inexperience workers / unskilled workers should not be deployed for skilled job.

5. THAT the Contractor's Gang leader / Supervisor / Senior most member available at every construction site shall brief to each worker daily before start of work about safety requirement and warn about imminent dangers and precautions to be taken against the imminent dangers (Daily Safety Drill). This is to be ensured without fail by Contractor and maintain record of each gang about daily safety instructions issued to workers and put up to RECPDCL site In-charge for his review and record.

6. THAT the Contractor shall ensure that working Gangs at site should not be left at the discretion of their Gang Leaders who are generally hired and having little knowledge about safety. Gang leader should be experienced and well versed with the safe working procedures applicable for transmission line/ Sub Station works. In case gang is having Gang leader not on permanent roll of the company then additional Supervisor from company's own roll having thorough knowledge about the works would be deployed so as to percolate safety instructions upto the grass root level in healthy spirits. Contractor has to ensure close supervision while executing critical locations of transmission lines / sub stations and ensures that all safety instructions are in place and are being followed.

7. THAT the Contractor shall maintain in healthy and working condition all kind of Equipments / Machineries / Lifting tools / Lifting tackles / Lifting gears / All kind of Ropes including wire ropes / Polypropylene ropes etc. used for Lifting purpose during execution of the project and get them periodically examined and load

tested for safe working load in accordance with relevant provisions and requirement of Building & other construction workers Regulation of Employment and Conditions of Services Act and Central Rule 1998, Factories Act 1948, Indian Electricity Act 2003 before start of the project. A register of such examinations and tests shall be properly maintained by the contractor and will be promptly produced as and when desired by the Engineer In-charge/Project Manager or by the person authorised by him. The Contractor has to ensure to give special attention on the formation / condition of eye splices of wire rope slings as per requirement of IS 2762 Specification for wire rope slings and sling legs.

THAT the Contractor has prepared a list of all Lifting machines, lifting Tools / Lifting Tackles / Lifting Gears etc. / All types of ropes and Slings which are subject to safe working load is enclosed at **Annexure – 2 (SP)** for review and approval of Engineer In-charge/Project Manager.

8. THAT the Contractor has to procure sufficient quantity of Personal Protective Equipment (PPE)conforming to Indian / International standards and provide these equipment to every workman at site as per need and to the satisfaction of Engineer-in-charge/Project Manager of RECPDCL. The Contractor's Site Supervisor/ Project Manager has to ensure that all workmen must use Personal Protective Equipment at site. The Contractor shall also ensure that Industrial Safety helmets are being used by all workmen at site irrespective of their working (at height or on ground). The Contractor shall further ensure use of safety shoes by all ground level workers and canvas shoes for all workers working at height, Rubber Gum Boots for workers working in rainy season and concreting job, Use of Twin Lanyard Full body Safety Harness with attachment of light weight such as aluminium alloy etc. and having features of automatic locking arrangement of snap hook, by all workers working at height for more than three meters and also for horizontal movement on tower shall be ensured by contractor. The Contractor shall not use ordinary half body safety harness at site. The Contractor has to ensure use of Retractable type fall arrestors by workers for ascending / descending on suspension insulator string and other similar works etc., Use of Mobile fall arrestor for ascending / descending from tower by all workers. The contractor has to provide cotton / leather hand gloves as per requirement, Electrical Resistance Hand gloves for operating electrical installations / switches, Face shield for protecting eyes while doing welding works and Dust masks to workers as per requirement. **The Contractor shall also provide Reflective Jackets to all workmen working on the site including differently coloured such Jackets to the persons working at height.** The Contractor will have to take action against the workers not using Personal Protective Equipment at site and those workers shall be asked to rest for that day and also their Salary be deducted for that day. RECPDCL may issue warning letter to Project Manager of contractor in violation of above norms.

THAT the Contractor shall prepare a detailed list of PPEs, activity wise, to commensurate with manpower deployed, which is enclosed at **Annexure – 3 (SP)** for review and approval of Engineer In-charge/Project Manager. It shall also be

ensured that the sample of these equipment shall be got approved from RECPDCL supervisory staff before being distributed to workers. The contractor shall submit relevant test certificates as per IS / International Standard as applicable to PPEs used during execution of work. All the PPE's to be distributed to the workers shall be checked by RECPDCL supervisory staff before its usage.

The Contractor also agrees for addition / modification to the list of PPE, if any, as advised by Engineer In-Charge/Project Manager.

9. THAT the Contractor shall procure, if required sufficient quantity of Earthing Equipment / Earthing Devices complying with requirements of relevant IEC standards (Generally IECs standards for Earthing Equipments / Earthing Devices are – 855, 1230, 1235 etc.) and to the satisfaction of Engineer In-Charge/ Project Manager and contractor to ensures to maintained them in healthy condition.

   THAT the Contractor has prepared / worked out minimum number of healthy Earthing Equipments with Earthing lead confirming to relevant IS / European standards per gang wise during stringing activity/as per requirement, which is enclosed herewith at **Annexure – 4 (SP)** for review and acceptance of Engineer In-Charge/ Project Manager prior to execution of work.

10. THAT the Contractor shall provide communication facilities i.e. Walky – Talkie / Mobile Phone, Display of Flags / whistles for easy communication among workers during Tower erection / stringing activity, as per requirement.

11. THAT the Contractor undertakes to deploy qualified safety personnel responsible for safety as per requirements of Employer/Statutory Authorities.

    THAT the Contractor employing more than 250 workmen whether temporary, casual, probationer, regular or permanent or on contract, shall employ at least one full time officer exclusively as qualified safety officer having diploma in safety to supervise safety aspects of the equipment and workmen who will coordinate with Engineer In-charge /Project Manager/Safety Co-ordinator of the Employer. In case of work being carried out through sub contractors the sub – contractor's workmen / employees will also be considered as the contractor's employees / workmen for the above purpose. If the number of workers are less than 250 then one qualified safety officer is to be deployed for each contract. He will report directly to his head of organization and not the Project Manager of contractor He shall also not be assigned any other work except assigning the work of safety. The curriculum vitae of such person shall be got cleared from RECPDCL Project Manager / Construction staff.

    The Contractor shall deploy one dedicated Safety Staff(s) for every 200 kms of a Transmission Line Project.

    The name and address of such safety officers/staff(s) of contractor will be promptly informed in writing to Engineer In-charge with a copy to safety officer -

In-charge before start of work or immediately after any change of the incumbent is made during the currency of the contract. The list is enclosed at **Annexure – 5A (SP)**.

THAT the Contractor has also prepared a list including details of Explosive Operator (if required), Safety officer / Safety Staff/ Safety supervisor / nominated person for safety for each erection / stringing gang, list of personnel trained in First Aid Techniques as well as copy of organisation structure of the Contractor in regard to safety. The list is enclosed at **Annexure – 5B (SP)**.

12. The Project Manager shall have the right at his sole discretion to stop the work, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and/or property, and/or equipment. In such cases, the Contractor shall be informed in writing about the nature of hazards and possible injury/accident and he shall comply to remove shortcomings promptly. The Contractor after stopping the specific work can, if felt necessary, appeal against the order of stoppage of work to the Project Manager within 3 days of such stoppage of work and decision of the Project Manager in this respect shall be conclusive and binding on the Contractor.

13. THAT, if, any Employer's Engineer/ supervisor at site observes that the Contractor is failing to provide safe working environment at site as per agreed Safety Plan / RECPDCL Safety Rule/ Safety Instructions / Statutory safety requirement and creates hazardous conditions at site and there is possibility of an accident to workmen or workmen of the other contractor or public or the work is being carried out in an un safe manner or he continues to work even after being instructed to stop the work by Engineer / Supervisor at site / RHQ / Corp. Centre, the Contractor shall be bound to pay a penalty of Rs. 10,000/ - per incident per day till the instructions are complied and as certified by Engineer / Supervisor of Employer at site. The work will remain suspended and no activity will take place without compliance and obtaining clearance / certification of the Site Engineer / Supervisor of the Employer to start the work.

14. THAT, if the investigation committee of Employer observes any accident or the Engineer In-charge/Project Manager of the Employer based on the report of the Engineer/Supervisor of the Employer at site observes any failure on the Contractor's part to comply with safety requirement / safety rules/ safety standards/ safety instruction as prescribed by the Employer or as prescribed under the applicable law for the safety of the equipment, plant and personnel and the Contractor does not take adequate steps to prevent hazardous conditions which may cause injury to its own Contractor's employees or employee of any other Contractors or Employer or any other person at site or adjacent thereto, or public involvement because of the Contractor's negligence of safety norms, the Contractor shall be liable to pay a compensation of Rs. 15,00,000/- (Rupees Fifteen Lakh only) per person affected causing death and Rs. 5,00,000/- (Rupees Five Lakh only) per person for serious injuries / 25% or more permanent disability to the Employer for further disbursement to the deceased family/

Injured persons. The permanent disability has the same meaning as indicated in Workmen's Compensation Act 1923. The above stipulations is in addition to all other compensation payable to sufferer as per workmen compensation Act / Rules

Notwithstanding above**, the Contractor shall also be responsible for payment of sum as indicated below additionally which shall be deposited in Safety Corpus Fund pursuant to GCC Sub-Clause 18.3.3.26:**

a.	**Upon 1st Fatal Accident due to negligence by the Contractor**	**Rs. 50,00,000/-**
b.	**Upon 2nd Fatal Accident due to negligence by the Contractor**	**Rs. 75,00,000/-**
c.	**Upon 3rd Fatal Accident due to negligence by the Contractor**	**Rs. 1,00,00,000/-**
d.	**Re-occurrence of Fatal Accident even after 3rd Fatal Accident due to negligence by the Contractor**	**Rs. 1,00,00,000/- per fatal accident**
e.	**Tower Collapse leading to more than one (01) death attributable to the Contractor as per the Accident Enquiry Committee Report**	**Rs. 1,00,00,000/- per fatal accident in addition to a, b, c or d above, as applicable**

THAT as per the Employer's instructions, the Contractor agrees that this amount shall be deducted from their running bill(s) immediately after the accident, That the Contractor understands that this amount shall be over and above the compensation amount liable to be paid as per the Workmen's Compensation Act /other statutory requirement/ provisions of the Bidding Documents.

15. THAT the Contractor shall submit Near-Miss-Accident report alongwith action plan for avoidance such incidence /accidents to Engineer – In-charge/ Project Manager. Contractor shall also submit Monthly Safety Activities report to Engineer – In-charge/ Project Manager and copy of the Monthly Safety Activities report also to be sent to Safety In-charge at RHQ of the Employer for his review record and instructions.

16. THAT the Contractor is submitting a copy of Safety Policy/ Safety Documents of its Company which is enclosed at **Annexure – 6 (SP)** and ensure that the safety Policy and safety documents are implemented in healthy spirit.

17. THAT the Contractor shall make available of First Aid Box [Contents of which shall be as per Building & other construction workers (Regulation of Employment and Conditions of Services Act and Central Rule 1998 / RECPDCL Guidelines)] to the satisfaction of Engineer In-Charge/ Project Manager with each gang at site and not at camp and ensures that trained persons in First Aid Techniques with each gang before execution of work.

18. THAT the Contractor shall submit an 'Emergency Preparedness Plan' for different incidences i.e. Fall from height, Electrocution, Sun Stroke, Collapse of pit, Collapse of Tower, Snake bite, Fire in camp / Store, Flood, Storm, Earthquake, Militancy etc. while carrying out different activities under execution i.e. foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal of materials at site / store etc. which is enclosed at **Annexure – 7 (SP)** for approval of the Engineer In-Charge/ Project Manager before start of work.

19. THAT the Contractor shall organise Safety Training Programs on Safety, Health and Environment and for safe execution of different activities of works i.e. foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal of materials at site / store etc. for their own employees including sub contractor workers on regular basis.

    The Contractor, therefore, submits copy of the module of training program, enclosed at **Annexure – 9 (SP)**, to Engineer In-charge/Project Manager for its acceptance and approval and records maintained.

20. THAT the Contractor shall conduct safety audit, as per Safety Audit Check Lists enclosed at **Annexure – 8 (SP)**, by his Safety Officer(s) every month during construction of Transmission Lines / Sub Stations / any other work and copy of the safety audit report will be forwarded to the Employer's Engineer In-charge / Site In-charge/Project Manager for his comments and feedback. During safety audit, healthiness of all Personal Protective Equipments (PPEs) shall be checked individually by safety officer of contractor and issue a certificate of its healthiness or rejection of faulty PPEs and contractor has to ensure that all faulty PPEs and all faulty lifting tools and tackles should be destroyed in the presence of RECPDCL construction staff. Contractor has to ensure that each gang be safety audited at least once in two months. During safety audit by the contractor, Safety officer's feedback from RECPDCL concerned shall be taken and recorded. The Employer's site officials shall also conduct safety audit at their own from time to time when construction activities are under progress. Apart from above, the Employer may also conduct surveillance safety audits. The Employer may take action against the person / persons as deemed fit under various statutory acts/provisions under the Contract for any violation of safety norms / safety standards.

21. THAT the Contractor shall develop and display Safety Posters of construction activity at site and also at camp where workers are generally residing.

22. THAT the Contractor shall ensure to provide potable and safe drinking water for workers at site / at camp.

23. THAT the Contractor shall do health check up of all workers from competent agencies and reports will be submitted to Engineer In-Charge within fifteen (15) days of health check up of workers as per statutory requirement.

24. THAT the Contractor shall submit information alongwith documentary evidences in regard to compliance to various statutory requirements as applicable which are enclosed at **Annexure – 10A (SP)**.

    The Contractor shall also submit details of Insurance Policies taken by the Contractor for insurance coverage against accident for all employees are enclosed at **Annexure – 10B (SP)**.

25. THAT a check-list in respect of aforesaid enclosures alongwith the Contractor's remarks, wherever required, is attached as **Annexure – Check List** herewith.

THE CONTRACTOR shall incorporate modifications/changes in this 'Safety Plan' necessitated on the basis of review/comments of the Engineer In-Charge/Project Manager within fourteen (14) days of receipt of review/comments and on final approval of the Engineer In-Charge/Project Manager of this 'Safety Plan', the Contractor shall execute the works under the Contract as per approved 'Safety Plan'. Further, the Contractor has also noted that the first progressive payment towards Supply of Supply of Services Contract shall be made on submission of 'Safety Plan' alongwith all requisite documents and approval of the same by the Engineer In-Charge/Project Manager.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorised representative under the common seal of the Company, the day, month and year first above mentioned.

For and on behalf of

M/s.....

WITNESS

1. Signature..... Signature.....

   Name..... Name.....

   Address..... Address.....

2. Signature..... Authorised representative

   Name..... (Common Seal)

   Address..... (In case of Company)

Note:
All the annexure referred to in this "Safety Plan" are required to be enclosed by the contractor as per the attached " Check List "

1. Safety Plan is to be executed by the authorised person and (i) in case of contracting Company under common seal of the Company or (ii) having the power of attorney issued under common seal of the company with authority to execute such contract documents etc., (iii) In case of (ii), the original Power of Attorney if it is specifically for this Contract or a Photostat copy of the Power of Attorney if it is General Power of Attorney and such documents should be attached to this Safety Plan.

2. For all safety monitoring/ documentation, Engineer In-charge / Regional In-charge of safety at RHQ will be the nodal Officers for communication.

CHECK LIST FOR SEFETY PLAN

S. N.	Details of Enclosure	Status of Submission of information/ documents	Remarks
1.	**Annexure – 1A (SP)** Safe work procedure for each activity i.e. foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal of materials at site / store etc. to be executed at site.	Yes/No	
2.	**Annexure – 1B (SP)** Manpower deployment plan, activity wise foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal of materials at site / store etc.	Yes/No	
3.	**Annexure – 2 (SP)** List of Lifting Machines i.e. Crane, Hoist, Triffor, Chain Pulley Blocks etc. and Lifting Tools and Tackles i.e. D shackle, Pulleys, come along clamps, wire rope slings etc. and all types of ropes i.e. Wire ropes, Poly propylene Rope etc. used for lifting purposes along with test certificates.	Yes/No	
4.	**Annexure – 3 (SP)** List of Personal Protective Equipment (PPE), activity wise including the following along with test certificate of each as applicable: 1. Industrial Safety Helmet to all workmen at site. (EN 397 / IS 2925) with chin strap and back stay arrangement. 2. Safety shoes without steel toe to all ground level workers and canvas shoes for workers working on tower.	Yes/No	

S. N.	Details of Enclosure	Status of Submission of information/ documents	Remarks
	3. Rubber Gum Boot to workers working in rainy season / concreting job. 4. Twin lanyard Full Body Safety harness with shock absorber and leg strap arrangement for all workers working at height for more than three meters. Safety Harness should be with attachments of light weight such as of aluminium alloy etc. and having a feature of automatic locking arrangement of snap hook and comply with EN 361 / IS 3521 standards. 5. Mobile fall arrestors for safety of workers during their ascending / descending from tower / on tower. EN 353 -2 (Guided type fall arresters on a flexible anchorage line.) 6. Retractable type fall arrestor (EN360: 2002) for ascending / descending on suspension insulator string etc. 7. Providing of good quality cotton hand gloves / leather hand gloves for workers engaged in handling of tower parts or as per requirement at site. 8. Electrical Resistance hand gloves to workers for handling electrical equipment / Electrical connections. IS : 4770 9. Dust masks to workers handling cement as per requirement. 10. Face shield for welder and Grinders. IS : 1179 / IS : 2553 11. Reflective Jackets 12. Other PPEs, if any, as per requirement etc.		
5.	**Annexure – 4 (SP)** List of Earthing Equipment / Earthing devices with Earthing lead conforming to IECs for earthing equipments are – (855, 1230, 1235 etc.) gang wise for stringing activity/as per requirement	Yes/No	
6.	**Annexure – 5A (SP)** List of Qualified Safety Officer(s)/Safety Staff(s)	Yes/No	

S. N.	Details of Enclosure	Status of Submission of information/ documents	Remarks
	alongwith their contact details		
7.	**Annexure – 5B (SP)** Details of Explosive Operator (if required), Safety officer / Safety Staff(s)/ Safety supervisor for every erection / stinging gang, any other person nominated for safety, list of personnel trained in First Aid as well as brief information about safety set up by the Contractor alongwith copy of organisation of the Contractor in regard to safety	Yes/No	
8.	**Annexure – 6 (SP)** Copy of Safety Policy/ Safety Document of the Contractor's company	Yes/No	
9.	**Annexure – 7 (SP)** 'Emergency Preparedness Plan' for different incidences i.e. Fall from height, Electrocution, Sun Stroke, Collapse of pit, Collapse of Tower, Snake bite, Fire in camp / Store, Flood, Storm, Earthquake, Militancy etc. while carrying out different activities under execution i.e. foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal of materials at site / store etc.	Yes/No	
10.	**Annexure – 8 (SP)** Safety Audit Check Lists (Formats to be enclosed)	Yes/No	
11.	**Annexure – 9 (SP)** Copy of the module of Safety Training Programs on Safety, Health and Environment, safe execution of different activities of works for Contractor's own employees on regular basis and sub contractor employees.	Yes/No	

S. N.	Details of Enclosure	Status of Submission of information/ documents	Remarks
12.	**Annexure – 10A (SP)** Information alongwith documentary evidences in regard to the Contractor's compliance to various statutory requirements including the following:		
(i)	Electricity Act 2003 _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(ii)	Factories Act 1948 _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(iii)	Building & other construction workers (Regulation of Employment and Conditions of Services Act and Central Act 1996) and Welfare Cess Act 1996 with Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(iv)	Workmen Compensation Act 1923 and Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(v)	Public Insurance Liabilities Act 1991 and Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(vi)	Indian Explosive Act 1948 and Rules. _____ [*Name of Documentary evidence in support of*	Yes/No	

S. N.	Details of Enclosure	Status of Submission of information/ documents	Remarks
	compliance]		
(vii)	Indian Petroleum Act 1934 and Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(viii)	License under the contract Labour (Regulation & Abolition) Act 1970 and Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(ix)	Indian Electricity Rule 1956 and amendments if any, from time to time. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(x)	The Environment (Protection) Act 1986 and Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(xi)	Child Labour (Prohibition & Regulation) Act 1986. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(xii)	National Building Code of India 2005 (NBC 2005). _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(xiii)	Indian standards for construction of Low/ Medium/ High/ Extra High Voltage	Yes/No	

S. N.	Details of Enclosure	Status of Submission of information/ documents	Remarks
	Transmission Line _____ [*Name of Documentary evidence in support of compliance*]		
(iv)	Any other statutory requirement(s) [*please specify*] _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
13.	**Annexure – 10B (SP)** Details of Insurance Policies alongwith documentary evidences taken by the Contractor for the insurance coverage against accident for all employees as below:		
(i)	Under Workmen Compensation Act 1923 and Rules. _____ [*Name of Documentary evidence in support of insurance taken*]	Yes/No	
(ii)	Public Insurance Liabilities Act 1991 _____ [*Name of Documentary evidence in support of insurance taken*]	Yes/No	
(iii)	Any Other Insurance Policies _____ [*Name of Documentary evidence in support of insurance taken*]	Yes/No	

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17. FORM OF JOINT DEED OF UNDERTAKING BY THE TOWER MANUFACTURER ALONGWITH THE BIDDER/CONTRACTOR

THIS DEED OF UNDERTAKING executed this …….. day of …….. Two Thousand and …… by M/s. ……..……., a Company incorporated under the laws of …… and having its Registered Office at …….. (hereinafter called the "Tower Manufacturer" which expression shall include its successors, executors and permitted assigns), and M/s. ……..……., a Company incorporated under the laws of …….. having its Registered Office at …….. (hereinafter called the "Bidder"/"Contractor" which expression shall include its successors, executors and permitted assigns) in favour of …….. *(insert names of the Employer)* ……., a Company incorporated under the Companies Act of 1956 having its registered office at ……..*(insert registered address of the Employer)*…… (hereinafter called the "Employer" which expression shall include its successors, executors and permitted assigns)

WHEREAS the "Employer" invited Bid as per its Specification No. …….. for manufacture, fabrication, supply of tower parts as per Employer's design, casting of foundation, erection of all types of towers, stringing of conductor and earthwire, testing and commissioning of ……Transmission Line.

AND WHEREAS Clause No. ……., Section ……, of ……., Vol.–… forming part of the Bid Documents inter-alia stipulates that the Bidder and/or Manufacturer must fulfill the Qualifying Requirements and be jointly and severally bound and responsible for the quality and timely supply of tower parts in the event the Bid submitted by the Bidder is accepted by the Employer resulting in a Contract.

AND WHEREAS the Bidder has submitted its Bid to the Employer vide Proposal No. …….…….. dated ……. based on tie-up with the Tower Manufacturer for supply of tower parts.

NOW THEREFORE THIS UNDERTAKING WITNESSETH as under:

1.0 In consideration of the award of Contract by the Employer to the Bidder (hereinafter referred to as the "Contract") we, the Tower Manufacturer and the Bidder/Contractor do hereby declare that we shall be jointly and severally bound unto the …… *(insert name of the Employer)* ……, for the manufacture, testing, supply of tower parts on FOR destination delivery at site basis in accordance with the Contract Specifications.

2.0 Without in any way affecting the generality and total responsibility in terms of this Deed of Undertaking, the Tower Manufacturer hereby agrees to depute their representatives from time to time to the Employer's Project site as mutually considered necessary by the Employer, Bidder/Contractor and the Tower Manufacturer to ensure proper quality, manufacture, testing and supply on FOR

destination delivery at site basis and successful performance of the material in accordance with Contract Specifications. Further, if the Employer suffers any loss or damage on account of non-performance of the material (tower parts) fully meeting the performance guaranteed as per Bid Specification in terms of the contract. We the Tower Manufacturer and the Contractor jointly and severally undertake to pay such loss or damages to the Employer on its demand without any demur.

3.0 This Deed of Undertaking shall be construed and interpreted in accordance with the laws of India and the Courts in Delhi shall have exclusive jurisdiction in all matters arising under the Undertaking.

4.0 As a security, the Tower Manufacturer shall apart from the Contractor's performance guarantee, furnish a Contract Performance Guarantee from its Bank in favour of the Employer in a form acceptable to the Employer. The value of such guarantee shall be equivalent to **02%** of the cost of tower parts to be supplied by the Tower Manufacturer as identified in the Contract awarded by the Employer to the Bidder/Contractor and it shall be part of guarantee towards the faithful performance/compliance of this Deed of Undertaking in terms of the Contract. The guarantee shall be unconditional, irrevocable and valid for the entire period of the Contract, namely till the end of the Defect Liability Period of under the Contract. The Bank Guarantee amount shall be payable to the Employer on demand without any reservation or demur.

5.0 We, the Tower Manufacture/ Bidder/Contractor agree that this Undertaking shall be irrevocable and shall form an integral part of the Contract and further agree that this Undertaking shall continue to be enforceable till the Employer discharges it. It shall become operative from the effective date of Contract.

IN WITNESS WHEREOF the Tower Manufacturer and/or the Bidder/Contractor have through their Authorised Representatives executed these presents and affixed Common seals of their respective Companies, on the day, month and year first above mentioned.

WITNESS	(For Tower Manufacturer)
Signature ……..	
Name ……..	(Signature of the authorized representative)
Office Address ……..	Name ……..
	Common Seal of Company …..……..
WITNESS	(For Bidder)

Signature ……..

Name ……..

Office Address ……..

(Signature of the authorized representative)

Name ……..

Common Seal of Company …..……..

Note:

1. For the purpose of executing the Deed of Joint Undertaking, the non-judicial stamp papers of appropriate value shall be purchased in the name of executant(s).

2. The Undertaking shall be signed on all the pages by the authorised representatives of each of the partners and should invariably be witnessed.

3. This Deed of Joint Undertaking duly attested by Notary Public of the place(s) of the respective executant(s), shall be submitted alongwith the bid.

4. In case the bid is submitted by a Joint Venture (JV) of two or more firms as partners, then the Joint deed of undertaking shall be modified accordingly.

20. FORM OF BANK GUARANTEE FOR CONTRACT PERFORMANCE (TO BE SUBMITTED BY TOWER MANUFACTURER)

Bank Guarantee No. …… Date.....

Contract No.....

……..*[Name of Contract]*……..

To: *[Name and address of the Employer]*

Dear Ladies and/or Gentlemen,

We refer to the Contract ("the Contract") signed on .....*(insert date of the Contract)*..... between you and M/s ..... *(Name of Contractor)* ....., having its Principal place of business at ……..*(Address of Contractor)* ..... and Registered Office at ……..*(Registered address of Contractor)* ..... ("the Contractor") concerning ……..... *(Indicate brief scope of work)* ..... for the complete execution of the …… *(insert name of Package alongwith name of the Project)*…….

Whereas, the Contractor and M/s. ..... *(Name of Tower Manufacturer)* ....., having its Principal place of business at ……..*(Address of Tower Manufacturer)* ..... and Registered Office at ……..*(Registered address of Tower Manufacturer)* ..... (hereinafter referred to as the "Tower Manufacturer"), as a pre-requisite for qualification of the Bidder/Contractor, have submitted a deed of joint undertaking declaring that they are jointly and severally bound and responsible for the quality and timely supply of tower/tower parts and that the Tower Manufacturer having agreed to furnish a Contract Performance Guarantee for the faithful performance/compliance of the Deed of Undertaking equivalent to (2%) two per cent of the cost of tower parts to be supplied by the Tower Manufacturer under the Contract, in addition to Contract Performance Guarantee equivalent to 10% (ten per cent) of the value of the Contract to be provided by the Contractor for the faithful performance of the entire Contract.

By this letter we, the undersigned, ……*(insert name & address of the issuing bank)* ……., a Bank (which expression shall include its successors, administrators, executors and assigns) organized under the laws of ..... and having its Registered/Head Office at ……..*(insert address of registered office of the bank)*……..... do hereby irrevocably guarantee payment to you up to …….. i.e., two percent (02%) of the cost of tower parts to be supplied by the Tower Manufacturer under the Contract until ninety (90) days beyond the Defect Liability Period i.e., upto and inclusive of …….. *(dd/mm/yy)*.

We undertake to make payment under this Letter of Guarantee upon receipt by us of your first written demand signed by your duly authorized officer declaring the Contractor/Tower Manufacturer to be in default under the Contract and without cavil or argument any sum or sums within the above named limits, without your need to prove or show grounds or reasons for your demand and without the right of the Contractor/Tower Manufacturer to dispute or question such demand.

Our liability under this Letter of Guarantee shall be to pay to you whichever is the lesser of the sum so requested or the amount then guaranteed hereunder in respect of any demand duly made hereunder prior to expiry of the Letter of Guarantee, without being entitled to inquire whether or not this payment is lawfully demanded.

This letter of Guarantee shall remain in full force and shall be valid from the date of issue until ninety (90) days beyond the Defect Liability Period of the Facilities i.e. upto and inclusive of …….. *(dd/mm/yy)* and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s. …… on whose behalf this Letter of Guarantee has been given.

Except for the documents herein specified, no other documents or other action shall be required, notwithstanding any applicable law or regulation.

Our liability under this Letter of Guarantee shall become null and void immediately upon its expiry, whether it is returned or not, and no claim may be made hereunder after such expiry or after the aggregate of the sums paid by us to you shall equal the sums guaranteed hereunder, whichever is the earlier.

All notices to be given under shall be given by registered (airmail) posts to the addressee at the address herein set out or as otherwise advised by and between the parties hereto.

We hereby agree that any part of the Contract may be amended, renewed, extended, modified, compromised, released or discharged by mutual agreement between you and the Contractor/Tower Manufacturer, and this security may be exchanged or surrendered without in any way impairing or affecting our liabilities hereunder without notices to us and without the necessity for any additional endorsement, consent or guarantee by us, provided, however, that the sum guaranteed shall not be increased or decreased.

No action, event or condition which by any applicable law should operate to discharge us from liability hereunder shall have any effect and we hereby waive any right we may have to apply such law so that in all respects our liability hereunder shall be irrevocable and, except as stated herein, unconditional in all respects.

For and on behalf of the Bank

[*Signature of the authorised signatory(ies)*]

Signature_____

Name_____

Designation_____

POA Number_____

Contact Number(s): Tel._____Mobile_____

Fax Number_____

email _____

Common Seal of the Bank_____

Witness:

Signature_____

Name_____

Address_____

Contact Number(s): Tel._____Mobile_____

email _____

Note:

1. For the purpose of executing the Bank Guarantee, the non-judicial stamp papers of appropriate value shall be purchased in the name of Bank who issues the 'Bank Guarantee'.

2. The Bank Guarantee shall be signed on all the pages by the Bank Authorities indicating their POA nos. and should invariably be witnessed.

3. The Bank Guarantee should be in accordance with the proforma as provided. However, in case the issuing bank insists for additional paragraph for limitation of liability, the following may be added at the end of the proforma of the Bank Guarantee [*i.e., end paragraph of the Bank Guarantee preceding the signature(s) of the issuing authority(ies) of the Bank Guarantee*]:

   Quote

   "Notwithstanding anything contained herein:

1. Our liability under this Bank Guarantee shall not exceed _____ (*value in figures*)_____ [_____ (*value in words*)_____].

2. This Bank Guarantee shall be valid upto _____*(validity date)*_____.

3. We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only & only if we receive a written claim or demand on or before _____ (*validity date*) _____."

Unquote

21. FORM FOR INFORMATION TO BE FURNISHED BY THE CONTRACTOR IN RESPECT OF THE PROCUREMENT MADE FROM MSE VENDORS

The Contractor shall furnish the details of items, components, raw materials, services etc. procured from MSEs and consumed for completion of scope of works under the contract directly or through our sub-suppliers/sub-vendors as per the details given herein below:

Sl. No.	Contract Agreement No.	Name of Contractor	Item Description as per contract Agreement	Qty	Total Value (In Rs.)	Executing Region	Items/components/raw materials sourced from MSE vendor for production of item at column 4	Total Value of the items/components/raw materials used for item at column 4 (In Rs.)	Name of MSE Vendor	Category (only Micro or Small)	Whether MSE owned by persons belonging to SC/ST category
1	2	3	4	5	6	7	8	9	10	11	12

Further, we hereby declare and confirm that the information mentioned above is correct and complete to best of our knowledge and the category of MSE vendors, as mentioned in the table above, has been ascertained at our end.

Note:

1. The Contractor shall be required to furnish the aforesaid information (contract-wise) on semi-annual basis i.e for period from 1st April to 30th September and from 1st October to 31st March for each Financial Year.
2. Submission of aforesaid information for the preceding 6 months, in respect of all the contracts in the Corporate Office of RECPDCL, shall be a condition for processing of bills by RECPDCL for payment after 30th September /31st March, as the case may be.
3. Only those items of Contract Agreement may be included which involve sourcing of items/components/raw materials/ services from MSEs.

Name of Contractor ----------
Name of Authorised Person ----------
Designation ----------
Signature ----------

(Format for Notarized Undertaking, related to Make in India & Cyber Security)

(To be Submitted by the Bidder on Rs. 100 Stamp Paper)

We hereby agree and undertake to procure the products associated with the Transmission System under **Tender Specification No-RECPDCL/PIA/JKPTCL/SS & LILO-01 of 2024 Dated: 15-01-2024,** i.e. " Construction of balance works of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Sceme-15 on Turn Key Basis" in compliance with the applicable laws for public procurement in India including the following:

a) Guidelines issued in Order No. F/No.6/18/2019-PPD by Ministry of Finance, Department of Expenditure, Public Procurement Division dated 23 July 2020, Order No No.9/16/2016-Trans-Part (2) dated 18 November 2020, latest Government of India Guidelines for Make in India, Domestically manufactured products, Atmanirbhar Bharat and circulars DIPP Office Memorandum No. P-45021/2/2017-PP (BE-II) date:16th Sept. 2020, MeitY Circular No.1(10)/2017-CLES dated 06.12.2019 and Order No. 11/05/2018-Coord. by the Ministry of Power dated 17 September 2020 including any amendments or modifications to the same from time to time.

b) As per Ministry of Power, GoI, Order No.25-l l/6/2018-PG, dated 02.07.2020 related to cyber security, as amended from time to time.

c) As per Department of Expenditure, Ministry of Finance, GoI Office Memorandum no. 6/18/2019-PPD dated 23.07.2020 regarding amendment to fundamental principles to public buying, as amended from time to time.

(Authorized Signatory)

Date -

Place -

Volume-II, Part-I
Technical specification (Substation)

PART-I

TECHNICAL SPECIFICATION

VOL-II, SEC-I

PROJECT

SECTION-I

PROJECT

1.0 GENERAL

1.1 Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL) is responsible for Transmission and distribution of electrical energy in the entire J&K state.

1.2 In order to provide reliable power supply in Jammu, Srinagar and Ladakh region, No. of 220kV New Sub stations and transmission lines, Augmentation of Sub stations, Up-gradation of transmission lines in the state is planned and and to be executed.

1.3 220/33kV Nagrota Substation in Jammu Region has been entrusted to RECPDCL for implementation by JKPTCL. The Ownership of the said substation shall however, remain vested with JKPTCL.

1.4 The present work is for completion of remaining work against the broad scope of work for the completion & commissioning of the Nagrota substation & LILO project as defined below:

2.0 SCOPE

The scope of this specification covers construction of the following 220/33kV Nagrota substation.

A) Part – I: Nagrota 220/33 kV (New) Substation with the following bays:-

- 2 nos. 220kV Line bays
- 2 nos. 220 kV bays for 2 x 50 MVA, 220/33 kV, 3 Phase transformers.
- 1 no. 220 kV bay for bus coupler
- 1 no. 220 kV bay for transfer bus coupler
- 2 nos of 33 kV bays for 2 x 50 MVA, 220/33 kV, 3 Phase Transformers
- 4 nos. of 33 kV bays for termination of 33kV Transmission lines
- 1 no. 33 kV bay for transfer bus coupler
- 1 no. of 33 kV bay for termination of 02 nos. LT Transformers

B) Part-II: Staff Quarters at Nagrota AIS – The scope of work shall include but not be limited to the following

a) Construction of balance work of Residential staff quarters & other buildings including boundary wall.
b) Contouring and site leveling (if required)
c) External water supply arrangement for colony & other buildings etc.
d) External sewerage system
e) Supply, Erection, testing & commissioning of lighting poles, panels and control cubicles of equipment (as required in complete).
f) Construction of underground water storage tank for colony & other buildings
g) Construction of septic tank & soak pit for control room and residential building
h) Supply, Erection, Testing & Commissioning of Pole mounted 1 x 160 KVA, 11/0.433 kV (Minimum BEE 4 Star Rating), Three Phase Distribution transformer along with 11kV Gang operated switch, Drop out fuse, Surge arrestors etc. in HV side and Main Township Distribution Board comprising of Two 200A, 20KA MCCB incoming feeders (One from MSB in ACDB Room & other

from 160KVA Transformer), 200 Amps, 20KA Bus, One 200A Bus coupler MCCB and Eight outgoing MCCB feeders (2 of 63A & 4 of 32 A & 2 of 25A), LT cable from Transformer to Main Township Distribution Board etc. in LV side.

i) External lighting and illumination for the Colony Area under present scope including Street Lighting with RCC htp poles with Led Lightning

j) Internal Electrification of the buildings.

k) From LT Sub-station - Cable Connection from LT Main Panel outgoing feeders to the Sub-Main Panels distribution box shall be provided by the Contractor as per Bid Price Schedule.

l) RCC Roads 3.75 Mtr. & 5.5 Mtr. as per enclosed General Arrangement drawing.

m) Any other item required for completion of scope of works

Details of Residential Quarters: -

Sr. No.	Particulars	Qty.	Area	Configuration
1.	Ornamental Works such as development of lawns and landscaping	L/S	-	
2.	LT Distribution and Street Lighting	L/S	-	
3.	Residential Quarters			
3.1	JEs Quarter -4 nos. (1 Block of 2 GF+2FF with common stairs)	4 Nos.	2500 Sq.Ft.	Double Story
3.2	SBA's Quarter – total 8 Nos. in 2 Blocks. Each Block having 2 Units of GF and 2 units of FF with Common Stairs)	8 Nos.	2400 Sq.Ft.	Double Story
4.	Roads for colony	As per enclosed GA drawing		
5.	Water supply incl. tube-well reservoirs etc.	L/S	-	
6.	Santry/Security Post	L/S	-	

C) Part – II: LILO work of 220kV Existing S/C Udhampur-Gladni Transmission Line at 220/33kV Nagrota Substaion

The detailed scope of work of Part – I is brought out in subsequent clauses of this section.

2.1 Design & engineering, manufacture, testing, supply on FOR destination site basis, including transportation & insurance, storage, erection, testing and commissioning of the following equipment's/items complete in all respects as per BPS

2.1.1 Nagrota 220/33kV New sub-station

(a) 220/33kV, 2x50MVA, 3 Phase Power Transformers along with all fittings, accessories, digital RTCC Panel (Consisting of 3 Nos. Digital RTCC relays, {Two for present and one for Future) plus 1 spare Digital RTCC relay) **including NIF Protection two Transformers**

(b) 33kV Circuit breakers, isolators, earth switches, current transformers, capacitive voltage transformers, Potential transformer, surge arresters , Bus Post Insulators and Horn gap fuses as per the attached BPS.

(c) 33/0.433kV, 2x250kVA Auxiliary LT transformer (Minimum BEE 4 Star Rating) along with fittings and accessories

(d) Complete relay and protection system for 220kV bays as per Section–Control and Relay panels.

(e) For 33kV bays, the requirement & specification for complete relay and protection system shall be as specified for 132kV in Section–Control and Relay panels. However for 33kV following may also be noted

- Only one physical Cabinet/panel shall be supplied for each 33kV Bay which will include CB relay panel, Line/Transformer /Bus Coupler/Incomer protection panel. Bay control unit, Ethernet switch for substation automation system shall be included in the same Cabinet/Panel.
- Bus Bar protection as envisaged in the Section- Control & Protection is not envisaged for 33kV Bus Bar. However, LBB protection for 33kV Circuit breakers shall be provided and it can be supplied as built-in function of any protection relay / IED of that bay.
- All protection relays shall be Numerical type with IEC 61850 compliant suitable to communicate with SAS.

(f) Complete Substation automation based on IEC 61850 including hardware and software for remote control station along with associated equipments for following bays (bay as defined in technical specification, Sec.-Substation Automation):

Sr. No	Description	No. of Bays
1	220kV Bays	6
2	33kV bays	8

For 33kV system, one BCU for two bays having facility of connecting all required digital I/O & analogue signal for both bays may also be acceptable.

The contractor shall also supply necessary BCU for monitoring and control of substation auxiliary system. Remote substation shall be identified during detailed engineering stage.

Integration of IEC 61850 communication based monitoring equipments like Online dissolved Gas analyzer, Insulating Oil drying system for 220kV Transformer unit with Substation Automation system is included in present scope.

(g) Digital protection couplers (DPCs) for both ends of 220kV Lines as per BPS. Required shifting & re-erection of existing Tele-protection equipments at Udhampur Substation/Gladni Substation to Nagrota Substation is also under present scope. Scope includes cable required for connecting DPC with the Communication (SDH) equipment in the substation control room building.

(h) Fiber Optic Communication System for all lines. LILO of 220 kV S/C Udhampur-Gladni is to be done at 220/33kV Nagrota Substation. OPGW based Communication system to be established from Nagrota to Udhampur as well as from Nagrota to Gladni. Therefore, Supply and Erection of complete telecommunication equipment as per BPS is to be done to establish Communication between Nagrota, Udhampur and Gladni.

(i) Fire Protection System-Portable Fire Extinguishers, Hydrant system, Fire alarm System as per BPS. Nitrogen based Fire Protection System (NFPS) is also envisaged for 220kV class transformers as per Technical specification. Required Underground oil storage tank etc associated with Nitrogen based Fire Protection System is also part of NFPS and included in the scope. All civil works for NFPS shall be as per contractor's design.

(j) Air conditioning system.

(k) LT switchgear (AC/DC Distribution boards) considering present and future 220 & 33kV bays as shown in SLD.

(l) 100kVA capacity DG Set

(m) Batteries & Battery Chargers (220V & 48V). The capacity for batteries and battery chargers shall be worked out by the Contractor for the present and future bays as shown in the Single Line Diagram of the substation and shall be subject to Owner's approval. However, the capacity for battery & ratings for battery chargers shall not be less than the capacity & rating mentioned below.

i. 220V Battery – 500 AH & 220V Float cum Boost Charger – 60A/60A.
ii. 48V Battery – 300 AH & 48V Float cum Boost Charger – 30A/30A

(n) 1.1 kV grade Power & Control cables along with complete accessories.

(o) Servo Voltage Stablizer, 250 kVA, 3 Phase

(p) Visual Monitoring System of Substation

(q) Balance Lattice structures(galvanised) for towers, beams, LM and equipment support structures (excluding CB support structure which will be as per manufacturer's design) as per BPS.

(r) Bus post Insulators for 245kV & 36kV

(s) **Erection hardware** inter-alia including insulator strings and hardware, clamps & connectors, Equipment terminal connectors (including for transformers), Conductors, Aluminum tubes, Bus bar and earthing materials (except main earth mat), Bay Marshaling box, spacers, cable supporting angles/channels, Cable trays & covers, Junction box, buried cable trenches as required.

(t) Complete lighting and illumination of the switchyard area, Control Room Building, FFPH Building, Security Room, Storage room and street lighting including lighting for approach road outside switchyard fencing and boundary wall.

(u) Complete main-earthmat including all associated works for the remaining area of the switchyard.

(v) Complete Direct stroke lightning protection (DSLP)

(w) Mandatory Spares as per BPS.

(x) Maintenance & Testing equipment

(y) Any other item required for completion of scope of works

2.1.2 Civil works - The scope of work shall include but not be limited to the following:-

2.1.2.1 Nagrota 220/33kV New sub-station:

(a) Foundation of transformers along with jacking pads, rail track, oil soak pit, sump pit as per BPS.

(b) Foundation for LMs, Towers and equipment's as per BPS

(c) Foundation of Auxiliary L.T. transformers

(d) Foundation for DG Set

(e) Foundation for lighting poles, Bay marshalling box, panels and control cubicles of equipment's(wherever required)

(f) Cable trenches along with covers and sump pits.

(g) Cable trench crossings with roads, rail tracks, culverts etc.

(h) Roads including approach road outside the fencing and boundary wall. All roads within boundary wall shall be concrete while approach road outside boundary wall shall be bitumen/RCC road.

(i) Buried cable trench for laying auxiliary power cables.

(j) Anti-weed treatment and stone spreading

(k) Rain water harvesting system

(l) Drainage system in the substation including culverts.

(m)Permanent water supply for control room, Security room etc.

(n) Chain link fencing and gates, parking shed.

(o) Control room building as per BPS

(p) Boundary wall along with Main gate as per BPS

(q) Fire Fighting Pump House Building as per BPS

(r) Fire Fighting Tank

(s) Security Room Building

(t) Contouring and Leveling of Plot as required

(u) Any other item required for completion of scope of works are deemed to be included without any additional financial implication to RECPDCL.

(v) Design & development of any additional drawings required for construction shall be in the scope of contractor.

(w) Volume/area of any cutting/filling required at site must be get verified by RECPDCL.

Note:

i. **Bidders are advised to note that some of the Civil Works as mentioned above at most of the locations have been partially completed. Accordingly, bidders may visit the site and determine the quantum of works to be carried out to complete the specified scope of work as per BPS.**
ii. **Bore well for the construction purpose shall be made available by the contractor without any additional price implication to RECPDCL.**
iii. **Bidders will have to make arrangements for power supply for construction works without any additional price implication to RECPDCL. RECPDCL shall in no case be responsible for any delay in works because of non-availability of power.**
iv. **Prior approval of RECPDCL shall be taken before carrying out any dismantling work at site.**

2.2 The bidder should survey the route of transportation and substation sites and fully familiarize himself with the route of transportation, culverts, roads & rail bridges, loading & unloading facilities and site conditions etc. Any strengthening / modification required in the existing culverts, road, bridges, etc. for transportation shall be carried out by the Contractor without any additional cost implication to the Employer

2.3 Before proceeding with the construction work of the new substations and existing substations, the Contractor shall fully familiarize himself with the site conditions and General arrangements & scheme etc. Though the Employer shall assist the contractor to the extent possible in obtaining the required information, it shall not be binding for the Employer to provide the same. The bidders are advised to visit the substation sites to acquaint themselves with the topography, infrastructure, and design philosophy and to collect required inputs so as to assess the total requirement for completion of specified scope. The bidder shall be fully responsible for providing all equipment, materials, system and services specified or otherwise which are required to complete the construction and successful commissioning, operation & maintenance of the specified scope in all respects.

All materials required for the Civil and construction/installation work shall be supplied by the Contractor. The cement and steel shall also be supplied by the Contractor.

The complete design **(unless specified otherwise in specification elsewhere)** and detailed engineering shall be done by the contractor based on conceptual tender drawings.

2.4 The Contractor shall also be responsible for the overall co-ordination with internal/external agencies, project management, training of Employer's manpower, loading, unloading, handling, moving to final destination including Employer supplied material for successful erection, testing and commissioning of the substation/switch yard.

2.5 Design of substation and its associated electrical & mechanical auxiliaries systems includes preparation of single line diagrams and electrical layouts, erection key diagrams, electrical and physical clearance diagrams, design calculations for Earth mat, Direct Stroke Lighting Protection (DSLP), Bus Bar & Spacers, control and protection schematics, wiring and termination schedules, design of firefighting system, designs and drawings of civil works and structures including proto corrected drawings for structures, indoor and outdoor lighting/illumination, All foundation design and drawings and all other relevant drawings & documents required for engineering of all facilities to be provided under this contract, are covered in the scope of the Contractor.

2.6 Any other items not specifically mentioned in the specification but which are required for erection, testing and commissioning and satisfactory operation of the substation are deemed to be included in the scope of the specification unless specifically excluded.

2.7 Specific exclusions

The following items of work are specifically excluded from the scope of the specifications:
(a) Employer's site office

2.8 Employer has standardized its technical specification for various equipment's and works for different voltage levels. Items which are not applicable for the scope of these packages, the technical specification for such items shall not be referred to.

3.0 PHYSICAL AND OTHER PARAMETERS

1. Meteorological data :-

1. Altitude above sea level :
   i) Nagrota : Below 1000m from MSL

2. Ambient Air Temperature :
   i) Nagrota: 48ºC(max)/ 4 ºC(min)

3. Average Humidity (in %) :
   i) Nagrota – 91%

4. The substation location is in wind speed Zone 2 i.e. 39m/s.

5. Seismic Requirement for Substations: As per IS 1893.

However, for design purposes, ambient temperature should be considered as 50 degree centigrade and Relative humidity 100% for the substation.

6. The fault level of all equipment to be supplied under present scope shall be as indicated below:

S. NO.	Voltage Level	Fault Level
1	220kV	40kA for 1 Sec
2	33kV	25kA for 3 Sec

3.2 **Soil Data**

Soil Investigation reports shall be provided by the Employer/RECPDCL to the successful bidder.

4.0 **SCHEDULE OF QUANTITIES**

The requirement of various items/equipment's and civil works are indicated in Bid price Schedules. All equipment's/items and civil works for which quantities has been given in the BPS shall be payable on unit rate basis. During actual execution, any variation in such quantities shall be paid based on the unit rate under each item incorporated in the letter of award.

Wherever the quantities of items/works are indicated in Lot/Set, the bidder is required to estimate the quantity required for entire execution and completion of works and incorporate their price in respective Bid price schedules. For erection hardware items, Bidders shall estimate the total requirement of the works and indicate module-wise lump sum price bay wise and include the same in relevant Bid price schedules. Any material/works for the modules not specifically mentioned in the description in BPS, as may be required shall be deemed to be included in the module itself.

Bidder should include all such items in the bid proposal sheets, which are not specifically mentioned but are essential for the execution of the contract. Item which explicitly may not appear in various schedules and required for successful commissioning of substation shall be included in the bid price and shall be provided at no extra cost to Owner.

5.0 BASIC REFERENCE DRAWINGS

5.1 For 220kV Substations, Double Main & Transfer Bus Scheme shall be followed and for 33kV Double Main with bypass Isolator Scheme shall be followed.

5.2 The list of finalized/approved drawings which have already been approved by RECPDCL is enclosed at **Annexure-A to Section Project.**

5.3 The list of approved vendors/manufacturer for supply of equipment is enclosed at **Annexure-II to Section-Project.**

5.4 The list of item/equipment to be handed over to the successful bidder by RECPDCL is enclosed at **Annexure-III to Section-Project**.

6.0 ORDER OF PRECEDENCE OF DIFFERENT SECTIONS OF TECHNICAL SPECIFICATION

For the purpose of present scope of work, technical specification (Vol II) shall consist of following sections and they should be read in conjunction with each other.

a) Section - Project

b) Section - General Technical Requirement (GTR)

c) Section - Transformer

d) Section - Switchgear

e) Section - Power and Control Cables

f) Section - LT Switchgear

g) Section - Battery and Battery Charger

h) Section - Lighting System

i) Section - LT transformer

j) Section - Fire Protection System

k) Section - Air Conditioning system

l) Section - DG Set

m) Section - Switchyard Erection

n) Section - Structures

o) Section - Civil Works

p) Section - Control and Relay Panels

q) Section - Telecommunication equipment

r) Section - Substation Automation System

s) Section - Visual monitoring system

In case of any discrepancy between Section-PROJECT and Section -GTR / other technical specifications on scope of works, Section-PROJECT shall prevail over all other sections.

In case of any discrepancy between Section -GTR and individual sections for various equipment's, requirement of individual equipment section shall prevail.

7.0 SPARES

7.1 Mandatory Spares

The mandatory spares shall be included in the bid proposal by the bidder. The prices of these spares shall be given by the Bidder in the relevant schedule of BPS) and shall be considered for evaluation of bid. It shall not be binding on the Employer to procure all of these mandatory spares.

The bidder is clarified that no mandatory spares shall be used during the commissioning of the equipment. Any spares required for commissioning purpose shall be arranged by the Contractor. The unutilised spares if any brought for commissioning purpose shall be taken back by the contractor.

8.0 SPECIAL TOOLS AND TACKLES

The bidder shall include in his proposal the deployment of all special tools and tackles required for erection, testing, commissioning and maintenance of equipment. However, a list of all such devices should be indicated in the relevant schedule provided in the BPS. In addition to this, the Contractor shall also furnish a list of special tools and tackles for the various equipment in a manner to be referred by the Owner during the operation of these equipment.

9.0 INTENTIONALLY LEFT BLANK

10.0 Training of Owner's Personnel.

The contractor shall organize and conduct complete and thorough training programmed (to be conducted in English language) providing necessary training material at no extra cost to the owner. However, the traveling and living expenses of owner's personnel, if any, shall be borne by owner. The training shall be carried out at the place of manufacture or as the case may require and as agreed by owner so as to ensure the complete adequacy of the programme and imparting of detailed knowledge of system/equipment design engineering and operation and maintenance aspects.

The duration of the training shall be as follows:

Design, operation and maintenance including procedures for fault attending for the Power Transformer, Circuit Breaker, Isolators, Instruments Transformers, Relay & Protection system at manufacturers'/suppliers' works for 20 personnel of Owner for 5 days under. Further training on FO based Communication equipment at manufacturers'/suppliers' works for 10 personnel of Owner for 5 days.

11.0 SPECIFIC REQUIREMENT

11.1 The contractor shall be responsible for safety of human and equipment during the working. It will be the responsibility of the Contractor to co-ordinate and obtain, Electrical Inspector's clearance before commissioning. Any additional items, modification due to observation of such statutory authorities shall be provided by the Contractor at no extra cost to the Employer.

11.2 Technical Requirement for Transmission Line sub-contractor:

Before engaging a sub-contractor for erection works of Transmission line, the successful bidder shall ensure to take prior approval from RECPDCL and should meet the following requirement:

The Transmission line contractor shall have completed physical construction of transmission line project(s) involving tower foundation, erection and stringing of not less than 10kM route length of 220kV or higher voltage class transmission line as a prime contractor or as a partner in a Joint Venture # within the last seven (07) years as on the date of the originally scheduled date of bid submission.

Note - : In case of works executed under a contract that had been awarded on a Joint Venture, the experience of individual Joint Venture partner shall be considered limited to the scope of that partner under the said contract.

11.3 The Power Transformer shall be provided with **On line insulating oil drying system.**

11.4 1.0H.P pump shall be provided and installed by the contractor for each transformer (220/33kV) soak pit to evacuate oil/rain water from sump pit to nearest drain. The estimated quantity of 1.0 H.P is given in BPS**.**

11.5 5.0H.P pump for 220/33kV S/S shall be supplied and installed by the contractor for each cable trench sump pit and drain sump pit. The estimated quantity of 5.0 H.P is given in BPS.

11.6 Erection, Testing and Commissioning of Power Transformer, Circuit Breaker, Isolators, Relay & protection panels, sub-station automation system and Tele-protection equipment's shall be done by the contractor under the supervision of respective equipment manufacturers. Such supervision charges shall be included by the bidder in the erection charges for the respective equipment in the BPS.

11.7 The bidder is required to quote the price of compete isolator i.e. Insulator and metallics together.

11.8 The detailed specification for maintenance & testing equipment's enclosed at Annexure – II**.**

11.9 The contractor shall provide outdoor power receptacle (with 400A rating) suitable for oil filtration unit near 220/66kV & 220/33kV transformer Area of switchyard. The provision for cable from Main switchboard to oil filtration units shall also be in the scope of contractor.

11.10 The requirement of digital protection coupler (for both end of 220 kV lines) shall be as Annexure-III of Section-Project.

11.11 The bidders are advised to visit the site and carry out the assessment of balance works to be completed by themselves and accordingly bid.

11.12 After the award of contract, the Contractor shall carry out joint assessment of quantity and the work executed at site along with RECPDCL. The quantity assessed in this joint survey will be construed as the quantity/work executed handed over to the Contractor.

11.13 The Contractor shall be provided with the approved engineered drawings which have been attached along with the bid document. The Contractor has to ensure to propose the item/equipment which will be compatible with the existing approved layouts/foundations. In case the Contractor proposes non-compatible item/equipment which may result in modifications to the already executed work (foundations/layout), the same will be carried out by the Contractor without any additional financial implication to RECPDCL.

11.14 The Contractor shall ensure to propose only **type tested equipment**.

11.15 Bidder should include all such items in the bid proposal sheets, which are not specifically mentioned but are essential for the execution of the contract. Item which explicitly may not appear in various schedules and required for successful commissioning of substation shall be deemed to be included in the bid price and shall be provided at no extra cost to Owner

11.16 Bidders are advised that the Vector group for the LT transformer may be suitably read as Dyn11 instead of Dyn1 as indicated in Section - IX LT transformer.

11.17 In section GTR and other Technical specification, the word "Purchaser" and/or "Owner" may be read as "Employer" (i**.e. RECPDCL). It is specifically intimated to all the bidders that the end user and owner of Nagrota sub-station will be JKPTCL. However, RECPDCL shall be considered as the "OWNER/EMPLOYER" till the time the substation is commissioned & Handed Over to JKPTCL by RECPDCL.**

11.18 List of approved drawings which shall be provided by RECPDCL (Owner/Employer) are enclosed at **Annexure-A to Section-Project**.

11.19 List of Owner Supplied material/equipment is enclosed at **Annexure-B to Section-Project**. The successful bidder shall ensure to take consolidated insurance which includes warrantee for Defect Liability Period on all supply items including Owner Supplied Material (whose cost is amounting to approx. Rs. 3.10 Cr.) as mentioned in the list enclosed at Annexure-B to Section-Project.

11.20 List of approved vendor/manufacturers is enclosed at **Annexure-C to Section-Project**.

Annexure-A to Section-Project

List of Approved Drawings: Civil

S.NO.	Approved Drawing Name	Drawing Reference	Revision
1	Foundation Drawing of 33kV Tower(3TBP/3TCP/3TD/3TE)	KDBIL/250 PJ/20-21/D1/74	0
2	Foundation Layout of 2x50MVA	KDBIL/250 PJ/20-21/D1/29	7
3	Combine Architectural Dwg of FFPH & Water Tank	KDBIL/250 PJ/20-21/D1/17	3
4	Structural Dwg oF FFPH	KDBIL/250 PJ/20-21/D1/28	1
5	33kV CT & 33kV LA combined Fdn. Dwg	KDBIL/250 PJ/20-21/D1/95	0
6	50MVA Trf Fdn Drawing	KDBIL/250 PJ/20-21/D1/77	3
7	Foundation Layout of 2x50MVA	KDBIL/250 PJ/20-21/D1/29	3
8	33kV PT Combined Fdn Dwg	KDBIL/250 PJ/20-21/D1/93	1
9	Fdn Dwg of 33kV Tower(3TGP)	KDBIL/250 PJ/20-21/D1/86	0
10	33kV Iso Fdn Dwg	KDBIL/250 PJ/20-21/D1/97A,97B,	0
11	220kV BPI Fdn Dwg	KDBIL/250 PJ/20-21/D1/124	0
12	Fdn Dwg of 33kV BPI Type A	KDBIL/250 PJ/20-21/D1/118A	0
13	Fdn Dwg of 33kV BPI Type B	KDBIL/250 PJ/20-21/D1/118B	0
14	Fdn Dwg CTK for 220kV	KDBIL/250 PJ/20-21/D1/67	0
15	NIFPS Fdn Dwg	KDBIL/250 PJ/20-21/D1/143	0
16	Oil Pit Fdn Dwg for PNT Fire System	KDBIL/250 PJ/20-21/D1/143	0
17	220kV CT Fdn Dwg	KDBIL/250 PJ/20-21/D1/68	0
18	220kV Fdn Dwg CTG	KDBIL/250 PJ/20-21/D1/60	0
19	220kV Fdn Dwg CD	KDBIL/250 PJ/20-21/D1/71	0
20	220kV Fdn Dwg CC	KDBIL/250 PJ/20-21/D1/72	0
21	220kV Fdn Dwg CTK	KDBIL/250 PJ/20-21/D1/026	0
22	Fdn Dwg CTA,CTB,CB FOR 220kV	KDBIL/250 PJ/20-21/D1/027	0
23	Fdn Dwg CC & CD (0-Filling)	KDBIL/250 PJ/20-21/D1/025	1
24	220kV Fdn Dwg CTK (0-Filling)	KDBIL/250 PJ/20-21/D1/026	1
25	Fdn Dwg CTA,CTB,CB FOR 220kV (0-Filling)	KDBIL/250 PJ/20-21/D1/027	1
26	Fdn Dwg CTG & CTH (0-Filling)	KDBIL/250 PJ/20-21/D1/024	1
27	33kV Iso Fdn Dwg	KDBIL/250 PJ/20-21/D1/97	0
28	220kV Fdn Dwg CTH	KDBIL/250 PJ/20-21/D1/61	0
29	Plinth Beam RCC for Car Parking shed	KDBIL/250 PJ/20-21/D1/87	0
30	Roof Beam RCC For Car Parking Shed	KDBIL/250 PJ/20-21/D1/87	0
31	Column Beam RCC For Car Parking Shed	KDBIL/250 PJ/20-21/D1/87	0
32	Footing Beam RCC For Car Parking Shed	KDBIL/250 PJ/20-21/D1/87	0
33	Roof Slab RCC For Car Parking Shed	KDBIL/250 PJ/20-21/D1/87	0
34	Slope Edge Protection Toe Wall	KDBIL/250 PJ/20-21/D1/136	0
35	Detail Of Cable Trench Section Drawing	KDBIL/250 PJ/20-21/D1/90	0

S.NO.	Approved Drawing Name	Drawing Reference	Revision
36	Fdn Drg Of 50 M LM. Lm1,Lm2	KDBIL/250 PJ/20-21/D1/142A	0
37	Fdn Drg Of 50 M LM. Lm2 in 1m Filling	KDBIL/250 PJ/20-21/D1/142B	0
38	33kV CT Combined Fdn Dwg	KDBIL/250 PJ/20-21/D1/91	0
39	33kV VCB Fdn Dwg	KDBIL/250 PJ/20-21/D1/137	0
40	Dwg of 5.5m & 3.7m Road	KDBIL/250 PJ/20-21/D1/37	0
41	Dwg of Septic Tank of CRB	KDBIL/250 PJ/20-21/D1/132	0
42	Dwg of 220kV Iso Fdn	KDBIL/250 PJ/20-21/D1/55	2
43	220kV CB Fdn Dwg	KDBIL/250 PJ/20-21/D1/56	0
44	220kV LA Fdn Dwg	KDBIL/250 PJ/20-21/D1/125	0
45	220kV CVT Fdn Dwg	KDBIL/250 PJ/20-21/D1/69	0
46	Outdoor Cable Trench	KDBIL/250 PJ/20-21/D1/140	2
47	Fdn Dwg of 33kV Tower(3TAP/3TD/3TE)	KDBIL/250 PJ/20-21/D1/83	0
48	AE Quarter Foundation Dwg	KDBIL/250 PJ/20-21/D1/30	1
49	CRB Lintel Beam	KDBIL/250 PJ/20-21/D1/46	1
50	Terrace Beam RCC Dwg	KDBIL/250 PJ/20-21/D1/41	1
51	First Floor Beam RCC Of CRB	KDBIL/250 PJ/20-21/D1/41	1
52	Terrace & Mumty Slab RCC Of CRB	KDBIL/250 PJ/20-21/D1/50	1
53	Drain & Road Layout	KDBIL/250 PJ/20-21/D1/101	2
54	Column RCC Dwg Of CRB	KDBIL/250 PJ/20-21/D1/35	0
55	First Floor Slab RCC OF CRB	KDBIL/250 PJ/20-21/D1/50	1
56	Plumbing & Sanitary of SBA Quarter	KDBIL/250 PJ/20-21/D1/131	1
57	First Floor Slab Detail Of JE Quarter	KDBIL/250 PJ/20-21/D1/100	0
58	Terrace & Mumty Slab Of JE Quarter	KDBIL/250 PJ/20-21/D1/100	0
59	Column RCC OF JE Quarter	KDBIL/250 PJ/20-21/D1/99	0
60	Ground Floor Lintel Beam Of JE Quarter	KDBIL/250 PJ/20-21/D1/103	1
61	First Floor Beam Of JE Quarter	KDBIL/250 PJ/20-21/D1/99	1
62	Plinth Beam Of JE Quarter	KDBIL/250 PJ/20-21/D1/99	1
63	Plumbing & Sanitary of JE Quarter	KDBIL/250 PJ/20-21/D1/131	1
64	Architecture JE Quarter	KDBIL/250 PJ/20-21/D1/20	1
65	Stair case RCC Dwg Of SBA Quarter	KDBIL/250 PJ/20-21/D1/122	0
66	Plinth Beam Of SBA Quarter	KDBIL/250 PJ/20-21/D1/109	0
67	First Floor Beam Of SBA Quarter	KDBIL/250 PJ/20-21/D1/109	0
68	Terrace Roof Beam of SBA Quarter	KDBIL/250 PJ/20-21/D1/109	0
69	Mumty Beam Of SBA Quarter	KDBIL/250 PJ/20-21/D1/109	0
70	First Floor Slab Detail Of SBA Quarter	KDBIL/250 PJ/20-21/D1/110	0
71	Terrace Roof & Mumty Slab Of SBA Quarter	KDBIL/250 PJ/20-21/D1/110	0
72	Ground Floor Lintel Beam Of SBA Quarter	KDBIL/250 PJ/20-21/D1/123	0
73	First Floor Lintel Beam Of SBA Quarter	KDBIL/250 PJ/20-21/D1/123	0
74	220kV Iso Str Dwg	KDBIL/250 PJ/20-21/D1/54	1
75	Mumty Beam RCC Of CRB	KDBIL/250 PJ/20-21/D1/41	1
77	220kV CVT Str Dwg	KDBIL/250 PJ/20-21/D1/57	0
78	Structure Layout OF 2x50 MVA	KDBIL/250 PJ/20-21/D1/11	2

S.NO.	Approved Drawing Name	Drawing Reference	Revision
79	220kV CT Str Dwg	KDBIL/250 PJ/20-21/D1/58	0
80	Tie Beam RCC of CRB	KDBIL/250 PJ/20-21/D1/37	1
81	Plinth Beam RCC Of CRB	KDBIL/250 PJ/20-21/D1/37	1
82	Contour GA Superimpose of Station	KDBIL/250 PJ/20-21/D1/02	7
83	Fdn Dwg Of CRB	KDBIL/250 PJ/20-21/D1/34	0
84	JE Quarter Fdn Dwg	KDBIL/250 PJ/20-21/D1/98	0
85	Terrace Roof Beam JE Quarter	KDBIL/250 PJ/20-21/D1/99	1
86	Mumty Beam of JE Quarter	KDBIL/250 PJ/20-21/D1/99	0
87	First Floor Lintel Beam Of JE Quarter	KDBIL/250 PJ/20-21/D1/103	1
88	SBA Quarter Fdn Dwg	KDBIL/250 PJ/20-21/D1/107	0
89	220kV LA Str Dwg	KDBIL/250 PJ/20-21/D1/127	0
90	Fdn Layout 2x50 MVA	KDBIL/250 PJ/20-21/D1/29	5
91	220kV HBPI Fdn Dwg	KDBIL/250 PJ/20-21/D1/146	0
92	Architecture Store Room	KDBIL/250 PJ/20-21/D1/45	1
93	Architecture of AE quarter	KDBIL/250 PJ/20-21/D1/13	3
94	Elevation of AE Quarter	KDBIL/250 PJ/20-21/D1/13	2
95	Architecture of Car Parking Shed	KDBIL/250 PJ/20-21/D1/43	1
96	Architecture Dwg Of Security Room	KDBIL/250 PJ/20-21/D1/15	2
97	Details of Main Gate	KDBIL/250 PJ/20-21/D1/14	2
98	AE Quarter Plinth Beam RCC	KDBIL/250 PJ/20-21/D1/31	2
99	AE Quarter Roof Beam RCC	KDBIL/250 PJ/20-21/D1/31	2
100	AE Quarter Column RCC	KDBIL/250 PJ/20-21/D1/31`	2
101	AE Quarter Slab RCC	KDBIL/250 PJ/20-21/D1/31	0
102	Plumbing & Sanitary of AE Quarter	KDBIL/250 PJ/20-21/D1/131	1
103	Plumbing & Sanitary of Security Room	KDBIL/250 PJ/20-21/D1/131	1
104	Plumbing & Sanitary of 2x50MVA	KDBIL/250 PJ/20-21/D1/131	1
105	RCC Retaining wall 2 Meter Height	KDBIL/250 PJ/20-21/D1/01	0
106	RCC Retaining wall 3 Meter Height	KDBIL/250 PJ/20-21/D1/01	0
107	RCC Retaining wall 4 Meter Height	KDBIL/250 PJ/20-21/D1/01	0
108	RCC Retaining wall 5 Meter Height	KDBIL/250 PJ/20-21/D1/01	0
109	RCC Retaining wall 6 Meter Height	KDBIL/250 PJ/20-21/D1/01	0
110	RRM Wall	KDBIL/250 PJ/20-21/D1/135	0
111	Boundary wall	KDBIL/250 PJ/20-21/D1/10	1

List of Approved Drawings: Electrical

S.NO.	Approved Drawing Name	Drawing Reference	Revision
1	PSLD of 2x50MVA	KDBIL/250PJ/20-21/D1/120	2
2	LT- SLD(AC) Drawing of 2x50MVA	KDBIL/250 PJ/20-21/D1/63	0
3	LT- SLD(DC) Drawing of 2x50MVA	KDBIL/250 PJ/20-21/D1/53	0
4	General Arrangement-Layout Plan 2x50MVA	KDBIL/250 PJ/20-21/D1/02	7
5	Section View of 2x50MVA	KDBIL/250 PJ/20-21/D1/07	2
6	DSLP Drawing of 2x50MVA	KDBIL/250 PJ/20-21/D1/16	1
7	Erection Drawing of 33kV Tower 3TD	KDBIL/250 PJ/20-21/D1/113	1
8	Fabrication of 33kV Beam (3BA,3BB,3BC,3BD,3BE,3BF,3BG,3BI)	KDBIL/250 PJ/20-21/D1/133	1
9	SLD of 50-M Lightening Mast MKD	KDBIL/250 PJ/20-21/D1/32	2
10	220kV LA Str. Drawing	KDBIL/250 PJ/20-21/D1/116	0
11	Erection Drawing 33kV Tower 3TAP	KDBIL/250 PJ/20-21/D1/104	1
12	Erection Drawing of 33kV Tower 3TBP	KDBIL/250 PJ/20-21/D1/78	1
13	Erection Drawing of 33kV Tower 3TCP	KDBIL/250 PJ/20-21/D1/80	1
14	Erection Drawing of 33kV Tower 3TE	KDBIL/250 PJ/20-21/D1/111	1
15	33kV Isolator Str	KDBIL/250 PJ/20-21/D1/88	1
16	220kV Normal/Tandem Iso Str	KDBIL/250 PJ/20-21/D1/154	2
17	33kV PT Str	KDBIL/250 PJ/20-21/D1/85	1
18	33kV LA Str	KDBIL/250 PJ/20-21/D1/94	1
19	220kV HBI Str	KDBIL/250 PJ/20-21/D1/145	0
20	220kV CT Str	KDBIL/250 PJ/20-21/D1/58	1
21	33kV CT Str	KDBIL/250 PJ/20-21/D1/59	1
22	220kV LA Str	KDBIL/250 PJ/20-21/D1/127	1
23	220kV CVT Str	KDBIL/250 PJ/20-21/D1/57	1
24	Erection Drawing of 33kV Tower 3TGP	KDBIL/250 PJ/20-21/D1/117	2
25	CRB Panel Arrangement and Indoor Cable Trench	KDBIL/250 PJ/20-21/D1/114	1
26	FFPH Illumination cum conduit	KDBIL/250 PJ/20-21/D1/40	1
27	220kV BPI Str Drawing	KDBIL/250 PJ/20-21/D1/121	1
28	33kV BPI Str Dwg	KDBIL/250 PJ/20-21/D1/102	1
29	Erection Dwg of 50M Lightening Mast	KDBIL/250 PJ/20-21/D1/128	1
30	SLD of 33kV Tower 3TGP	KDBIL/250 PJ/20-21/D1/79	0
31	Fabrication Detail for 220kV Tower Type "CTB"	KDIPL/JK/NAG/220kV/CTB	0
32	Fabrication Detail for 220kV Tower Type "CTK"	KDIPL/JK/NAG/220kV/CTK	0
33	Fabrication Detail for 220kV Tower Type "CTA"	KDIPL/JK/NAG/220kV/CTA	0
34	Fabrication Detail for 220kV Beam Type "BG1"	KDIPL/JK/NAG/220kV/BG1	0
35	Fabrication Detail for 220kV Column Type "CTH"	KDIPL/JK/NAG/220kV/CTH	0
36	Fabrication Detail for 220kV Column Type "CTG"	KDIPL/JK/NAG/220kV/CTG	0
37	Fabrication Detail for 220kV Column Type "CB"	KDIPL/JK/NAG/220kV/CB	0
38	Fabrication Detail for 220kV Column Type "CC"	KDIPL/JK/NAG/220kV/CC	0
39	Fabrication Detail for 220kV Peak "2PI"	KDIPL/JK/NAG/220kV/P1	0
40	Fabrication Detail for 220kV Beam MKD "B1"	KDIPL/JK/NAG/220kV/B1	0

S.NO.	Approved Drawing Name	Drawing Reference	Revision
41	Fabrication Detail for 220kV Column Type "CD"	KDIPL/JK/NAG/220kV/CD	0
42	SLD Drawing 33kV Tower 3TAP	KDBIL/250 PJ/20-21/D1/76	0
43	SLD Drawing 33kV Tower 3TD	KDBIL/250 PJ/20-21/D1/76	0
44	SLD Drawing 33kV Tower 3TE	KDBIL/250 PJ/20-21/D1/76	0
45	SLD Drawing 33kV Tower 3DB	KDBIL/250 PJ/20-21/D1/76	0
46	Fabrication Dwg 33kV BPI Str	KDBIL/250 PJ/20-21/D1/102A	0
47	SLD OF 33kV BPI Str Dwg	KDBIL/250 PJ/20-21/D1/102	0
48	Double Pole Structure Drawing with connected HGF&BPI	KDBIL/250 PJ/20-21/D1/148	2
49	Type detail of HG Fuse for 33kV	KDBIL/250 PJ/20-21/D1/148	2
50	Type detail of pin insulator for disc insulator for 33kV	KDBIL/250 PJ/20-21/D1/148	2
51	Type detail of Bus Post for 33kV	KDBIL/250 PJ/20-21/D1/148	2
52	CRB Panel Arrangement and Indoor Cable Trench	KDBIL/250 PJ/20-21/D1/144	1

Annexure-B to Section-Project

List of Owner Supplied Material

Following is the list of material which shall be handed over to the Contractor by M/s RECPDCL after award of contract

S. No.	Description of Equipment	Quantity	Make
SUBSTATION PORTION			
1	220 kV SF6 Circuit Breaker	06 nos.	M/s Siemens Ltd.
2	220 kV, 800 A Current Transformer	15 nos.	M/s Mehru Electrical & Mechanical Engineers (P) Ltd.
3	220 kV, 1600 A Current Transformer	03 nos.	
4	220 kV CVT	12 nos.	
5	33 kV, 1200 A Current Transformer	21 nos.	
6	33 kV, 2000 A Current Transformer	03 nos.	
7	33 kV Potential Transformer	06 nos.	
8	33 kV, 2500 A Vacuum Circuit Breaker	1 nos.	M/s ABB Ltd.
9	Lattice Structure		
A	Non-standard gantry structures including all Bolts & Nuts (Towers, Beam)	135.712 MT	
B	Non-standard Lightening Mast structures including all Bolts & Nuts	0.028 MT	
C	Non-standard equipment support structures including all Bolts & Nuts	10.152 MT	
TRANSMISSION LINE PORTION			
1	Stubs (Mild Steel)	0.216 MT	
2	Stubs (HT Steel)	9.062 MT	

Note: Contractor shall take consolidated insurance which would include warrantee for Defect Liability Period on all the above Owner Supplied Material also (whose cost is amounting to approx. Rs. 3.10 Cr.).

Annexure-C to Section-Project

List of Approved Vendor/Manufacturer for Equipment

The following vendor/manufacturer are approved by RECPDCL for carrying out the item of the facilities indicated. Where more than one vendor/manufacturer is listed, the Contractor is free to choose between them, but it must notify to the Employer of its choice in good time prior to appointing any selected Subcontractor. In accordance with tender document, the Contractor is free to submit proposals for vendor/manufacturer for additional items from time to time. However, the Contractor has to ensure that the proposed vendor/manufacturer is PGCIL approved. Non-PGCIL approved vendors shall not be accepted in any case. No Subcontracts shall be placed with any such Subcontractors for additional items until the Subcontractors have been approved in writing by RECPDCL and their names have been added to this list of Approved vendor/manufacturer.

List of Approved Vendor/Manufacturer		
S. No.	**Description of Equipment**	**Name of the manufacturer/vendor**
1	220/33kV Power Transformer	Toshiba/CGL/Bharat Bijlee/ABB/ Siemens/BHEL/Kanohar/ EMCO/T&R/ INDOTECH Transformers Approved Vendor of POWERGRID
2	SHUNT REACTOR	CG/ALSTOM/Siemens/TBEA and Other Approved Vendor of POWERGRID
3	245kV Circuit Breaker	CGL/GE/ABB/Siemens/ALSTOM/ Approved Vendor of POWERGRID
4	245kV Capacitive Voltage Transformer	CGL/GE/ABB/Siemens/ALSTOM/BHEL/ MEHRU/ Approved Vendor of POWERGRID
5	245kV Voltage Transformer	CGL/GE/ABB/Siemens/ALSTOM/MEHRU/SCT and Other Approved Vendor of POWERGRID
6	245kV Current Transformer	CGL/GE/ABB/Siemens/Mehru/BHEL/ALSTOM/TOSIIIBA/SCT and Other Approved Vendor of POWERGRID
7	245kV ISOLATOR	ABB /Siemens/GR Power/S&S/HIVELM/Switchgear & Structures/ Approved Vendor of POWERGRID
8	36kV ISOLATOR	ABB/Siemens/ G R Power / HIVELM / Universal / Electrolites / Ultima/Switchgear & Structures/ Approved Vendor of POWERGRID
9	245 kV & 36kV Surge Arrester	Oblum/Lamco/CGL/ Approved Vendor of POWERGRID
10	Control & Relay Panel	Schneider/ABB/Siemens/GE India/ BHEL / ALSTOM / ZIV / L&T and Other Approved Venders of POWERGRID
11	Substation Automation	Schneider/ABB/Siemens/GE India/ALSTOM /ZIV/L&T and Other Approved Vendor of POWERGRID
12	DIGITAL PROTECTION COUPLER	ABB/ALSTOM/ZIV-Spain/Siemens and Other Approved Vendor of POWERGRID
13	33kV HT Cable	KEI/Paramount/HAVELLS/Polycab/RPG/ Approved Vendor of POWERGRID

14	1.1 kV Power & Control Cables (PVC)	Polycab Cables/ KEI/Gemscab/ Paramount Cables/ Havells/RPG/ LASER and Other Approved Vendor of POWERGRID
15	1.1 kV XLPE Power Cables	KEI/ Paramount/Universal/ Gemscab/Krishna/Havells and Other Approved Vendor of POWERGRID
16	110V & 48V Battery	Amara Raja/Exide/HBL/ Approved Vendor of POWERGRID
17	110V & 48V Battery Charger	STATCON/HBL/Amara Raja/Chabbl/Caldyne/Chloride/ Approved Vendor of POWERGRID
18	LT Switchgear	Vikas Engg./Unilec/ Jackson/ SPACEAGE / Jasper / Nitya / BHEL / Maktel/Control & Switchgear and Other Approved Vendor of POWERGRID
19	LT Transformer	ABB/ TESLA/Toshiba/Technical Associate/East India/Vijay/ Approved Vendor of POWERGRID
20	33kV Indoor Switchgear (GIS Type)	Siemen Germany/Switchgear/CGL/ABB/L&T/Scheinder/ Approved Vendor of POWERGRID
21	132 & 220 kV INDOOR SWITCHGEAR (GIS TYPE)	ABB/GE/Siemens/HYOSUNG/CGL/ Approved Vendor of POWERGRID

Further, erection portion of the contract shall not be subcontracted without the prior approval of the Employer. However, such approval shall not be necessary for engaging labour.

Note:

1. Contractor may propose new make/sub-vendor meeting technical (qualifying) requirement as stipulated in technical Specification for above mentioned brought - out items within 60 days from the date of NOA for approval of RECPDCL. The cost of assessment shall borne by contractor in case of new vendors as per RECPDCL requirement

ANNEXURE-I

Sr. No.	Item Description	Unit	Quantity
1	2	3	4
	MANDATORY SPARES for 220/33kV NAGROTA SUBSTATION		
A	**220/33kV, 50MVA, 3Phase Transformer**		
i)	Bushing of each rating with metal parts & gaskets and lifting tools	Set	1
ii)	Oil Cooler pump with motor	Set	1
iii)	Cooler fan with Motor	No.	1
iv)	Buchholz Relay(Main Tank) complete with floats and contacts	Set	1
v)	Local and Remote WTI with sensing device and contact(each)	Set	1
vi)	Oil Temperature Indicator (OTI) with sensing device and contact (each)	Set	1
vii)	Magnetic oil level gauge	No.	1
viii)	Starters, contactors, switches & Relays for Electrical control Panels (One set of each type)	Set	1
ix)	Remote Tap Position Indicator	No.	1
x)	Oil Flow Indicator with Flow Switch	Set	1
xi)	Spare insulating oil to be handed over to PDD, J&K after commissioning for O&M requirement	KL	10
xii)	Fire Detectors of Nitrogen Injection type fire prevention system	No.	2
xiii)	Thermostat of Nitrogen prevention system	No.	1
B	**245 kV CIRCUIT BREAKER**		
	Complete Pole of Circuit Breaker including Grading Capacitor, pole column, Interrupter, with driving mechanism Box and Marshaling Box but without support structure for.		
i)	2500Amp, 40KA, (No. of Pole)	No.	1
ii)	Grading Capacitors (if applicable)	No.	1
iii)	Rubber gaskets, O rings and seals for SF6 gas (complete replacement for one breaker)	Set	1
iv)	Trip coils with resistor	Nos.	2
v)	Closing coils with resistor	Nos.	1
vi)	Molecular filter for SF6 Circuit for 1 Pole of CB	Nos.	2
vii)	Terminal pads and connectors	Nos	2
viii)	Corona rings	Nos	1
Ix)	Relays, power contactors, switch-fuse units, limit switches, push buttons, timers and MCBs etc	Set	1
x)	Pressure switches (one no. of each type)	set	1
xi)	Auxiliary Switch Assembly (One no. of each type)	set	1
C	**245kV ISOLATORS**		
C1	**245kV, 1600 Amp, 40 kA Isolator**		
i)	One complete pole of Isolator including support insulator with 1 E/S with operating mechanism for main isolator and earth switch (excluding structure)	No.	1
ii)	Copper contact fingers for female & male contacts.	Set	2

iii)	Open/Close Contactor Assembly, Timer, Key Interlock push button switch & auxiliary switches.	Set	1
iv)	Limit switch	Set	2
v)	Terminal pads & Connectors	No.	3
vi)	Corona shielding ring	No.	3
C2	**245kV, 2500 Amp, 40 kA Isolator**		
i)	One complete pole of Isolator including support insulator with 1 E/S with operating mechanism for main isolator and earth switch (excluding structure)	No.	1
ii)	Copper contact fingers for female & male contacts.	Set	2
iii)	Open/Close Contactor Assembly, Timer, Key Interlock push button switch & auxiliary switches.	Set	1
iv)	Limit switch	Set	2
v)	Terminal pads & Connectors	No.	3
vi)	Corona shielding ring	No.	3
D	**245kV CURRENT TRANSFORMER(1-Phase)**		
i)	800Amps, 40kA with 120% extended current rating	No.	1
ii)	1600Amps, 40kA with 150% extended current rating	No.	1
E	**245kV Capacitive Voltage Transformer**		
i)	4400 pF	No.	1
F	**216kV SURGE ARRESTOR**		
i)	Complete Surge Arrestor	No.	1
ii)	Surge Counter/Monitor	No.	5
G	**36kV CIRCUIT BREAKER**		
G1	2500Amp, 25KA Circuit breaker		
i)	Complete Pole of Circuit Breaker including Grading Capacitor, pole column, Interrupter, with driving mechanism Box and Marshaling Box but without support structure for.		
a)	2500Amp, 25KA (No. of Pole)	No.	1
ii)	Rubber gaskets, O rings and seals for SF6 gas (complete replacement for one breaker)	Set	1
iii)	Trip coils with resistor	No.	2
iv)	Closing coils with resistor	No.	1
v)	Molecular filter for SF6 Circuit for 1 Pole of CB	No.	2
vi)	Terminal pads and connectors	No.	2
vii)	Corona rings	No.	1
viii)	Relays, power contactors, switch-fuse units, limit switches, push buttons, timers and MCBs etc.	Set	1
ix)	Pressure switches (one no. of each type)	set	1
x)	Auxiliary Switch Assembly (One no. of each type)	set	1
G2	1250Amp, 25KA Circuit breaker		

i)	Complete Pole of Circuit Breaker including Grading Capacitor, pole column, Interrupter, with driving mechanism Box and Marshaling Box but without support structure for.		
a)	1250Amp, 25KA (No. of Pole)	No.	1
ii)	Rubber gaskets, O rings and seals for SF6 gas (complete replacement for one breaker)	Set	1
iii)	Trip coils with resistor	No.	2
iv)	Closing coils with resistor	No.	1
v)	Molecular filter for SF6 Circuit for 1 Pole of CB	No.	2
vi)	Terminal pads and connectors	No.	2
vii)	Corona rings	No.	1
viii)	Relays, power contactors, switch-fuse units, limit switches, push buttons, timers and MCBs etc.	Set	1
ix)	Pressure switches (one no. of each type)	set	1
x)	Auxiliary Switch Assembly (One no. of each type)	set	1
H	**36kV ISOLATOR**		
H1	2500A, 25kA, 36kV Isolator		
i)	One complete pole of Isolator with support insulator, MOM for both main isolator and earth switch (excluding structure)	No.	1
ii)	Copper contact fingers for female & male contacts.	Set	2
iii)	Open/Close Contactor Assembly, Timer, Key Interlock push button switch & auxiliary switches.	Set	1
iv)	Limit switch	Set	2
v)	Terminal pads & Connectors	No.	3
vi)	Corona shielding ring, if applicable	No.	3
H2	1250A, 25kA, 36kV Isolator		
i)	One complete pole of Isolator with support insulator, MOM for both main isolator and earth switch (excluding structure)	No.	1
ii)	Copper contact fingers for female & male contacts.	Set	2
iii)	Open/Close Contactor Assembly, Timer, Key Interlock push button switch & auxiliary switches.	Set	1
iv)	Limit switch	Set	2
v)	Terminal pads & Connectors	No.	3
vi)	Corona shielding ring, if applicable	No.	3
I	**36kV CURRENT TRANSFORMER**,		
i)	1200A,25kA,1-Ph Current Transformer-120% rating	No	1
ii)	2000A, 25 KA, 1-PHASE CURRENT TRANSFORMER WITH 150% EXTENDEDRATING	No	1
J	**Potential Transformer (1 Ph.)** **33kV/√3/110/√3/110/√3/110/√3**	No	1
K	**30kV SURGE ARRESTOR**		
i)	Complete Surge Arrestor	No.	1
ii)	Surge Counter/Monitor	No.	5

L	**RELAY PROTECTION PANEL**		
i)	Transformer protection panel :	No.	1
a)	Transformer differential protection	No.	1
b)	REF protection relay with non-linear resistor	No.	1
c)	Directional over current & E/F Protection Relay		
ii)	Line protection panel :	Set	1
a)	Numerical distance relay (1 no. of each type)		
iv)	Breaker Relay panel:	No.	1
a)	Breaker failure relay	Nos.	2
b)	Trip circuit supervision relay	No.	1
c)	Auto Reclose relay with check synchronizing relay and dead line charging relay	Set	1
d)	Self reset trip relay (relay of each type)	Set	1
e)	Hand reset trip relay(relay of each type)	Set	1
f)	Timer relay(relay of each type)	Set	1
g)	DC supervision relay(relay of each type)	Set	1
h)	Flag relays(relay of each type)	Set	1
i)	Auxiliary relays(relay of each type)	No.	1
M	**SUBSTATION AUTOMATION SYSTEM**		
1	Bay control (IED) of each type	set	1
2	Ethernet switch of each type	set	1
N	**BATTERY CHARGER**		
N1	**220 Volt**		
1	Set of control cards	Set	1
2	Set of relays	Set	1
3	Rectifier transformer	No	1
4	Thyristor/diode	Set	1
5	Fuses of Thyristor with indicators	Set	1
N2	**48 Volt**		
1	Set of control cards	Set	1
2	Set of relays	Set	1
3	Rectifier transformer	No	1
4	Thyristor/diode	Set	1
5	Fuses of Thyristor with indicators	Set	1
O.	**DG Set**		
1	Self-starter assembly	No	1
2	AVR(Auto voltage regulator)/AVR Card	set	1
P.	**LT Transformer (315 kVA)**		
1	Bushings	No.	1no. of each type
2	OTI & WTI with sensing device	No	1no. of each type
3	Diaphragm for pressure relief vent	No.	1

4	Silica gel container	No.	1
5	Set of Valves	No.	1no. of each type
6	Buchholz relay (if applicable)	No.	1
Q.	**LT Transformer (160 kVA)**		
1	Bushings	No.	1no. of each type
2	OTI & WTI with sensing device	No	1no. of each type
3	Diaphragm for pressure relief vent	No.	1
4	Silica gel container	No.	1
5	Set of Valves	No.	1no. of each type
6	Buchholz relay (if applicable)	No.	1
R.	**Illumination System**		
	5% of each type of lighting fixture supplied	set	1
S.	**Erection Hardware Items**		
	5% spares of the actual quantities for Insulator strings & hardwares, clamps & connectors (including equipment connectors), spacers, corona bell and welding sleeves,	set	1
T	**Tele Communication**		
a	**SDH Equipment (STM-4 MADM upto 5MSP Protected directions)**		
(i)	Common cards, Cross-connect/control cards, Optical base card, power supply card, power cabling, other hardware & accessories(each)	Set	1
(ii)	**Optical Interface Cards/SFP#**		
a	S4.1 SFP	Nos.	1
b	L4.1 SFP	Nos.	1
(iii)	**Tributary Cards**		
a	E1 interface Card(Min. 16 interfaces per card)	Nos.	1
b	Ethernet Interface 10/100 Base T with layer-2 switching (Min 8 Interfaces per card)	Nos.	1
b	**VOIP Telephone Instrument**	Nos.	1
c	**Pre Connectorised Optical Fibre Patch cords(10 Mtrs)-pack of six patch cords**	Set	1
d	**Approach cable(24)**		
	Nagrota		
(a)	24 Fibre (DWSM)	Km	0.5

(b)	Installation hardware set for above 24f,fibre optic approach cable	Set	1
	Gladni		
(a)	24 Fibre (DWSM)	Km	0.5
(b)	Installation hardware set for above 24f,fibre optic approach cable	Set	1
	Udhampur		
(a)	24 Fibre (DWSM)	Km	0.5
(b)	Installation hardware set for above 24f,fibre optic approach cable	Set	1
U	**LT Switchgear**		
i)	MCB of each rating and Type	Set	1

TECHNICAL SPECIFICATION FOR MAINTENANCE & TESTING EQUIPMENTS

1. **BDV TEST KIT**

i) The equipment shall be suitable for determination of electrical strength (break down voltage) of insulating oil confirming to IS-335 up to 100 kV when measured in accordance with IS:6792. The equipment shall be used in laboratory.

ii) The test cell shall be as per IS:6792 and IEC-156-1995 suitable for BDV up to 100kV without external flash over.

iii) HV chamber interlocking and zero start interlocking shall be provided.

iv) The unit shall have motorized drive to increase voltage linearly as per the rate specified in IS: 6792 . Provision shall also be available for manual increase of voltage.

iv) The unit shall be complete with motorised test cell stirrer, calibrator and necessary gauges for adjusting the gap.

v) It shall be suitable for 230V, single phase, AC, 50Hz supply with variations of ±10% and ±5% in voltage and frequency respectively.

vi) Kit shall be supplied along with all accessories operating manual, spare fuses , indication lamps, power supply chord etc. all that is required for carrying out measurements. It should offer repeatability of test results.

viii) It should have overload and short-circuit protection

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2. **Megohm meter– 5KV Digital Battery operated**.

Sr.NO	Description	Specifications
1.	Type	5 KV Digital Battery Operated.
2.	Insulation test voltage	5 KV in steps of 0.5,1,2.5,5 KV DC
3.	Short Circuit Current	1.5 mA minimum
4.	Accuracy(test voltage)	±3% of nominal voltages or better
5.	Range of Measurement	0 to 200 G Ohm minimum
6.	Additional features	Shall be able to compute and display Polarisation Index and Dielectric Absorption Ratio as per Indian Standards.
7.	Accuracy(resistance)	±5% of reading±3 digits or better
8.	Operation	Motor Driven by mains/batteries
9.	Display & scale length	Digital and Analog in bargraph, with auto switch off feature
10.	Power Supply	230±10% ,50 Hz
11.	Batteries	12 V/1.2 AH Rechargeable
12.	Battery Charger	Automatic Inbuilt for AC voltage 110 to 240 V
13.	Response time	Less than 3 sec

14.	Capacitive Discharge	Automatic after insulation test is over,<
15.	Guard termination	To be provided
16.	Accessories	Test leads, Power supply leads, charger leads, Carrying case, Manual etc. required for testing
17.	Demonstration	Acceptance of kit subject to successful demonstration in charged switchyard environment to the satisfaction of PDD.
18.	Calibration Certificate	Calibration Certificate from NABL accredited lab or internationally reputed lab, shall be submitted. Date of calibration shall not be older than one month from the date of supply of Kit.
19.	Environmental and Statutory requirement	Shall conform EMI/EMC and environmental protection requirement as per relevant International standard. Copy indicating conformation shall be enclosed. • Temp- -5 to 50 deg C. • Humidity-upto 95% non-condensing
20.	Functional requirement.	The instrument shall work in charged switchyard environment conditions.
21.	Additional safety Requirement	The kit and accessories shall be robust and rugged enough, so that it can be transported safely at different locations .The transportation case and packing of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement of kit.

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3. Digital Multimeter

i) Heavy Duty, shock proof, splash proof, dust proof.

ii) Measurement Range:

Description		Range	Accuracy
a)	DC Voltage	0 – 1000 Volts	±0.25%
b)	AC Voltage	0 – 750 Volts	±0.75%
c)	DC Current	0 – 10 Amp	±0.75%
d)	AC Current	0 – 10 Amp	±1.5%
e)	Resistance	0 – 30 Mohms min.	±1.0%
f)	Continuity Check	0 – 250 Ohms min	
g)	Diode Test Unit		±1%

iii) Display — 3 and ½ digit, LCD,Bar graph.

iv) Polarity — Automatic, No indication for positive polarity, Minus (-) sign for negative polarity. With Capacitance, frequency and Temp. measurement features

v) Over range indication – Half digit display with other digits blank.

vi) Low battery indication
vii) Power Supply – Single Standard 9 V Battery.
viii) Transient Protection: 2 KV (DCV / ACV and Ohm Ranges).
ix) Environment: Operating 0 – 55 degree Centigrade, 80% RH at 35 degree C, Storage –20 to 60 deg.C, 70% RH at 40 deg. C.
x) Accessories: Test leads set, temp. probe, High Voltage probe, Carrying case, spare fuses, Manual etc.
xi) The instrument shall work in charged switchyard environment conditions.
xii) Instrument shall confirm to International/Indian safety and EMC standards

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4. Oil sampling Bottles

- Capacity - 1 Ltrs
- Container - Made of Stainless Steel.
- 2 Nos. of 0.25" of S.S. needle valve with SS T type handle one on each side.
- 2 Nos. of SS adopters with end caps one on each side.
- The valves should be 100 % leak proof .
- Suitable for Dissolved Gas Analysis Test.
- The design of bottle & seal shall be such that loss of Hydrogen shall not exceed 5% per week. Copy of type test report to be enclosed.
- Suitable for collecting oil samples from transformers and shunt reactors.
- Bottles shall be robust enough ,so that no damage occurs during frequent transportation of samples from site to laboratory.

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5. Portable SF6 Gas Refilling Device

Sr. No	Description	Specification
1.	Functional Requirement	Equipment shall be able to evacuate and fill the SF6 gas in breakers, cylinder etc. Mobile unit shall be mounted on a cart provided with wheels for easy movement. The cart shall have provision for carrying a SF6 gas cylinder.
2.	Assembly parts	The equipment shall basically consist of a vacuum pump, vacuum gauge, SF6 gas regulator with H.P and L.P manometers, Three way valve and hoses of sufficient length with couplings for connecting to SF6 gas cylinder and to equipment
3.	Accessories	It shall consist of pressure reducer for SF6, Indicating instruments (gauge indication in bar), Hose DN8/6 m long, Hose DN8/ 0.7 m long , Coupling tongue part DN8 and DN20, SF6 bottle connection W21.8 x1/14" ,Power Supply cable with three pin ,Opearting Instruction manual, Or equivalent accessories that is all required for carrying out specified work.
4.	Vacuum Pump	Pump 10 m3 /h (final vacuum<1mbar)

5.	Operating Voltage	230±10% ,50 Hz
6.	Packing	The Cart along with wheels shall be robust and rugged enough, so that it can be transported safely at different locations. The transportation case and packing of the kit shall be such that the transportation from one station to other will not affect the performance.

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6. Automatic Capacitance and Tan Delta Kit

The equipment shall be suitable to measure capacitance and tan delta of EHV class transformers (1/2/3 windings), bushings, CT, windings of shunt reactors, bus & line CVT's and grading capacitors of CB's at site in a charged switchyard up to 400 kV AC. The kit should have the feature of suppression of electrical and magnetic interference due to line frequency and it should also have the feature of measuring tan delta and capacitance at different frequencies than line frequency.

The kit shall be capable of measuring capacitance and tan delta of each winding of 315 MVA transformers in suitable switching mode so that capacitance of other windings does not affect the reading etc.

An optional arrangement if available for measurement of inductance, transformer turns ratio, transformer leakage reactance and loss ,winding resistance etc may be included in offer, However the tech/financial evaluation will be made for the basic kit which have facility of measurement of tan delta and capacitance with induction suppression feature as detailed above in para-1.

The kit shall be able to measure the ambient temperature and relative humidity with inbuilt/optional arrangement.

The equipment shall be complete with measuring bridge, HV power supply unit of 12 KV, Standard Capacitor, PC/Video Screen etc. The effects of induced voltage on instrument during testing for getting final measurement should be compensated automatically. The kit shall be capable of measuring excitation current of transformer winding at 12 KV.

The kit should have the facility of generation of test frequency independent of power line frequency for measurement of tan delta and capacitance.

The equipment shall be robust enough to sustain the jerks during the transportation in local condition.

The kit should be light weight, its packing and transportation cases/trolley shall be such that the shifting of kit from one substation to other will not affect its performance and accuracy in measurement of the kit

Sr,No	Description	Specification
1.	Output Voltage and Current	0 - 12 KV and 100 mA (Min) continues and 200mA & above intermittent @ frequency range 45 Hz to 70 Hz

2.	Tan Delta (DF)	Range - 0 to 100%min Accuracy -1% or better, of the reading Resolution - 4 digit or better
3.	Power Factor	Range - 0 to 100%min Accuracy - 1% or better of the reading Resolution - 4 digit or better
4.	Capacitance	Range - 1pf to 2µf min Accuracy - 0.5 % min + 0.1 pf of the reading. Resolution - 6 digit
5.	Power supply(Input)	230V±10% AC, 50Hz±5%
6.	Induction suppression	Fully automatic
7.	Display/Operation	VGA LCD, Front panel/key pad mounted on control unit.
8.	Data Store	Facility for data storing in the kit & down loadig to PC
9.	Safety features	- Short circuit protection - Over voltage protection - Interlock for HV output. - Reliable ground connections etc.
10.	Indications	HV supply ON, Ground open, Power supply ON etc.
11.	Cables and	- HV/LV screened cable set – 20 meters (min) with clamps & connectors. - Power supply cable - Grounding cable with clamps - One set of interconnecting cables. - Other cables and accessories required for carrying out measurement. - One set of fuses and indicating lamps and other consumables shall be supplied with kit.
12.	Software	Data analysis software in windows 98/2000/latest version with the features of - Storing and downloading of files in data base for further analysis in PC. - Facility of drawing graphs between voltages tan δ with temperature correction of tan δ values, frequencies etc. - Comparing of different value of same parameter at different period/time
13.	Repeatability	It should offer repeatability of test results in charged switchyard.

14.	Environment	The kit shall be compatible for EMI / EMC requirement as per relevant IEC .
15	Operating conditions	Shall operate at Temperature -5 to 50 deg C, Humidity not condensing up to 95%,
16	Demonstration/ Inspection	Acceptance of the kit shall be subjected to the arrangement of successful demonstration by supplier to the satisfaction of PDD, J&K at prescribed site.
17.	Calibration	Calibration certificate from/traceable to, NABL accredited lab or internationally reputed lab, shall be submitted. Date of calibration shall not be older than one month from the date of supply of Kit.

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7. Dew Point Kit for SF6 gas

Sr.No	Item	Specification
1.	Functional Requirement	The Instrument shall be able to measure the dew point of SF6 and Nitrogen available in the electrical equipment or Cylinders.
2.	Measuring Range	-80 to 0 ˚C minimum @ +/-2% or better Accuracy
3.	Display	Digital
4.	Accessories	Compatible inlet and out let couplings, Hoses, carrying case, Instruction manual, Power supply chord, Charger, The accessories shall be suitable to the equipments in PDD, J&K
5.	Pressure during Measurement	Atmospheric to 30 Mpa max.
6.	Flow Rate during Measurement	0.5 to 5 L/min
7.	Power Supply	Internal rechargeable battery pack with charger. To be operated on 220 +/- 10% V AC, 50+/-10% Hz. Or Equivalent
8.	Operating Temperature	-20 to 50 deg C.
9.	Calibration	Calibration certificate from/traceable to, NABL accredited lab or internationally reputed lab, shall be submitted. Date of calibration shall not be older than one month from the date of supply of Kit.
10.	Demonstration.	Acceptance of kit subject to successful demonstration in charged switchyard environment to the satisfaction of PDD.

11.	Packing and	The kit and accessories shall be robust and transport cases rugged enough, so that it can be transported safely at different locations .The transportation case and packing of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement of kit.

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8. Transformer Oil Filtration Plant

8.1 Performance Requirements

8.1.1 The ultra High Vacuum type oil treatment plant of capacity 3KL/6KL per hour will be mobile and will be suitable for treatment of new oil and reconditioning of used oil in EHV class transformer, shunt reactor and other oil filled equipments in order to achieve properties of treated oil within specified limits at the rated capacity.

8.1.2 The plant will be capable of treatment of new oil (as per IEC 296/IS:335 and reconditioning of used oil as per IS: 1865/IEC:422 for oil in service) at rated capacity on single pass basis as follows:

(i) Removal of moisture from 100 ppm to 3 ppm (maxm.)

(ii) Removal of dissolved gas content from 10% by vol to 0.1% by vol.

(iii) Improvement of dielectric strength break down voltage from 20 KV to 70 KV (min)

(iv) Vacuum level of degassing Not more than 0.15 torr (0.2mbar) Chamber at rated flow and max. At final stage.(degassing chambers of different degree of vacuum will have efficient surface areas to achieve the final parameters. A detailed justification as to how end parameters will be met with detailed calculations and test reports in support of the same will be submitted along with the offer.

(v) Filtering capacity: Max. particle size less than 0.5 micron in the filtered oil.

(vi) (a) Processing temperature 40deg C to 60 deg C

(b) Maximum allowed temp. in oil to prevent oxidation (when oil is at atmospheric pressure) 60 deg C

8.1.3 Contractor shall furnish detailed calculation to establish the sizing and capability of the vacuum pumping system with respect to moisture and gas removal as above.

8.1.4 Contractor shall submit test reports, test methodology to prove the capability of the plant offered.

8.1.5 The plant will also have two independent vacuum pumping systems one for evacuating the transformer for vacuum filling of oil in transformer and the other for degassing chamber. The blank off vacuum of each pumping system will be 10-3 torr or less.

8.1.6 The plant will be provided with control and indication panel with full automation.

8.1.7 The plant will be fitted with hoses for connection of oil lines and vacuum lines to transformers and reactors. Hoses will have leakage rate of 10-12 torr ltr/ sec (max.)

8.1.8 The plant will be suitable for cleaning and degassing of the oil stored in the storage tanks.

8.1.9 All equipments required as above will be mounted on a towable road worthy trailer unit with 04 nos. pneumatic tyres.

8.2 Design & Construction

The features and construction details of each 3KL/6KL per hour capacity mobile outdoor type oil filtration & purification plant will be in accordance with the requirements stated hereunder.

8.2.1 Oil Pump (Inlet Side)

8.2.1.1 Two (2) nos. electrically driven oil pumps with one (1) working and One (1) standby will be provided. Selection switch will be provided for selection of either of pumps. The pumps will be single stage positive displacement gear type. Suitable mechanical seals will be provided to ensure vacuum tightness. A built in pressure relief valve to recirculate the oil to suction side in case of accidental pressure rise will be provided. Suction lift of the pump will be atleast 5 meters of transformer oil at atmospheric pressure and temperature. A seperate by pass valve is provided across the gear pump so that the flow rate through the filter can be adjusted as required. The pump should be controlled by frequency drive .This should help to set the flow rating of filter plant from 2000-4000LPH / 3000-6000 LPH .

8.2.1.2 The pumps will be provided with an interlock with delay such that if there is no oil flow for 30 sec. through the heater, the pump will trip automatically and also if the pump is not operating the heater will not be energized.

8.2.2 Magnetic Strainer

8.2.2.1 The plant will be provided with a suitable magnetic strainer with wire mesh to filter all particles of sizes above 0.5 mm and all magnetic particles. The strainer will be installed at the suction of the oil pump described above.

8.2.3 Heater

8.2.3.1. An oil heater for heating up inlet oil will be provided at the discharge side of the oil pump.

8.2.3.2. The oil heater vessel will be of Mild Steel welded construction and insulated with glass/ mineral wool.

8.2.3.3 The vessel will be constructed for ultra high vacuum and pressure application.

8.2.3.4 Electric heater will be provided inside the heater vessel to heat up oil from lowest ambient temperature to temperature required for filtration / degasification operation in single pass. The heater will also be rated for heating the inlet oil from lowest ambient temperature to 70 degC in single pass during filling up of transformers. Two separate temperature setting with thermostatic controllers will be provided for this purpose.

8.2.3.5 The heating will be indirect type and specific heat load will not exceed 2.0 Watt / cm2 in order to avoid local overheating.

8.2.3.6 The total heating capacity will be divided into three independent thermostatically controlled heating stages evenly balancing the three phases of power supply. The control switches and knobs will be housed on a control panel.

8.2.3.7 An additional preset temper proof safety thermostat set at the highest temperature will be provided on the heater to put off the heater and give audio and visual alarm to take care of accidental overheating.

8.2.3.8 The heater body will be so designed as to follow replacement of heating elements without draining of oil. Suitable pressure relief valve, vent and drain valves and two (2) dial type temperature gauges at inlet and outlet of the heater will be provided.

8.2.4 Filter

8.2.4.1 Cartridge filter as may be required to ensure maximum particle size of less than 0.5 micron in the filtered oil will be provided.

8.2.4.2 The filter body will be fabricated of mild steel and designed for leak tightness at full vacuum and high pressures. The oil will flow from dirty oil chamber to clean oil chamber through filter elements.

8.2.4.3 Cartridge type element used will be suitable for transformer oil in service and submicron filtration, the media will be non-hygroscopic and of high dirt holding capacity.

8.2.4.4 The filter elements will be easily removable for replacement when required. Compound gauge to indicate pressure across the filter vent and drain with valves and other necessary accessories.

8.2.5 Coarse Filter

8.2.5.1For treating dirty oil, coarse filter of adequate rating may be supplied for supplementing the capacity of filter elements. These units will be designed for quick

and easy replacement of media. A sludge outlet for receiving the solid impurities and cleaning the filter plate without opening the unit will be provided. The unit will also be provided with vent and drain valves, pressure gauges at inlet and outlet and other necessary accessories.

8.2.6 External Solenoid Operated valves

8.2.6.1 Two valves will be provided at the inlet and outlet of the plant. The moment inlet and outlet pumps are switched on these valves open thus making way for oil to pass. In case of power failure, oil from the transformer will not enter the plant and the vacuum system.

8.2.7 Degassing chamber

8.2.7.1 The degassing chamber will be of welded construction and will be suitable for operation under full vacuum. The fill of raschig rings and trays for distribution will be designed for efficient distribution of oil over large areas. Incoming transformer oil will be spread over these rings in the form of film and over a longer surface area thus achieving better degassing and dehumidification.

8.2.7.2 The degassing chamber will be either single stage or multi stage type suitable for ensuring the desired oil properties. Arrangement for condensing back lighter fraction (Aromatics) of the insulating oil into the system will be provided.

8.2.7.3 The degassing channels will have adequate height to allow long enough free fall for complete degassing. Design will be such as to minimize foam formation.

8.2.7.4 The degassing chambers will be provided with suitable level monitor for oil or foam level in the chamber and will trip the inlet gear pump when the level rises above the designed maximum level in order to prevent foam/ oil to enter the vacuum pumping system. The oil inlet pump starts again automatically once the oil level in the degassing chamber falls below the preset oil level.

8.2.7.5 Necessary illuminated sight glass will be provided through which oil flow through the degasser can be viewed clearly.

8.2.7.6 The degasser will be provided with vacuum gauges, vacuum breaking valves, main and auxiliary vacuum connections and other necessary accessories.

8.2.8 Vacuum Pumping System

8.2.8.1 The pump will be provided with a suitable vacuum pumping system for creating adequate high vacuum in the degassing chambers. The pumping system will consist of suitable combination of Roots Blowers and Rotary vane vacuum pumps with interstage condensing units.

8.2.8.2 The Roots blowers will be of reputed make. Suitable built in labyrinth packing system, slinger rings, oil return chambers will be provided between bearings and working chambers to prevent penetration of lubricating oil to the working chamber. The pumps motor will be dynamically balanced. The pumps will be suitable for starting evacuation from atmospheric pressure and will be applied with necessary overflow valve.

8.2.8.3 The rotary vane vacuum pumps will be installed after the roots blower. An automatic by pass valve across the roots blower will permit operation of rotary vane pump

alone to operate when so required. The rotary vane pumps are provided with gas ballast valve to prevent contamination of vacuum pump oil with moisture. The vacuum pump will also be provided with suitable non-return valve device such that in the event of power failure the vacuum in the degassing chamber will be maintained and the vacuum pump oil is not sucked back into the degassing chamber. A high vacuum safety valve (piston type) to prevent back streaming of oil and air intrusion will be provided. The pump motors will have return stop device.

8.2.8.4 Necessary water cooled condensing units to condense the lighter faction (Aromatics) and return the same to the transformer oil will be provided to reduce the loss of aromatics. Condensing units will also be suitable for operation with broken ice for remote location operation where cooling water connection is not available.

8.2.9 Vacuum Pumping System for Transformer Evacuation

8.2.9.1An independent vacuum pumping system will be provided for evacuating the transformer for oil filling. The vacuum level required for transformer evacuation for oil transfer is about 0.76 torr (1 m bar) for transformer oil heated to 70-80 degC. The pumping system will be identical to that of the degassing vacuum system. The capacity will be adequate for evacuation of transformer in one hour. The vacuum systems for degasser and transformer evacuation will be inter connected in such a way that it will be possible to use either or both the systems for any of the purpose. A reinforced of 10 mts. Length will be provided. The hoses will be for vacuum leakage rate of 10-2 torr litre/ sec.

8.2.10 Oil Extraction Pump

8.2.10.1Suitable pumping system will be provided for extracting oil from degasser under vacuum and supplying to transformer/ reactor etc., at discharge pressure of 1.5 Kg/ cm2 at the outlet hose nozzle of the plant, the pump will be either glandless centrifugal type with canned motors or a combination of gear pump and centrifugal pump with mechanical seals suitable for extracting oil from high vacuum degassing chamber. The oil extraction pump will be located at a suitable level below the degasser chamber so as to ensure adequate suction head for the pump. The pump will be supplied with double check valve assembly and solenoid operated non-return valve. In order to stop reverse flow of the oil in case of power failure, the pumping system will preferably be self priming type alternatively priming device with safety interlock to protect pump against dry running will be provided. Sampling valves will be provided at the discharge of extraction pump for testing of oil properties. A recirculation line with valves will be provided to recirculate a part of the purified oil to the inlet point if necessary during operation. The outlet pump should be control by frequency drive to give controlled output from range 2000-4000 LPH/3000 – 6000 LPH .

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9. **Circuit Breaker Test Kit (Circuit Breaker analyzer with DCRM including transducer**

Sr.no	Description	Specifications

1	Functional Requirement	This instrument shall have microprocessor-based operation with LCD display for testing of EHV Circuit Breakers in the charged switchyard environment. (420 kV AC and 500 kV DC). To measure the CB contact movement during opening, closing, auto-reclosing and make/break operation, contact speed at various stages of operation, travel of contacts, Main and auxiliary contacts (wet and dry), opening time, closing time and make break time, closing resistor pre-insertion time etc. Dynamic contact resistance measurement of Arcing and Main Contact with minimum 100 Amp DC current while closing/opening of CB. The kit should also be capable of indicating trip/closing coil currents (analogue values).DCR measurements shall be shall be carried out for minimum one pole (two breaks) at a time. In case, to meet the functional requirements as mentioned above if more than one units are required, the facility to co-relate/interface various parameters, shall be supplied along with the kit.
2	Channels	Contact channels :24 (4 each for main and PIR) Auxiliary contacts: 2 dry + 2 wet Current and Voltage: 3 each .
3.1	Ranges & Accuracy	Main/Auxiliary Contacts: 0 to 4000 ms minimum
	Accuracy	: ± 0.1 % or better
	Resolution	: ±0.1 ms at 10 Kc.
3.2	Contact Travel	: 0 to 10 m/s speed, 350 mm minimum
	Accuracy	: ± 0.1 % or better
	Resolution	: ± 2mm or better
3.3	Dynamic Contact Resistance	: 0 to 2000 microhm
	Accuracy	: ± 2 % or better
3.4	Coil currents	: 0 to 25 Amps
	Accuracy	: ± 1 % or better
4	Sampling rate	Selectable – 100 Hz,1 Khz,10 KHz or better.
5	Power Supply	230VAC±10%, 50Hz±5% with variations in voltage and frequency respectively.
6	Software	Window based software for analysis of data shall be supplied along with the equipment.

7	Data Storage	The kit should have enough data storage capacity not less than 2 MB with battery backup.
8	Repeatability	The instrument should have proven for repeatability of test results in charged switchyard conditions. Documentary evidence for this should be furnished along with the bid.
9	Kit output	Rs 232 port to down load data to external PC .The kit should have facility to get hard copy through plain paper printer by directly connecting printer to test kit
10	Travel Adapter and	Travel adapter and Transducers (Rotary/Linear) along with various clamps/fixtures to suit any type of model of CB. The details of CB existing at PDD, J&K S/Stn will be furnished to the successful Bidder
11	Accessories	All standard accessories including test leads of 15 meters with suitable clamps, connectors, cables, power supply cords, printer, travel transducers, fuses, carrying case, manual etc. all those required for carrying out testing of CB and DCRM
12	Environment	Temp- 0 to 50 Deg C. Humidity – 95 % non Condensing The test kit shall be compatible for EMI / EMC environment as per relevant IEC
13	Demonstration	The acceptance of kit is subjected to successful demo to the satisfaction of PDD, J&K at prescribed site.
14	Calibration certificate	Calibration certificate from/traceable to, International/govt. approved lab shall be submitted.

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10. **Primary Injection Kit**

i)	Ranges	a)	0 – 500 Amps.AC
		b)	0 – 1000 Amps.AC

ii) Open circuit Voltage- 0 to 6 Volts(minimum) at 1000 Amp.
iii) Ranges selectable by change of link connections.
iv) Continuous Current control by variable Auto Transformer
v) Current measurement by Ammeter of accuracy 1%
vi) Input Power Supply 230 V±10% ac 50 ± 5%Hz

vii) Provided with metallic enclosure.
viii) Mobility – Kit should be sturdy and mobile on metal surface in switchyard.
ix) Kit shall be supplied along with all accessories and cable set (15 mtr. length), clamps ,connectors, spare fuses ,indication lamps, power supply cable, etc. all that is required for carrying out measurement for one unit.
x) Kit shall have safety features like fuses/MCBs, ON indications etc.

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11) **SECONDARY INJECTION KIT**

i) Ranges a) 0 – 1 Amps.AC
b) 0 – 5 Amps.AC
c) 0 – 10 Amps.AC
d) 0 ¬ - 30 Amps AC
ii) Resolution - 0.01Amp
iii) Should have digital time interval meter 0 to 99.99 sec with 1 ms resolution.
iv) Continuous Current control by variable Auto Transformer
v) Current & Voltage measurement by Digital Ammeter and Voltmeter.
vi) Input power supply 230 V±10% ac 50 ± 5%Hz
vii) Output variable voltages 0 –250 V AC
viii) Provided with metallic enclosure.
ix) Kit shall be supplied along with all accessories and cable set(3 mtr. length),spare fuses ,indication lamps, power supply chord etc. all that is required for carrying out measurements.
x) Kit shall have safety features like fuses/MCBs, ON indications etc.
xi) It should have overload and short-circuit protection

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12. **DIGITAL LEVEL METER**

Sr.no	Description	Specification
1.	Functional requirement	Equipment shall be used for measurement of strength of PLCC signal It should include impedance & return loss measuring attachment compatible with level generator The kit and accessories shall be robust and rugged enough, so that it can be transported safely at different locations .The transportation case and packing of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement of kit.
2.	Frequency	200 Hz to 620 kHz (balanced) 50Hz to 620 kHz (unbalanced)
3.	Input Impedance's	75, 125, 150, 600 ohm
4.	Min readable level	-90db/dbm
5.	Sensitivity in step of 10 db	Sensitivity in step of 10 db: with balanced input –60 to +20 db/dbm

		with unbalanced input –70 to +10 db/dbm
6.	Automatic tuning	Between level meter and generator to be provided
7.	Power supply	230 V, single phase, AC 50Hz supply with variations of ±10% and ±5% in voltage & frequency respectively.
8.	Error of level measurement	< 0.1 db at 0 db level at 0 scale division.
9.	Resolution	1Hz
10.	Impedence Measurement	i)Frequency Range : 300Hz to 600 kHz ii)Measuring Range : 50 to 3000 ohms iii)Accuracy : ±10%
11.	Balance & return loss measurement	i)Frequency Range : 300Hz to 600 kHz ii)Impedance Limits : 60 to 1200 ohms iii)Return loss : 40 db iv)Accuracy : ±1 db
12.	Accessories	Measuring cable, power cable, synchroniser cable, Battery connecting cable, fuse, operating manual, and any other accessories required for use of the specified equipment.
13.	Calibration Certificate	Calibration certificate from/traceable to, NABL accredited lab or internationally reputed lab, shall be submitted. Date of calibration shall not be older than one month from the date of supply of Kit.

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13. **AUTOMATIC TRANSFORMER TURNS RATIO TESTER**

The equipment offered shall be used for measurement of turns ratio of various power and distribution transformers automatically displaying the ratio without requiring any manual balancing of decades.

Technical Requirement
Input Supply Voltage: 230 Volts, 50 Hz, single phase a.c. with variations of ±15 % & ±5 % in voltage and frequency.

Measuring Principle
It should display actual turns ratio of different vector groups in three phase transformers without conversion.

Measuring range 1 to 200

Accuracy +-5 % of FSD

The kit should be supplied with 15m of test lead.

General Requirements
It should offer repeatability of test results.

The test kit shall be compatible for EMI/EMC environment as per IEC 1000.

As per requirement of ISO-9001, calibration certificate for each testing instrument covering entire range shall be supplied with the test kit at the time of supply.

The testing equipments are generally meant for carrying out testing at site and movement from one place to another is unavoidable. Therefore equipment shall be robust in design so that it gives desired performance even in adverse site conditions.

Environmental conditions such as temperature, humidity, vibration, bump etc. shall be as per IS-9000 and IS 9001 or equivalent standards. Required certificates confirming to above standards shall be furnished along with the offer.

Necessary transport packing arrangement shall be supplied along with the equipment.

The equipment shall generally comply with the requirement of relevant Indian standard or equivalent International standard such as IEC, BS, ASTM, ISO, etc.

The supplier should have adequate "After Sales Service" facility in India.

14.0 **Oil Storage Tank**

14.1 General

This specification is for oil storage tank. Oil Storage tank shall be supplied if specified in Bid Price schedule.

14.2 Standard

The oil storage tank shall be designed and fabricated as per relevant standards.

14.3 Specifications

Transformer oil storage tanks shall be towable on pneumatic tyres and rested on manual screw jacks of adequate quantity & size. The tank shall be cylindrical in shape and mounted horizontally and made of mild steel plate of adequate thickness. Size of the storage tank shall be as follows:

Diameter	:	1.5 meter (For 10 cubic meter capacity) 2.0 meter (For 20 cubic meter capacity)
Minimum Capacity	:	As mentioned in BPS

The tank shall be designed for storage of oil at a temperature of 100degC.

14.3.1 The Bidder may further note that maximum height of any part of the complete assembly of the storage tank shall not exceed 4.0 metres above road top.

14.3.2 The tank shall have adequate number of jacking pad so that it can be kept on jack while completely filled with oil. The tank shall be provided with suitable saddles so that tank can be rested on ground after removing the pneumatic tyres.

14.3.3 The tank shall also fitted with manhole, outside & inside access ladder, silicagel breather assembly, inlet & outlet valve, oil sampling valve with suitable adopter, oil drainage valve, air vent etc. Pulling hook on both ends of the tank shall be provided so that the tank can be pulled from either end while completely filled with oil. Bidder shall indicate the engine capacity in horse power to pull one tank completely fitted with oil. Oil level indicator shall be provided with calibration in terms of litre so that at any time operator can have an idea of oil in the tank. Suitable arrangement shall also be provided to prevent overflow in the tank. Solenoid valve (Electro-mechanically operated) with centrifugal pump shall be provided at bottom inlet so that pump shall be utilized both ways during oil fill up and draining. Suitable arrangement shall also be provided to prevent overflow and drain from the tank/

14.3.4 The following accessories shall form part of supply along with each Oil storage tank.

i) Four numbers of suitable nominal bore rubber hoses for transformer oil application upto temperature of 100deg.C, full vacuum and pressure up to 2.5 Kg/ cm2 with couplers and unions each not less than 10 metre long shall be provided.

ii) Two numbers of suitable nominal bore vacuum hoses, suitable for full vacuum without collapsing and kinking, with couplers and unions each not less than 10 metre long shall also be provided.

(iii) One number of digital vacuum gauge with sensor capable of reading up to 0.001 torr, operating on 230V 50Hz AC supply shall be supplied. Couplers and unions for sensor should block oil flow in the sensor. Sensor shall be provided with atleast 8 meter cable so as to suitably place the Vacuum gauge at ground level.

14.3.5 The painting of oil storage tank and its control panel shall be as per clause no 3.1.1.8 Chapter – 18 Transformer.

14.3.6 The tank shall contain a self-mounted centrifugal oil pump with inlet and outlet valves, with couplers -suitable for flexible rubber hoses and necessary switchgear for its control. There shall be no rigid connection to the pump. The pump shall be electric motor driven, and shall have a discharge of not less than 3.0kl/hr (For 10 cubic meter capacity) / 6.0 kl/hr (For 20 cubic meter capacity) with a discharge head of 8.0m. The pump motor and the control cabinet shall be enclosed in a cubical with IP-55 enclosure.

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15. **TRANSFORMER DC WINDING RESISTANCE MEASUREMENT**

The instrument shall be used for measuring DC winding resistance of the large transformers/reactors upto 400kV class where high inductance is present.

The test kit shall be able to withstand inductive kicks from transformer winding.

Variation in test current shall not result in loss of accuracy.

The display or resistance should be through LED/LCD without requiring any balancing of decades to obtain stable readings.

It should employ four wire method and no lead compensation shall be required for the measurement.

Built-in-discharge circuit should be provided to discharge the specimen when test is completed or when current lead accidentally disconnects or when instrument power supply is lost.

Technical Parameter

Test current	Min 25 Amp DC in range of 0-2000 milliohm
Resolution	1 milliohm
Range	0 to 10 ohms
Accuracy	+-0.5 % of full scale reading or better

Open circuit voltage minimum 30 volts DC.
The instrument shall contain all standard accessories including test leads of 20m with suitable clamps/connectors and carrying case.

It shall be suitable for 230V, single phase AC, 50 Hz supply with variations of ±15 % and ±5 % in voltage and frequency respectively.

General Requirements
It should offer repeatability of test results in charged switchyard.

The test kit shall be compatible for EMI/EMC environment as per IEC 1000.

As per requirement of ISO-9001, calibration certificate for each testing instrument covering entire range shall be supplied with the test kit at the time of supply.

The testing equipments are generally meant for carrying out testing at site and movement from one place to another is unavoidable. Therefore equipment shall be robust in design so that it gives desired performance even in adverse site conditions.

Environmental conditions such as temperature, humidity, vibration, bump etc. shall be as per IS-9000 and IS 9001 or equivalent standards. Required certificates confirming to above standards shall be furnished along with the offer.

Necessary transport packing arrangement shall be supplied along with the equipment.

The equipment shall generally comply with the requirement of relevant Indian standard or equivalent International standard such as IEC, BS, ASTM, ISO, etc.

The supplier should have adequate “After Sales Service” facility in India.

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16. **SF6 GAS FILTERING, EVACUATING AND DRYING PLANT**

The capacity of this plant shall be such that it shall not take appreciable time for filling or evacuating of the breaker. The required vacuum for complete evacuation shall be attained with the help of this plant.

- This shall include all the necessary devices for measurement of purity, moisture content, decomposition products etc. of SF6 gas. Mixing with air/oil/moisture during above process should be proved to be Nil during testing. The storage capacity of the reservoir should be sufficient for storing complete SF6 gas for at least one 420kV Circuit Breaker (3 poles) or 105 kgs whichever is higher.

- The plant shall be complete with accessories and fittings so that SF6 gas from the breaker can be directly filled in the plant storage reservoir.

- In case purging of the equipment before filling with SF6 gas is desirable, then the required equipment for dry gases etc. shall be furnished as a part of the plant.

- For heavy items within the plant, the lifting hooks shall be provided for lifting and moving with the overhead cranes.

The SF6 gas handling plants shall comply with following requirements:

i) The plant shall be complete with all the necessary pipes, couplings, flexible tubes and valves for coupling to the equipment for the filling or evacuating SF6 gas to be used with all necessary instructions for storage and handling of the plant.

ii) The design and construction of the plant, valves, couplings, and connections shall be such that leakage of SF6 gas shall be minimum. Similarly valves, couplings and pipe work shall be so arranged that accidental loss of gas to the atmosphere shall be minimum.

iii) Facilities shall be provided to reduce the gas pressure within the Circuit Breaker to a value not less than 8 mill bars.

SF6 gas composition analyzing equipment and instruments for the following functions shall be provided:

a) The moisture content measurement or alternatively dew point measurement.

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17. **Relay Operation Timer**

- Range : 1 m Sec. To 999.9 Sec.
- Resolution : 1 mSec (Range – 1 mS to 9.999 Sec.)
  : 10 mSec (Range– 10 mS to 99.99 Sec.)
  : 100 mSec (Range – 100 mS to 999.9 Sec.)
- Time base Accuracy : +/- 0.1%
- Accuracy : +/- 1 count +/- Time base accuracy
- Display : 4 digit LED/ LCD
- Power supply : 230 VAC +/- 10% at 50 Hz.
- Suitable for use in EHV S/S.
- Operating Modes:
  By Potential free open contact closing (Start/Stop)
  By Potential free close contact opening (Start/Stop)

By step +ve voltage application (50 V to 250 V DC)
By step +ve voltage removal (50 V to 250 V DC)

- Should have latching facility and reset facility.
- Calibration Certificate- Calibration certificate from/traceable to, NABL accredited lab or internationally reputed lab, shall be submitted. Date of calibration shall not be older than one month from the date of supply of Kit.

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18. **THREE PHASE VARIAC**

The three phase variac is required for testing and maintenance purpose in Substation.

Technical Parameters:

Type: Variable Transformer (Manual)

Primary voltage: 440 – 480 Volts AC

Frequency: 50 Hz

Phase: 3 (Three)

Secondary Voltage: 0 to 480 volts AC

Secondary Current: 5 Amps

Termination: Screw terminals

Cooling: Air cooled

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19. Online Dissolved Gas (Multi-gas) and Moisture Analyser

19.1 Online Dissolved Gas (Multi-gas) and Moisture Analyser (if specified in BPS) along with all required accessories shall be provided for measurement & analysis of dissolved gases and moisture in the oil. Interpretations shall be as per IEC 60599-1999.

19.2 The equipment shall detect, measure and analyse the following gases:

Gases & Moisture Parameters	Typical Detection Range
H2	5 – 5,000 ppm
CH4	5 – 5,000 ppm
C2H6	5 – 5,000 ppm
C2H4	3 – 5,000 ppm
C2H2	1 – 3,000 ppm
CO	10 – 10,000 ppm
CO2	20 – 30,000 ppm
O2	500 – 25,000 ppm

H2O 2 – 100 % RS should have facility for measurement of moisture in oil in ppm

19.3 The analyser should measure (not calculate) all above gases and should have 100% sensitivity. The equipment shall be capable of transferring data to sub-station automation system confirming to IEC 61850. Necessary interface arrangement shall be provided by the contractor for integration with automation system. The necessary type test report for such confirmation shall be submitted during detailed engineering.

19.4 Equipment shall have facility to give SMS alert to at least three users whenever any fault gas violates the predefined limit.

19.5 Equipment should work on station auxiliary supply. In case other supply is required for the equipment then suitable converter shall be included. All the necessary power and control cables, communication cables, cable accessories as required shall be provided by the supplier.

19.6 Online DGA shall be installed out door on transformer in harsh ambient and noisy condition (Electromagnetic induction, Corona, and capacitive coupling). Suitable arrangement shall be provided to take care of vibration for tank mounting. The equipment shall be suitable for proper operation in EHV substation (800kV) environment where switching takes place in the EHV/HV System. The suitable indications for power On, Alarm, Caution, normal operation etc. shall be provided on the front panel of the equipment. The equipment shall have IP55 Stainless Steel enclosure, suitable for 55 0C ambient temperature and EMI and EMC compatibility. The Equipment must carry a minimum of two (2) years manufacturer's Warranty.

19.7 The equipment shall connect to the transformer's main body in two locations. One Connection is for the supply of oil from the transformer. Second connection is for the return of the oil to the transformer. The connecting oil lines must be of Stainless Steel rigid pipes or flexible hoses.

19.8 The equipment shall be able to measure gas concentration and when downloaded should immediately compare it with user selected alarm & caution level for immediate display. The sampling rate shall be selectable as 2 or 4 or 6 or 12 hours etc. The equipment shall have inbuilt memory to store these results for complete one year even if sampling is done at the lowest interval.

19.9 The Equipment must have an automatic Calibration facility at fixed intervals. For calibration if anything required including cylinder must be mounted with the Equipment.

19.10 The technical feature of the equipment shall be as under:

Accuracy + 10%
Repeatability +3% to 10% depending upon gases
Oil temperature range - 200 C to + 1200 C
External Temp. Range - 200 C to + 550 C
(External temp range of 550 C is important and should not be compromise due to Indian ambient & operating conditions.)

Humidity range	10 to 95 %
Operating Voltage	230 Vac; 50 Hz (±20% variation)
Communications	USB & IEC 61850 compliant

19.11 **Software for fault indication and fault diagnostics shall include following**
Fault indication:

i) IEEE, IEC or user configurable levels of dissolved gases
ii) Rate of change trending
Fault Diagnosis:
i) Key gases
ii) Ratios (Rogers, IEC. etc.)
iii) Duval's Triangle

19.12 The equipment shall be supplied with all necessary accessories required for carrying out DGA of oil sample complete in all respect as per the technical specification. The following shall be also form a part of supply.

1) Software
2) Operation Manual (2 set for every unit),
3) Software Manual and
4) Compact disc giving operation procedures of Maintenance Manual & Trouble shooting instructions.

20.0 **SF6 Gas Leak Detector**

The following features are required:

Battery operated

Light weight

Quick response time
Portable and easy to use

Audible alarm

Sensitive to leakage of gas

Leak rate 1x $10^{-}6$ ml/sec

It should be complete with all leads, sensors, operating manual etc.

21.0 **Earth Resistance Tester – For measurement of earth resistance**

Technical Parameters:

Battery operated

Light Weight

Portable and easy to use

Measuring range: 0-20 Ohm / 0-200 Ohm / 0 – 2000 ohm

Accuracy: ±2%

Accessories: Test Leads
Auxiliary earth bars
Heavy duty case
Instruction manual
Battery

Indication: Low battery
Open circuit indication
Over range indication

22.0 **Phase Sequence Meter - Required to check phase sequence**

Operation Voltage: 60 to 600 Volts Three Phase

Operating frequency: 50 to 60 Hz

Accessories: Test Leads
Alligator clips
Instruction manual

23.0 **Digital Micro ohm meter – For measurement of very low resistance**

Range: 1μΩ - 200Ω

Accuracy: 0.02%

Output: Digital

Resolution: 1μΩ

Accessories: Leads, Instruction manual, Heavy duty clip

SPECIFICATION FOR DIGITIAL PROTECTION COUPLER

1.0 Digital protection coupler for protection signalling through optical fibre cable system.

1.1 The Digital protection signalling equipment is required to transfer the trip commands from one end of the line to the other end in the shortest possible time with adequate security and dependability. It shall also monitor the healthiness of the link from one end to the other and give alarms in case of any abnormality. The protection signalling equipment shall have a proven operating record in similar application over EHV systems and shall operate on 48V DC (+10%, -10%). It shall provide minimum four commands. These commands shall be suitable for Direct tripping, Intertripping and Blocking protection schemes of EHV lines.

The protection signalling equipment shall communicate to the remote end interfacing with SDH terminal equipment at its 2Mbps port. It shall provide suitable interfaces for protective relays, which operate at 220/110V DC. Power supply points shall be immune to electromagnetic interface.

1.2 Principle of operation

During normal operation, protection signalling equipment shall transmit a guard signal/code. In case Protection signalling equipment is actuated by protective relays for transmission of commands, it shall interrupt the guard signal/code and shall transmit the command code to the remote end. The receiver shall recognize the command code and absence of the guard code and will generate the command to the protective relays.

All signal processing i.e. generation of tripping signal and the evaluation of the signals being received shall be performed completely digital using Digital Signal Processing techniques.

1.3 Loop testing

An automatic loop testing routine shall check the teleprotection channel. It shall also be possible to initiate a loop test manually at any station by pressing a button on the front of the equipment. Internal test routine shall continuously monitor the availability of the protection signaling equipment. Proper tripping signal shall always take the priority over the test procedure. The high speed digital protection signalling equipment shall be designed and provided with following features.

- Shall work in conjunction with SDH terminal equipment.
- It shall communicate on G 703 (E1,2 Mbps)
- Full Duplex operation
- Auto loop facility shall be provided.
- Shall meet IEC 60834-1 standard
- Shall be able to transmit upto 4 commands with trip counter simultaneously or sequentially in one 2Mbps channel

Bidder shall quote for protection signalling equipment suitable for 4 commands with separate trip counters for transmit and receive. With regard to trip counters alternate arrangement .i.e. Laptop along with software & all accessories to download events including carrier receipt and transmit shall be acceptable. Laptop for the above shall be supplied at each substation under substation package.

High security and dependability shall be ensured by the manufacturer. Probability of false tripping and failure to trip shall be minimum. Statistical curves/figures indicating above mentioned measures shall be submitted along with the bid.

The DPC can be either housed in offered Control & Protection Panel / PLCC Panel or in separate panel.

Reports of the following tests as per clause 9.2 of Chapter 2-GTR shall be submitted for approval for protection signalling equipment and relays associated with the protection signalling equipment and interface unit with protective relay units, if any.

i) <u>General equipment interface tests</u> :

a) Insulated voltage withstand tests
b) Damped oscillatory waves disturbance test
c) Fast transient bursts disturbance test
d) Electrostatic discharge disturbance test
e) Radiated electromagnetic field test
f) RF disturbance emission test

ii) <u>Specific power supply tests</u>

a) Power supply variations
b) Interruptions
c) LF disturbance emission
d) Reverse polarity

iii) Tele-protection system performance tests

a) Security
b) Dependability
c) Jitter
d) Recovery time
e) Transmission time
f) Alarm functions
g) Temperature and Humidity tests (As per IEC 68-2)

- Dry heat test (50°C for 8 hours)
- Low temperature test (-5°C for 8 hours)
- Damp heat test (40°C/95%RH for 8 hours)

All the above tests at i, ii & iii (except temperature & humidity tests) shall be as per IEC 60834-1 and the standards mentioned therein.

iv) Relays

a) Impulse voltage withstand test as per IEC 60255.

b) High frequency disturbance test as per IEC 60255.

The protection signalling equipment shall be of modular construction and preferably mounted in the Relay panels. Cabling between the protection signalling equipment & Protection relays and between protection signalling equipment & Communication equipment shall be in the scope of bidder.

The input/output interface to the protection equipment shall be achieved by means of relays and the input/output rack wiring shall be carefully segregated from other shelf/cubicle wiring.

The isolation requirements of the protection interface shall be for 2kV rms.

1.4 Major technical Particulars

The major technical particulars of protection signalling equipment shall be as follows.

i) Power supply 48V DC +10%, -10%

ii) Number of commands 4 (four)

iii) Operating time <7 ms

iv) Back to back operate time without propagation delay ≤ 8 ms

v) Interface to Protection relays

	Input:	Contact Rating:	
	Rated voltage	:	250 volts DC
	Maximum current rating:	5 amps	
Output:	Contact Rating:		
	Rated voltage	:	250 volts DC
	Rated current	:	0.1 A DC
	Other parameters	:	As per IEC-255-0-20

vi) Alarm contact

Rated voltage	:	250 volts DC
Rated current	:	0.1 A DC
Other parameters	:	As per IEC-255-0-20

vii) Digital communication interface: G 703(E1)

TECHNICAL SPECIFICATION

VOL-II, SEC-II

GENERAL TECHNICAL REQUIREMENT

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SECTION–II GENERAL TECHNICAL REQUIREMENT

1.0 FOREWORD

1.1 The provisions under this chapter are intended to supplement general requirements for the materials, equipment's and services covered under other chapters of tender documents and is not exclusive.

2.0 GENERAL REQUIREMENT

2.1 The contractor shall furnish catalogues, engineering data, technical information, design documents, drawings etc., fully in conformity with the technical specification during detailed engineering.

2.2 It is recognised that the Contractor may have standardised on the use of certain components, materials, processes or procedures different from those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to Purchaser.

2.3 Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification and bid price schedule but which are necessary for commissioning and satisfactory operation of the switchyard/substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment provided, shall be inter-changeable with one another.

3.0 STANDARDS

3.1 The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India / relevant IS / IEC standard or Acceptable International Standard.

3.2 The equipment to be furnished under this specification shall conform to latest issue with all amendments (as on the date of bid opening) of standard specified under Annexure-A of this chapter, unless specifically mentioned in the specification.

3.3 The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other.

3.4 The Contractor shall also note that list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS, IEC or equivalent international standard.

3.5 When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.6 Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards specified under Annexure-A / individual chapters for various equipment shall also, be accepted, however the salient points of difference shall be clearly brought out in the Additional information schedule of the bid along with English language version of such standard. The equipment conforming to standards other than specified under Annexure-A / individual chapters for various equipment shall be subject to Purchaser's approval.

4.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

4.1 The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, restrike etc. under such over voltage conditions.

4.2 All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.

4.3 All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc. for the equipment.

4.4 The bidder shall design terminal connectors of the equipment taking into account various forces that are required to withstand.

4.5 The equipment shall also comply with the following:

a) To facilitate erection of equipment, all items to be assembled at site shall be "match marked".

b) All piping, if any between equipment control cabinet / operating mechanism to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.

4.6 Equipment's and system shall be designed to meet the following major technical parameters as brought out hereunder.

4.6.1 System Parameter

220kV System

SL No	Description of parameters	220 kV System
1.	System operating voltage	220kV
2.	Maximum operating voltage of the system(rms)	245kV
3.	Rated frequency	50Hz
4.	No. of phase	3
5.		
i)	Full wave impulse withstand voltage (1.2/50 microsec.)	1050 kVp
ii)	Switching impulse withstand voltage (250/2500 micro sec.) dry and wet	-
iii)	One minute power frequency dry withstand voltage (rms)	-
iv)	One minute power frequency dry and wet withstand voltage (rms)	460kV
6.	Corona extinction voltage	156kV
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 156kV rms for 220kV system	1000 micro-volt
8.	Minimum creepage distance (25mm/kV)	6125 mm
9.		
i.	Phase to phase	2100 mm
ii.	Phase to earth	2100 mm
iii)	Sectional clearances	5000 mm

SL No	Description of parameters	220 kV System
10.	Rated short circuit current for 1 sec. duration	40kA
11.	System neutral earthing	Effectively earthed

132kV & 33 kVSystem

SL No	Description of parameters	132 kV System	33 kV System
1.	System operating voltage	132kV	33kV
2.	Maximum operating voltage of the system(rms)	145kV	36kV
3.	Rated frequency	50Hz	50Hz
4.	No. of phase	3	3
5.	Rated Insulation levels		
i)	Full wave impulse withstand voltage (1.2/50 microsec.)	650 kVp	170 kVp
ii)	One minute power frequency dry and wet withstand voltage (rms)	275kV	70kV
6.	Corona extinction voltage	105kV	-
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 92KV rms for 132KV system	500 micro-volt	-
8.	Minimum creepage distance (25mm/kV)	3625 mm	900 mm
9.	Min. Clearances		
i.	Phase to phase	1300 mm	320 mm
ii.	Phase to earth	1300 mm	320 mm
iii)	Sectional clearances	4000 mm	3000 mm
10.	Rated short circuit current	31.5 kA for 1 Sec	25 kA for 3 Sec
11.	System neutral earthing	Effectively earthed	Effectively earthed

Note :

1. **The above parameters are applicable for installations up to an altitude of 1000m above mean sea level. For altitude exceeding 1000m, necessary altitude correction factor shall be applicable.**
2. The insulation and RIV levels of the equipment's shall be as per values given in the respective chapter of the equipment's.

4.6.2 Major technical parameters of bushings / hollow column / support insulators are given below:

220kV System

S.N.	Parameters	220 kV

(a)	Max. System voltage Um(kV)	245
(b)	Impulse withstand voltage (dry & wet) (kVp)	± 1050
(c)	Power frequency withstand voltage (dry and wet) (kV rms)	460
(d)	Total creepage distance (min) (mm)	6125

132kV & 33kV System

S.N.	Parameters	**132 kV**	**33kV**
(a)	Max. System voltage Um(kV)	145	36
(b)	Impulse withstand voltage (dry & wet) (kVp)	± 650	± 170
(c)	Power frequency withstand voltage (dry and wet) (kV rms)	275	75
(d)	Total creepage distance (min) (mm)	3625	900

4.6.3 Major Technical Parameters

The major technical parameters of the equipment's are given below. For other parameters and features respective technical chapters should be referred.

4.6.3.1

(A) For 245 kV & 145 kV Circuit Breaker and Isolator

Rated voltage kV (rms)	245	145
Rated frequency (Hz)	50	50
No. of Poles	3	3
Design ambient temperature (°C)	50	50

Rated insulation levels :

1) Full wave impulse withstand voltage (1.2/50 micro sec.)

- between line terminals and ground	± 1050 kVp	±650 kVp
- between terminals with circuit breaker open	± 1050 kVp	±650 kVp
- between terminals with isolator open	± 1200 kVp	±750 kVp

2) One minute power frequency dry and wet withstand voltage

- between line terminals and ground	460 kV (rms)	275 kV (rms)
- between terminals with circuit breaker open	460 kV (rms)	275 kV (rms)
- between terminals with Isolator open	530 kV (rms)	315kV (rms)

Max. radio interference voltage (microvolts) for frequency between 0.5 MHz and 2 MHz in all positions of the equipments.	1000 (at 156 kV rms)	500 (at 92 kV rms)

Minimum creepage distance:-

Phase to ground (mm)	6125	3625
Between CB Terminals (mm)	6125	3625
System neutral earthing	Effectively earthed	Effectively earthed
Seismic acceleration	- 0.5g horizontal -	
Rating of Auxiliary Contacts	10 A at 220/110 V DC (as applicable)	
Breaking capacity of Auxiliary Contacts	2 A DC with circuit time constant of not less than 20ms.	
Phase to phase spacing (mm)	4500 or 4000	3000 or 2700

Auxiliary Switch shall also comply with other clauses of this chapter.

(B) FOR 245 kV & 145 kV CT/CVT/SA

Rated voltage kV (rms)	245	145
Rated frequency (Hz)	50	50
No. of poles	1	1
Design ambient temperature (°C)	50	50

Rated insulation levels :

1)	Full wave impulse withstand voltage (1.2/50 micro sec.)		
-	between line terminals and ground for CT and CVT	± 1050 kVp	±650 kVp
-	for arrester housing	± 1050 kV peak	±650 kVp
2)	One minute power frequency dry and wet withstand voltage		
-	between line terminals and ground for CT and CVT	460 kV rms	275 kV rms
-	for arrester housing	460 kV rms	275kV rms

Max. radio interference voltage (microvolts) for frequency between 0.5 MHz and 2 MHz in all positions of the equipment.	1000 for CT/CVT 500 for SA (at 156 kV rms)	500 (at 92 kV rms)
Minimum creepage distance :-		
Phase to ground (mm)	6125	3625
System neutral earthing	- Effectively earthed -	
Seismic acceleration	- 0.5g horizontal -	
Partial discharge for :-		

-	Surge arrester at 1.05 COV	- Not exceeding 50 pc. -
-	for CT/CVT	- Not exceeding 10 pc. –

(C) **For 33 kV Vacuum Circuit Breaker and Isolator**:

Rated voltage kV (rms)	36
Rated frequency (Hz)	50
No. of Poles	3
Design ambient temperature (°C)	50

Rated insulation levels :

1) Full wave impulse withstand voltage (1.2/50 micro sec.)

-	between line terminals and ground	±170 kVp
-	between terminals with circuit breaker open	±170 kVp
-	between terminals with isolator open	±170 kVp

2) One minute power frequency dry and wet withstand voltage

-	between line terminals and ground	70kV(rms)
-	between terminals with circuit breaker open	70kV(rms)
-	between terminals with Isolator open	70kV(rms)

Minimum creepage distance:

Phase to ground (mm)	900
Between CB Terminals (mm)	900

System neutral earthing	Effectively earthed
Seismic acceleration	0.5 g
Rating of Auxiliary Contacts	10 A at 250 V DC
Breaking capacity of Auxiliary Contacts	2 A DC with circuit time constant of not less than 20ms

Auxiliary Switch shall also comply with other clauses of Chapter-GTR.

(D) FOR 33kV CT/VT/SA

Rated voltage kV (rms)	36
Rated frequency (Hz)	50
No. of poles	1
Design ambient temperature (°C)	50

Rated insulation levels :

1) Full wave impulse withstand voltage (1.2/50 micro sec.)

-	between line terminals and ground	±170 kVp
-	for arrester housing	±170 kVp

2) One minute power frequency dry and wet withstand voltage

-	between line terminals and ground	70kV rms
-	for arrester housing	70kV rms

Minimum creepage distance :

Phase to ground (mm)	900
Between Terminals (mm)	900
System neutral earthing	- Effectively earthed -
Seismic acceleration	0.5 g
Cantilever strength of bushing	350 kg (minimum)

(E) Technical Parameters of Bushings/Hollow Column Insulators/support insulators for 33kV:

(a)	Rated Voltage (kV)	36
(b)	Impulse withstand voltage (Dry & Wet) (kVp)	±170
(c)	Power frequency withstand voltage (dry and wet) (kV rms)	75
(d)	Total creepage distance (mm)	900

(e) Pollution Class-III Heavy (as per IEC 71) and as specified in Section-2 for all class of equipment.

The requirement of alternate long & short sheds stated in model technical specification shall not be applicable in case of 33 kV.

5.0 ENGINEERING DATA AND DRAWINGS

5.1 The list of drawings/documents which are to be submitted to the Purchaser shall be discussed and finalised by the Purchaser at the time of award.

The Contractor shall necessarily submit all the drawings/ documents unless anything is waived.

5.2 The Contractor shall submit 4 (four) sets of drawings/ design documents /data / detailed bill of quantity and 1 (one) set of test reports for the approval of the Purchaser. The contractor shall also submit the softcopy of the above documents in addition to hardcopy.

5.3 Drawings

5.3.1 All drawings submitted by the Contractor shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, dimensions, internal & the external connections, fixing arrangement required and any other information specifically requested in the specifications.

5.3.2 Drawings submitted by the Contractor shall be clearly marked with the name of the Purchaser, the unit designation, the specifications title, the specification number and the name of the Project. Employer/Consultant has standardized few drawings/documents of various make including type test reports which can be used for all projects having similar requirements and in such cases no project specific approval (except for list of applicable drawings alongwith type test reports) is required. However, distribution copies of standard drawings/documents shall be submitted as per provision of the contract. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in SI units.

5.4 The review of these data by the Purchaser will cover only general conformance of the data to the specifications and documents interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. This review by the Purchaser may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the Purchaser shall not be considered by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

5.5 All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Contractor's drawing or work by the Purchaser shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

5.6 All engineering data submitted by the Contractor after final process including review and approval by the Purchaser shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Purchaser in Writing.

5.7 Approval Procedure

The scheduled dates for the submission of the drawings as well as for, any data/information to be furnished by the Purchaser would be discussed and finalised at the time of award. The following schedule shall be followed generally for approval and for providing final documentation.

i)	Approval/comments/ by Purchaser on initial submission	As per agreed schedule
ii)	Resubmission (whenever required)	Within 3 (three) weeks from date of comments
iii)	Approval or comments	Within 3 (three) weeks of receipt of resubmission.

iv)	Furnishing of distribution copies (5 hard copies per substation and one scanned copy (pdf format) for Corporate Centre)	2 weeks from the date of approval
v)	Furnishing of distribution copies of test reports	
	(a) Type test reports (one scanned softcopy in pdf format per substation plus one for corporate centre one hardcopy per substation)	2 weeks from the date of final approval &
	(b) Routine Test Reports (one copy for each substation)	-do-
vi)	Furnishing of instruction/ operation manuals (2 copies per substation and one softcopy (pdf format) for corporate centre & per substation)	As per agreed schedule
(vii)	As built drawings (two sets of hardcopy per substation & one softcopy (pdf format) for corporate centre & per substation)	On completion of entire works

NOTE:

(1) The contractor may please note that all resubmissions must incorporate all comments given in the earlier submission by the Purchaser or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.

(2) All drawings should be submitted in softcopy form, however substation design drawings like SLD, GA, all layouts etc. shall also be submitted in AutoCAD Version. SLD, GA & layout drawings shall be submitted for the entire substation in case of substation extension also.

(3) The instruction Manuals shall contain full details of drawings of all equipment being supplied under this contract, their exploded diagrams with complete instructions for storage, handling, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.

(4) If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/ additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Purchaser.

(5) The Contractor shall furnish to the Purchaser catalogues of spare parts.

(6) All As-built drawings/documents shall be certified by site indicating the changes before final submission.

6.0 MATERIAL/ WORKMANSHIP

6.1 General Requirement

6.1.1 Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended.

6.1.2 In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard, the Purchaser shall decide upon the question of similarity. When required by the specification or when required by the Purchaser the Contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

6.1.3 The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

6.1.4 Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

6.1.5 All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be considered as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, levelling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances, instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits suitable guards shall be provided for the protection of personnel on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purposes. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

6.1.6 The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.

6.2 Provisions for Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipment's located in non-air conditioned areas shall also be of same type.

6.2.1 Space Heaters

6.2.1.1 The heaters shall be suitable for continuous operation at 230V as supply voltage. On-off switch and fuse shall be provided.

6.2.1.2 One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

6.2.1.3 Suitable anti condensation heaters with the provision of thermostat shall be provided.

6.2.2 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

6.2.3 Ventilation opening

Wherever ventilation is provided, the compartments shall have ventilation openings with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds and suitable provision shall be made so as to avoid any communication of air / dust with any part in the enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc.

6.2.4 Degree of Protection

The enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide degree of protection as detailed here under:

a) Installed out door: IP- 55

b) Installed indoor in air conditioned area: IP-31

c) Installed in covered area: IP-52

d) Installed indoor in non-air conditioned area where possibility of entry of water is limited: IP-41.

e) For LT Switchgear (AC & DC distribution Boards): IP-52

The degree of protection shall be in accordance with IS:13947 (Part-I)/ IEC-60947 (Part-I) / IS 12063 / IEC-60529. Type test report for degree of protection test, shall be submitted for approval.

6.3 RATING PLATES, NAME PLATES AND LABELS

6.3.1 Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Purchaser. The rating plate of each equipment shall be according to IS/IEC requirement.

6.3.2 All such nameplates, instruction plates, rating plates of transformers, reactors, CB, CT, CVT, SA, Isolators, Capacitor Banks, C & R panels and PLCC/Communication equipment's shall be provided with English inscriptions.

6.4 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into successful Operation, shall be furnished by the Contractor unless specifically excluded under the exclusions in these specifications and documents.

7.0 DESIGN IMPROVEMENTS / COORDINATION

7.1 The bidder shall note that the equipment offered by him in the bid only shall be accepted for supply. However, the Purchaser or the Contractor may propose changes in the specification of the equipment or quality thereof and if the Purchaser & contractor agree upon any such changes, the specification shall be modified accordingly.

7.2 If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

7.3 The Contractor shall be responsible for the selection and design of appropriate equipment's to provide the best co-ordinated performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

7.4 The Contractor has to coordinate designs and terminations with the agencies (if any) who are Consultants/Contractor for the Purchaser. The names of agencies shall be intimated to the successful bidders.

7.5 The Contractor will be called upon to attend design co-ordination meetings with the Engineer, other Contractor's and the Consultants of the Purchaser (if any) during the period of Contract. The Contractor shall attend such meetings at his own cost at Owner's Corporate Centre, Srinagar, J&K or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

8.0 QUALITY ASSURANCE PROGRAMME

8.1 To ensure that the equipment and services under the scope of this Contract whether manufactured or performed within the Contractor's Works or at his Sub-contractor's premises or at the Purchaser's site or at any other place of Work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points necessary. Such programme shall be broadly outlined by the contractor and finalised after discussions before the award of contract. The detailed programme shall be submitted by the contractor after the award for reference. A quality assurance programme of the contractor shall generally cover the following:

(a) His organisation structure for the management and implementation of the proposed quality assurance programme:

(b) Documentation control system;

(c) Qualification data for bidder's key personnel;

(d) The procedure for purchases of materials, parts components and selection of sub-Contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.

(e) System for shop manufacturing and site erection controls including process controls and fabrication and assembly control;

(f) Control of non-conforming items and system for corrective actions;

(g) Inspection and test procedure both for manufacture and field activities.

(h) Control of calibration and testing of measuring instruments and field activities;

(i) System for indication and appraisal of inspection status;

(j) System for quality audits;

(k) System for authorising release of manufactured product to the Purcahser.

(l) System for maintenance of records;

(m) System for handling storage and delivery; and

(n) A quality plan detailing out the specific quality control measures and procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.

The Purchaser or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Contractor/his vendor's quality management and control activities.

8.2 Quality Assurance Documents

The contractor would be required to submit all the Quality Assurance Documents as stipulated in the Quality Plan at the time of purchaser's inspection of equipment/material

9.0 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

9.1 All equipment being supplied shall conform to type tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective chapters.

9.2 The reports for all type tests as per technical specification shall be furnished by the Contractor alongwith equipment / material drawings. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by Utility or representative of accredited test lab or reputed consultant.

The test reports submitted shall be of the tests conducted within last 10 (ten) years prior to the originally Scheduled date of bid opening. In case the test reports are of the test conducted earlier than 10 (ten) years prior to the originally Scheduled date of bid opening, the contractor shall repeat these test(s) at no extra cost to the purchaser.

However, in case of instrument transformers, the following type tests should have been conducted within 5 (five) years prior to the originally Scheduled date of bid opening.

i) Lightning Impulse Test

ii) Switching Impulse Test

iii) Multiple Chopped Impulse Test (For CT)

iv) Chopped Impulse Test (For CVT)

In case the test reports are of these tests (for instrument transformers) as mentioned above are conducted earlier than 5 (five) years prior to the originally Scheduled date of bid opening, the contractor shall repeat these test(s) at no extra cost to the purchaser.

Further, in the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the Technical Specification or any/all type tests not carried out, same shall be carried out without any additional cost implication to the Purchaser.

The Contractor shall intimate the Purchaser the detailed program about the tests atleast two (2) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.

Further, in case type tests are required to be conducted / repeated and the deputation of Inspector/Purchaser's representative is required, then all the expenses shall be borne by the contractor.

9.3 The Purchaser, his duly authorised representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractor's/sub-vendors premises or Works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if part of the Works is being manufactured or assembled at other premises or works, the Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works. Inspection may be made at any stage of manufacture, despatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

9.4 The Contractor shall give the Purchaser /Inspector fifteen (15) days written notice for on-shore and six (6) weeks notice for off-shore material being ready for joint testing including contractor and ***Purchaser.*** Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Purchaser /inspector, unless witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Contractor may proceed alone with the test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of tests in triplicate.

9.5 The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser /Inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

9.6 When the factory tests have been completed at the Contractor's or Sub-Contractor's works, the Purchaser/inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser /Inspector, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Engineer/Inspector. Failure of the Purchaser /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the Works. The completion of these tests or the issue of the certificate shall not bind the Purchaser to accept the equipment should, it, on further tests after erection,

is found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of CIP by the Purchaser.

9.7 In all cases where the Contract provides for tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser /Inspector or to his authorised representative to accomplish testing.

9.8 The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract.

9.9 The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

9.10 The Purchaser reserves the right for getting any field tests not specified in respective chapters of the technical specification conducted on the completely assembled equipment at site. The testing equipments for these tests shall be provided by the Purchaser.

10.0 TESTS

10.1 Pre-commissioning Tests

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Purchaser and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests to be performed is given in respective chapters and shall be included in the Contractor's quality assurance programme.

10.2 Commissioning Tests

10.2.1 The available instrumentation and control equipment will be used during such tests and the Purchaser will calibrate all such measuring equipment and devices as far as practicable.

10.2.2 Any special equipment, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.

10.2.3 The specific tests requirement on equipment has been brought out in the respective chapters of the technical specification.

10.3 The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning the equipment and the switchyard. However necessary fee shall be reimbursed on production of requisite documents.

11.0 PACKAGING & PROTECTION

11.1 All the equipment's shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the Purchaser, the Contractor shall also submit packing details/associated drawing for any equipment/material under his scope of supply, to facilitate the Purchaser to repack any equipment/material at a later date, in case the need arises. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes should be taken into account. The Contractor shall be responsible for any loss or damage during transportation, handling and storage

due to improper packing. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Purchaser takes no responsibility of the availability of the wagons.

11.2 All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

12.0 FINISHING OF METAL SURFACES

12.1 All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. High tensile steel nuts & bolts and spring washers shall be electro galvanized to service condition 4. All steel conductors including those used for earthing / grounding (above ground level) shall also be galvanized according to Equivalent International Standards.

12.2 HOT DIP GALVANISING

12.2.1 The minimum weight of the zinc coating shall be 610 gm/sq.m and minimum average thickness of coating shall be 86 microns for all items having thickness 6mm and above. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq. m minimum.

12.2.2 The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discolored patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

12.2.3 After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

12.2.4 The galvanized steel shall be subjected to six one minute dips in copper sulphate solution as per IEC.

12.2.5 Sharp edges with radii less than 2.5 mm shall be able to withstand four immersions of the Standard Preece test. All other coatings shall withstand six immersions. The following galvanizing tests should essentially be performed as per relevant Indian Standards.

- Coating thickness
- Uniformity of zinc
- Adhesion test
- Mass of zinc coating

12.2.6 Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

12.3 PAINTING

12.3.1 All sheet steel work shall be degreased, pickled, phosphated in accordance with the IS-6005/Equivalent International standard "Code of practice for phosphating iron and sheet". All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swarf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

12.3.2 After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type

zinc chromate primer. The first coat may be "flash dried" while the second coat shall be stoved.

12.3.3 After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.

12.3.4 The exterior and interior colour of the paint in case of new substations shall preferably be RAL 7032 for all equipment, marshalling boxes, junction boxes, control cabinets, panels etc. unless specifically mentioned under respective chapters of the equipment's. Glossy white colour inside the equipment's /boards /panels/junction boxes is also acceptable. The exterior colour for panels shall be matching with the existing panels in case of extension of a substation. Each coat of primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipment's.

12.3.5 In case the Bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures, like electrostatic painting etc., the procedure shall be submitted alongwith the Bids for Purchaser's review & approval.

12.3.6 The colour scheme as given below shall be followed for Fire Protection and Air Conditioning systems

S.No.	PIPE LINE	Base colour	Band colour
Fire Protection System			
1	Hydrant and Emulsifier system pipeline	FIRE RED	-
2	Emulsifier system detection line – water	FIRE RED	Sea Green
3	Emulsifier system detection line – Air	FIRE RED	Sky Blue
4	Pylon support pipes	FIRE RED	
Air Conditioning System			
5	Refrigerant gas pipeline – at compressor suction	Canary Yellow	-
6	Refrigerant gas pipeline – at compressor discharge	Canary Yellow	Red
7	Refrigerant liquid pipeline	Dark Admiralty	-

		Green	
8	Chilled water pipeline	Sea Green	-
9	Condenser water pipeline	Sea Green	Dark Blue

The direction of flow shall be marked by → (arrow) in black colour.



Base Colour Direction of flow Band Colour

12.3.7 For aluminium casted surfaces, the surface shall be with smooth finish. Further, in case of aluminium enclosures the surface shall be coated with powder (coating thickness of 60 microns) after surface preparation for painting.

13.0 HANDLING, STORING AND INSTALLATION

13.1 In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

13.2 Contractor may engage manufacturer's Engineers to supervise the unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s) and shall extend full cooperation to them.

13.3 The contractor shall have to ensure that the hard and flat indoor and outdoor storage areas are in place prior to commencement of delivery of material at site. Contractor shall also ensure availability of proper unloading and material handling equipment like cranes etc. and polyester/nylon ropes of suitable capacity to avoid damage during unloading and handling of material at site. All indoor equipment's shall be stored indoors. Outdoor equipment may be stored outdoors but on a hard and flat raised area properly covered with waterproof and dustproof covers to protect them from water seepage and moisture ingress. However, all associated control panels, marshalling boxes operating boxes etc. of outdoor equipment's are to be stored indoors only.

Storage of equipment on top of another one is not permitted if the wooden packing is used. Material opened for joint inspection shall be repacked properly as per manufacturer's recommendations.

During storage of material regular periodic monitoring of important parameters like oil level / leakage, SF6 / Nitrogen pressure etc. shall be ensured by the contractor.

13.4 In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the Purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

13.5 Where assemblies are supplied in more than one section, Contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage

during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.

13.6 Contractor shall be responsible for examining all the shipment and notify the Purchaser immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. The Contractor shall submit to the Purchaser every week a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.

13.7 The Contractor shall be fully responsible for the equipment/material until the same is handed over to the Purchaser in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by Purchaser, as well as protection of the same against theft, element of nature, corrosion, damages etc.

13.8 Where material / equipment is unloaded by Purchaser before the Contractor arrives at site or even when he is at site, Purchaser by right can hand over the same to Contractor and there upon it will be the responsibility of Contractor to store the material in an orderly and proper manner.

13.9 The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment which requires indoor storage.

13.10 The words 'erection' and 'installation' used in the specification are synonymous.

13.11 Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.

13.12 The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances as given in clause 4.6 the Contractor shall immediately proceed to correct the discrepancy at his risks and cost.

13.13 Equipment Bases

A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.

14.0 TOOLS AND TACKLES

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately, packed and brought on to Site.

15.0 AUXILIARY SUPPLY

15.1 The sub-station auxiliary supply is normally met through a system indicated under chapter "Electrical & Mechanical Auxiliaries" having the following parameters. The auxiliary power for station supply, including the equipment drive, cooling system of any equipment, air-conditioning, lighting etc shall be designed for the specified Parameters as under. The DC supply for the instrumentation and PLCC system shall also conform the parameters as indicated in the following.

Normal	Variation in	Frequency in	Phase/W	Neutral

Voltage	Voltage	HZ	ire	connection
400V	± 10	50 ± 2.5%	3/4 Wire	Solidly Earthed.
230V	± 10	50 ± 2.5%	1/2 Wire	Solidly Earthed.
220V	190V to 240V	DC	-	Isolated 2 wire System
110V	95V to 120V	DC	-	Isolated 2 wire System
48V	_	DC	_	2 wire system (+) earthed

Combined variation of voltage and frequency shall be limited to ± 10%.

16.0 SUPPORT STRUCTURE

16.1 The equipment support structures shall be suitable for equipment connections at the first level i.e 5.9 meter and 4.6 meter from plinth level for 245 kV substations and 145kV respectively. All equipment support structures shall be supplied alongwith brackets, angles, stools etc. for attaching the operating mechanism, control cabinets & marshalling box (wherever applicable) etc.

16.2 Support structure shall meet the following mandatory requirements:

16.2.1 The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or supporting insulators to the bottom of the equipment base, where it rests on the foundation pad shall be 2.55 metres.

17.0 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

17.1 All power clamps and connectors shall conform to ANSI/NEMA CC1/ Equivalent International standard and shall be made of materials listed below:

For connecting ,ACSR conductors	Aluminum alloy casting conforming to BS:1490/ Equivalent International Standard
For connecting equipment terminals made of copper with ACSR conductors	Bimetallic connectors made from aluminum alloy casting conforming to BS:1490/ Equivalent International Standard with 2mm thick bimetallic liner.
For connecting GI	Galvanized mild shield wire
i) Bolts nuts and plain washers	Electrogalvanised for sizes Plain, washers below M12, for thers hot dip galvanised.
ii) Spring washers for item ‘a’ to ‘c’	Electrogalvanised mild steel

17.2 Necessary clamps and connectors shall be supplied for all equipment and connections. The requirement regarding external corona and RIV as specified for any equipment shall include its terminal fittings. If corona rings are required to meet these requirements they shall be considered as part of that equipment and included in the scope of work.

17.3 Where copper to aluminum connections are required, bi-metallic clamps shall be used, which shall be properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to parts which are not current carrying or subjected to stress.

17.4 Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified in each particular case, are also included in the scope of Work.

17.5 No current carrying part of any clamp shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner of minimum 2 mm thickness shall be cast integral with aluminum body or 2 mm thick bi-metallic strips shall be provided for Bi-metallic clamps.

17.6 All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

17.7 Flexible connectors, braids or laminated straps made for the terminal clamps for bus posts shall be suitable for both expansion or through (fixed/sliding) type connection of 4" IPS AL. tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.

17.8 Clamp shall be designed to carry the same current as the conductor and the temperature rise shall be equal or less than that of the conductor at the specified ambient temperature. The rated current for which the clamp/connector is designed with respect to the specified reference ambient temperature, shall also be indelibly marked on each component of the clamp/connector, except on the hardware.

17.9 All current carrying parts shall be designed and manufactured to have minimum contact resistance.

17.10 Clamps and connectors shall be designed to be corona controlled.

17.11 Tests

17.11.1 Clamps and connectors should be type tested as per NEMA CC1/ Equivalent International Standard and shall also be subjected to routine tests as per NEMA CC1/ Equivalent International Standard. Following type test reports shall be submitted for approval as per clause 9.2 above except for sl. no.(ii) & (iii) for which type test once conducted shall be applicable (i.e. the requirement of test conducted within last ten years shall not be applicable).

i) Temperature rise test (maximum temperature rise allowed is 35°C over 50°C ambient)

ii) Short time current test

iii) Corona (dry) and RIV (dry) test (for 220 KV and above voltage level clamps)

iv) Resistance test and tensile test

18.0 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

18.1 All types of boxes, cabinets etc. shall generally conform to & be tested in accordance with IS-5039/IS-8623/IEC-60439, as applicable, and the clauses given below:

18.2 Control cabinets, junction boxes, Marshalling boxes & terminal boxes shall be made of sheet steel or aluminum enclosure and shall be dust, water and vermin proof. Sheet steel used shall be atleast 2.0 mm thick cold rolled or 2.5 mm hot rolled or alternately 1.6 mm thick stainless steel can also be used. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminum enclosed box the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

18.3 A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes / Control cabinets to prevent ingress of rain water.

18.4 Cabinet/boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of the gasket shall be such that it does not get damaged /cracked during the operation of the equipment.

18.5 All doors, removable covers and plates shall be gasketed all around with suitably profiled EPDM/Neoprene gaskets. The gasket shall be tested in accordance with approved quality plan, IS:11149, IS:3400 / Equivalent International Standard. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

18.6 All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate above the base of the marshalling kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland plate. Gland plate shall have provision for some future glands to be provided later, if required. The Nickel plated glands shall be dust proof, screw on & double compression type and made of brass. The gland shall have provision for securing armour of the cable separately and shall be provided with earthing tag. The glands shall conform to BS:6121.

18.7 A 230V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.

18.8 For illumination, a fluorescent tube or CFL or LED of approximately 9 to 15 watts shall be provided. The switching of the fittings shall be controlled by the door switch.
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For junction boxes of smaller sizes such as lighting junction box, manual operated earth switch mechanism box etc., plug socket, heater and illumination is not required to be provided.

18.9 All control switches shall be of MCB/rotary switch type and Toggle/piano switches shall not be accepted.

18.10 Positive earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire shall be terminated on to the earthing pad and secured by the use of self-etching washer. Earthing of hinged door shall be done by using a separate earth wire.

18.11 The bay marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/feruling by pasting the same on the inside of the door.

18.12 a) The following routine tests alongwith the routine tests as per IS 5039/ IEC 60529/ Equivalent International Standard shall also be conducted:

i) Check for wiring

ii) Visual and dimension check

b) The enclosure of bay marshalling kiosk, junction box, terminal box shall conform to IP-55 as per IS:13947 / IEC 60529/ Equivalent International Standard including application of, 2.0 KV rms for 1 (one) minute, insulation resistance and functional test after IP-55 test.

19.0 TERMINAL BLOCKS AND WIRING

19.1 Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All interphase and external connections to equipment or to control cubicles will be made through terminal blocks.

19.2 Terminal blocks shall be 650V grade and have continuous rating to carry the maximum expected current on the terminals and non-breakable type. These shall be of moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be non-disconnecting stud type of Elmex or Phoenix or Wago or equivalent make.

19.3 Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

19.4 The terminal shall be such that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally.

19.5 The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable.

19.6 The terminal blocks shall be of extensible design.

19.7 The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

19.8 The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

19.9 Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

a)	All circuits except CT/PT circuits	Minimum of two of 2.5 sq mm copper flexible.
b)	All CT/PT circuits	Minimum of 4 nos. of 2.5 sq mm copper flexible.

19.10 The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live.

19.11 Atleast 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

19.12 There shall be a minimum clearance of 250 mm between the First/bottom row of terminal block and the associated cable gland plate for outdoor ground mounted marshalling box and the clearance between two rows of terminal blocks shall be a minimum of 150 mm.

19.13 The Contractor shall furnish all wire, conduits and terminals for the necessary interphase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets.

19.14 All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both

longitudinal and transverse modes. The Contractor shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

20.0 LAMPS & SOCKETS

20.1 Sockets

All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round plug as per Indian Standard. They shall be switched sockets with shutters.

20.2 Hand Lamp:

A 230 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.

20.3 Switches and Fuses:

20.3.1 Each panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with miniature circuit breaker / switchfuse units. Selection of the main and Sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

20.3.2 All fuses shall be of HRC cartridge type conforming to IS:9228 / Equivalent International Standard mounted on plug-in type fuse bases. Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

21.0 Bushings, Hollow Column Insulators, Support Insulators:

21.1 Bushings shall be manufactured and tested in accordance with IS 2099 / IEC-60137 while hollow column insulators shall be manufactured and tested in accordance with IS:5621 / IEC-62155. The support insulators shall be manufactured and tested as per IS: 2544 / IEC-60168 and IEC-60273. The insulators shall also conform to IEC-60815 as applicable.

The bidder may also offer composite hollow insulators, conforming to IEC-61462.

21.2 Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.

21.3 Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.

21.4 Support insulators/bushings/hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

21.5 When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the normal rated voltage.

21.6 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

21.7 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.

21.8 Tests

In bushing, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests in accordance with IS: 2099 & IS: 2544 & IS : 5621/ Equivalent International Standard .

22.0 MOTORS

Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall be subjected to routine tests as per applicable standards. The motors shall be of approved make.

22.1 Enclosures

a) Motors to be installed outdoor without enclosure shall have hose proof enclosure equivalent to IP-55 as per IS:4691 / IEC 60529 / Equivalent International Standard. For motors to be installed indoor i.e. inside a box, the motor enclosure, shall be dust proof equivalent to IP-44 as per IS: 4691 / Equivalent International Standard.

b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.

c) Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing.

d) Motors weighing more than 25 Kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

22.2 Operational Features

a) Continuous motor rating (name plate rating) shall be at least ten (10) percent above the maximum load demand of the driven equipment at design duty point and the motor shall not be over loaded at any operating point of driven equipment that will rise in service.

b) Motor shall be capable at giving rated output without reduction in the expected life span when operated continuously in the system having the particulars as given in Clause 15.0 of this Chapter.

22.3 Starting Requirements:

a) All induction motors shall be suitable for full voltage direct-on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.

b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.

c) The locked rotor current shall not exceed six (6) times the rated full load current for all motors, subject to tolerance as given in IS:325/ Equivalent International Standard .

d) Motors when started with the driven equipment imposing full starting torque under the supply voltage conditions specified under Clause 15.0 shall be capable of withstanding atleast two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.

e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speed lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

22.4 Running Requirements:

a) The maximum permissible temperature rise over the ambient temperature of 50 degree C shall be within the limits specified in IS:325 / Equivalent International Standard (for 3 - phase induction motors) after adjustment due to increased ambient temperature specified.

b) The double amplitude of motor vibration shall be within the limits specified in IS: 4729/ Equivalent International Standard. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

c) All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.

22.5 TESTING AND COMMISSIONING

An indicative list of tests is given below. Contractor shall perform any additional test based on specialties of the items as per the field Q.P. / Instructions of the equipment Contractor or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

(a) Insulation resistance.

(b) Phase sequence and proper direction of rotation.

(c) Any motor operating incorrectly shall be checked to determine the cause and the conditions corrected.

23.0 TECHNICAL REQUIREMENT OF EQUIPMENTS

Following equipment shall be offered from the Indian manufacturer(s) who meets the technical requirements as stipulated here, provided the same equipment are not covered under the Bidder's Qualifying requirement of the Bidding Documents.

Legend:

* : voltage class of respective equipment as applicable.

: satisfactory operation means certificate issued by the Employer/Utility certifying the operation without any adverse remark.

@ : **Circuit Breaker Bay** means a bay used for controlling a line or a transformer or a reactor or a bus section or a bus coupler and comprising of

at least one circuit breaker, one disconnector and three nos. of single phase CTs / Bushing CTs

NOA: means Notification Of Award

23.1 Technical requirements for 220/132/110/33kV* Air Insulated Switchgear (AIS) Equipment* (i.e Circuit Breaker, Isolator, Current Transformer, Capacitive Voltage transformer, Inductive Voltage transformer, Surge Arrester and Wave Trap)

(i) The manufacturer(s) whose 220/132/110/33kV* equipment(s) are offered, must have, manufactured, type tested (as per IEC/IS or equivalent standard) and supplied 220/132/110/33kV* or higher voltage class equipment(s), which are in satisfactory operation# for atleast two (2) years as on the date of NOA.

(ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India for the offered equipment and not meeting the requirement stipulated in (i) above, can also be considered provided that

a) 220/132/110/33kV* or higher Voltage class equipment(s) must have been manufactured in the above Indian works & type tested (as per IEC/IS standard) and supplied as on the date of NOA.

b) Contractor shall furnish performance guarantee for an amount of 10% of the ex-works cost of the equipments(s)* and this performance guarantee shall be in addition to the contract performance guarantee to be submitted by the contractor.

23.2 Technical Requirement for 220kV, 132kV and 110kV class Transformer

(i) The manufacturer whose transformer(s) are offered must have designed, manufactured, tested and supplied 220kV/132kV/110kV* or higher voltage class transformers. These Transformer(s) must have been in satisfactory operation# for atleast two (2) years as on the date of NOA.

(ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India and not meeting the requirement stipulated in (i) above, can also be considered provided that

a) 220kV (applicable for supply of 220kV class Transformer)/ 132kV (applicable for supply of 132kV & 110kV class Transformer) or higher voltage class transformers must have been designed, manufactured in the above Indian works based on technological support of collaborator, type tested (as per IEC/IS standard) and supplied as on the date of NOA.

b) The collaborator meets the requirements stipulated in (i) above. A valid collaboration agreement for technology transfer / license to design, manufacture, test and supply 220kV/132kV/110kV* transformer in India, shall be submitted.

c) the collaborator shall furnish performance guarantee for an amount of 10% of the ex-works cost of such equipment(s) and this performance guarantee shall be in addition to contract performance guarantee to be submitted by the contractor.

23.3 Technical Requirement for 220KV Grade XLPE Power Cables

(i) The manufacturer(s) whose XLPE Power Cables are offered must have designed, manufactured, type tested and supplied in a single contract atleast 5 (five) km of single core, 220kV or higher grade XLPE insulated cable which must be in operation for atleast 2 (two) years as on the date of NOA.

(ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India and not meeting the requirement stipulated in (i) above, can also be considered provided that

a) The manufacturer must have designed, manufactured, type tested and supplied 220kV or higher grade XLPE insulated cable and which must be in satisfactory operation# for atleast one (1) year as on the date of NOA.

OR

b) The manufacturer must have designed, manufactured, type tested and completed Pre-qualification (PQ) tests as per IEC for 220kV or higher grade XLPE insulated Cable as on the date of NOA.

23.4 Technical Requirement for 132KV, 110kV, 66kV Grade XLPE Power Cables

(i) The manufacturer(s) whose XLPE Power Cables are offered must have designed, manufactured, type tested and supplied in a single contract atleast 5 (five) km of single core, 132KV/110kV/66kV* or higher grade XLPE insulated cable which must be in satisfactory operation# for atleast two (2) years as on the date of NOA.

(ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India and not meeting the requirement stipulated in (i) above, can also be considered provided that

a) The manufacturer must have designed, manufactured, type tested and supplied 132KV/110kV/66kV* or higher grade XLPE insulated cable and which must be in satisfactory operation# for atleast one (1) year as on the date of NOA.

23.5 Technical Requirement for 1.1 KV Grade PVC Control Cable

The manufacturer(s), whose PVC control cables are offered, must have designed, manufactured, tested and supplied in a single contract atleast 100 Kms of 1.1kV grade PVC insulated control cables as on the originally scheduled date of bid opening. Further the manufacturer must also have designed, manufactured, tested and supplied atleast 1 km of 27C x 2.5 Sq.mm or higher size as on the date of NOA.

23.6 Technical Requirement for 1.1 KV Grade PVC Power Cable

The manufacturer(s), whose PVC Power Cables are offered, must have designed, manufactured, tested and supplied in a single contract atleast 100 Kms of 1.1kV or higher grade PVC insulated power cables as on the date of NOA/award. Further the manufacturer must also have designed, manufactured, tested and supplied atleast 1 km of 1C x 150 Sq. mm or higher size as on the date of NOA.

23.7 Technical Requirement for 1.1 KV Grade XLPE Power Cables

The manufacturer(s), whose XLPE Power cables are offered, must have designed, manufactured, tested and supplied in a single contract atleast 25 Kms of 1.1 KV or higher grade XLPE insulated power cables as on the date of NOA/award. Further the

manufacturer must also have designed, manufactured, tested and supplied atleast 1 km of 1C x 630 Sq. mm or higher size as on the date of NOA.

23.8 Technical Requirement for LT Switchgear

i) The manufacturer whose LT Switchgear(s) are offered, must be a manufacturer of LT Switchboards of the type and rating being offered. He must have designed, manufactured, tested and supplied atleast 50 nos. draw out circuit breaker panels, out of which atleast 5 nos. should have been with relay and protection schemes with current transformer. He must have also manufactured atleast 50 nos. MCC panels comprising of MCCBs (ie Moulded Case Circuit Breakers) modules of the type offered which must be in satisfactory operation# as on the date of NOA.

ii) The Switchgear items (such as circuit breakers, fuse switch units, contactors etc.), may be of his own make or shall be procured from reputed manufacturers and of proven design, atleast one hundred circuit breakers of the make and type being offered must have been in satisfactory operation# as on the date of NOA.

23.9 Technical Requirements for Battery

The manufacturer whose Batteries are offered, must have designed, manufactured and supplied DC Batteries of the type specified and being offered, having a capacity of atleast 600 AH and these must be satisfactory operation# for atleast two (2) years in power sector or industrial installations as on the date of NOA.

23.10 Technical Requirements for Battery Charger

The manufacturer, whose Battery Chargers are offered, must have designed, manufactured and supplied Battery Chargers generally of the type offered, with static automatic voltage regulators and having a continuous output of atleast ten (10) KW and these must have been in satisfactory operation# as on the date of NOA.

23.11 Technical Requirements for LT Transformer

i) The manufacturer, whose LT transformer(s) are offered, must have designed, manufactured, type tested including short circuit test as per IEC/IS or equivalent standards and supplied transformer(s) of atleast 33kV class of 630kVA or higher. The transformer must have been in satisfactory operation# for atleast two (2) years as on the date of NOA.

ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India and not meeting the requirement stipulated in (i) above, can also be considered provided that

a) At least 33kV class of 630 kVA or higher rating LT transformer(s) must have been designed, manufactured in the above Indian works, type tested (as per IEC/IS standard) including short circuit test and supplied as on the date of NOA.

b) the contractor shall furnish performance guarantee for an amount of 10% of the ex-works cost of the equipment(s) and this performance guarantee shall be in addition to contract performance guarantee to be submitted by the contractor.

23.12 **Technical Requirements for Control, Relay & Protection System and Sub-station Automation System**

The manufacturer whose Control, Relay & Protection System (Control & protection Intelligent Electronic Devices (IEDs)), and Sub-station Automation System (as applicable) are offered, must have designed, manufactured, tested, installed and commissioned Control, Relay & Protection system along with Sub-station Automation System which must have been in satisfactory operation# on (specified voltage level or

above [applicable for 220kV & below substation] for atleast two (2) years as on the date of NOA.

AND

The Manufacturer or their joint venture or subsidiary company or parent company must be a manufacturer of control and protection IEDs and must have established repair, testing and integration (atleast for 4 bays) facilities for Control, Relay & Protection System and Sub-station Automation System in India.

23.13 Technical Requirements for analog and digital PLCC panels (220kV & 132kV)

(i) The manufacturer whose PLCC panels are offered, must have designed, manufactured, tested, supplied and commissioned PLCC panels for (i) 220 kV System or above [applicable for 220 kV Substation] & (iii) 132 kV system or above [applicable for 132 kV substation] and the same must have been in satisfactory operation# for atleast two (2) years as on the date of NOA.

(ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India and not meeting the requirement stipulated in (i) above, can also be considered provided that

a) PLCC panels must have been manufactured in the above Indian works based on technological support of collaborator, type tested (as per IEC/IS standard) and supplied as on the date of NOA.

b) collaborator shall furnish performance guarantee for an amount of 10% of the ex-works cost of such equipment(s) and this performance guarantee shall be in addition to contract performance guarantee to be submitted by the contractor.

c) The collaborator meets the requirements stipulated in (i) above. A valid collaboration agreement for technology transfer/license to design, manufacture, test and supply PLCC panels in India, shall be submitted.

23.14 Technical Requirement of Communication Equipment

The SDH equipment shall be offered from a manufacturer(s) who has been manufacturing SDH equipments for the last three (3) years and SDH equipment manufactured by such manufacturer(s) shall have been satisfactory operation in 110kV or higher voltage Power Substations for at least two (2) years as on the date of NOA.

23.15 Technical Requirement of Fire Fighting System

The bidder or his sub-vendor should have designed, supplied, tested, erected and commissioned at least one number fire protection system of the each type described in (i), (ii) and (iii) below in installations such as power plants, substations, refineries, fertilizer plants or other industrial or commercial installations. Such systems must have been designed and comply to International Standard code (FOC, LONDON or NFPA, USA etc) executed during last ten (10) years and should have been in successful operation for at least 2 years as on the originally Scheduled date of bid opening.

(i) Automatic hydrant type fire protection system.

(ii) Nitrogen injection Fire Protection System (NFPS)

(iii) Smoke detection system.

In case bidder himself do not meet the requirement of design, he can engage a consultant(s) who must have designed i) Automatic hydrant type fire protection system, ii) NFPS and iii) Smoke detection system, which must be in successful operation for at least two years as on the originally Scheduled date of bid opening.

ANNEXURE - A

LIST OF SPECIFICATIONS

GENERAL STANDARDS AND CODES

Indian Electricity Rules

Indian Electricity Act

Indian Electricity (Supply) Act

Indian Factories Act

IS-5	-	Colors for Ready Mixed Paints
IS – 335	-	New Insulating Oils
IS-617	-	Aluminium and Aluminium Alloy Ingots and casting For General Engineering Purpose
IS-1448 (P1 to P145)	-	Methods of Test for Petroleum and its Products
IS-2071 (P1 to P3)	-	Methods of High Voltage Testing
IS-12063	-	Classification of degrees of protection provided by Enclosures of electrical equipment
IS-2165 P1:1997 P2:1983	-	Insulation Coordination
IS-3043	-	Code of Practice for Earthing
IS-6103	-	Method of Test for specific Resistance (Resistivity) of Electrical Insulating Liquids
IS-6104	-	Method of Test for interfacial tension of Oil against water By the Ring Method
IS-6262	-	Method of Test for Power factor & Dielectric Constant of Electrical Insulating Liquids
IS-6792	-	Method for determination of electric strength of Insulating Oils
IS-5578	-	Guide for marking of Insulated Conductors
IS-11353	-	Guide for uniform system of marking & Identification of Conductors & apparatus terminals
IS-8263	-	Methods of Radio Interference Test on High Voltage Insulators
IS-9224(Part 1 to P4)	-	Low Voltage Fuses
IEC-60060 (Part 1 to P4)	-	High Voltage Test Techniques
IEC 60068	-	Environmental Test
IEC-60117	-	Graphical Symbols
IEC-60156,	-	Method for the Determination of the Electrical Strength of Insulation Oils.
IEC-60270,	-	Partial Discharge Measurements.
IEC-60376	-	Specification and Acceptance of New Sulphur Hexafloride

IEC-60437	-	Radio Interference Test on High Voltage Insulators.
IEC-60507	-	Artificial Pollution Tests on High Voltage Insulators to be used on AC Systems.
IEC-62271-1	-	Common Specification for High Voltage Switchgear & Controlgear Standards.
IEC-60815	-	Guide for the Selection of Insulators in respect of Polluted Conditions.
IEC-60865 (P1 & P2)	-	Short Circuit Current - Calculation of effects.
ANSI-C.1/NFPA.70	-	National Electrical Code
ANSI-C37.90A	-	Guide for Surge Withstand Capability (SWC) Tests
ANSI-C63.21,	-	Specification for Electromagnetic Noise and
C63.3	-	Field Strength Instrumentation 10 KHz to 1 GHZ
C36.4ANSI-C68.1	-	Techniquest for Dielectric Tests
ANSI-C76.1/EEE21	-	Standard General Requirements and Test Procedure for Outdoor Apparatus Bushings.
ANSI-SI-4	-	Specification for Sound Level Metres
ANSI-Y32-2/C337.2	-	Drawing Symbols
ANSI-Z55.11	-	Gray Finishes for Industrial Apparatus and Equipment No. 61 Light Gray
NEMA-107T	-	Methods of Measurements of RIV of High Voltage Apparatus
NEMA-ICS-II	-	General Standards for Industrial Control and Systems Part ICSI-109
CISPR-1	-	Specification for CISPR Radio Interference Measuring Apparatus for the frequency range 0.15 MHz to 30 MHz
CSA-Z299.1-1978h	-	Quality Assurance Program Requirements
CSA-Z299.2-1979h	-	Quality Control Program Requirements
CSA-Z299.3-1979h	-	Quality Verification Program Requirements
CSA-Z299.4-1979h	-	Inspection Program Requirements

TRANSFORMERS AND REACTORS

IS:10028 (Part 2 & 3)	-	Code of practice for selection, installation and maintenance of Transformers (P1:1993), (P2:1991), (P3: 1991)
IS-2026 (P1 to P4)	-	Power Transformers
IS-3347 (Part 1 to Part 8)	-	Dimensions for Porcelain Transformer Bushings for use in lightly polluted atmosphere
IS-3639	-	Fittings and Accessories for Power Transformer
IS-6600	-	Guide for loading of Oil Immersed Transformers
IEC-60076 (Part 1 to 5)	-	Power Transformers
IEC-60214	-	On-Load Tap-Changers.

IEC-60289	-	Reactors.
IEC- 60354	-	Loading Guide for Oil - Immersed power trans formers
IEC-60076-10	-	Determination of Transformer and Reactor Sound Levels
ANSI-C571280	-	General requirements for Distribution, Power and Regulating Transformers
ANSI-C571290	-	Test Code for Distribution, Power and Regulation Transformers
ANSI-C5716	-	Terminology & Test Code for Current Limiting Reactors
ANSI-C5721	-	Requirements, Terminology and Test Code for Shunt Reactors Rated Over 500 KVA
ANSI-C5792	-	Guide for Loading Oil-Immersed Power Transformers upto and including 100 MVA with 55 deg C or 65 deg C Winding Rise
ANSI-CG,1EEE-4	-	Standard Techniques for High Voltage Testing

CIRCUIT BREAKERS

IEC-62271-100	-	High-voltage switchgear and controlgear - Part 100: Alternating current circuit-breakers
IEC-62271-101	-	High-voltage switchgear and controlgear - Part 101: Synthetic testing
IEC-62155	-	Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V
IEC-62271-110	-	High-voltage switchgear and controlgear - Part 110: Inductive load switching
IEC-62271-109	-	High-voltage switchgear and controlgear - Part 110: Inductive load switching

CURRENT TRANSFORMERS, VOLTAGE TRANSFORMERS AND COUPLING CAPACITOR VOLTAGE TRANSFORMERS

IS-2705 (P1 to P4)	-	Current Transformers
IS-3156 (P1 to P4)	-	Voltage Transformers
IS-4379	-	Identification of Contents of Industrial Gas Cylinders
IEC-60044-1	-	Current transformers.
IEC-60044-2	-	Inductive Voltage Transformers.
IEC-60044-5	-	Instrument transformers - Part 5: Capacitor voltage transformers
IEC-60358	-	Coupling capacitors and capacitor dividers.
IEC-60044-4	-	Instrument Transformes : Measurement of Partial Discharges
IEC-60481	-	Coupling Devices for power Line Carrier Systems.
ANSI-C5713	-	Requirements for Instrument transformers
ANSIC92.2	-	Power Line Coupling voltage Transformers
ANSI-C93.1	-	Requirements for Power Line Carrier Coupling Capacitors

BUSHING

IEC-60137	-	Insulated Bushings for Alternating Voltages above 1000V

SURGE ARRESTERS

IS-3070 (Part 2)	-	Lightning Arrestors for alternating current systems: Metal oxide lightning arrestors without gaps
IEC-60099-4	-	Metal oxide surge arrestors without gaps
IEC-60099-5	-	Selection and application recommendation
ANSI-C62.1	-	IEE Standards for S A for AC Power Circuits
NEMA-LA 1	-	Surge Arresters

CUBICLES AND PANELS & OTHER RELATED EQUIPMENTS

IS-722, IS-1248 IS-3231, IS-3231 (P-3)	-	Electrical Relays for Power systems Protection
IS-5039	-	Distributed Pillars for voltages not exceeding 1000 volts
IEC-60068.2.2	-	Basic environmental testing procedures Part 2: Test B: Dry heat
IEC-60529	-	Degree of Protection provided by enclosures.
IEC-60947-4-1	-	Low voltage switchgear and control gear.
IEC-61095	-	Electromechanical Contactors for household and similar purposes.
IEC-60439 (P1 & 2)	-	Low Voltage Switchgear and control gear assemblies
ANSI-C37.20	-	Switchgear Assemblies, including metal enclosed bus.
ANSI-C37.50	-	Test Procedures for Low Voltage Alternating Current Power Circuit Breakers
ANSI-C39	-	Electric Measuring instrument
ANSI-C83	-	Components for Electric Equipment
NEMA-AB	-	Moulded Case Circuit and Systems
NEMA-CS	-	Industrial Controls and Systems
NEMA-PB-1	-	Panel Boards
NEMA-SG-5	-	Low voltage Power Circuit breakers
NEMA-SG-3	-	Power Switchgear Assemblies
NEMA-SG-6	-	Power switching Equipment
NEMA-5E-3	-	Motor Control Centers
1248 (P1 to P9)	-	Direct acting indicating analogue electrical measuring instruments & their accessories.

Disconnecting switches

IEC-62271-102	-	High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches
IEC-60265 (Part 1 & 2)	-	High Voltage switches
ANSI-C37.32	-	Schedule of preferred Ratings, Manufacturing Specifications and Application Guide for high voltage Air Switches, Bus supports and switch accessories

ANSI-C37.34	-	Test Code for high voltage air switches
NEMA-SG6	-	Power switching equipment
PLCC and line traps		
IS-8792	-	Line Traps for AC Power Systems
IS-8793	-	Methods of Tests for Line Traps
IS-8997	-	Coupling Devices for PLC Systems
IS-8998	-	Methods of Test for Coupling Devices for PLC Systems
IEC-60353	-	Line traps for A.C. power systems.
IEC-60481	-	Coupling Devices for power line carrier systems.
IEC-60495	-	Single sideboard power line carrier terminals
IEC-60683	-	Planning of (single Side-Band) power line carrier systems.
CIGRE	-	Teleprotection report by Committee 34 & 35.
CIGRE	-	Guide on power line carrier 1979.
CCIR	-	International Radio Consultative Committee
CCITT	-	International Telegraph & Telephone Consultative Committee
EIA	-	Electric Industries Association
Protection and control equipment		
IEC-60051: (P1 to P9)	-	Recommendations for Direct Acting indicating analogue electrical measuring instruments and their accessories.
IEC-60255 (Part 1 to 23)	-	Electrical relays.
IEC-60297		
(P1 to P4)	-	Dimensions of mechanical structures of the 482.6mm (19 inches) series.
IEC-60359	-	Expression of the performance of electrical & electronic measuring equipment.
IEC-60387	-	Symbols for Alternating-Current Electricity meters.
IEC-60447	-	Man machine interface (MMI) - Actuating principles.
IEC-60521	-	Class 0.5, 1 and 2 alternating current watt hour metres
IEC-60547	-	Modular plug-in Unit and standard 19-inch rack mounting unit based on NIM Standard (for electronic nuclear instruments)
ANSI-81	-	Screw threads
ANSI-B18	-	Bolts and Nuts
ANSI-C37.1	-	Relays, Station Controls etc.
ANSI-C37.2	-	Manual and automatic station control, supervisory and associated telemetering equipment
ANSI-C37.2	-	Relays and relay systems associated with electric power apparatus
ANSI-C39.1	-	Requirements for electrical analog indicating instruments

MOTORS

IS-325	-	Three Phase Induction motors
IS-4691	-	Degree of protection provided by enclosure for rotating electrical machinery
IEC-60034 (P1 to P19:)	-	Rotating electrical machines
IEC-Document 2	-	Three phase induction motors
(Central Office) NEMA-MGI	Motors and Generators	

Electronic equipment and components

MIL-21B, MIL-833 & MIL-2750

IEC-60068 (P1 to P5)	-	Environmental testing
IEC-60326 (P1 to P2)	-	Printed boards
		Material and workmanship standards
IS-1363 (P1 to P3)	-	Hexagon Head Bolts, Screws and Nuts of product grades C
IS-1364(P1 to P5)	-	Hexagon Head Bolts, Screws and Nuts of products grades A and B
IS-3138	-	Hexagon Bolts and Nuts (M42 to M150)
ISO-898	-	Fasterners: Bolts, Screws and Studs
ASTM	-	Specification and tests for materials

Clamps & connectors

IS-5561	-	Electric Power connectors
NEMA-CC1	-	Electric Power connectors for sub station
NEMA-CC 3	-	Connectors for Use between aluminium or aluminum-Copper Overhead Conductors

Bus hardware and insulators

IS-2121	-	Fittings for Aluminum and steel core Al Conductors for overhead transmission lines
IS-731	-	Porcelain Insulators for overhead power lines with a nominal voltage greater than 1000 volts
IS-2486 (P1 to P4)	-	Insulator fittings for overhead power lines with a nominal voltage greater than 1000 volts
IEC-60120	-	Dimensions of Ball and Socket Couplings of string insulator units.
IEC-60137	-	Insulated bushings for alternating voltages above 1000 V.
IEC-60168	-	Tests on indoor and outdoor post insulators of ceramic material or glass for Systems with Nominal Voltages Greater than 1000 V.
IEC-62155	-	Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V
IEC-60273	-	Characteristices of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
IEC-61462	-	Pressurized and un-pressurized insulator for use in electrical equipment with rated voltage greater than

		1000V – Definitions, Test methods, acceptance criteria and design recommendations
IEC-60305	-	Insulators for overhead lines with nominal voltage above 1000V-ceramic or glass insulator units for a.c. systems Characteristics of String Insulator Units of the cap and pintype.
IEC-60372 (1984)	-	Locking devices for ball and socket couplings of string insulator units : dimensions and tests.
IEC-60383 (P1 and P2)	-	Insulators for overhead lines with a nominal voltage above 1000 V.
IEC-60433	-	Characteristics of string insulator units of the long rod type.
IEC-60471	-	Dimensions of Clevis and tongue couplings of string insulator units.
ANSI-C29	-	Wet process proelain insulators
ANSI-C29.1	-	Test methods for electrical power insulators
ANSI-C92.2	-	For insulators, wet-process porcelain and toughened glass suspension type
ANSI-C29.8	-	For wet-process porcelain insulators apparatus, post-type
ANSI-G.8	-	Iron and steel hardware
CISPR-7B	-	Recommendations of the CISPR, tolerances of form and of Position, Part 1
ASTM A-153	-	Zinc Coating (Hot-Dip) on iron and steel hardware
Strain and rigid bus-conductor		
IS-2678	-	Dimensions and tolerances for wrought Aluminum and Aluminum Alloys drawn round tube
IS-5082	-	Wrought Aluminum and Aluminum Alloy Bars, Rods, Tubes and Sections for Electrical purposes
ASTM-B 230-82	-	Aluminum 1350 H19 Wire for electrical purposes
ASTM-B 231-81	-	Concentric - lay - stranded, aluminum 1350 conductors
ASTM-B 221	-	Aluminum - Alloy extruded bar, road, wire, shape
ASTM-B 236-83	-	Aluminum bars for electrical purpose (Bus-bars)
ASTM-B 317-83	-	Aluminum-Alloy extruded bar, rod, pipe and structural shapes for electrical purposes (Bus Conductors)
Batteryand battery charger		
Battery		
IS-1651	-	Stationary Cells and Batteries, Lead Acid Type (with Tubular Positive Plates)
IS-1652	-	Stationary Cells and Batteries, Lead Acid Type (with Plante Positive Plates)
IS-1146	-	Rubber and Plastic Containers for Lead Acid storage Batteries
IS-6071	-	Synthetic Separators for Lead Acid Batteries

IS-266	-	Specification for Sulphuric Acid
IS-1069	-	Specification for Water and Storage Batteries
IS-3116	-	Specification for sealing compound for Lead Acid Batteries
IS-1248	-	Indicating Instruments
IS-10918	-	Vented type Nickel Cadmium Batteries
IEC:60896-21&22	-	Lead Acid Batteries Valve Regulated types – Methods of Tests & Requirements
IEC: 60623	-	Vented type nickel Cadmium Batteries
IEC:60622	-	Secondary Cells & Batteries – Sealed Ni-Cd rechargeable single cell
IEC:60623	-	Secondary Cells & Batteries – Vented Ni-Cd rechargeable single cell
IEC:60896-11	-	Stationary Lead Acid Batteries – Vented Type – General requirements & method of tests
IEEE-485	-	Recommended practices for sizing of Lead Acid Batteries
IEEE-1115	-	Sizing of Ni-Cd Batteries
IEEE-1187	-	Recommended practices for design & installation of VRLA Batteries
IEEE-1188	-	Recommended practices for design & installation of VRLA Batteries
IEEE-1189	-	Guide for selection of VRLA Batteries
Battery Charger		
IS-3895	-	Mono-crystalline Semiconductor Rectifier Cells and Stacks
IS-4540	-	Mono-crystalline Semiconductor Rectifier Assemblies and Equipment
IS-6619	-	Safety Code for Semiconductor Rectifier Equipment
IS-2026	-	Power Transformer
IS-2959	-	AC Contractors for voltages not exceeding 1000 Volts
IS-1248	-	Indicating Instruments
IS-2208	-	HRC Fuses
IS-13947(Part-3)	-	Air Break Switches, air break Disconnectors & Fuse combination units for voltages not exceeding 1000 Volts AC or 1200Volts DC
IS-2147	-	Degree of protection provided by enclosures for low voltage switchgear and control gear
IS-6005	-	Code of practice for phosphating of Iron and Steel
IS-3231	-	Electrical relays for Power System Protection
IS-3842	-	Electrical relays for AC systems
IS-5	-	Colours for ready mix paint
IEEE-484	-	Recommended Design for installation design and installation of large lead storage batteries for generating stations and substations.

IEEE-485	-	Sizing large lead storage batteries for generating stations and substations
Wires and cables		
ASTMD-2863	-	Measuring the minimum oxygen concentration to support candle like combustion of plastics (oxygen index)
IS-694	-	PVC Insulated Cables for working voltages upto and including 1100Volts
IS-1255	-	Code of practice for installation and maintenance of power cables upto and including 33kV
IS-1554 (P1 and P2)	-	PVC Insulated (Heavy Duty) Electric Cables (Part 1) for working voltages upto and including 1100Volts
IS-1753	-	Aluminum Conductor for Insulated Cables
IS-2982	-	Copper Conductor in Insulated Cables
IS-3961 (P1 to P5)	-	Recommended Current ratings for Cables
IS-3975	-	Mild steel Wires, formed wires and tapes for armouring of cables
IS-5831	-	PVC insulating and sheath of electric cables
IS-6380	-	Electrometric insulating and sheath of electric cables
IS-7098	-	Cross linked polyethylene insulated PVC sheathed cables for working voltage upto and including 1100 volts
IS-7098	-	Cross linked polyethylene insulated PVC sheathed cables for working voltage from 3.3kV upto and including 33kV
IS-8130	-	Conductors for insulated electric cables and flexible cords
IS-1753	-	Aluminum conductor insulated cables
IS-10418	-	Specification for drums for Electric Cables.
IEC-60096 (part 0 to p4)	-	Radio Frequency cables.
IEC-60183	-	Guide to the Selection of High Voltage Cables.
IEC-60189 (P1 to P7)	-	Low frequency cables and wires with PVC insulation and PVC sheath.
IEC-60227 (P1 to P7)	-	Polyvinyl Chloride insulated cables of rated voltages up to and including 450/750V.
IEC-60228	-	Conductors of insulated cables
IEC-60230	-	Impulse tests on cables and their accessories.
IEC-60287 (P1 to P3)	-	Calculation of the continuous current rating of cables (100% load factor).
IEC-60304	-	Standard colours for insulation for low-frequency cables and wires.
IEC-60331	-	Fire resisting characteristics of Electric cables.
IEC-60332 (P1 to P3)	-	Tests on electric cables under fire conditions.
IEC-60502	-	Extruded solid dielectric insulated power cables for rated voltages from 1 kV upto to 30 kV
IEC-754 (P1 and P2)	-	Tests on gases evolved during combustion of electric cables.

Painting

IS-6005	-	Code of practice for phosphating of Iron and Steel
ANSI-Z551	-	Gray finishes for industrial apparatus and equipment
SSPEC	-	Steel structure painting council

HORIZONTAL CENTRIFUGAL PUMPS

IS-1520	-	Horizontal Centrifugal pumps for clear, cold and fresh water
IS-9137	-	Code for acceptance test for centrifugal and axial pumps
IS-5120	-	Technical Requirement – Rotodynamic special purpose pumps
API-610	-	Centrifugal pumps for general services
	-	Hydraulic Institutes Standards
BS:599	-	Methods of testing pumps
PTC-8.2	-	Power Test Codes - Centrifugal pumps

DIESEL ENGINES

IS-10000	-	Methods for tests for internal combustion system
IS-10002	-	Specification for performance requirements for constant speed compression ignition engines for general purposes (above 20KW)
ISO-3046	-	Reciprocating internal combustion engine performance
IS-554	-	Dimensions for pipe threads where pressure tight joints are required on threads
ASME Power Test Code	-	Internal combustion engine PTC-17
	-	Codes of Diesel Engine Manufacturer's Association, USA

PIPING VALVES & SPECIALITIES

IS-636	-	Non percolating flexible firefighting delivery hose
IS-638	-	Sheet rubber jointing and rubber inserting jointing
IS-778	-	Gun metal gate, globe and check valves for general purpose
IS-780	-	Sluice valves for water works purposes (50 to 300mm)
IS-901	-	Couplings double male and double female instantaneous pattern for fire fighting
IS-902	-	Suction hose couplings for fire fighting purposes
IS-903	-	Fire hose delivery couplings branch pipe nozzles and nozzle spanner
IS-1538	-	Cast iron fittings for pressure pipes for water, gas and sewage
IS-1903	-	Ball valve(horizontal plunger type) including floats for water supply purposes
IS-2062	-	SP for weldable structural steel

IS-2379	-	Colour code for identification of pipe lines
IS-2643	-	Dimensions of pipe threads for fastening purposes
IS-2685	-	Code of practice for selection, installation and maintenance of sluice valves
IS-2906	-	Sluice valves for water works purposes (350 to 1200mm size)
IS-3582	-	Basket strainers for fire fighting purposes (Cylindrical type)
IS-3589	-	Electrically welded steel pipes for water, gas and sewage (150 to 2000mm nominal diameter)
IS-4038	-	Foot valves for water works purposes
IS-4927	-	Unlined flax canvas hose for fire fighting
IS-5290	-	Landing valves (internal hydrant)
IS-5312 (Part 1)	-	Swing check type reflex (non-return valves)
IS 5306	-	Code of practice for fire extinguishing installation and equipment on premises
Part – I	-	Hydrant system, hose reels and foam inlets
Part-II	-	Sprinkler system
BS:5150	-	Specification for cast iron gate valves

PG Test Procedures

NFPA-13	-	Standard for the installation of sprinkler system
NFPA-15	-	Standard for water spray fixed system for the fire protection
NFPA-12A	-	Standard for Halong 1301 Fire Extinguishing System
NFPA-72E	-	Standard on Antomatic Fire Detectors
NFPA-12	-	Standard on Carbon dioxide extinguisher systems

Electrical generating and distributing stations code of practice

Steel structures

IS-228	-	Method of Chemical Analysis of Pig iron, cast iron and plain carbon and low alloy steels
IS-802(P1 to P3)	-	Code of practice for use of structural steel in overhead transmission line towers
IS-806	-	Code of practice for use for steel tubes in general building construction
IS-808	-	Dimensions for hot rolled steel beams, column channel and angle sections
IS-814	-	Covered electrodes for manual arc welding of carbon manganese steel
IS-816	-	Code of practice for use of metal arc welding for general construction in mild steel
IS-817	-	Code of practice for training and testing of metal arc welders Part 1: Manual metal arc welding

IS-875 (P1 to P4)	-	Code of practice for design loads (other than earthquake) for buildings and structures
IS-1161	-	Steel tubes for structural purposes
IS-1182	-	Recommended practice for radiographic examination of fusion welded butt joints in steel plates
IS-1363(P1 to P3)	-	Hexagonal head bolts, screws and nuts of products grade C
IS-1364	-	Hexagonal head bolts, screws and nuts of products grades A and B
IS-1367 (P1 to P18)	-	Technical supply condition for threaded steel fasteners
IS-1599	-	Methods for bend test
IS-1608	-	Method for tensile testing of steel products
IS-1893	-	Criteria for earthquake resistant design of structures
IS-1978	-	Line pipe
IS-2062	-	Steel for general structural purpose
IS-2595	-	Code of practice for radiographic testing
IS-3063	-	Single coil rectangular section spring washer for bolts, nuts and screws
IS-3664	-	Code of practice of ultrasonic pulse echo testing by contact and immersion method
IS-7205	-	Safety code for erection of structural steel work
IS-9595	-	Recommendation of metal arc welding of carbon and carbon manganese steels
ANSI-B18.2.1	-	Inch series square and Hexagonal bolts and screws
ANSI-B18.2.2	-	Square and hexagonal nuts
ANSI-G8.14	-	Round head bolts
ASTM-A6	-	Specification for General Requirements for rolled steel plates, shapes, sheet piling and bars of structural use
ASTM-A36	-	Specifications of structural steel
ASTM-A47	-	Specification for malleable iron castings
ASTM-A143	-	Practice for safeguarding against embilement of Hot Galvanized structural steel products and procedure for detaching embrilement
ASTM-A242	-	Specification for high strength low alloy structural steel
ASTM-A283	-	Specification for low and intermediate tensile strength carbon steel plates of structural quality
ASTM-A394	-	Specification for Galvanized steel transmission tower bolts and nuts
ASTM-441	-	Specification for High strength low alloy structural manganese vanadium steel.
ASTM-A572	-	Specification for High strength low alloy colombium-Vanadium steel of structural quality

AWS D1-0	-	Code for welding in building construction welding inspection
AWS D1-1	-	Structural welding code
AISC	-	American institute of steel construction
NEMA-CG1	-	Manufactured graphite electrodes
Piping and pressure vessels		
IS-1239 (Part 1 &2)	-	Mild Steel Tubes, tubular and other wrought steel fittings
IS-3589	-	Seamless Electrically welded steel pipes for water, gas and sewage
IS-6392	-	Steel Pipe Flanges
ASME	-	Boiler and pressure vessel code
ASTM-A120	-	Specification for pipe steel, black and hot dipped, zinc-coated (Galvanized) welded and seamless steel pipe for ordinary use
ASTM-A53	-	Specification for pipe, steel, black, and hot-dipped, zinc coated welded and seamless
ASTM-A106	-	Seamless carbon steel pipe for high temperature service
ASTM-A284	-	Low and intermediate tensile strength carbon-silicon steel plates for machine parts and general construction.
ASTM-A234	-	Pipe fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures
ASTM-S181	-	Specification for forgings, carbon steel for general purpose piping
ASTM-A105	-	Forgings, carbon steel for piping components
ASTM-A307	-	Carbon steel externally threated standard fasteners
ASTM-A193	-	Alloy steel and stainless steel bolting materials for high temperature service
ASTM-A345	-	Flat rolled electrical steel for magnetic applications
ASTM-A197	-	Cupola malleable iron
ANSI-B2.1	-	Pipe threads (Except dry seal)
ANSI-B16.1	-	Cast iron pipe flangesand glanged fitting. Class 25, 125, 250 and 800
ANSI-B16.1	-	Malleable iron threaded fittings, class 150 and 300
ANSI-B16.5	-	Pipe flanges and flanged fittings, steel nickel alloy and other special alloys
ANSI-B16.9	-	Factory-made wrought steel butt welding fittings
ANSI-B16.11	-	Forged steel fittings, socket-welding and threaded
ANSI-B16.14	-	Ferrous pipe plug, bushings and locknuts with piplethreads
ANSI-B16.25	-	Butt welding ends
ANSI-B18.1.1	-	Fire hose couplings screw thread.
ANSI-B18.2.1	-	Inch series square and hexagonal bolts and screws

ANSI-B18.2.2	-	Square and hexagonal nuts
NSI-B18.21.1	-	Lock washers
ANSI-B18.21.2	-	Plain washers
ANSI-B31.1	-	Power piping
ANSI-B36.10	-	Welded and seamless wrought steel pipe
ANSI-B36.9	-	Stainless steel pipe

ACSR MOOSE CONDUCTOR

IS-6745	-	Method for Determination of mass of Zinc coatings on Zinc coated Iron and Steel articles
IS-209	-	Zinc Ingot
IS-398 Part- V	-	Aluminium Conductors for Overhead Transmission
IS-1778	-	Reels and Drums for Bare Conductors
IS-2629	-	Recommended practice for Hot dip galvanizing on Iron and Steel
IS-2633	-	Methods for testing uniformity of coating of zinc coated articles
IS-4826	-	Hot dip Galvanized coatings on Round Steel WiresPurposes
BS:215(Part-II)	-	Aluminum Conductors galvanized steel reinforced extra high voltage (400 kV and above)

GALVANISED STEEL EARTHWIRE

IS-1521	-	Method for tensile testing of steel wire
IS-1778	-	Reels and Drums for Bare Conductors
IS-2629	-	Recommended practice for Hot dip galvanizing on Iron and Steel
IS-2633	-	Methods for testing uniformity of coating of zinc coated articles
IS-4826	-	Hot dip Galvanized coatings on Round Steel Wires
IS-6745	-	Method for Determination of mass of Zinc coatings on Zinc coated Iron and Steel articles
IS-209	-	Zinc Ingot
IS-398 (P1 to P5:1992)	-	Aluminium Conductors for overhead transmission purposes.

ANNEXURE - B

Sl No.	LIST OF DRAWINGS/DOCUMENTS
1	Single Line Diagram
2	Electrical Layout – Plan and Sections
3	Tower, Equipment & cable trench layout drawing
4	Earthing system design calculation & layout drawing
5	Lighting protection system design & drawings
6	Structure Layout (Plan & Section) drawing
7	Cantilever Strength calculations (if applicable)
8	Design calculation for Sag – Tension stringing chart
9	GTP and drawings for Bus-Post Insulator
10	Tension/suspension string insulator and Hardware Assembly GTP and drawing
11	Soil Investigation Report (if applicable)
12	**Circuit Breakers (220kV,132kV, 33 kV- As applicable)** - GA drawing, GTP, Type test Reports
13	**CTs & CVTs (220kV,132 kV, 33kV- As applicable)** - GA drawing, GTP, Type test Reports
14	**Surge Arrestors (216kV,120kV, 30kV- As applicable)** - GA drawing, GTP, Type test Reports
15	**Isolators (220kV,132kV, 33 kV- As applicable)** - GA drawing, GTP, Type test Reports
16	**Capacitor Bank 39.78MVAR,36kV** - GA drawing, GTP, Type Test Reports
17	**Control, Relay Panels and Substation Automation system** - GTP, technical literature, type test reports
18	**PLCC, LINE TRAP & Digital Protection Coupler** - GTP and technical literature
19	**Civil Works (as applicable)** **a)** Control Room cum Administrative Building structure design, Foundation Design & Drg., Plinth Beam Design & Drg. and column Design & Drg. upto G.F./F.F Level **b)** Auto transformer foundation design/drawings **c)** Reactor foundation design/drawings **d)** 220/132/33kV Tower, structure & foundation design/drawings. **e)** 220/132/33kV Equipment support structure & foundation design/drawing
20	Gas Insulated SubStation Drawing

NOTE:

1. The above list of drawing/document is only illustrative and not exhaustive. The contractor shall submit drawings/documents as per requirement of Technical specification.

TECHNICAL SPECIFICATION

VOL-II, SEC-III

SWITCHGEAR (CIRCUIT BREAKER)

CONTENTS

Clause. No.	Description
1.0	General
2.0	Duty requirements
3.0	Total Break Time
4.0	Constructional Features
5.0	Sulphur Hexafluoride Gas (SF6 Gas)
6.0	Insulators
7.0	Spare Parts and Maintenance Equipment
8.0	Operating Mechanism & Control
9.0	Support Structure
10.0	Terminal Connector Pad
11.0	Interpole Cabling
12.0	Fittings & Accessories
13.0	Additional Data to be Furnished
14.0	Tests
15.0	Technical Parameters
16.0	Pre-commissioning tests

SECTION-III
SWITCHGEAR (CIRCUIT BREAKER)

1.0 GENERAL

1.1 The circuit breakers and accessories shall conform to IEC: 62271-100, IEC: 62271-01 and other relevant IEC standards except to the extent explicitly modified in the specification and shall also be in accordance with requirements specified in Chapter 2-GTR.

1.2 245/145 kV live tank type circuit breakers offered would be of sulphur hexafluoride (SF6) type only and of class C2-M2 as per IEC

1.3 The circuit breaker shall be complete with terminal connectors, operating mechanism, control cabinets, piping, interpole cable, cable accessories like glands, terminal blocks, marking ferrules, lugs, pressure gauges, density monitors (with graduated scale), galvanised support structure for CB and control cabinets, their foundation bolts and all other circuit breaker accessories required for carrying out all the functions the CB is required to perform.

All necessary parts to provide a complete and operable circuit breaker installation such as main equipment, terminals, control parts, connectors and other devices whether specifically called for herein or not shall be provided.

1.4 Painting shall be done in line with Chapter 2 - GTR. REL-5032 or similar shades can be used for painting. The support structure of circuit breaker shall be hot dip galvanised. Exposed hardware items shall be hot dip galvanised or Electro-galvanised.

1.5 The circuit breakers shall be designed for use in the geographic and meteorological conditions as given in Chapter 2 - GTR.

2.0 DUTY REQUIREMENTS:

2.1 The circuit breakers shall be capable of performing their duties without opening resistors.

2.2 The circuit breaker shall meet the duty requirements for any type of fault or fault location also for line switching when used on a 245/145 kV effectively grounded system, and perform make and break operations as per the stipulated duty cycles satisfactorily.

2.3 The breaker shall be capable of interrupting the steady state and transient magnetising current corresponding of power transformers.

2.4 The circuit breaker shall also be capable of:

i) Interrupting line/cable charging current as per IEC without use of opening resistors.

ii) Clearing short line fault (Kilometric faults) with source impedance behind the bus equivalent to symmetrical fault current specified.

iii) Breaking 25% of the rated fault current at twice rated voltage under phase opposition condition.

2.5 The Breaker shall satisfactorily withstand the high stresses imposed on them during fault clearing, load rejection and re-energisation of lines with trapped charges. The breaker shall also withstand the voltages specified under Clause 15 of this Chapter.

3.0 TOTAL BREAK TIME:

3.1 The total break time as specified under this Chapter shall not be exceeded under any of the following duties:

i) Test duties T10, T30, T60, T100a, T100s (TRV as per IEC: 62271-100)

ii) Short line fault L75, L90 (- do -)

3.2 The Bidder may please note that total break time of the breaker shall not be exceeded under any duty conditions specified such as with the combined variation of the trip coil voltage, (70-110%) and arc extinguishing medium pressure etc. While furnishing the proof of the total break time of complete circuit breaker, the Bidders may specifically bring out the effect of non-simultaneity between contacts between poles and show how it is covered in the guaranteed total break time.

3.3 The values guaranteed shall be supported with the type test reports.

4.0 CONSTRUCTIONAL FEATURES:

The features and constructional details of circuit breakers shall be in accordance with requirements stated hereunder:

4.1 **Contacts**

4.1.1 The gap between the open contacts shall be such that it can withstand atleast the rated phase to ground voltage for 8 hours at zero gauge pressure of SF6 gas due to the leakage. The breaker should be able to withstand all dielectric stresses imposed on it in open condition at lock out pressure continuously (i.e. 2 p.u. across the breaker continuously, for validation of which a power frequency dielectric with stand test conducted for a duration of at least 15 minutes is acceptable).

4.2 **The SF6 Circuit Breaker shall meet the following additional requirements:**

a) The circuit breaker shall be single pressure type. The design and construction of the circuit breaker shall be such that there is a minimum possibility of gas leakage and entry of moisture. There should not be any

condensation of SF6 gas on the internal insulating surfaces of the circuit breaker.

b) All gasketted surfaces shall be smooth, straight and reinforced, if necessary, to minimise distortion and to make a tight seal, the operating rod connecting the operating mechanism to the arc chamber (SF6 media) shall have adequate seals. The SF6 gas leakage should not exceed 0.5% per year and the leakage rate shall be guaranteed for at least 10 years. In case the leakage under the specified conditions is found to be greater than 0.5% after one year of commissioning of circuit breaker, the manufacturer will have to supply free of cost, the total gas requirement for subsequent ten (10) years, based on actual leakage observed during first year of operation after commissioning.

c) In the interrupter assembly there shall be an absorbing product box to minimise the effect of SF6 decomposition products and moisture. The material used in the construction of the circuit breakers shall be fully compatible with SF6 gas decomposition products.

d) Each pole shall form an enclosure filled with SF6 gas independent of two other poles and the SF6 density of each pole shall be monitored. For CBs of voltage class of 245/145 kV or less, a common SF6 scheme/density monitor shall also be acceptable.

e) The dial type SF6 density monitor shall be adequately temperature compensated to model the pressure changes due to variations in ambient temperature within the body of circuit breaker as a whole. The density monitor shall have graduated scale and shall meet the following requirements:

i) It shall be possible to dismantle the density monitor for checking/replacement without draining the SF6 gas by providing suitable interlocked non return valve coupling.

f) Each Circuit Breaker shall be capable of withstanding a vacuum of minimum 8 millibars without distortion or failure of any part.

g) Sufficient SF6 gas including that will be required for gas analysis during filling shall be provided to fill all the circuit breakers installed. In addition spare gas shall be supplied in separate unused cylinders as per requirement specified in Chapter 1 - PSR.

4.3 Provisions shall be made for attaching an operational analyser to record contact travel, speed and making measurement of operating timings, pre-insertion timings of closing resisters if used, synchronisation of contacts in one pole.

5.0 SULPHUR HEXAFLUORIDE GAS (SF6 GAS):

a) The SF6 gas shall comply with IEC 60376, 60376A and 60376B and shall be suitable in all respects for use in the switchgear under the operating conditions.

b) The high pressure cylinders in which the SF6 gas is shipped and stored at site shall comply with requirements of the relevant standards and regulations.

c) Test: SF6 gas shall be tested for purity, dew point, air, hydrolysable fluorides and water content as per IEC 60376, 60376A and 60376B and test certificates shall be furnished to Employer indicating all the tests as per IEC 60376 for each lot of SF6 gas in stipulated copies as indicated in Chapter-GTR. Gas bottles should be tested for leakage during receipt at site.

6.0 INSULATORS:

a) The porcelain of the insulators shall conform to the requirements stipulated under Chapter 2-GTR.

b) The mechanical characteristics of insulators shall match with the requirements specified under this Chapter.

c) All hollow insulators shall conform to IEC-62155.

d) Hollow Porcelain for pressurised columns/chambers should be in one integral piece in green and fired stage.

7.0 SPARE PARTS AND MANDATORY MAINTENANCE EQUIPMENT:

The bidder shall include in his proposal spare parts and maintenance equipment in accordance with Chapter 1-PSR. Calibration certificates of each maintenance equipment shall be supplied alongwith the equipment.

8.0 OPERATING MECHANISM AND CONTROL

8.1 **General Requirements**

8.1.1 Circuit breaker shall be operated by spring charged mechanism or hydraulic mechanism or a combination of these. The mechanism shall be housed in a weather proof and dust proof control cabinet as stipulated in Section 2-GTR.

8.1.2 The operating mechanism shall be strong, rigid, not subject to rebound.

8.1.3 The mechanism shall be antipumping and trip free (as per IEC definition) under every method of closing.

8.1.4 The mechanism shall be such that the failure of any auxiliary spring will not prevent tripping and will not cause trip or closing operation of the power operating devices.

8.1.5 A mechanical indicator shall be provided to show open and close position of the breaker. It shall be located in a position where it will be visible to a man standing on the ground level with the mechanism housing closed. An operation counter shall also be provided in the central control cabinet.

8.1.6 Working parts of the mechanism shall be corrosion resisting material, bearings which require grease shall be equipped with pressure type grease fittings. Bearing pin, bolts, nuts and other parts shall be adequately pinned or locked to prevent loosening or changing adjustment with repeated operation of the breaker.

8.1.7 The bidder shall furnish detailed operation and maintenance manual of the mechanism alongwith the operation manual for the circuit breaker. The instruction manuals shall contain exploded diagrams with complete storage, handling, erection, commissioning, troubleshooting, servicing and overhauling instructions.

8.2 **Control:**

8.2.1 The close and trip circuits shall be designed to permit use of momentary contact switches and push buttons.

8.2.2 Each breaker shall be provided with two (2) independent tripping circuits, pressure switches and coils each to be fed from separate DC sources and connected to a different set of protective relays.

8.2.3 The breaker shall normally be operated by remote electrical control. Electrical tripping shall be performed by shunt trip coils. However, provisions shall be made for local electrical control. For this purpose a local/remote selector switch and close and trip control switch/push buttons shall be provided in the Breaker central control cabinet.

8.2.4 The trip coils shall be suitable for trip circuit supervision during both open and close position of breaker. The trip circuit supervision relay would be provided on relay panels.

8.2.5 Closing coil and associated circuits shall operate correctly at all values of voltage between 85% and 110% of the rated voltage. Shunt trip coil and associated circuits shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110% of rated voltage. However, even at 50% of rated voltage the breaker shall be able to open. If additional elements are introduced in the trip coil circuit their successful operation and reliability for similar applications on outdoor circuit breakers shall be clearly brought out in the additional information schedules.

8.2.6 Density Monitor contacts and pressure switch contact shall be suitable for direct use as permissive in closing and tripping circuits. The density monitor shall be placed suitably inclined in such a way so that the readings are visible from ground level with or without using binoculars. Separate contacts have to be used for each of tripping and closing circuits. If contacts are not suitably rated and multiplying relays are used then fail safe logic/schemes are to be employed. DC supplies for all auxiliary circuits shall be monitored and provision shall be made for remote annunciations and operation lockout in case of D.C. failures. Density monitors are to be so mounted that the contacts do not change on vibration during operation of circuit Breaker.

8.2.7 The auxiliary switch of the breaker shall be positively driven by the breaker operating rod.

8.3 **Spring operated mechanism:**

a) Spring operated mechanism shall be complete with motor in accordance with Chapter 2 - GTR. Opening spring and closing spring with limit switch for automatic charging and other necessary accessories to make the mechanism a complete operating unit shall also be provided.

b) As long as power is available to the motor, a continuous sequence of the closing and opening operations shall be possible. The motor shall have adequate thermal rating for this duty.

c) After failure of power supply to the motor one close open operation shall be possible with the energy contained in the operating mechanism.

d) Breaker operation shall be independent of the motor which shall be used solely for compressing the closing spring. Facility for manual charging of the closing spring shall also be provided. The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring.

e) Closing action of circuit breaker shall compress the opening spring ready for tripping.

f) When closing springs are discharged after closing a breaker, closing springs shall be automatically charged for the next operation and an indication of this shall be provided in the local and remote control cabinet.

g) Provisions shall be made to prevent a closing operation of the breaker when the spring is in the partial charged condition. Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of closing springs when the breaker is already in the closed position.

h) The spring operating mechanism shall have adequate energy stored in the operating spring to close and latch the circuit breaker against the rated making current and also to provide the required energy for the tripping mechanism in case the tripping energy is derived from the operating mechanism.

9.0 SUPPORT STRUCTURE:

a) The structure design shall be such that during operation of circuit breaker vibrations are reduced to minimum.

10.0 TERMINAL CONNECTOR PAD:

The circuit breaker terminal pads shall be made up of high quality electrolytic copper or aluminum and shall be conforming to Australian standard AS-2935

for rated current. The terminal pad shall have protective covers which shall be removed before interconnections.

11.0 INTERPOLE CABLING:

11.1 All cables to be used by contractor shall be armoured and shall be as per IEC-502 (1100 Volts Grade). All cables within & between circuit breaker poles shall be supplied by the CB manufacturer.

11.2 Only stranded conductor shall be used. Minimum size of the conductor for interpole control wiring shall be 1.5 sq.mm. (Copper).

11.3 The cables shall be with oxygen index Min-29 and temp. index as 250°C as per relevant standards.

12.0 FITTINGS AND ACCESSORIES

12.1 Following is a partial list of some of the major fittings and accessories to be furnished by Contractor in the Central Control cabinet. Number and exact location of these parts shall be indicated in the bid.

i) Cable glands (Double compression type), Lugs, Ferrules etc.

ii) Local/remote changeover switch.

iii) Operation Counter

iv) Control switches to cut off control power supply.

v) Fuses as required.

vi) The number of terminals provided shall be adequate enough to wire out all contacts and control circuits plus 24 terminals spare for future use.

vii) Antipumping relay.

viii) Pole discrepancy relay (for electrically ganged CBs).

ix) D.C. Supervision relays.

xi) Rating and diagram plate in accordance with IEC incorporating year of manufacture.

13.0 ADDITIONAL DATA TO BE FURNISHED:

a) Drawing, showing contacts in close, arc initiation, full arcing, arc extinction and open position.

b) The temperature v/s pressure curves for each setting of density monitor alongwith details of density monitor.

c) Data on capabilities of circuit breakers in terms of time and number of operations at duties ranging from 100% fault currents to load currents of the lowest possible value without requiring any maintenance or checks.

d) The effect of non-simultaneity between contacts between poles and also show how it is covered in the guaranteed total break time.

e) Sectional view of non-return couplings if used for SF6 pipes.

f) Details & type of filters used in interrupter assembly and also the operating experience with such filters.

g) Details of SF6 gas:

i) The test methods used in controlling the quality of gas used in the circuit breakers particularly purity and moisture content.

ii) Proposed tests to assess the conditions of the SF6 within a circuit breaker after a period of service particularly with regard to moisture contents of the gas.

h) All duty requirements as applicable to 245/145 kV CBs specified under Clause 2.0 of this Chapter shall be provided with the support of adequate test reports.

14.0 TESTS:

14.1 In accordance with the requirements stipulated under Chapter 2 -GTR the circuit breaker alongwith its operating mechanism shall conform to IEC:62271-100.

14.2 The test reports of the type tests and the following additional type tests shall also be submitted for Purchaser's review:

i) Out of phase closing test as per IEC:62271-100.

ii) Line charging breaking current for proving parameters as per clause no. 15.9 of this Chapter.

iii) Test to demonstrate the Power Frequency withstand capability of breaker in open condition at Zero Gauge pressure and at lockout pressure (Ref. Clause 4.1.1).

iv) Seismic withstand test in unpressurised condition.

v) Verification of the degree of protection.

vi) Static Terminal Load test.

vii) Critical Currents test (if applicable).

14.3 **Routine Tests**

Routine tests as per IEC:62271-100 shall be performed on all circuit breakers.

In addition to the mechanical and electrical tests specified by IEC, the following tests shall also be performed.

1) Speed curves for each breaker shall be obtained with the help of a suitable operation analyser to determine the breaker contact movement during opening, closing, auto-reclosing and trip free operation under normal as well as limiting operating conditions (control voltage pressure etc.). The tests shall show the speed of contacts directly at various stages of operation, travel of contacts, opening time, closing time, shortest time between separation and meeting of contacts at break

   make operation etc. This test shall also be performed at site for which the necessary operation analyser alongwith necessary transducers, cables, console, etc. where included in scope of supply shall be furnished and utilised. In case of substations where operation analyser is existing the bidder shall utilise the same. However necessary adopter and transducers etc. if required shall have to be supplied by the bidder.

2) Measurement of Dynamic Contact resistance measurement for arcing & main contacts. Signature of Dynamic contact resistance measurements shall be taken as reference for comparing the same during operation and maintenance in order to ascertain the healthiness of contacts.

15.0 TECHNICAL PARAMETERS:

(In addition to those indicated in Chapter 2 2-GTR)

I. 245 kV CIRCUIT BREAKER:

A15.1	Rated continuous current(A) at design ambient temperature.	1600/2500 (as applicable)
A15.2	Rated short circuit current breaking capacity at rated voltage	40 kA / 50 kA (as applicable) with percentage DC component as per IEC: 62271-100 corresponding to minimum opening time under operating conditions specified.
A15.3	Symmetrical interrupting capability (kArms)	40 / 50 (as applicable)
A15.4	Rated short circuit making current (kAp)	100 / 125 (as applicable)

A15.5	Short time current carrying capability for one second (kArms)	40 / 50 (as applicable)
A15.6	Rated operating duty	O-0.3sec-CO-3min-CO cycle
A15.7	Reclosing	Single phase & three phase autoreclosing
A15.8	First pole to clear factor	1.3
A15.9	Rated line/cable charging interrupting current at 90 deg. leading power factor angle (A. rms)	As per IEC

(The breaker shall be able to interrupt the rated line/cable charging current with test voltage immediately before opening equal to the product of U/√3 & 1.4 as per IEC: 62271-100).

A15.10	Temperature rise over the design ambient temperature		As per IEC: 62271-100
A15.11	i)	Total break time as per Cl.3.0 of this Chapter (ms)	65
A15.11	ii)	Rated break time as per IEC (ms)	60
A15.12	Total closing time (ms)		Not more than 200
A15.13	Operating mechanism		spring
A15.14	Max. difference in the instants of closing/ opening of contacts (ms)		
	i)	Between poles (opening)	3.3
	ii)	Between poles (closing)	5.0

The above shall be at rated control voltage and rated operating and quenching media pressures.

A15.15	Trip coil and closing coil voltage	220/110 V DC with variation as specified
A15.16	Noise level at base and upto 50 m (distance from base of breaker)	140 dB (Max.)

A15.17	Rated terminal load	As per IEC or as per the value calculated by Chapter 2-GTR, whichever is higher.
A15.18	Auxiliary contacts	Besides requirement of specification, the bidder shall wire up 5 NO + 5 NC contacts for future use of purchaser.
A15.19	No of Terminals in common Control cabinet Purchaser's use.	All Contacts & control circuits to be wired out upto common control cabinet plus 24 terminals exclusively for

II. 145 kV CIRCUIT BREAKER:

B15.1	Rated continuous current(A) at design ambient temperature.	1600
B15.2	Rated short circuit current breaking capacity at rated voltage	31.5 kA with percentage DC component as per IEC: 62271-100 corresponding to minimum opening time under operating conditions specified
B15.3	Symmetrical interrupting capability (kA rms)	31.5
B15.4	Rated short circuit making current (kAp)	80
B15.5	Short time current carrying capability for one second (kA rms)	31.5
B15.6	Out of phase breaking current capacity (kA rms)	As per IEC
B15.6	Rated operating duty	O-0.3sec-CO-3min-CO cycle
B15.7	Reclosing	Single phase (for Line only) & three phase Auto reclosing
B15.8	First pole to clear factor	1.3
B15.9	Rated line/cable charging interrupting current at 90 deg. leading power factor angle (A. rms)	As per IEC

(The breaker shall be able to interrupt the rated line/cable charging current with test voltage immediately before opening equal to the product of U/√3 & 1.4 as per IEC: 62271-100).

B15.10	Temperature rise over the design ambient temperature	As per IEC: 62271-100
B15.11	i) Total break time as per Cl.3.0 of this Chapter (ms)	65
B15.11	ii) Rated break time as per IEC (ms)	60
B15.12	Total closing time (ms)	Not more than 150
B15.13	Operating mechanism	spring
B15.14	Max. difference in the instants of closing/ opening of contacts (ms) between poles at rated control voltage and rated operating and quenching media pressures.	3.3
B15.15	Trip coil and closing coil voltage	220/110 V DC with variation as specified
B15.16	Noise level at base and upto 50 m (distance from base of breaker)	140 dB (Max.)
B15.17	Rated terminal load	As per IEC or as per the value calculated by Chapter-GTR, whichever is higher.
B15.18	Auxiliary contacts	Besides requirement of specification, the bidder shall wire up 5 NO + 5 NC contacts for future use of Purchaser.
B15.19	No. of Terminals in common control cabinet	All contacts & control circuits to be wired out up to common control cabinet plus 24 terminals exclusively for Purchaser's use.

III 33kV VACUUM CIRCUIT BREAKER

a)Rated operating duty cycle	0-3min-CO-3 min-CO
b)First pole to clear factor	1.3
c)Rated line/cable charging interrupting	As per IEC

current at 90 deg. Leading power factor angle (A rms)	
(The breaker shall be able to interrupt the rated line/cable charging current with test voltage immediately before opening equal to the product of U/(root)3 & 1.4 as per IEC – 62271-100)	
e)Rated break-time as per IEC (ms)	45
f)Total closing time (ms)	Not more than 80
g)Operating mechanism	Pneumatic/Spring/Hydraulic/ or a combination of these
h) Max. difference in the instants of closing/opening of contacts between poles at rated control voltage and rated operating and quenching media pressures (ms).	3.3
i) Trip coil & closing coil voltage	220/110V DC with variation as specified
j) Noise level at base of CB and up to 50 mtr. distance from base of CB.	140 db (max)
k) Rated terminal load	As per IEC
l) Auxiliary contracts (Auxiliary switch shall also comply with requirements stipulated under chapter 2 GTR)	Besides requirement of specification, the bidder shall wire up to 5 NO + 5 NC contacts for future use of owner.
m) No. of Terminals in Common Control cabinet	All Contacts & control circuits to be wired out up to common control cabinet plus 24 terminals exclusively for owners's use.
n)Rated continuous current at design ambient temperature (amp).	2500/1600/1250/800 (as applicable)
o)Rated short circuit current breaking capacity at total voltage.	25 KA with percentage DC component as per IEC-62271-100 corresponding to minimum opening time & operating conditions specified.
p) Symmetrical interrupting capability (KA,rms)	25
q) Rated short circuit making current (KAP)	As per IEC
r)Short time current carrying capability for 3 second (KA,rms)	25
s)Reclosing	Three phase auto reclosing

16.0 PRE-COMMISSIONING TESTS

16.1 An indicative list of tests is given below. All routine tests except power frequency voltage dry withstand test on main circuit breaker shall be repeated on the completely assembled breaker at site. Contractor shall perform any additional test based on specialties of the items as per the field Q.P./instructions of the equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Employer for approval.

(a) Insulation resistance of each pole.

(b) Check adjustments, if any suggested by manufacturer.

(c) Breaker closing and opening time.

(d) Slow and Power closing operation and opening.

(e) Trip free and anti-pumping operation.

(f) Minimum pick-up voltage of coils.

(g) Dynamic Contact resistance measurement.

(h) Functional checking of control circuits interlocks, tripping through protective relays and auto reclose operation.

(i) Insulation resistance of control circuits, motor etc.

(j) Resistance of closing and tripping coils.

(k) SF6 gas leakage check.

(l) Dew Point Measurement

(m) Operation check of pressure switches and gas density monitor during gas filling.

(n) Checking of mechanical 'CLOSE' interlock, wherever applicable.

(o) Resistance measurement of main circuit.

(p) Checking of operating mechanisms

(q) Check for annunciations in control room.

16.2 The contractor shall ensure that erection, testing and commissioning of circuit breaker shall be carried out under the supervision of the circuit breaker manufacturer's representative. The commissioning report shall be signed by the manufacturer's representative.

TECHNICAL SPECIFICATION

VOL-II, SEC-IV

SWITCHGEAR, ISOLATORS

CONTENTS

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10.0	Spare Parts & Mandatory Maintenance Equipment
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SECTION - IV
SWITCHGEAR ISOLATORS

1.0 GENERAL:

1.1 The Isolators and accessories shall conform in general to IEC: 62271-102, IS: 9921 except to the extent explicitly modified in specification and shall be in accordance with requirement of Section 2-GTR.

1.2 Isolators shall be outdoor, off-load type. Earth switches shall be provided on isolators wherever called for, with possibility of being mounted on any side of the isolator. 220 kV & below rated isolators shall be double break type, unless specified otherwise.

1.3 Complete isolator with all the necessary items for successful operation shall be supplied including but not limited to the following:

1.3.1 Isolator assembled with complete Support Insulators, operating rod insulator, base frame, linkages, operating mechanism, control cabinet, interlocks etc.

1.3.2 All necessary parts to provide a complete and operable isolator installation, control parts and other devices whether specifically called for herein or not.

1.3.3 The isolator shall be designed for use in the geographic and meteorological conditions as given in Section 2-GTR.

2.0 DUTY REQUIREMENTS:

a) Isolators and earth switches shall be capable of withstanding the dynamic and thermal effects of the maximum possible short circuit current of the systems in their closed position. They shall be constructed such that they do not open under influence of short circuit current.

b) The earth switches, wherever provided, shall be constructionally interlocked so that the earth switches can be operated only when the isolator is open and vice versa. The constructional interlocks shall be built in construction of isolator and shall be in addition to the electrical interlocks. Suitable mechanical arrangement shall also be provided for delinking electrical drive for manual operation.

c) In addition to the constructional interlock, isolator and earth switches shall have provision to prevent their electrical and manual operation unless the associated and other interlocking conditions are met. All these interlocks shall be of fail-safe type. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply and within a variation range as stipulated in Section 2-GTR.

d) The earthing switches shall be capable of discharging trapped charges of the associated lines.

e) The isolator shall be capable of making/breaking normal currents when no significant change in voltage occurs across the terminals of each pole of isolator on account of make/break operation.

f) Isolator rated for above 72.5 kV shall be of extended mechanical endurance class - M2 as per IEC-62271-102. Isolator rated for 72.5 kV and below shall be of extended mechanical endurance class - M1 as per IEC-62271-102. All earth switches shall be of M0 duty**.**

3.0 CONSTRUCTIONAL FEATURES:

The features and constructional details of Double Break Isolators, earth switches and accessories shall be in accordance with requirements stated hereunder:

3.1 **Contacts:**

a) The contacts shall be self-aligning and self-cleaning and so designed that binding cannot occur after remaining closed for prolonged periods of time in a heavily polluted atmosphere.

b) No undue wear or scuffing shall be evident during the mechanical endurance tests. Contacts and spring shall be designed so that readjustments in contact pressure shall not be necessary throughout the life of the isolator or earthing switch. Each contact or pair of contacts shall be independently sprung so that full pressure is maintained on all contacts at all time.

c) Contact springs shall not carry any current and shall not loose their characteristics due to heating effects.

d) The moving contact of double break isolator shall have turn-and -twist type or other suitable type of locking arrangement to ensure adequate contact pressure.

3.2 **Base :**

Each single pole of the isolator shall be provided with a complete galvanised steel base provided with holes and designed for mounting on a supporting structure.

3.3 **Blades :**

a) All metal parts shall be of non-rusting and non-corroding material. All current carrying parts shall be made from high conductivity electrolytic

copper/aluminium. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts, shall be made of copper silicon alloy or stainless steel or equivalent. The bolts or pins used in current carrying parts shall be made of non-corroding material. Ferrous parts, other than stainless steel shall not be used in close proximity of main current path. All ferrous castings, if used elsewhere shall be made of malleable cast iron or cast-steel. No grey iron shall be used in the manufacture of any part of the isolator.

b) The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona rings shall be provided. **Corona shields are not acceptable.** Corona rings shall be made up of aluminum/aluminum alloy.

c) Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks, or accidental touching of the connecting rods of the operating mechanism.

d) The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals. i.e. after every 1000 operations or after 5 years whichever is earlier.

3.4 **Insulator :**

a) The insulator shall conform to or IEC-60168. The porcelain of the insulator shall conform to the requirements stipulated under Section 2-GTR and shall have a minimum cantilever strength of **1000**/600 Kgs. for 245/145 kV insulators respectively.

b) Pressure due to the contact shall not be transferred to the insulators after the main blades are fully closed.

c) The parameters of the insulators shall meet the requirements specified under Section 2-GTR.

d) Insulator shall be type and routine tested as per IEC-60168**.**

e) For 245 kV Insulator: (For Isolator)

Top PCD	=	127 mm
No. of holes	=	4 x M16
Bottom PCD	=	**275 mm**
No. of holes	=	8 x 18 dia

f) For 145 kV Insulator: (For Isolator)

Top PCD	=	127 mm
No. of holes	=	4 x M16
Bottom PCD	=	254 mm

No. of holes = 8 x 18 dia

3.5 **Name Plate :**

The name plate shall conform to the requirements of IEC incorporating year of manufacture.

4.0 EARTHING SWITCHES :

a) Where earthing switches are specified these shall include the complete operating mechanism and auxiliary contacts.

b) The earthing switches shall form an integral part of the isolator and shall be mounted on the base frame of the isolator.

c) Earthing switches shall be only locally operated.

d) The earthing switches shall be constructionally interlocked with the isolator so that the earthing switches can be operated only when the isolator is open and vice versa. The constructional interlocks shall be built in construction of isolator and shall be in addition to the electrical interlocks. Suitable mechanical arrangement shall be provided for de-linking electrical drive for manual operation.

e) Each earth switch shall be provided with flexible copper/aluminum braids for connection to earth terminal. These braids shall have the same short time current carrying capacity as the earth blade. The transfer of fault current through swivel connection will not be accepted.

f) The plane of movement and final position of the earth blades shall be such that adequate electrical clearances are obtained from adjacent live parts in the course of its movement between ON and OFF position.

g) The frame of each isolator and earthing switches shall be provided with two reliable earth terminals for connection to the earth mat.

h) Isolator design shall be such as to permit addition of earth switches at a future date. It should be possible to interchange position of earth switch to either side.

i) The earth switch should be able to carry the same fault current as the main blades of the Isolators and shall withstand dynamic stresses.

5.0 OPERATING MECHANISM :

a) The bidder shall offer motor operated Isolators and earth switches. Isolators of 36 kV and below and earth switches of 72.5 kV and below rating shall be manual operated.

b) Control cabinet/operating mechanism box shall conform to the requirement stipulated in Section 2-GTR and shall be made of cast aluminium/aluminum sheet of adequate thickness (minimum 3 mm) .

c) A "Local/Remote" selector switch and a set of open/ close push buttons shall be provided on the control cabinet of the isolator to permit its operation through local or remote push buttons.

d) Provision shall be made in the control cabinet to disconnect power supply to prevent local/remote power operation.

e) Motor shall be an AC motor and conform to the requirements of Section 2-GTR.

f) Suitable reduction gearing shall be provided between the motor and the drive shaft of the isolator. The mechanism shall stop immediately when motor supply is switched off. If necessary a quick electromechanical brake shall be fitted on the higher speed shaft to effect rapid braking.

g) Manual operation facility (with handle) should be provided with necessary interlock to disconnect motor.

h) Gear should be of forged material suitably chosen to avoid bending/jamming on operation after a prolonged period of non operation. Also all gear and connected material should be so chosen/surface treated to avoid rusting.

i) The test report for blocked rotor test of motor shall be submitted as per the requirement of clause 23.0 of Section 2: GTR of Technical Specification.

j) Only stranded conductor shall be used for wiring. Minimum size of the conductor for control circuit wiring shall be 1.5 sq.mm. (Copper).

k) The operating mechanism shall be located such that it can be directly mounted on any one of the support structure.

6.0 OPERATION :

a) The main Isolator and earth switches shall be gang operated in case of 245kV,145 kV & 36kV. However, 245 kV Tandem Isolators shall be individual-pole operated. The operating mechanism of the three poles shall be well synchronized and interlocked.

b) The design shall be such as to provide maximum reliability under all service conditions. All operating linkages carrying mechanical loads shall be designed for negligible deflection. The length of inter insulator and interpole operating rods shall be capable of adjustments, by means of screw thread which can be locked with a lock nut after an adjustment has

been made. The isolator and earth switches shall be provided with "over center" device in the operating mechanism to prevent accidental opening by wind, vibration, short circuit forces or movement of the support structures.

c) Each isolator/pole of isolator and earthswitch shall be provided with a manual operating handle enabling one man to open or close the isolator with ease in one movement while standing at ground level. Non-detachable type manual operating handle shall have provision for padlocking. For detachable type manual operating handles, suitable provision shall be made inside the operating mechanism box for parking the detached handles. The provision of manual operation shall be located at a convenient operating height from the base of isolator support structure.

d) The isolator shall be provided with positive continuous control throughout the entire cycle of operation. The operating pipes and rods shall be sufficiently rigid to maintain positive control under the most adverse conditions and when operated in tension or compression for isolator closing. They shall also be capable of withstanding all torsional and bending stresses due to operation of the isolator. Wherever supported the operating rods shall be provided with bearings on either ends. The operating rods/ pipes shall be provided with suitable universal couplings to account for any angular misalignment.

e) All rotating parts shall be provided with grease packed roller or ball bearings in sealed housings designed to prevent the ingress of moisture, dirt or other foreign matter. Bearings pressure shall be kept low to ensure long life and ease of operation. Locking pins wherever used shall be rustproof.

f) Signaling of closed position shall not take place unless it is certain that the movable contacts, have reached a position in which rated normal current, peak withstand current and short time withstand current can be carried safely. Signaling of open position shall not take place unless movable contacts have reached a position such that clearance between contacts is atleast 80% of the isolating distance.

g) The position of movable contact system (main blades) of each of the Isolators and earthing switches shall be indicated by a mechanical indicator at the lower end of the vertical rod of shaft for the Isolators and earthing switch. The indicator shall be of metal and shall be visible from operating level.

h) The contractor shall furnish the following details alongwith quality norms, during detailed engineering stage.

   (i) Current transfer arrangement from main blades of isolator alongwith milli volt drop immediately across transfer point.

(ii) Details to demonstrate smooth transfer of rotary motion from motor shaft to the insulator alongwith stoppers to prevent over travel.

7.0 TERMINAL CONNECTOR STUD/PAD:

The isolator terminal pads/studs shall be made of high quality copper or aluminium and shall be conforming to Australian standard AS-2935 for rated current. The terminal pad shall have protective covers which shall be removed before interconnections.

8.0 SUPPORT STRUCTURE:

245/145/36 kV Isolators shall be suitable for mounting on support structures to be supplied in accordance with stipulations of Section 2-GTR.

9.0 TESTS:

9.1 In continuation to the requirements stipulated under Section 2-GTR the isolator alongwith its earthing switch and operating mechanism should have been type tested as per IEC and shall be subjected to routine tests in accordance with IEC-62271-102. — Minimum 1000 Nos. mechanical operations in line with mechanical endurance test, M0 duty, shall be carried out on 1 (one) isolator out of every lot of Isolators, assembled completely with all accessories, as acceptance test for the lot. The travel characteristics measured at a suitable location in the base of insulator along with motor current/power drawn, during the entire travel duration are to be recorded at the start and completion and shall not vary by more than (+/-) 10% after completion of 1000 cycles of operation. After completion of test, mechanical interlock operation to be checked**.**

9.2 The test reports of the type tests and the following additional type tests (additional type tests are required for isolators rated above 72.5 kV only) shall also be submitted for the Purchaser's review.

(i) Radio interference voltage test.

(ii) Seismic withstand test on isolator mounted on Support structure. The test shall be performed in the following position :

Isolator open	E/S Closed
Isolator open	E/S Open
Isolator Closed	E/S Open

10.0 SPARE PARTS AND MAINTENANCE EQUIPMENT:

Bidder shall include in his proposal mandatory spare parts in accordance with the requirements stipulated in Section 1 - PSR.

11.0 TECHNICAL PARAMETERS:
(In addition to those specified under Section 2-GTR)

I. 245 kV ISOLATORS:

A11.1	Type	Outdoor
A11.2	Rated current at 50°C ambient temperature	1600A / 2500 A (As applicable).
A11.3	Rated short time withstand current of isolator and earth switch (for 1 Sec.)	40 kA/ 50 kA (as applicable)
A11.4	Rated dynamic short circuit withstand current of isolator and earth switch	100 kAp / 125 kAp (as applicable)
A11.5	Temperature rise over design ambient temperature	As per table V of IEC-694.
A11.6	Rated mechanical terminal load	As per table III of IEC-62271-102 or as per value calculated in Section 2-GTR whichever is higher.
A11.7	Operating mechanism of isolator/earth switch	A.C. Motor operated
A11.8	No. of auxiliary contacts on each isolator	Besides requirement of this spec., the bidder shall wire up 5 NO + 5 NC to TBs (Reversible) for Purchaser's future use.
A11.9	No. of auxiliary contacts on each earthing switch	Besides requirement of this spec., the bidder shall wire up 3 NO + 3 NC to TBs (Reversible) for Purchaser's future use.
A11.10	Operating time	15 sec. or less
A11.11	Number of terminal in control cabinet (Interpole cabling shall be supplied by Contractor)	All contacts & control circuits are to be wired upto control cabinet plus 24 spare terminals evenly distributed.

II. 145 kV ISOLATORS:

B11.1	Type	Outdoor

B11.2	Rated current at 50°C ambient temperature	1250A / 1600 A (As applicable)
B11.3	Rated short time withstand current of isolator and earth switch	31.5 kA for 1 Sec.
B11.4	Rated dynamic short circuit withstand current of isolator and earth switch	80 kAp
B11.5	Temperature rise over design ambient temperature	As per table V of IEC-694.
B11.6	Rated mechanical terminal load.	As per table III of IEC-62271-102 or as per value calculated in Section 2-GTR whichever is higher.
B11.7	Operating mechanism of isolator/earth switch	A.C. Motor operated
C11.8	No. of auxiliary contacts on each isolator	Besides requirement of this spec., 5 NO + 5 NC to contacts, wired to terminal block exclusively for Purchaser's use in future.
B11.9	No. of auxiliary contacts on each earthing switch	Besides requirement of this spec., the bidder shall wire up 3 NO + 3 NC to TBs (Reversible) for Purchaser's future use.
B11.10	Operating time	15 sec. or less
B11.11	Number of terminal in control cabinet (Interpole cabling shall be supplied by Contractor)	All contacts & control circuits are to be wired upto control cabinet plus 24 spare terminals evenly distributed.

III. 33kV ISOLATOR

C11.1	Type	Outdoor (Double Break)
C11.2	Temperature rise over design ambient temperature	As per table V of IEC 62271-1
C11.3	Rated mechanical terminal load	As per table-III of IEC 62271-102

		IEC 129(1984) or as per value calculated in Section 2- GTR whichever is higher
C11.4	Number of terminals in control cabinet (Interpole cabling shall be Supplied by contractor)	All contacts and control circuits are to be wired upto control cabinet plus 24 terminals exclusively for Owner's use.
C11.5	Rated current at design ambient temperature	2500/1600/1250/800Amps(as applicable).
C11.6	Rated short time withstand current of isolator and earthswitch	25 kA for 3 Sec
C11.7	Rated dynamic short circuit withstand current of isolator and earth switch	As per IEC
C11.8	Operating mechanism for Isolator and Earth switch	Manual
C11.9	No. of auxiliary contacts on each isolator	5 NO + 5 NC contacts, wired to terminal block exclusively for Owner's use in future.
C11.10	No. of auxiliary contacts on each earthing switch	3 NO + 3 NC contacts wired to terminal block exclusively for Owner's use in future.

C.I The porcelain of the 36 kV insulators shall have minimum cantilever strength of 450 KGS

C.II 33 kV Isolator shall be gang operated for main blades and earth switches.

12.0 PRE-COMMISSIONING TESTS

12.1 An indicative list of tests on isolator and earthswitch is given below. Contractor shall perform any additional test based on specialties of the items as per the field Q.P./instructions of the equipment Supplier or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

(a) Insulation resistance of each pole.

(b) Manual and electrical operation and interlocks.

(c) Insulation resistance of control circuits and motors.

(d) Ground connections.

(e) Contact resistance.

(f) Proper alignment so as to minimize vibration during operation.

(g) Measurement of operating Torque for isolator and Earth switch.

(h) Resistance of operating and interlocks coils.

(i) Functional check of the control schematic and electrical & mechanical interlocks.

(j) 50 operations test on isolator and earth switch.

12. 2 The contractor shall ensure that erection, testing and commissioning of Isolators above 72.5 kV class shall be carried out under the supervision of the Isolator manufacturer's representative. The commissioning report shall be signed by the manufacturer's representative.

TECHNICAL SPECIFICATION

VOL-II, SEC-V

SWITCHGEAR, INSTRUMENT TRANSFORMER

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SECTION - V
SWITCHGEAR
INSTRUMENT TRANSFORMERS

1.0 GENERAL:

1.1 The instrument transformers and accessories shall conform to the latest version of the standards specified below except to the extent explicitly modified in the specification and shall be in accordance with the requirements in Section 2-GTR.

Current Transformers IEC: 60044-1

Capacitive Voltage Transformers IEC:60044-5 / IEC-60358

Inductive Voltage Transformers IEC:60044-2

1.2 The instrument transformers shall be complete with its terminal box and a common marshalling box for a set of 3 instrument transformers.

1.3 The external surface of instrument transformer, if made of steel, shall be hot dip galvanized or painted as per **Section 2-GTR.**

1.4 The impregnation details alongwith tests/checks to ensure successful completion of impregnation cycle shall be furnished for approval.

1.5 The instrument transformers shall be designed for use in geographic and meteorological conditions as given in Section 2-GTR.

2.0 CONSTRUCTION FEATURES:

The features and constructional details of instrument transformers shall be in accordance with requirements stipulated hereunder:

2.1 a) Instrument transformers shall be of 245/145 kV class, oil filled/ SF6 gas filled, suitable for outdoor service and upright mounting on steel structures. 245/145 kV Instrument transformers shall be with shedded porcelain/ polymer bushings/Insulators

b) Bushings/Insulators shall conform to requirements stipulated in Section-GTR. The bushing/insulator for CT shall be one piece without any metallic flange joint.

c) Oil filling and drain plugs, oil sight glass shall be provided for CT and for electromagnetic unit of CVT etc. The Instrument transformer shall have cantilever strength of not less than 350 kg **for** 245kV and 145 kV Instrument transformers. For CVT with polymer housing, the cantilever strength shall not be less than 150kg. Oil filling and drain plugs are not required with SF6 gas filled CT.

d) Instruments transformers shall be hermetically sealed units. Bidder/ Manufacturer shall furnish details of the arrangements made for the sealing of instrument transformers *during detailed engineering*.

Bidder/Manufacturer shall also furnish the details of site tests to check the effectiveness of hermetic sealing for approval.

e) Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.

f) In case of SF_6 filled CTs/Inductive VTs, it shall be provided with a suitable SF_6 gas density monitoring device, with NO/NC contacts to facilitate the remote annunciation and tripping in case of SF_6 leakage. Provisions shall be made for online gas filling. Suitable rupture disc shall be provided to prevent explosion.

2.2 **Terminal box/Marshalling Box:**

Terminal box shall conform to the requirements of Section 2-GTR.

2.3 **Insulating Oil:**

a) Insulating oil to be used for instrument transformers shall be of EHV grade and shall conform to IEC - 60296 (required for first filling). Non–PCB based synthetic insulating oil conforming to IEC 60867 can also be used in the capacitor units of CVT with specific approval from the owner, the proposal for which shall be submitted during detailed engineering stage.

b) The SF6 gas shall comply with IEC-60376, 60376A and 60376B and shall be suitable in all respects for use in the switchgear under operating conditions.

2.4 **Name Plate:**

Name plate shall conform to the requirements of IEC incorporating the year of manufacture. The rated current, extended current rating in case of current transformers and rated voltage, voltage factor in case of voltage transformers shall be clearly indicated on the name plate. The rated thermal current in case of CT shall also be marked on the name plate.

The intermediate voltage in case of capacitor voltage transformer shall be indicated on the name plate.

3.0 CURRENT TRANSFORMERS:

a) Current transformers shall have single primary either ring type, or hair pin type and suitably designed for bringing out the secondary terminals in a weather proof (IP 55) terminal box at the bottom. PF Terminal for measurement of tan delta and capacitance of the unit shall be provided. These secondary terminals shall be terminated to stud type non disconnecting terminal blocks inside the terminal box. In case “Bar primary” inverted type

current transformers are offered the manufacturer will meet following additional requirements:

(i) The secondaries shall be totally encased in metallic shielding providing a uniform equipotential surface for even electric field distribution.

(ii) The lowest part of the insulation assembly shall be properly secured to avoid any risk of damage due to transportation stresses.

(iii) The upper part of insulation assembly resting on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly & top dome.

(iv) Nitrogen if used for hermetic sealing (in case of live tank design) should not come in direct contact with oil.

(v) Bidder/Manufacturer shall recommend whether any special storage facility is required for spare CT.

b) Different ratios specified shall be achieved by secondary taps only and primary reconnection shall not be accepted.

c) Core lamination shall be of cold rolled grain oriented silicon steel or other equivalent alloys. The cores used for protection shall produce undistorted secondary current under transient conditions at all ratios with specified CT parameters.

d) The expansion chamber at the top of the porcelain insulators should be suitable for expansion of oil.

e) Facilities shall be provided at terminal blocks in the marshalling box for star delta formation, short circuiting and grounding of CT secondary terminals.

f) Current transformer's guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.

g) For 245/145 kV class CTs, the rated extended primary current shall be 120% (or 150% if applicable) on all cores of the CTs as specified in the Section 1 – GTS.

h) For 245/145 kV current transformer, characteristics shall be such as to provide satisfactory performance of burdens ranging from 25% to 100% of rated burden over a range of 5% to 120%(or specified rated extended current whichever is higher) of rated current in case of metering CTs and up to the accuracy limit factor/knee point voltage in case of relaying CTs.

i) The current transformer shall be suitable for horizontal transportation. It shall be ensured that the CT is able to withstand all the stresses imposed on it while transporting and there shall be no damage in transit. The Contractor shall submit the details of packing design to the Purchaser for review.

j) For 245/145 kV CTs the instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CTs/reactor are used in the current transformers then all parameters specified shall have to be met treating auxiliary CTs as an integral part of the current transformer. The auxiliary CTs/reactor shall preferably be inbuilt construction of the CTs. In case these are to be mounted separately these shall be mounted in the central marshalling box suitably wired upto the terminal blocks.

k) The wiring diagram plate for the interconnections of the three single phase CTs shall be provided inside the marshalling box.

l) The current transformers should be suitable for mounting on lattice support structure or pipe structure to be provided by the Contractor in accordance with stipulations of Section 2-GTR.

m) The CT shall be so designed as to achieve the minimum risks of explosion in service. Bidder/Manufacturer shall bring out in his offer, the measures taken to achieve this.

n) 245/145 kV current transformers shall be suitable for high speed auto reclosing.

4.0 VOLTAGE TRANSFORMERS:

a) 245/145 kV Voltage transformers shall be capacitor voltage divider type with electromagnetic units and shall be suitable for carrier coupling. 36kV Voltage transformers shall be Inductive Type.

b) Voltage transformers secondaries shall be protected by HRC cartridge type fuses for all the windings. In addition fuses shall be provided for the protection and metering windings for fuse monitoring scheme. The secondary terminals of the VTs shall be terminated to the stud type non - disconnecting terminal blocks in the individual phase secondary boxes via the fuse.

c) VTs shall be suitable for high frequency (HF) coupling required for power line carrier communication. Carrier signal must be prevented from flowing into potential transformer (EMU) circuit by means of a RF choke/reactor suitable for effectively blocking the carrier signals over the entire carrier frequency range i.e. 40 to 500 KHz. Details of the arrangement shall be furnished along with the bid. H.F. terminal of the VT shall be brought out through a suitable bushing and shall be easily accessible for connection to the coupling filters of the carrier communication equipment, when utilised. Further, earthing link with fastener to be provided for HF terminal.

d) The electromagnetic unit comprising compensating reactor, intermediate transformer and protective and damping devices should have separate terminal box with all the secondary terminals brought out.

e) The damping device, which should be permanently connected to one of the secondary windings, should be capable of suppressing the ferroresonance oscillations.

f) The accuracy of 0.2 on secondary III for all VTs should be maintained through out the entire burden range upto 50 VA on all the windings without any adjustments during operation.

g) 245/145 kV VTs shall be suitable for mounting on Lattice Structure/ tubular GI pipe as required .

h) It should be ensured that access to secondary terminals is without any danger of access to high voltage circuit.

i) A protective surge arrester shall be provided *if required,* to prevent breakdown of insulation by incoming surges and to limit abnormal rise of terminal voltage of shunt capacitor/primary winding, tuning reactor/RF choke etc. due to short circuit in transformer secondaries. In case of an alternate arrangement, bidder shall bring out the details in the bid.

j) The wiring diagram for the interconnection of the three single phase CVTs shall be provided inside the marshalling box in such a manner that it does not deteriorate with time.

5.0 TERMINAL CONNECTORS:

The terminal connectors shall meet the requirements as given in Section 2-GTR.

6.0 TESTS:

6.1 In accordance with the requirements in Section-GTR, Current and Voltage Transformers should have been type tested and shall be subjected to routine tests in accordance with IEC:60044-1 and IEC: 60044-5/60044-2 respectively.

6.2 The test reports of the type tests and the following additional type tests (additional type tests are required for Instrument Transformers, rated above 72.5 kV only) shall also be submitted for the Purchaser's review.

a) **Current Transformers:**

i) Radio interference voltage test as per IEC 60044-1.

ii) Seismic withstand test.

iii) Thermal stability test, i.e. application of rated voltage and rated extended thermal current simultaneously by synthetic test circuit. (not applicable for SF6 filled CT)

iv) Thermal co-efficient test i.e. measurement of tan delta as a function of temperature (at ambient and between 80°C & 90°C) and voltage (at 0.3, 0.7, 1.0 and 1.1 Um/√3) (not applicable for SF6 filled CT)

v) The current transformer shall be subjected to Multiple chopped impulse test (not applicable for SF6 filled CT) by any one of the following two methods given below to assess the CT performance in service to withstand the high frequency over voltage generated due to closing & opening operation of isolators. Alternatively, method as per IEC:60044-1 may be followed:

Method I*: 600 negative polarity lightning impulses chopped on crest will be applied to current transformer. The opposite polarity amplitude must be limited to 50% of crest value when the wave is chopped. One impulse per minute shall be applied and every 50 impulse high frequency currents form the windings and total current to earth will be recorded and be compared with reference currents recorded applying one or more (max 20) reduced chopped impulses of 50% of test value.*

Oil samples will be taken before and 3 days after the test. Gas analysis must not show appreciable rate of increase in various gases related with the results of the analysis performed before test.

Total sum of crest values of current through secondaries must not exceed 5% of the crest value of total current to earth.

CT must withstand dielectric tests after this test to pass the test.

Method II*: 100 negative polarity impulses with a rise and fall time of less than 0.25 microsecond corrected to atmospheric condition shall be applied at one minute interval and total current through insulation of earth will be recorded. The amplitude of first opposite polarity should be limited to 50% of the chopped impulse crest value. Voltage and total current wave shapes shall be recorded after every 10 impulses, and will be compared with reference wave shapes recorded before test at 50% of test values.*

Oil sample shall be taken before and 3 days after the test and CT shall be deemed to have passed the test if the increase in gas content before and after test is not appreciable.

b) **Voltage transformers:**

i) High frequency capacitance and equivalent series resistance measurement (as per IEC-60358) for CVT.

ii) Seismic withstand test.

iii) Stray capacitance and stray conductance measurement of the low voltage terminal (as per IEC-60358) for CVT.

iv) Determination of temperature coefficient test (as per IEC-60358).

v) Radio interference voltage test as per IEC-60044-5/IEC-60044-2. However the RIV level shall be as specified in clause Major Technical Parameters in Section-GTR.

vi) Apart from the above, report of all special tests mentioned in IEC-60044-5 for Capacitive voltage transformer shall also be submitted for approval.

6.3 The current and voltage transformer shall be subjected to the following routine tests in addition to routine tests as per IEC.

a) **CURRENT TRANSFORMERS:**

ROUTINE TESTS:

for Oil filled CTs

i) Measurement of Capacitance.

ii) Oil leakage test.

iii) Measurement of tan delta at 0.3, 0.7, 1.0 and 1.1 Um/√3.

for SF6 filled CTs

i) Dew point measurement

ii) SF6 alarm/ lockout check.

iii) SF6 leakage test. Gas leakage rate shall be maintained within 0.2% per annum.

b) **VOLTAGE TRANSFORMERS:**

Routine tests on Capacitive voltage transformer shall be done in line with IEC-60044-5.

7.0 SPARE PARTS AND MAINTENANCE EQUIPMENT:

The Bidder shall include in his proposal spare parts equipment in accordance with Section-Project.

8.0 TECHNICAL PARAMETERS:

A. 245 kV CURRENT TRANSFORMERS:

A8.1	Rated Primary current	1600/800 A (As applicable)
A8.2	Rated short time thermal current	40 kA for 1 sec/50 kA for 1 sec. (as applicable)
A8.3	Rated dynamic current kA (peak)	100 / 125 (as applicable)
A8.4	Maximum temperature rise over design ambient temperature	As per IEC:60044-1

A8.5	One minute power frequency withstand voltage sec. terminal & earth	5 kV
A8.6	Number of terminals	All terminals of control circuits are to be wired upto marshaling box plus 20% spare terminals evenly distributed on all TBs.
A8.7	Type of insulation	Class A

Current transformers shall also comply with requirements of Table - IIA.

B. 145 kV CURRENT TRANSFORMERS:

B8.1	Rated Primary current	1250A
B8.2	Rated short time thermal current	31.5 kA for 1 sec.
B8.3	Rated dynamic current	80 kA (peak)
B8.4	Maximum temperature rise over design ambient temperature	As per IEC:60044-1
B8.5	One minute power frequency withstand voltage sec. terminal & earth	5 kV
B8.6	Number of terminals	All terminals of control circuits are to be wired upto marshaling box plus 20% spare terminals evenly distributed on all TBs.
B8.7	Type of insulation	Class A

Current transformers shall also comply with requirements of Table – IIB/ or IIC as applicable.

C. 33 kV CURRENT TRANSFORMERS:

C8.1	Rated Primary current -	2000/1200 A(as applicable)
C8.2	Rated Extended Primary current	150%/120% (on all cores)
C8.3	Rated short time thermal Current	25 kA for 3 sec.
C8.4	Rated dynamic current	As per IEC

C8.5.	Maximum temperature rise over design ambient Temperature	As per IEC:44-1
C8.6.	One minute power frequency with stand voltage sec. terminal & earth	5 kV
C8.7	Number of terminals	All terminals of control circuits are to be wired upto marshaling box plus 20% spare terminals evenly distributed on all TBs.
C8.8	Type of insulation	Class A

Current transformers shall also comply with requirements of Table IID/IIE as applicable.

D. 245 KV VOLTAGE TRANSFORMERS:

D8.1	System fault level (for 1 second)	40 kA / 50 kA (as applicable)
D8.2	Standard reference range of frequencies for which the accuracies are valid	96% to 102% for protection and 99% to 101% for measurement
D8.3	High frequency capacitance entire carrier frequency range	Within 80% to 150% of ratedfor capacitance **(for CVT only)**
D8.4	Equivalent series resistance over the entire carrier frequency range	Less than 40 ohms **(for CVT only)**
D8.5	Stray capacitance and stray conductance of the LV terminal over entire carrier frequency range	As per IEC:358 **(for CVT only)**
D8.6	One minute power frequency withstand voltage:	
	i) Between LV (HF) terminal and earth terminal	10 kV (rms) for exposed terminals and 4 KV (rms) for terminals enclosed in a weather proof box
	ii) For secondary winding	3 kV (rms)

D8.7	Maximum temperature rise over design ambient temperature	As per IEC:60044-2 or 60044-5
D8.8	Number of terminals in control cabinet (interpole cabling is to be supplied by Purchaser)	All terminals are wired up to marshaling box plus 12 terminals exclusively for Purchaser's use.
D8.9	Rated Total Thermal burden (VA)	300 (100VA/winding)

Voltage Transformers shall also comply with the requirements of Table-IA of this Section.

E. 145 KV VOLTAGE TRANSFORMERS:

E8.1	System fault level	31.5 kA for 1 second
E8.2	Standard reference range of frequencies for which the accuracies are valid	96% to 102% for protection and 99% to 101% for measurement
E8.3	High frequency capacitance for entire carrier frequency range	Within 80% to 150% of rated capacitance **(for CVT only)**
E8.4	Equivalent series resistance over the entire carrier frequency range	Less than 40 ohms **(for CVT only)**
E8.5	Stray capacitance and stray conductance of the LV terminal over entire carrier frequency range	As per IEC:358 **(for CVT only)**
E8.6	One minute power frequency withstand voltage:	
	i) Between LV (HF) terminal and earth terminal	10 kV (rms) for exposed terminals and 4 KV (rms) for terminals enclosed in a weather proof box
	ii) For secondary winding	3 kV (rms)
E8.7	Maximum temperature rise over design ambient temperature	As per IEC:60044-2 or 60044-5
E8.8	Number of terminals in control cabinet (interpole pole cabling is to be supplied by Purchaser)	All terminals are wired upto marshaling box plus 12 terminals exclusively for Purchaser's use.

E8.9	Rated Total Thermal burden (VA)	300 (100VA/winding)

Voltage Transformers shall also comply with the requirements of Table-IB of this Section.

F. 33 kV POTENTIAL TRANSFORMERS

F8.1	**System Fault level**	25kA for 3 sec
F8.2	Standard reference range of Frequencies for which the Accuracies are valid	96% to 102% for protection and 99% to 102% for measurement
F8.3	One minute power frequency Withstand voltage:	
	i) Between LV terminal and earth terminal	10kVrms for exposed terminals and 4kVrms for terminals enclosed in a weather proof box.
	ii) For secondary winding	2 kV rms
F8.4	Maximum temperature rise over design ambient temperature	As per IEC 186
F8.5	Number of terminals in control Cabinet	All terminals of control circuits are wired upto marshalling box Plus spare 20% terminals evenly distributed on all TBs
F8.6	Rated total thermal burden	75 VA

Voltage Transformers shall also comply with the requirements of Table-IC of this Section

9.0 PRE-COMMISSIONING TESTS

9.1 An indicative list of tests is given below. Contractor shall perform any additional test based on specialties of the items as per the field Q.P./Instructions of the equipment Supplier or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

9.2 **Current Transformers**

(a) Insulation Resistance Test for primary and secondary.

(b) Polarity test

(c) Ratio identification test - checking of all ratios on all cores by primary injection of current.

(d) Dielectric test of oil (wherever applicable).

(e) Magnetizing characteristics test.

(f) Tan delta and capacitance measurement

(g) Secondary winding resistance measurement

(h) Contact resistance measurement (wherever possible/accessible).

(i) Test for SF6 (for SF6 filled CTs) – Dew point measurement, SF6 alarm/ lockout check.

(j) DGA test of oil.

Dissolved gas analysis to be carried out at the time of commissioning. CTs must have adequate provision for taking oil samples from the bottom of the CT without exposure to atmosphere. Bidder/Manufacturer shall recommend the frequency at which oil samples should be taken and norms for various gases in oil after being in operation for different durations. Bidder/Manufacturer should also indicate the total quantity of oil which can be withdrawn from CT for gas analysis before refilling or further treatment of CT becomes necessary.

9.3 **Voltage Transformers/Capacitive Voltage Transformers**

(a) Insulation Resistance test for primary (if applicable) and secondary winding.

(b) Polarity test

(c) Ratio test

(d) Dielectric test of oil (wherever applicable).

(e) Tan delta and capacitance measurement of individual capacitor stacks.

(f) Secondary winding resistance measurement.

TABLE - IA

REQUIREMENTS OF 245 KV CAPACITIVE VOLTAGE TRANSFORMERS

S.No.	PARTICULAR			
1.	Rated primary voltage (kV rms)	245		
2.	Type	Single phase capacitor VT		
3.	No. of secondaries	3		
4.	Rated voltage factor	1.2 continuous 1.5 - 30 seconds		
5.	Phase angle error	± 10 minutes (For metering core)		
6.	Capacitance (pf)	4400/8800 (As applicable)	+ 10% - 5%	
		Secondary I	Secondary II	Secondary III
7.	Voltage Ratio 220/0.11	220/0.11	220/0.11	
8.	Application	Protection	Protection	Metering
9.	Accuracy	3 P	3 P	0.2
10.	Output burden (VA) (minimum)	50	50	50

TABLE - IB

REQUIREMENTS OF 145 KV CAPACITIVE VOLTAGE TRANSFORMERS

S.No.	PARTICULAR			
1.	Rated primary voltage (kV rms)	145		
2.	Type	Single phase capacitor VT		
3.	No. of secondaries	3		
4.	Rated voltage factor	1.2 continuous		
		1.5 - 30 seconds		
5.	Phase angle error	± 10 minutes (For metering core)		
6.	Capacitance (pf)	8800		+ 10%/-5%
		Secondary I	Secondary II	Secondary III
7.	Voltage Ratio 132/0.11	132/0.11	132/0.11	
8.	Application	Protection	Protection	Metering
9.	Accuracy	3 P	3 P	0.2
10.	Output burden (VA) (minimum)	50	50	50

TABLE- IC

REQUIREMENTS OF 33 KV POTENTIAL TRANSFORMERS

S.No.	PARTICULAR				
1.	Rated primary voltage (kV rms)	36			
2.	Type	Single phase PT			
3.	No. of secondaries	3			
4.	Rated voltage factor	1.2 continuous 1.5 - 30 seconds			
5.	Phase angle error	+/- 20 minutes (for metering core)			
6.	Standard reference range of frequencies for which the Accuracies are valid	96% to 102% for protection and 99% to 102% for measurement			
7.	One minute power frequency Withstand voltage:				
	i) Between LV terminal and earth earth terminal	10kVrms for exposed terminals and 4kVrms for terminals enclosed in a weather proof box.			
	ii) For secondarywinding	2 kVrms			
8.	Maximum temperature rise over design ambient temperature	As per IEC 186			
9.	Number of terminals in control Cabinet	All terminals of control circuits are wired upto marshalling box Plus spare 20% terminals evenly distributed on all TBs			
10.	Rated total thermal burden	75 VA			
		Secon-dary I		Secon-dary II	Secon-daryIII
11.	.Voltage Ratio	33/0.11		33/0.11	33/0.11
12.	Application	Protec-tion	tion	Protec-ing	Meter-
13.	Accuracy	3 P	3 P	0.5	
14.	Output burden (VA) (minimum)	50	50	25	

TABLE – IIA-1

REQUIREMENTS FOR 245 KV CURRENT TRANSFORMERS

No.of Cores	Core No.	Appli-cation	Current ratio	Output burden (VA)	Accuracy class as per IEC: 44-1	Min. knee pt.volt-age (Vk)	Max. CT sec.wdg. resist-ance(ohms)	Max. Excit-ation cur-rent at Vk (in mA)
5	1	BUS DIFF CHECK	800-400-200/1 200/1 Tap	- 200 on	- 400/200 400/1 Tap	800/ 100 on	4/2/1 800/1Tap;	50 on
	2	BUS DIFF CHECK	800-400-200/1 200/1 Tap	- 200 on	- 400/200 400/1 Tap	800/ 100 on	4/2/1 800/1Tap;	50 on
	3	METERING	800-400-200/1	20	**0.2S**	-	-	-
	4	TRANS BACK UP PROTN.	800-400-200/1 200/1Tap1	- 400/1 Tap	- 400/200 200 on	800/ 100 on	4/2/1 800/1Tap;	50 on /LINE
	5	TRANS. DIFF/LINE PROTN.	800-400-200/1 200/1Tap1	- 200 on	- 400/200	800/ 400/1 Tap	4/2/1 800/1Tap; 100 on	50 on

All relaying CTs shall be of accuracy class TPS as per IEC 60044-1

TABLE – IIA-2

REQUIREMENTS FOR 245 KV CURRENT TRANSFORMERS

No.of Cores	Core No.	Appli-cation	Current ratio	Output burden (VA)	Accuracy class as per IEC: 44-1	Min. knee pt.volt-age (Vk)	Max. CT sec.wdg. resist-ance(ohms)	Max. Excit-ation cur-rent at Vk (in mA)
5	1	BUS DIFF CHECK	1600-800/1	- 800/1 Tap	-	1600/ 800 Tap; 50 on	8/4 1600/1	25 on
	2	BUS DIFF MAIN	1600-800/1	-	-	1600/ 800	8/4	25 on 1600/1 Tap; 50 on 800/1 Tap
	3	METERING	1600-800/1	20	**0.2S**	-	-	-

	4	TRANS. BACK UP/LINE PROTN.	1600-800/1	-	-	1600/800	8/4 1600/1	25 on Tap; 50 on 800/1 Tap
	5	TRANS. DIFF/LINE PROTN	1600-800/1	-	-	1600/800	8/4	25 on 1600/1 Tap; 50 on 800/1 Tap

All relaying CTs shall be of accuracy class TPS as per IEC 60044-1

TABLE – IIB

REQUIREMENTS FOR 145 KV CURRENT TRANSFORMERS

No.of Cores	Core No.	Appli-cation	Current ratio	Output burden (VA)	Accuracy class as per IEC: 44-1	Min. knee pt.volt-age Vk	Max. CT sec.wdg. resist-ance(ohms)	Max. Excit-ation cur-rent at Vk (in mA)
5	1	BUS DIFF CHECK	1200-600-300/1	- 600/1	- 600 /300 50 on Tap	1200/ Tap;	12/6/3 1200/1	25 on 100 on 300/1
	2	BUS DIFF MAIN	1200-600-300/1	- 600/1	- 600 /300 50 on Tap	1200/ Tap;	12/6/3 1200/1	25 on Tap 100 on 300/1
	3	METERING	1200-600/1	20	**0.2S**	-	-	-
	4	TRANS. BACK UP/LINE PROTN.	1200-600-300/1	-	- 600/300	1200/	12/6/3 1200/1 Tap;	25 on 50 on 600/1 Tap 100 on 300/1
	5	TRANS. DIFF/LINE PROTN	1200-600-300/1	-	-	1200/ 600/300	12/6 /3	25 on 1200/1 Tap; 50 on 600/1 Tap 100 on 300/1

All relaying CTs shall be of accuracy class T PS as per IEC 60044-1.

TABLE – II C
REQUIREMENTS FOR 145 kV CURRENT TRANSFORMERS

No.of Cores	Core No.	Appli-cation	Current ratio	Output burden (VA)	Accuracy class as per IEC: 44-1	Min. knee pt.volt-age Vk	Max. CT sec. wdg. resist-ance(ohms)	Max. Excit-ation cur-rent at Vk (in mA)
5	1	BUS DIFF CHECK	800-400-200/1	-	- 400/200	800/ Tap;	8/4/2 800/1	25 on 50 on 400/1 Tap 100 on 200/1Tap
	2	BUS DIFF MAIN	800-400-200/1	- 400/1	- 400/200 50 on	800/ Tap;	8/4/2 800/1 200/1Tap	25 on Tap 100 on
	3	METERING	400-200/1	20	**0.2S**	-	-	-
	4	TRANS. BACK UP/LINE PROTN.	800-400-200/1	-	- 400/200	800/	8/4/2 800/1 Tap;	25 on 50 on 400/1 Tap 100 on 200/1Tap
	5	TRANS. DIFF/LINE PROTN	800-400-200/1	-	-	800/ 400/200	8/4/2	25 on 800/1 Tap; 50 on 400/1 Tap 100 on 200/1Tap

All relaying CTs shall be of accuracy class TPS as per IEC 60044-1.

TABLE – II D
REQUIREMENTS FOR 145 kV CURRENT TRANSFORMERS

No.of Cores	Core No.	Appli-cation	Current ratio	Output burden (VA)	Accuracy class as per IEC: 44-1	Min. knee pt.volt-age Vk	Max. CT sec.wdg. resist-ance(ohms)	Max. Excit-ation cur-rent at Vk (in mA)
5	1	BUS DIFF CHECK	600-300/1	-	-	600/300 Tap;	6/3 600/1	30 on 60 on 300/1 Tap
	2	BUS DIFF MAIN	600-300/1	-	- on 300/1	600/300 Tap;	6/3 600/1	30 on Tap
	3	METERING	300-150/1	20	**0.2S**	-	-	-
	4	TRANS. BACK UP/LINE PROTN.	600-300/1	-	-	600/300	6/3 Tap;	30 on 600/1 60 on 300/1 Tap
	5	TRANS. DIFF/LINE PROTN	600-300/1	-	-	600/300	6/3	30 on 600/1 Tap; 60 on 300/1 Tap

All relaying CTs shall be of accuracy class TPS as per IEC 60044-1.

TABLE – IIE
REQUIREMENTS FOR 33 kV CURRENT TRANSFORMERS

Current Transformer (1200A)

No.of Cores	Core No.	Appli-cation	Current ratio	Output burden(VA)	Accuracy class as per IEC: 44-1	Min. knee pt.volt-age Vk	Max.CT sec.wdg. resis-ance(ohms)	Max.Excit-ation cur-rent at Vk (in mA)	Remarks
3	1	O/C & E/F	1200-600-300/1	-	T.P.S.	1200/600/300	12/6/3	30 on 1200/1 Tap; 60 on 600/1 Tap 90 on 300/1 Tap	
	2	METERING	1200-600-300/1	30	0.2	-	-	-	
	3	TRANS. DIFF PROTN	1200-600-300/1	-	T. P.S.	1200/600 /300	12/6/3	30 on 1200/1 Tap 60 on 600/1 Tap 90 on 300/1 Tap	

TABLE – IIF
REQUIREMENTS FOR 33 kV CURRENT TRANSFORMERS

Current Transformer (2000A)

No.of Cores	Core No.	Appli-cation	Current ratio	Output burden(VA) mA)	Accuracy class as per IEC: 44-1	Min. knee pt.volt-age Vk	Max.CT sec.wdg. resis-	Max.Excit-ation cur-rent at Vk ance(ohms)	Remarks (in
3	1	O/C & E/F	2000-1000/1	-	T.P.S.	2000/ /1000	20/ 10	18 on 2000/1 Tap; 36 on 1000/1 Tap	
	2	METERING	2000-1000	30	0.2	-	-	-	
	3	TRANS. DIFF PROTN	2000-1000/1	-	T. P.S.	2000/ 10 1000	20/ 2000/1 Tap	18 on 36 on 1000/1 Tap	

TECHNICAL SPECIFICATION

VOL-II, SEC-VI

SWITCHGEAR, SURGE ARRESTOR

CONTENTS

Clause No.	Description
1.0	GENERAL
2.0	DUTY REQUIREMENTS
3.0	CONSTRUCTIONAL FEATURES
4.0	FITTINGS AND ACCESSORIES
5.0	TESTS
6.0	SPARE PARTS AND MAINTENANCE EQUIPMENT
7.0	TECHNICAL PARAMETERS
8.0	PRE COMMISSIONING TESTS

SECTION - VI

SWITCHGEAR- SURGE ARRESTERS

1.0 GENERAL:

1.1 The Surge arresters shall conform to IEC: 60099-4 except to the extent modified in the specification and shall also be in accordance with requirements under Section 2 -GTR.

1.2 Arresters shall be of hermetically sealed units, self supporting construction, suitable for mounting on tubular support structures to be supplied by the Contractor.

1.3 The Surge Arrestors shall be designed for use in the geographic and meteorological conditions as given in the Section 2 -GTR.

2.0 DUTY REQUIREMENTS:

a. The surge arresters shall be of heavy duty station class and gapless type without any series or shunt gaps.

b. The surge arresters shall be capable of discharging over-voltages occurring during switching of unloaded transformers, reactors and long lines.

c. 245/145/36 kV class arrester shall be capable for discharging energy equivalent to class 3 of IEC for 245/145/36 kV system on two successive operations.

d. The surge arresters shall be suitable for withstanding forces as defined in Section 2-GTR.

e. The reference current of the arresters shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

f. The surge arresters are being provided to protect the following equipment whose insulation levels are indicated in the table given below:-

Equipment to be protected	Lightning impulse(kVp) for 245 kV system	Lightning Surge for 145 kV system
Power transformer	± 950	± 550
Instrument Transformer	± 1050	± 650
Reactor	--	--
CB/Isolator Phase to ground	± 1050	± 650
CB/Isolator Across open contacts	± 1050(for CB) ± 1200(for Isolator	± 750

g. The duty cycle of CB installed in 245/145 kV System of the Purchaser shall be O-0.3 sec-CO-3 min-CO. The Surge Arrester shall be suitable for such circuit breaker duties in the system.

3.0 CONSTRUCTIONAL FEATURES:

The features and constructional details of surge arresters shall be in accordance with requirement stipulated hereunder:

a) The non-linear blocks shall be of sintered metal oxide material. These shall be provided in such a way as to obtain robust construction, with excellent mechanical and electrical properties even after repeated operations.

b) The surge arresters shall be fitted with pressure relief devices suitable for preventing shattering of porcelain housing and providing path for flow of rated fault currents in the event of arrester failure. Details shall be furnished in the bids alongwith quality checks.

c) The arresters shall not fail due to arrester porcelain contamination.

d) Seals shall be provided in such a way that these are always effectively maintained even when discharging rated lightning current.

e) Outer insulator shall be porcelain/polymer conforming to requirements stipulated in Section 2-GTR. Terminal connectors shall conform to requirements stipulated under Section 2-GTR. The outer insulator housing shall be so coordinated that external flashover will not occur due to application of any impulse or switching surge voltage upto the maximum design value for arrester.

f) The end fittings shall be made of corrosion proof material and preferably be nonmagnetic.

g) The name plate shall conform to the requirements of IEC incorporating the year of manufacture.

h) The heat treatment cycle details alongwith necessary quality checks used for individual blocks alongwith insulation layer formed across each block are to be furnished. Metalizing coating thickness for reduced resistance between adjacent discs is to be furnished with additional information schedule of bid proposal sheets alongwith procedure for checking the same. Details of thermal stability test for uniform distribution of current on individual disc is to be furnished.

i) The manufacturer will submit Data for rejection rate of ZnO blocks during manufacturing/operation for the past three years.

j) The sealing arrangement of the Surge Arrester stacks shall be done incorporating grooved flanges with the O-rings/elliptical cross-section gaskets of Neoprene or Butyl rubber.

k) The Surge arrester with porcelain housing shall have a cantilever strength of not less than 350 kg for 216 /120kV surge arresters or as per the value obtained vide

Section 2-GTR, whichever is higher. For Surge arrester with polymer housing, the cantilever strength shall not be less than 150kg.

4.0 FITTINGS AND ACCESSORIES:

a) 216/120/30 kV Arresters shall be complete with insulating base and Surge monitor having provision for bolting to flat surface of structure.

b) Self contained discharge counters, suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit alongwith necessary connection. Suitable leakage current meters should also be provided. The reading of milliammeter and counters shall be visible through an inspection glass panel. The terminals shall be robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends.

c) Surge monitor consisting of discharge counters and milliammeters should be suitable to be mounted on support structure of the arrester and should be tested for IP66 degree of protection. The standard supporting structure for surge arrester should be provided with a mounting pad, for fixing the surge monitor. The surge monitor should be suitable for mounting on this standard mounting pad. Also all nuts, bolts, washers etc. required for fixing the surge monitor shall have to be supplied by the Contractor.

The arrangement for Surge Monitor enclosure fixing to the structure shall be at its rear/bottom. Connection between the Surge Arrester base and Surge Monitor shall be through a 2.0 m(minimum) long insulated copper rod/strip of at least 75 sq.mm cross sectional area. The cable shall be terminated at rear/bottom side of the Surge Monitor. The gaskets of the surge monitors shall be of Neoprene, Butyl or equivalent material.

d) Grading/corona rings shall be provided on each complete arrester unit as required. Suitable terminal connectors shall be supplied by the Contractor.

5.0 TESTS:

5.1 **In accordance with the requirements stipulated under Section 2-GTR, the surge arresters should have been type tested as per IEC and shall be subjected to routine and acceptance tests in accordance with IEC document For contamination test, procedures outlined in 60099-3 shall be followed.**

The test reports of the type tests and the following additional type tests(additional type tests are required for Surge Arresters above 72.5 kV class only) shall also be submitted for the Purchaser's review.

i) Radio interference voltage test as per IEC 60099-4.

ii) Seismic withstand test.

iii) Contamination test.

iv) Test to verify the Power frequency versus time characteristics.
Temporary over voltage profile for arresters are to be mutually agreed.

Each metal oxide block of surge arresters shall be tested for the guaranteed specific energy capability in addition to the routine/acceptance test as per IEC: 60099-4.

5.2 (a) **Acceptance Tests:**

1. Measurement of power frequency reference voltage of the arrester units.

2. Lightning Impulse Residual voltage on arrester units. (IEC clause 6.3.2).

3. Internal Ionisation or partial Discharge test.

(b) **Special Acceptance Test:**

1. Thermal stability test on three sections. (IEC Clause 7.2.2).

2. Aging & Energy Capability test on blocks (procedure to be mutually agreed).

3. Wattloss test.

(c) **Routine Tests:**

1. Sealing test: Water dip test at 1.5m depth from top of Surge Arrestor for 30 minutes shall be performed during assembly of Surge Arrester stacks (followed by other routine tests, i.e. P.D. Measurement, Reference Voltage, Residual Voltage & IR measurement).

2. Measurement of reference voltage.

3. Residual voltage test of arrester unit.

4. Internal Ionisation test or partial discharge test.

5. Verticality check on completely assembled Surge arresters as a sample test on each lot.

(d) **Test on Surge Monitors:**

The Surge monitors shall also be connected in series with the test specimens during residual voltage and current impulse withstand tests to verify efficacy of the same. Additional routine/ functional tests with one 100A and 10kA current impulse (8/20 micro sec.) shall also be performed on the Surge monitor.

Surge monitors shall be routinely tested for water dip test at 1.5m for 30 minutes. No water vapors shall be visible on the monitor glass.

(e) **Test on insulators**

All routine tests shall be conducted on the hollow column insulators as per IEC 62155. Polymer housing shall be tested in accordance to IEC-61462.

6.0 SPARE PARTS AND MAINTENANCE EQUIPMENT:

Bidder shall include in his proposal spare parts and maintenance equipment, as mentioned in Section 1-PSR.

7.0 TECHNICAL PARAMETERS:

A. 245 kV CLASS SURGE ARRESTER

A7.0(a)	Rated arrester voltage	216 kV
A7.0(b)	Nominal discharge current	10 kA of 8/20 microsecond wave
A7.0(c)	Minimum discharge capability	5kJ/kV (referred to rated arrester voltage corresponding to minimum discharge. characteristics
A7.0(d)	Continuous operating voltage at 50 deg.C	168 kV rms
A7.0(e)	Max. switching surge residual voltage (1kA)	500 kVp
A7.0(f)	Max. residual voltage at	
	i) 5 kA	560 kVp
	ii) 10 kA nominal discharge current	600 kVp
A7.0(g)	Max. steep current impulse residual voltage at 10 kA.	650 kVp
A7.0(h)	Long duration discharge class	3
A7.0(i)	High current short duration test value (4/10 micro second wave)	100 kAp
A7.0(j)	Current for pressure relief test	40 kA rms / 50 kA rms (as applicable)
A7.0(k)	Low current long duration test value (2400 micro sec)	As per IEC.

A7.0(l)	Pressure relief class	40 kA / 50 kA (as applicable)

B. 145 kV CLASS SURGE ARRESTER

B7.0(a)	Rated arrester voltage	120 kV
B7.0(b)	Nominal discharge current	10 kA of 8/20 microsecond wave
B7.0(c)	Minimum discharge capability	5kJ/kV (referred to rated arrestor voltage corresponding to minimum discharge characteristics.
B7.0(d)	Continuous operating voltage at 50 deg.C	102 kV rms
B7.0(e)	Max. switching surge residual voltage (1kA)	280 kVp
B7.0(f)	Max. residual voltage at	
	i) 5 kA	310 kVp
	ii) 10 kA nominal discharge current	330 kVp
B7.0(g)	Long duration discharge class	3
B7.0(h)	High current short duration test value (4/10 micro second wave)	100 kAp
B7.0(i)	Current for pressure relief test	40 kA rms
B7.0(j)	Low current long duration test value (2400 micro sec)	As per IEC.
B7.0(k)	Pressure relief class	31.5 kA

C 33kV Surge Arresters

C7.0(a)	Rated arrester voltage	30 kV
C7.0(b)	Nominal discharge capability	10 kA of 8/20 microsecond wave
C7.0(c)	Minimum discharge capability	5kJ/kV (referred to rated arrester voltage corresponding to minimum discharge

characteristics).

C7.0(d)	Continuous operating voltage at 50 deg.C	24 kV rms
C7.0(e)	Max. switching surge residual voltage (0.5kA)	63 kVp
C7.0(f)	Max. residual voltage	
	(i) 5 kA	80 kVp
	(ii) 10 kA nominal discharge current	85 kVp
C7.0(g)	Long duration discharge class	2
C7.0(h)	High current short duration test value (4/10 micro second wave)	100 kAp
C7.0(i)	Current for Pressure Relief test	40kA rms
C7.0(j)	Low current long duration test value (2000 micro sec)	As per IEC.
C7.0(k)	Pressure relief class as per IEC-60099-1	A

8.0 PRE-COMMISSIONING TESTS

8.1 An indicative list of tests is given below.

(a) operation check of LA counter.

(b) Insulation resistance measurement

(c) Capacitance and Tan delta measurement of individual stacks.

(d) Third harmonic resistive current measurement (to be conducted after energisation.)

Contractor shall perform any additional test based on specialties of the items as per the field Q.P./Instructions of the equipment Supplier or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

TECHNICAL SPECIFICATION

VOL-II, SEC-VII

LT SWITCHGEAR

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SECTION - VII
LT SWITCHGEAR

1.1. CONSTRUCTIONAL DETAILS OF SWITCHBOARDS AND DISTRIBUTION BOARDS

1.1.1. All boards shall be of metal enclosed, indoor floor mounted, compartmentalised double front construction and freestanding type.

1.1.2. All board frames, shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness not less than 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness not less than 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary. Gland plate shall be cold rolled sheet steel having thickness not less than 3 mm in all cases. However, in case of termination of single core power cables, gland plate shall be of non-magnetic material of at least 4mm thickness.

1.1.3. All panel edges and cover/door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members.

1.1.4. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cut-outs shall be true in shape and devoid of sharp edges.

1.1.5. All boards shall be of dust and vermin proof construction and shall be provided with a degree of protection of IP: 52, for category I enclosure as per IS: 13947 (Part-I) / IEC 60947 (Part-1). However, the busbar chambers having a degree of protection of IP: 42, in accordance with IS:13947 (Part-I) / IEC 60947 (Part-1), are also acceptable where continuous busbar rating exceeds 1000 Amp. Provision shall be made in all draw out Air Circuit Breaker compartments for providing IP: 52 degree of protection, when Circuit breaker trolley, has been removed. Panels with lighting transformers shall have IP 31 degree of protection in accordance with IS: 13947 (Part-I) / IEC 60947 (Part-1). Door frame of panels, meters, relays, Breaker cut-outs shall be provided with neoprene rubber gaskets generally conforming to Type – II, Class 2A as per IS: 11149 IEC / International Standards.

1.1.6. Provision of louvers on boards would not be preferred. However, louvers backed with metal screen are acceptable on the busbar chambers where continuous busbar rating exceeds 1000 Amps. Panels with lighting transformers in lighting distribution boards shall have louvers.

1.1.7. All boards shall be of uniform height not exceeding 2450 mm.

1.1.8. Boards shall be easily extendible on both sides, by the addition of the vertical sections after removing the end covers of bus bar chambers.

1.1.9. Boards shall be supplied with base frames made of structural steel sections, alongwith all necessary mounting hardware required for welding the base frames to the insert plates.

1.1.10. a) All boards shall be of double front construction and shall have :-

(i) A completely enclosed busbar compartment for running horizontal busbars and vertical busbars. Busbar chambers shall be completely enclosed with metallic portions. Bolted covers shall be provided for access to horizontal and Vertical busbars for repair and maintenance, which shall be feasible without disturbing

feeder compartment. Vertical bus bar chambers shall be accessible from front as well as back side of the panel and shall be of at least 350 mm width. One set of vertical busbars shall be used in between two adjacent sections for switchgear connections. In case of ACB feeders, the panel shall have single front without any vertical busbar chamber, however vertical busbars associated with ACBs shall be located in rear side and shall be additionally covered with metallic perforated/ transparent acrylic or polyvinyl bolted sheets to avoid direct access after opening rear door of chamber.

(ii) Completely enclosed switchgear compartment(s) one for each circuit for housing circuit breaker or MCCB or motor starter.

(iii) A distinct compartment or alley for power and control cables on each side of panel. Cable alley compartment shall have a through metallic partition for segregating cables on both sides. Cable alley door shall preferably be hinged. Cable alley shall have no exposed live parts. Any live terminals shall be fully shrouded/insulated from safety aspects. However, it shall be of atleast 350mm width.

(iv) A compartment for relays and other control devices associated with a circuit breaker.

b) Lighting transformers shall be supplied in separate and distinct panel completely assembled for incoming cable connection from bottom and outgoing connection through busbar with adjacent associated lighting distribution board. Lighting transformers shall have provision of base channel with rollers for taking in and out from the panel in case of maintenance after disconnecting incoming and outgoing connections. Provision of single phase fans at least two (2) numbers of suitable ratings shall be made in the panel for ventilation. These fans shall run in sequential mode at suitable time interval to be controlled by thermostat and timer. The offered design of panel should be such that in no case, temperature rise of lighting transformers shall exceed the permissible limits for the class of insulation of lighting transformer.

1.1.11. Sheet steel barriers shall be provided between two adjacent vertical panels running to the full height of the switchboard, except for the horizontal busbar compartment. Each shipping section shall have full metal sheets at both ends for transport and storage.

1.1.12. All equipments associated with a single circuit except MCB circuits shall be housed in a separate compartment of the vertical section. The Compartment shall be sheet steel enclosed on all sides with the withdrawal units in position or removed. The front of the compartment shall be provided with the hinged single leaf door, with locking facilities.
In case of circuits controlled by MCBs, group of MCB feeders can be offered in common compartment. In such case number of MCB feeder to be used in a common compartment shall not exceed 4 (four) and front of MCB compartment, shall have a viewing port of toughen glass sheet for viewing and sheet steel door of module shall be lockable with star knob/panel key.

1.1.13. After isolation of power and control circuit connections it shall be possible to safely carryout maintenance in a compartment with the busbar and adjacent circuit live. Necessary shrouding arrangement shall be provided for this purpose over the cable terminations located in cable alley.

1.1.14. The minimum clearance in air between phases and between phase and earth for the entire run of horizontal and vertical busbars, shall be 25 mm. For all other components, the clearance between "two live parts", " A live part and an earthed part" and isolating distance shall be atleast ten (10) mm throughout. Wherever it is not possible to maintain these

clearances, insulation shall be provided by sleeving or barriers. However, for horizontal run of busbar minimum clearance of 25 mm should be maintained even if they are sleeved.

1.1.15. The temperature rise of horizontal & vertical busbars when carrying rated current along its full run shall in no case exceed 55°C, with silver plated joints and 40°C with all other type of joints over an outside ambient temperature of 50°C.

1.1.16. All busbar chambers shall be provided with removable bolted covers. The covers shall be provided with danger labels.

1.1.17. All identical circuit breakers and module chassis of same test size shall be fully interchangeable without having to carryout modifications.

1.1.18. All Circuit breaker boards shall be of Single Front type, with fully drawout circuit breakers, which can be drawn out without having to unscrew any connections. The circuit breakers shall be mounted on rollers and guides for smooth movement between SERVICE, TEST and ISOLATED positions and for withdrawal from the Switchboard. Testing of the breaker shall be possible in the TEST position.

1.1.19. Wherever two breaker compartments are provided in the same vertical section, insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit.

1.1.20. All disconnecting contacts for power circuits shall be of robust design and fully self aligning. Fixed and moving contacts of the power drawout contact system shall be silver plated. Both fixed and moving contacts shall be replaceable.

1.1.21. All AC & DC boards shall be of double Front type.

1.1.22. All module shall be fixed type except air circuit breaker module, which shall be drawout type.

1.1.23. The connections from bus bars to the main switch shall be fully insulated/shrouded, and securely bolted. The partition between the feeder compartment and cable alley may be non-metallic and shall be of such construction as to allow cable cores with lugs to be easily inserted in the feeder compartment for termination.

1.1.24. All equipment and components shall be neatly arranged and shall be easily accessible for operation and maintenance. The internal layout of all modules shall be subject to PURCHASER approval. Bidder shall submit dimensional drawings showing complete internal details of bus bars and module components, for each type and rating for approval.

1.1.25. The tentative power and control cable entries shall be from bottom. However, Purchaser reserves the right to alter the cable entries, if required, during detailed engineering, without any additional commercial implication.

1.1.26. Adopter panels and dummy panels required to meet the various busbar arrangements and layouts required shall be included in Bidder's scope of work.

1.2. DERATING OF EQUIPMENTS

1.2.1. The current ratings of all equipments as specified in the Single Line Diagram For AC & DC System are the minimum standards current ratings at a reference ambient temperature as per relevant Indian Standards.

1.3. POWER BUS BARS AND INSULATORS

1.3.1. All AC Distribution Boards shall be provided with three phase buses and a neutral bus bars and the DC Distribution Boards shall be provided with two busbars.

1.3.2. All busbars and jumper connections shall be of high conductivity aluminium/copper of adequate size.

1.3.3. The Cross-Section of the busbars shall be uniform throughout the length of Switchgear and shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents.

1.3.4. All busbars shall be adequately supported by adequate numbers of high strength type Polyester fibre glass Moulded Insulators to withstand short circuit withstand capability of panel. Separate supports shall be provided for each phase and neutral busbar. If a common support is provided anti-tracking barriers shall be provided between the supports.

1.3.5. All busbars joints shall be provided with high tensile steel bolts. Belleville/spring washers and nuts, so as to ensure good contacts at the joints. Non-silver plated Busbars joints shall be thoroughly cleaned at the joint locations and a suitable contact grease shall be applied just before making a joint.

1.3.6. All busbars shall be colour coded as per IS: 11353-1985 (Guide for Uniform System of Marking and Identification of Conductors and apparatus Terminals / IEC: 60446.

1.3.7. The Bidder shall furnish calculations, establishing the adequacy of busbar sizes for specified current ratings, On the basis of short circuit current and temperature rise consideration at specified ambient temp.

1.4. EARTH BUS

1.4.1. A galvanised steel earthing shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded / bolted to the frame work of each panel and breaker earthing contact bar vertical bus shall be provided in each vertical section which shall in turn be bolted / welded to main horizontal ground bus.

1.4.2. The earth bus shall have sufficient cross-section to carry the momentary short circuit and short time fault currents to earth without exceeding the allowable temperature rise.

1.4.3. Suitable arrangements shall be provided at each end of the horizontal earth bus for bolting to Purchaser's earthing conductors. The horizontal earth bus shall project out the switch-board ends and shall have predrilled holes for this connection. A joint spaced and taps to earth bus shall be made through at least two bolts.

1.4.4. All non-current metal work of the Switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosures frame work and the truck shall be maintained even after painting.

1.4.5. The truck and breaker frame shall get earthed while the truck is being inserted in the panel and positive earthing of the truck and breaker frame shall be maintained in all positions. SERVICES & ISOLATED, as well as throughout the intermediate travel.

1.4.6. Air Circuit Breaker (ACB) module frame shall get engaged to the vertical earth bus, before the disconnecting contacts on these module are engaged to the vertical busbar.

1.4.7. All metallic cases of relays, instruments and other panel mounted equipments shall be connected to earth by independent stranded copper wires of size not less than 2.5 mm^2. Insulation colour code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors and soldering is not acceptable. Looping of earth Connection which would result in loss of earth connection to the devices when a device is removed is not acceptable. However, looping of earth connections between equipment to provide alternative paths or earth bus is acceptable.

1.4.8. VT and CT secondary neutral point earthing shall be at one place only, on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit.

1.4.9. All hinged doors shall be earthed through flexible earthing braid.

1.4.10. Caution nameplate `Caution-Live Terminals' shall be provided at all points where the terminals are like to remain live and isolation is possible only at remote end.

1.5. AIR CIRCUIT BREAKERS

1.5.1. Circuit breakers shall be three-pole air break horizontal drawout type and shall have inherent fault making and breaking capacities as specified in "Technical Parameters". The circuit breakers which meet specified parameter only after provision of releases or any other devices shall not be acceptable.

1.5.2. Circuit breakers shall be mounted along with it operating mechanism on a wheeled carriage. Suitable guides shall be provided to minimise misalignment of the breaker.

1.5.3. There shall be `Service', `Test' and `Fully withdrawn positions for the breakers. In `Test' position the circuit breaker shall be capable of being tested for operation without energising the power circuits i.e. the power Contacts shall be disconnected while the Control circuits shall remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the `SERVICE', `TEST' OR FULLY WITHDRAWN' position. It shall be possible to close the door in TEST position.

1.5.4. All circuit breakers shall be provided with 4 NO and 4 NC potentially free auxiliary contacts. These contacts shall be in addition to those required for internal mechanism of the breaker. Separate limit switches each having required number of contacts shall be provided in both `SERVICE' & `TEST' position of the breaker. All contacts shall be rated for making continuously carrying and breaking 10 Amps at 230V AC and 1 Amp (Inductive) at 220V DC.

1.5.5. Suitable mechanical indications shall be provided on all circuit breakers to show `OPEN'. `CLOSE', `SERVICE', `TEST' and `SPRING CHARGED' positions.

1.5.6. Main poles of the circuit breakers shall operate simultaneously in such a way that the maximum difference between the instants of contacts touching during closing shall not exceed half cycle of rated frequency.

1.5.7. All circuit breakers shall be provided with the interlocks as explained in further clauses.

1.5.8. Movement of a circuit breaker between SERVICE AND TEST positions shall not be possible unless it is in OPEN position. Attempted with drawl of a closed circuit breaker shall trip the circuit breaker.

1.5.9. Closing of a circuit breaker shall not be possible unless it is in SERVICE, TEST POSITION or

in FULLY WITHDRAWN POSITION.

1.5.10. Circuit breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage to cover the stationary isolated contacts when the breaker is withdrawn. It shall however, be possible to open the shutters intentionally, against spring pressure for testing purpose.

1.5.11. A breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.

1.5.12. Circuit breakers shall be provided with electrical anti-pumping and trip free feature, even if mechanical anti-pumping feature is provided.

1.5.13. Mechanical tripping shall be possible by means of front mounted RED `Trip' push-button. In case of electrically operated breakers these push buttons shall be shrouded to prevent accidental operation.

1.5.14. Breaker controlled motors shall operate satisfactorily under the following conditions:

(i) Direct on-line starting of Induction Motors rated 110 kW to 220 kW with a locked rotor current of seven times the rated current, and starting time of up to 30 seconds.

(ii) Breaking on-load, full load and locked rotor currents of Induction Motors for rated 100 kW to 220 kW.

1.5.15. Means shall be provided to slowly close the circuit breaker in withdrawn position. If required for inspection and setting of Contacts, in service position slow closing shall not be possible.

1.5.16. Power operated mechanism shall be provided with a universal motor suitable for operation 220V DC Control supply with voltage variation from 90% to 110% rated voltage. Motor insulation shall be class `E' or better.

1.5.17. The motor shall be such that it requires not more than 30 seconds for fully charging the closing spring.

1.5.18. Once the closing springs are discharged, after the one closing operation of circuit breaker, it shall automatically initiate, recharging of the spring.

1.5.19. The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.

1.5.20. Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.

1.5.21. All circuit breakers shall be provided with closing and trip coils. The closing coils shall operate correctly at all values of Voltage between 85% to 110% at rated control voltage. The trip coil shall operate satisfactorily under all values of supply voltage between 70% to 110% of rated control voltage.

1.5.22. Provision for mechanical closing of the breaker only in `TEST' and `WITHDRAWN' positions shall be made.

1.5.23. PROTECTION CO-ORDINATION

1.5.23.1. It shall be the responsibility of the Contractor to fully co-ordinate the overload and short circuit tripping of the circuit breakers with the upstream and down stream circuit breakers/fuses/motor starters, to provide satisfactory discrimination.

1.6. MOULDED CASE CIRCUIT BREAKER (MCCB) and MCB

1.6.1. MCCB shall in general conform to IS: 13947 (Part – II) / IEC: 60947 Part-2. All MCCB offered shall have Ics = 100% Icu rating.

1.6.2. MCCB shall be flush mounted on the AC/DC distribution boards and shall have extended handle.

1.6.3 MCCBs shall be provided with thermo-magnetic type release for over current and short circuit protection. The setting of the thermal release shall be adjustable between 80% to 100% of the rated current. The MCCB shall have breaking capacity not less than 20kA.

1.6.4 MCCBs used for ACDB incomers and Bus coupler shall be equipped with stored energy mechanism for electrical closing and tripping. All other MCCBs shall be manually operated. The operating handle should give a clear trip indication.

1.6.5 Miniature circuit breaker (MCB) shall conform to IS: 8828/ IEC: 60898.

1.7 RELAYS

1.7.1 All relays and timers in protective circuits shall be flush mounted on panel front with connections from the inside. They shall have transparent dust tight covers removable from the front. All protective relays shall have a drawout construction for easy replacement from the front. They shall either have built-in test facilities, or shall be provided with necessary test blocks and test switches located immediately below each relay. The auxiliary relays and timers may be furnished in non-drawout cases.

1.7.2 All AC relays shall be suitable for operation, at 50 Hz with 110 volts VT secondary and 1 amp or 5 amp CT secondary.

1.7.3 All protective relays and timers shall have at least two potentially free output contacts. Relays shall have contacts as required for protection schemes. Contacts of relays and timers shall be silver faced and shall have a spring action. Adequate number of terminals shall be available on the relay cases for applicable relaying schemes.

1.7.4 All protective relays auxiliary relays and timers shall be provided with hand reset operation indicators (Flags) for analysing the cause of operation.

1.7.5 All relays shall withstand a test voltage of 2 KV (rms) for one minute.

1.7.6 Motor starters shall be provided with three element, ambient temperature compensated, time lagged, hand reset type overload relays with adjustable settings. The setting ranges shall be properly selected to suit the motor ratings. These relays shall have a separate black coloured hand reset push button mounted on compartment door and shall have at least one changeover contact.

1.7.7 All fuse-protected contactor-controlled motors shall have single phasing protection, either as a distinct feature in the overload relays (by differential movement of bimetallic strips), or as a separate device. The single phasing protection shall operate even with 80% of the set

current flowing in two of the phases.

1.8 CONTACTORS

1.8.1 Motor starter contactors shall be of air break, electromagnetic type rated for uninterrupted duty as per IS: 13947 (Part - 4) / IEC: 60947 Part 4.

1.8.2 Contactors shall be double break, non-gravity type and their main contacts shall be silver faced.

1.8.3 Direct on line starter contactors shall be of utilisation category AC2. These contactors shall be as per IS: 13947 (Part - 4) / IEC: 60947 Part 4.

1.8.4 Each contactor shall be provided with two (2) normally open (NO) and two (2) normally close (NC) auxiliary contacts.

1.8.5 Operating coils of contactors shall be of 230V AC unless otherwise specified elsewhere. The Contactors shall operate satisfactorily between 85% to 110% of the rated voltage. The Contactor shall drop out at 70% of the rated voltage.

1.9 INSTRUMENT TRANSFORMERS

1.9.1 All current and voltage transformers shall be completely encapsulated cast resin insulated type suitable for continuous operation at the temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated condition and the outside ambient temperature is 50°C.

1.9.2 All instrument transformers shall be able to withstand the thermal and mechanical stresses resulting from the maximum short circuit and momentary current ratings of the associated switchgear.

1.9.3 All instrument transformer shall have clear indelible polarity markings. All secondary terminals shall be wired to a separate terminal on an accessible terminal block where star-point formation and earthing shall be done.

1.9.4 Current transformers may be multi or single core type. All voltage transformers shall be single phase type. The Bus VTs shall be housed in a separate compartment.

1.9.5 All VTs shall have readily accessible MCBs on both primary and secondary sides.

1.10 INDICATING INSTRUMENTS

1.10.1 All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96 mm square size with 90 degree scales, and shall have an accuracy class of 2.5 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.

1.10.2 All instruments shall be compensated for temperature errors and factory calibrated to directly read the primary quantities. Means shall be provided for zero adjustment without removing or dismantling the instruments.

1.10.3 All instruments shall have white dials with black numerals and lettering. Black knife edge pointer with parallax free dials will be preferred.

1.10.4 Ammeters provided on Motor feeders shall have a compressed scale at the upper current region to cover the starting current.

1.10.5 Watt-hour meters shall be of 3 phase three element type, Maximum demand indicators need not be provided.

1.11 CONTROL & SELECTOR SWITCHES

1.11.1 Control & Selector switches shall be of rotary type with escutcheon plates clearly marked to show the function and positions. The switches shall be of sturdy construction suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred.

1.11.2 Circuit breaker selector switches for breaker Controlled motor shall have three stay put positions marked `Switchgear', `Normal' and `Trial' respectively. They shall have two contacts of each of the three positions and shall have black shade handles.

1.11.3 Ammeter and voltmeter selector switches shall have four stay put position with adequate number of contacts for three phase 4 wire system. These shall have oval handles Ammeter selector switches shall have make before break type contacts to prevent open circuiting of CT secondary's.

1.11.4 Contacts of the switches shall be spring assisted and shall be of suitable material to give a long trouble free service.

1.11.5 The contact ratings shall be at least the following :

(i)	Make and carry continuously	10 Amp.
(ii)	Breaking current at 220V DC	1 Amp (Inductive)
(iii)	Breaking current at 230V AC	5 Amp (at 0.3 pf lagging)

1.12 AIR BREAK SWITCHES

1.12.1 Air breaker switch shall be of the heavy duty, single throw group operated, load break, fault make type complying with IS: 13947 Part-3 / IEC: 60947 Part-3.

1.12.2 The Bidder shall ensure that all switches are adequately rated so as to be fully protected by the associated fuses during all abnormal operating conditions such as overload, locked motor, short circuit etc.

1.12.3 Switch operating handles shall be provided with padlocking facilities to lock them in `OFF' position.

1.12.4 Interlocks shall be provided such that it is possible to open the cubicle door only when the switch is in `OFF' position and to close the switch only when the door is closed. However suitable means shall be provided to intentionally defeat the interlocks explained above.

1.12.5 Switches and fuses for AC/DC control supply and heater supply wherever required shall be mounted inside and cubicles.

1.13 PUSH BUTTONS

1.13.1 Push-buttons shall be of spring return, push to actuate type. Their contacts shall be rated to make, continuously carry and break 10A at 230V and 0.5A (inductive) at 220V DC.

1.13.2 All push-buttons shall have one normally open and one normally closed contact, unless specified otherwise. The contact faces shall be of silver or silver alloy.

1.13.3 All push-buttons shall be provided with integral escutcheon plates marked with its function.

1.13.4 The colour of the button shall be as follows :

(i) GREEN : For motor START, Breaker CLOSE
(ii) RED : For motor TRIP, Breaker OPEN
(iii) BLACK : For overload reset.

1.13.5 All push-buttons on panels shall be located in such a way that Red-push-buttons shall always be to the left of green push-buttons.

1.14 INDICATING LAMPS

1.14.1 Indicating lamps shall be of the panel mounting cluster LED type. The lamps shall have escutcheon plates marked with its function, wherever necessary.

1.14.2 Lamps shall have translucent lamp-covers of the following colours, as warranted by the application :

(i) RED : For motor ON, Breaker CLOSED
(ii) GREEN : For motor OFF, Breaker OPEN
(iii) WHITE : For motor Auto-Trip
(iv) BLUE : For all healthy conditions (e.g. control supply, and also for 'SPRING CHARGED"
(v) AMBER: For all alarm conditions (e.g. overload) Also for `SERVICE' and `TEST' positions indicators.

1.14.3 Lamps shall be easily replaceable from the front of the cubicle.

1.14.4 Indication lamps should be located just above the associated push buttons/control switches. Red lamps shall invariable be located to the right of green lamps. In case a white lamp is also provided, it shall be placed between the red and green lamps along with the centre line of control switch/push button pair. Blue and Amber lamps should normally be located above the Red and Green lamps.

1.14.5 When associated with push-buttons, red lamps shall be directly above the green push button, and green lamps shall be directly above the red push-button. All indicating lamps shall be suitable for continuous operation at 90 to 110% of their rated voltage.

1.15 FUSES

1.15.1 All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC Circuits shall be of class 2 type, 20 kA (RMS) breaking current at 400 AC, and for DC circuits Class 1 type 4 kA breaking current.

1.15.2 Fuses shall have visible operation indicators.

1.15.3 Fuses shall be mounted on fuses carriers, which are mounted on fuse bases, wherever it is not possible to mount fuses on carriers fuses shall be directly mounted on plug in type of

bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchgear.

1.15.4 Fuse rating shall be chosen by the Bidder depending upon the circuit requirements and these shall be subject to approval of PURCHASER.

1.16 TERMINAL BLOCKS

1.16.1 Terminal blocks shall be of 750 volts grade and have continuous rating to carry the maximum expected current on the terminals. It shall be complete with insulating barriers, clip-on-type/stud type terminals for Control Cables and identification strips. Marking on terminal strip shall correspond to the terminal numbering on wiring on diagrams. It shall be similar to `ELEMEX' standard type terminals, cage clamp type of Phoenix or WAGO or equivalent

1.16.2 Terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary leads shall be provided with short circuiting and earthing facilities. It shall be similar to `Elem.' `CATD' - Type.

1.16.3 In all circuit breaker panels at least 10% spare terminals for external connections shall be provided and these spare terminals shall be uniformly distributed on all terminal blocks. Space for adding another 10% spare terminals shall also be available.

1.16.4 All terminal blocks shall be suitable for terminating on each side, two (2) Nos. of 2.5 mm square size standard copper conductors.

1.16.5 All terminals shall be numbered for identification and grouped according to the function. Engraved white-on-black labels shall be provided on the terminal blocks.

1.16.6 Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.

1.16.7 Terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal block. The minimum clearance between the first row of terminal block and the associated cable gland plate shall be 250 mm.

1.17 NAME PLATES AND LABELS

1.17.1 All switchgears, AC/DC distribution boards, shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear also.

1.17.2 All name plates shall be of non-rusting metal or 3-ply lamicoid with white engraved lettering on black back ground. Inscriptions and lettering sizes shall be subject to PURCHASER approval.

1.17.3 Suitable plastic sticker labels shall be provided for easy identification of all equipments located inside the panel/module. These labels shall be positioned so as to be clearly visible and shall give the device number as mentioned in the module wiring drawings.

1.18 SPACE HEATER

1.18.1 Space heater shall be provided in all the boards for preventing harmful moisture condensation.

1.18.2 The space heaters shall be suitable for continuous operation on 230V AC, 50 Hz, single phase supply, and shall be automatically controlled by thermostats. Necessary isolating switches and fuses shall also be provided.

1.19 CONTROL AND SECONDARY WIRING

1.19.1 All switchboards shall be supplied completely wired internally upto the terminal blocks ready to receive Purchaser's control cables.

1.19.2 All inter cubicle and inter panel wiring and connections between panels of same switchboard including all bus wiring for AC and DC supplies shall be provided by the bidder.

1.19.3 All internal wiring shall be carried out with 1100 V grade, single core, 1.5 square mm or larger stranded copper wires having colour coded, PVC insulation. CT circuits shall be wired with 2.5 square mm copper wires. Voltage grade and insulation shall be same as above.

1.19.4 Extra-flexible wires shall be used for wiring to device mounted on moving parts such as hinged doors.

1.19.5 All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminals blocks.

1.20 POWER CABLES TERMINATION

1.20.1 Cable termination compartment and arrangement for power cables shall be suitable for stranded aluminium conductor, armoured XLPE/PVC insulated and sheathed, single core/three core, 1100 V grade cables.

1.20.2 All necessary cable terminating accessories such as Gland plates, supporting clamps and brackets, power cable lugs, hardware etc. shall be provided by the successful bidder, to suit the final cable sizes which would be advised later.

1.20.3 The gland plate shall be of removable type and shall cover the entire cable alley. Bidder shall also ensure that sufficient space is provided for all cable glands. For all single core cables, gland plates shall be of non-magnetic Material.

1.21 TYPE TESTS

1.21.1 Type tests reports on Panels (Switchgear and Control gear assemblies) as per IS: 8263 Part – I / IEC: 60439 Part-1 shall be submitted for the following tests in line with clause 9.0 of Section 2 GTR before the fabrication of switchgear is started:

i) Verification of temperature rise limits
ii) Verification of the dielectric properties
iii) Verification of short circuit strength
iv) Verification of the continuity of the protective circuit
v) Verification of clearances and creepage distances
vi) Verification of mechanical operation
vii) Verification of degree of protection

1.21.2 Contractor shall submit type test reports for the following Switchgear and Control gears before the fabrication of switchgear is started:

1. Circuit breakers/MCCB as per IS: 13947 Part – 2 / IEC: 60947 Part 2.
2. Protective Relays as per IEC: 60255.
3. Lighting transformers as per IS: 2026 / IEC:60076

For above equipments, test conducted once are acceptable (i.e. The requirement of test conducted within last five years shall not be applicable)

1.22 ERECTION, TESTING AND COMMISSIONING

1.22.1 The Contractor shall unload, erect, install, test and put into commercial use all electrical equipment included in this specification.

1.22.2 Equipment shall be installed in a neat, workman like manner so that it is level, plumb, square and properly aligned and oriented. Tolerance shall be as established in Contractor's drawings or as stipulated by purchaser. No equipment shall be permanently bolted down to foundations until the alignment has been checked and found acceptable by the purchaser.

1.22.3 Contractor shall furnish all supervision, labour tools equipment rigging materials, bolts, wedges, anchors, concrete inserts etc. in proper time required to completely install, test and commission the equipment.

1.22.4 Manufacturer's and purchaser's instructions and recommendations shall be correctly followed in handling, setting, testing and commissioning of all equipment.

1.22.5 Contractor shall move all equipment into the respective room through the regular door or openings specifically provided for this purpose. No part of the structure shall be utilised to lift or erect any equipment without prior permission of Purchaser.

1.22.6 All boards shall be installed in accordance with relevant code of practices and at Purchaser's instructions. All boards shall be installed on finished surfaces, concrete or steel stills. Contractor shall be required to install and align any channel sills which form part of foundations. In joining shipping sections of switchboards together adjacent housing of panel sections or flanged throat sections shall be bolted together after alignment has been completed. Power bus, enclosures ground and control splices of conventional nature shall be cleaned and bolted together being drawn up with torque spanner of proper size or by other approved means.

1.22.7 All boards shall be made completely vermin proof.

1.22.8 Contractor shall take utmost care in holding instruments, relaying and other delicate mechanism wherever the instruments and relays are supplied separately they shall be mentioned only after the associated panels have been erected and aligned. The packing materials employed for safe transit of instrument and relays shall be removed after ensuring that panel have been completely installed and to further movement of the same should be necessary. Any damage shall be immediately reported to Purchaser.

1.22.9 Equipment furnished with finished coats of paint shall be touched by up Contractor if their surface is specified or marred while handling.

1.22.10 After installation of panels, power and control wiring and connections, Contractor shall perform operational tests on all switchboards, to verify proper operation of switch-boards/panels and correctness of all equipment in each and every respect. The cable opening and cables entries for cables terminating to the panels shall be sealed with fire sealing materials.

1.23 COMMISSIONING CHECK TESTS

The Contractor shall carry out the following commissioning checks, in addition to the other checks and tests recommended by the manufacturers.

1.23.1 General

1.23.1.1 Check name plate details according to the specification.

1.23.1.2 Check for physical damage.

1.23.1.3 Check tightness of all bolts, clamps, joints connecting terminals.

1.23.1.4 Check earth connection.

1.23.1.5 Check cleanliness of insulators and bushings.

1.23.1.6 Check all moving parts for proper lubrication.

1.23.1.7 Check settings of all the relays.

1.23.2 Circuit Breakers

1.23.2.1 Check alignment of breaker truck for free movement.

1.23.2.2 Check correct operation of shutters.

1.23.2.3 Check control wiring for correctness of connections, continuity and IR values.

1.23.2.4 Manual operation of breaker completely assembled.

1.23.2.5 Power closing/opening operation, manually and electrically.

1.23.2.6 Breaker closing and tripping time.

1.23.2.7 Trip free and anti-pumping operation.

1.23.2.8 IR values, minimum pick up voltage and resistance of coils.

1.23.2.9 Contact resistance

1.23.2.10 Simultaneous closing of all the three phases.

1.23.2.11 Check electrical & mechanical interlocks provided.

1.23.2.12 Check on spring charging motor, correct operation of limit switches, and time of charging.

1.23.2.13 All functional checks.

1.23.3 Current Transformers

1.23.3.1 Megger between winding and winding terminals to body.

1.23.3.2 Polarity test

1.23.3.3 Ratio identification checking of all ratios on all cores by primary injection of current.

1.23.3.4 Spare CT cores, if available, to be shorted and earthed.

1.23.4 Voltage Transformer

1.23.4.1 Insulation resistance test

1.23.4.2 Ratio test on all cores.

1.23.4.3 Polarity test.

1.23.4.4 Line connections as per connection diagram.

1.23.5 Cubicle Wiring

1.23.5.1 Check all switch developments.

1.23.5.2 Each wire shall be traced by continuity tests and it should be made sure that the wiring is as per relevant drawing. All interconnections between panels/equipment shall be similarly checked.

1.23.5.3 All the wires shall be meggered to earth.

1.23.5.4 Functional checking of all control circuit e.g. closing, tripping control, interlock, supervision and alarm circuit.

1.23.6 Relays

1.23.6.1 Check connections and wiring.

1.23.6.2 Megger all terminals to body.

1.23.6.3 Megger AC to DC terminals.

1.23.6.4 Check operating characteristics by secondary injection.

1.23.6.5 Check minimum pick up voltage of DC coils.

1.23.6.6 Check operation of electrical/mechanical targets.

1.23.6.7 Relays settings.

1.23.6.8 Check CT and VT connections with particular reference to their polarities for directional relays, wherever required.

1.23.7 Meters

1.23.7.1 Check calibration by comparing it with a sub-standard.

1.23.7.2 Megger all insulated portions.

1.23.7.3 Check CT and VT connections with particular reference to their polarities for power type meters.

1.24 SPECIAL TOOLS AND TACKLES

1.24.1 The Bidder shall include in his proposal any special tools and tackles required for erection, testing commissioning and maintenance of the equipments offered.

1.24.2 The list of these special tools and tackles shall be given in the bid proposal sheets alongwith their respective prices.

1.24.3 The total price of the special tools and tackles shall be included in proposal sheets.

1.25 EQUIPMENT TO BE FURNISHED

1.25.1 The Bidder shall quote for various AC/DC distribution boards in accordance with this specification.

1.25.2 Standard scheme of interconnection of switchboards and distribution boards alongwith tentative feeder disposition for each board is indicated in Standard SLD of AC & DC system enclosed alongwith bid documents. The bidder shall quote board prices on the basis of standard SLD and their estimation of feeders for entire present and future bays requirement. Any other feeder required as per system requirement for efficient and reliable operation shall be deemed to be included in bidder's scope.

1.25.3 The Bill of Materials for each type of module shall be as under. These are minimum indicative requirement of the system. The necessary auxiliary relays, push buttons and indicating lamps shall be provided as per scheme requirement. Any other item/component required with in a module for efficient and reliable operation shall be deemed to be included in bidder's scope.

1.25.4 Module Type AE (Electrically controlled circuit breaker for incoming and Bus Coupler Circuit).

(i) One (1) Triple pole air circuit breaker complete with all accessories and power operated mechanism as specified.

(ii) Two (2) Neutral link.

(iii) Three (3) Current Transformer for metering.

(iv) One (1) Ammeter with selector switch.

(v) Three (3) Current Transformer for relaying.

(vi) One (1) Triple pole instantaneous over-current relay having the setting range of 200-800% or 500-2000% of CT secondary and adjustable definite minimum time.

(vii) One (1) Instantaneous earth fault relay having an adjustable setting range of 10-40% or 20 - 80% of CT secondary current and adjustable definite minimum time. The earth fault relay shall be provided with a stabilising resistor.

(viii) One(1) set Current and Voltage transducers.
(ix) One(1) set High speed tripping relays.

1.25.5 Module Type - M1 (Circuit Breaker Controlled Motor Feeder)

(i) One (1) Triple pole Air Circuit Breaker complete with accessories,and power operated mechanism as specified.

(ii) One (1) Three position 6 pole selector switch 'SWITCHGEAR/NORMAL /TRIAL'.

(iii) Three (3) Current Transformer for metering.

(iv) One (1) Ammeter with Ammeter Selector Switch

(v) Three (3) Current Transformer for relaying.

(vi) One (1) Triple pole instantaneous over-current relay for providing positive sequence current protection in all the three phases. The relay setting range shall be continuously adjustable between 200-800% or 400-1600% of CT secondary rated current as required.

(vii) One (1) Double pole inverse definite minimum time over current relays connected in R & B phases for over current protection of motor rated 110 kW - 200 kW. The relay shall have an adjustable setting range of 50% - 200% of CT Secondary current and time setting range of 0-30 Second. The relay shall be CDGM-22 of EE or equivalent.

(viii) One (1) Single pole adjustable definite time delay relay for motor overload alarm connected in Y-phase only. The relay shall have resetting ratio of not less than 90%. The relay shall have continuously adjustable time delay range of 2.5 to 25 Sec.

(ix) One (1) Instantaneous earth fault relay having an adjustable setting range of 10-40% or 20-80% of CT secondary current. The earth fault relay shall be provided with a stabilising resistor.

(x) One(1) set Current and Voltage transducers.

(xi) One(1) set High speed tripping relay.

1.25.6 Module Type E

(i) One (1) Four pole MCCB

1.25.7 Module G-1 (VT Module with under Voltage Relay)

(i) Three (3) $\frac{415}{\sqrt{3}}$ / $\frac{110}{\sqrt{3}}$ volts single phase voltage transformer star/star connect with star point solidly earthed mounted on common draw out chassis. Accuracy Class 0.5 for protection and metering with 50VA Burden.

(ii) Six (6) HRC Fuses mounted on the above chassis.

(iii) One (1) Four position voltmeter selector switch.

(iv) One (1) Voltmeter (0-500V)

(v) One (1) Double pole instantaneous under voltage relays with continuous variable setting range of 40-80% of 110 Volts.

(vi) One (1) Time delay pick up relay having a time setting range of 0.5 to 3 secs. with 3 `NO'. Self reset contacts, suitable for 220V DC.

(vii) One (1) Auxiliary relay 220V DC with 2 NO. self reset contacts.

(viii) Three (3) Indicating lamps with series resistor and colour lenses (Red, Blue & Yellow).

1.25.8 Module Type G-2

(i) Three (3) HRC Fuse

(ii) One (1) Voltmeter (0-500V)

(iii) One (1) Voltmeter selector switch four position (R-Y, Y-B, B-R OFF).

(iv) Three (3) Indication lamps (Red, Blue & Yellow)

1.25.9 Module Type H & H (BC) (Isolating Switch Controlled Incoming Circuit)

(i) One (1) Four pole MCCB

(ii) One (1) Red Indicating lamp to indicate isolating switch closed position.

1.25.10 Module Type S : (DC Metering and Protection Module)

(i) One (1) Voltmeter 300-0-300V DC for 220V DC DB/Voltmeter 0-75V DC for 50V DCDB

(ii) One (1) Three (3) position voltmeter selector switch

(iii) One (1) Instantaneous under voltage relay with 95% of 220V DC. The resetting ratio of relay of relay should not be more than 1.25. The relay shall be provided with a series resistor and a push button across if for resetting (pick up) the relay at about 105% of the drop out voltage.

(iv) One (1) Instantaneous over voltage relay with setting range of 110% of 220V DC. The resetting ratio of relay should not be less than 0.8. The relay shall have a push button in series of resetting the relay at about 95% of the operating voltage.

(v) One (1) Earth leakage relay only for 220V DC system having adjustable pick up range between 3 to 7 milliamps the relay shall be suitable for 220V DC/230V AC Auxiliary supply.

1.25.11 Module Type X

One (1) One (1) Double pole 250 V MCB/ MCCB suitable for 20kA for 1 sec. Fault level

1.25.12 Module Type-DC (Incomer from Battery & Chargers)

(i) One (1) Double pole 250V DC MCCB for incomer from Battery.

(ii) One (1) DC ammeter with shunt and range of 90-0-400 Amps. For 220V DC DB and 90-0-200 Amp for 50V DC DB.

(iii) Two (2) Double pole 250V DC MCCB/MCB

(iv) One (1) Double pole single throw 250V DC air break switch connecting battery & charger sections to DC DB.

(v) One(1) setVoltage and Current Transducers

1.25.13 Module Type DG-1 (Electrically Controlled Circuit Breaker for Incomer from DG Set)

a) One (1) Four pole circuit breaker complete with all accessories and power operated mechanism as specified.

b) One (1) Frequency meter.

c) One (1) Voltmeter with selector switch.

d) One (1) Remote/Local Selector switch.

e) Three (3) Current transformers for metering.

f) Six (6) Current Transformers for differential protection (out of this 3 Nos. will be supplied loose for mounting in DG set panel).

g) Three (3) Current transformers for relaying.

h) One (1) Ammeter Selector Switch.

i) One (1) Ammeter

j) One (1) Wattmeter of range 0-300 KW.

k) One (1) Three pole voltage controlled definite time delay relayhaving current setting range of 50-200% of CT secondary current and adjustable time delay 0.3 to 3 secs.

l) One (1) Watt hour meter with six (6) digits and minimum count of one (1) kwh.

m) One (1) Single pole definite time over current relay having a continuous setting range of 50-200% of CT secondary current and a time delay of 2.5-25 secs connected in CT of Y phase for overload alarm. The relay shall have a setting ratio of not less than 90%.

n) One (1) Three pole differential protection relay having an operating current setting range of 10-40% of generator full load current. The relay shall be of high impedance type, with necessary stabilizing resistors.

o) Two (2) Push buttons for Remote starting & stopping of DG Set (Red, Green).

p) One(1) set Current and Voltage transducers.

q) One(1) set High speed tripping relays.

1.25.14 Module Type H1

One (1) Double pole DC Switch with pad locking facility in off position.

1.25.15 Module Type EL

(i) One (1) Four pole MCCB

(ii) One (1) Contactor

(iii) Electronic Timer suitable for continuous operation, push button and selector switch be as per scheme requirement

1.26 PARAMETERS

1.26.1 Power Supply

1.26.1.1	AC System		3 phase, 4 wire, solidly earthed
	a)	Voltage	415 Volts, ± 10%
	b)	Frequency	50 Hz ± 2.5%
	c)	Combined variation	± 105% Absolute Sum in Voltage & frequency
	d)	Fault Level	20 kA (rms)
1.26.1.2	**DC System**		2 Wire, unearthed
	a)	System voltage	220V ± 10%
	b)	Fault Level	4 kA
	c)	System Voltage	48 V ± 10%
	d)	Fault Level	--

1.26.2 Control Supply Voltage

	a)	Trip and closing coils	220V DC Unearthed
	b)	Spring charging	220V DC Unearthed

1.26.3 Cubicle Data

1.26.3.1 Busbar Rating

	a)	Continuous for Vertical panels.	As specified in Standard SLD For AC & DC system.

b)	Short time (1 sec. kA (rms)		20 kA
c)	Momentary (kA) PEAK		45 kA
d)	Ambient Temperature		50°C
e)	One Minute Power Frequency Withstand		
	I.	Power Circuit	2500 Volts (rms)
	II.	Control Circuit	2500 Volts (rms)

1.26.3.2 Cubicle Colour Finish

a)	Interior	Smoke Grey shade No.692
b)	Exterior	Smoke Grey shade No.692

1.26.4 Circuit Breaker

a)	Type	Air Break
b)	No. of poles	3
c)	Voltage & Frequency	415 Volts, ± 10%, 50 HZ + 2.5%
d)	Rated Operating Duty	As per IEC
e)	Rated service short-circuit Breaking capacity (Ics)	20 kA (RMS)
f)	Short Circuit making current	45 kA (Peak)
g)	Short time withstand current for 1 sec. duration.	20 kA (RMS) for 1 sec.
h)	Operating Mechanism current for 1 sec. duration.	20 kA (RMS) for 1 sec.
i)	No. of auxiliary contacts	4 NO & 4 NC contacts for Purchaser's use on fixed portion of the cubicle
j)	Short Circuit breaking current	
	I. AC Component	20 kA (RMS)
	II. DC Component	As per IEC: 60947 (Part 2)

1.26.5 MOULDED CASE CIRCUIT BREAKER

	AC System	DC System

a)	No. of poles	4	2
b)	Voltage & Frequency	415 Volts, ± 10% 50 HZ ± 2.5%	250V
c)	Rated Operating Duty	As per IEC	
d)	Rated service short-circuit Breaking capacity (Ics)	20 kA (RMS)	4 kA
e)	Short Circuit making current	45 kA (Peak)	-
f)	No. of auxiliary Contacts (only for incomer And bus-coupler MCCBs)	1 NO &1 NC	1 NO &1 NC
g)	Rated Ultimate Short Circuit breaking capacity		
	I. AC Component	20 kA (RMS)	As per IEC
	II. DC Component	As per IS:13947 IEC 60947	

1.26.6 Meters

a)	Accuracy class	2.5
b)	One minute power frequency withstand test voltage in KV	2.0

1.26.7 Current Transformers

a)	Type	Cast resin, Bar primary
b)	Voltage class and frequency	650V, 50 Hz
c)	Class of Insulation	E or better
d)	Accuracy class metering CT	Class 1, VA adequate for application but not less than 7.5 VA.
e)	Accuracy class protection CT	5 P 15, VA adequate for application, but not less than 7.5 VA.
f)	Accuracy class differential protection	PS, KPV = 300V
g)	Short Time Current Rating (for CTs Associated with circuit breakers)	

I.	Current	20 kA (RMS)
II.	Duration	One Second
III.	Dynamic Rating	45 kA (Peak)
IV.	One minute power frequency withstand test voltage.	2.5 kV (rms)

1.26.8 Voltage Transformer

a)	Type	Cast Resin
b)	Rated Voltage	
	Primary	415/√3 V
	Secondary	110/√3 V
c)	Method of connection	
	Primary	Star
	Secondary	Star
d)	Rated voltage factor	1.1 continuous, 1.5 for 3 seconds
e)	Class of insulation	E or better
f)	One minute power frequency withstand voltage	2.5 KV (RMS)
g)	Accuracy class	0.5, not less than 20VA

1.26.9 Relay

a)	One minute power Frequency withstand test	2 kV (rms)

1.26.10	**Transducers (1 phase)**	**Current**	**Voltage**
	a) Operating Voltage	220 V DC	220V DC
	b) I/P	1A.	110V AC
	c) O/P	4-20 mA	4-20 mA
	d) Type	Analogue	Analogue

1.26.11 **Lighting Transformers**

Lighting transformers shall be of 100 KVA rating, 400/4400 V, 3 phase, 50 Hz Dry type natural air cooled type. The technical parameters of these lighting transformers are as

follows:

Technical Parameters of Lighting Transformer

Type of transformer	:	Dry type natural air cooled
Rating	:	100 KVA
Voltage ratio	:	415/415 volts
No. of phases	:	Three
Frequency	:	50 Hz
Winding connection	:	Dyn-1
Class of insulation	:	'B' class
Impedance	:	4% ± 10%
No. of taps & steps	:	5, ± 5% in steps of 2.5%
Ref. standard	:	IEC: 60076

1.27 AUTOMATIC CONTROL OF OUTDOOR LIGHTING

1.27.1 EL-type module of 400V Main lighting distribution board and Emergency lighting distribution board and shall be controlled by timer and contactor module to facilitate its operation automatically.

1.28 AUTOMATIC SUPPLY CHANGEOVER

Automatic changeover between Incomer I, Incomer II, and DG set is to be carried out during the failure of supply in one/or both the incomers. After the restoration of the supply, system shall be restored to normal condition automatically. The requirement of changeover under various conditions are as below:

(i) Under normal conditions i.e. when supply is available in both the incomers, incomers I&II of 400 V Main switchboard, ACDB shall be in closed condition and Bus couplers and DG set breaker shall be in open condition.

(ii) In case of failure of either of the sources, the incomer of that source shall trip and Bus coupler shall get closed. On restoration of supply, normal conditions described above are to be established automatically.

iii) In case of failure of supply in both the sources, both incomers, incomers of ACDBs and ACDB Bus coupler shall trip and DG set breaker switched on.
On restoration of one or both sources, DG set breaker shall trip, DG set stopped and conditions described in paragraph (i) /(ii) shall be restored.

To avoid unnecessary operation of switchgear for momentary disturbances all changeovers from one state to another shall be initiated after a time delay, after the conditions warranting such change has been detected.

1.29 ANALOGUE INPUTS

LT System shall have provision of following analogue inputs for owner's substation automation purpose. These analogue inputs shall be generated by distinct transducers to be provided in respective modules. These inputs shall be wired up to respective terminal blocks.

ANALOGUE INPUTS:

i) Voltage R-Y, Y-B, B-R of Main Switch Board section-I
ii) Voltage R-Y, Y-B, B-R of Main Switch Board section-II
iii) Current from LT transformer-I
iv) Current from LT transformer-II
v) Voltage of 220/110V DCDB-I
vi) Voltage of 220/110V DCDB-II
vii) Current from 220/110V Battery set-I
viii) Current from 220/110V Battery set-II
ix) Voltage of 48V DCDB-I
x) Voltage of 48V DCDB-II
xi) Current from 48V Battery set-I
xii) Current from 48V Battery set-II

1.30 **DIGITAL (Potential Free) INPUTS:**

LT System shall have provision of following digital inputs for owner's substation automation purpose. These digital inputs shall be made available in the form of potential free contacts to be provided in respective modules. These potential free contacts shall be wired up to respective terminal blocks.

i) Main (MSB) Incomer-I breaker On/Off
ii) Main (MSB) Incomer-II breaker On/Off
iii) Main(MSB) 400V Bus-I/II U/V
iv) Main (MSB) bus coupler breaker on/off
v) DG set breaker on/off
vi) LT transformer-I Bunchholz Alarm & trip
vii) LT transformer-II Buchloz Alarm & trip
viii) LT transformer-I WTI Alarm & trip
ix) LT transformer-II WTI Alarm & trip
x) LT transformer-I OTI Alarm & trip
xi) LT transformer-II OTI Alarm & trip
xii) 220/110 V DC-I earth fault
xiii) 220/110V DC-II earth fault

TECHNICAL SPECIFICATION

VOL-II, SEC-VIII

BATTERY AND BATTERY CHARGER

Table of contents

Clause No.	Description
1.1	GENERAL TECHNICAL REQUIREMNTS
1.2	Battery
1.3	Battery Charger
	Annexure-I

SECTION - VIII BATTERY AND BATTERY CHARGER

1.1. GENERAL TECHNICAL REQUIREMENTS

1.1.1.1. All materials/components used in battery chargers and batteries shall be free from flaws and defects and shall conform to the relevant Indian/IEC standards and good engineering practice.

1.1.1.2. DC System shall consist of two (2) float-cum-boost chargers and two (2) battery sets for each of 220/110V and 48 V systems respectively. The standard scheme drawing is enclosed with this specification.

1.1.1.3. Bidder shall select number of cells, float and Boost voltage to achieve following system requirement:

System Voltage	Maximum Voltage during Float operation	Minimum voltage available when no charger working and battery fully discharged upto 1.85V per cell.	Minimum Nos of cell
220 Volt	242 Volt	198 Volt	107
110 Volt	121 Volt	99 Volt	54
48 Volt	52.8 Volt	43.2 Volt	23

Bidder shall furnish calculation in support of battery sizing, selection of number of cells, float and Boost voltages during detailed engineering for Owners acceptance.
Battery sizing calculations shall be done as per IEEE- 485 on the basis of following duty cycle:

	Load	**Duration**	**Type Of Loads**
220V/ 110V DC System	Continuous Load	3 hours	Relays, IEDs, Station HMIs, spring charging, Isolator interlocking load, Miscellaneous permanently connected loads etc.
	Emergency Load	1 hour	Substation emergency lighting loads.
	Momentary Load	1 minute	Breaker closing, Tripping loads (taking simultaneous occurrence as per system)
48V DC System	Continuous Load	3 hours	Continuous load associated with PLCs.(when speech is not working)
	Momentary Load	15 minute	Loads associated with PLCs (when speech is working)

1.2. Battery

1.2.1. **Type**

The DC Batteries shall be VRLA (Valve Regulated Lead-Acid) type and shall be Normal Discharge type. These shall be suitable for a long life under continuous float operations and occasional discharges. Air-conditioning shall be provided in Battery room the requirement of which has been specified elsewhere in the Technical Specification. The 220/110 V DC system is unearth and 48 V DC system is + ve earth system.

1.2.2. **Constructional Requirements**

The design of battery shall be as per field proven practices. Partial plating of cells is not permitted. Paralleling of cells externally for enhancement of capacity is not permitted. Protective transparent front covers with each module shall be provided to prevent accidental contact with live module/electrical connections.

1.2.3. **Containers**

The container material shall have chemical and electro-chemical compatibility and shall be acid resistant. The material shall meet all the requirements of VRLA batteries and be consistent with the life of battery. The container shall be fire retardant and shall have an Oxygen Index of at least 28 %. The porosity of the container shall be such as not to allow any gases to escape except from the regulation valve. The tensile strength of the material of the container shall be such as to handle the internal cell pressure of the cells in the worst working condition. Cell shall not show any deformity or bulge on the sides under all working conditions. The container shall be capable of withstanding the rigours of transport, storage and handling. The containers shall be enclosed in a steel tray.

1.2.4. **Cell Covers**

The cell covers shall be made of suitable material compatible with the container material and permanently fixed with the container. It shall be capable to withstand internal pressure without bulging or cracking. It shall also be fire retardant. Fixing of Pressure Regulation Valve & terminal posts in the cover shall be such that the seepage of electrolyte, gas escapes and entry of electro-static spark are prevented.

1.2.5. **Separators**

The separators used in manufacturing of battery cells, shall be of glass mat or synthetic material having high acid absorption capability, resistant to sulphuric acid and good insulating properties. The design of separators shall ensure that there is no misalignment during normal operation and handling.

1.2.6. **Pressure Regulation Valve**

Each cell shall be provided with a pressure regulation valve. The valve shall be self-re-sealable and flame retardant. The valve unit shall be such that it cannot be opened without a proper tool. The valve shall be capable to withstand the internal cell pressure specified by the manufacturer.

1.2.7. **Terminal Posts**

Both the +ve and –ve terminals of the cells shall be capable of proper termination and shall ensure its consistency with the life of the battery. The surface of the terminal post extending above the cell cover including bolt hole shall be coated with an acid resistant and corrosion retarding material. Terminal posts or any other metal part which is in contact with the electrolyte shall be made of the same alloy as that of the plates or of a proven material that does not have any harmful effect on cell performance. Both +ve and –ve posts shall be clearly and unambiguously identifiable.

1.2.8. **Connectors, Nuts & Bolts, Heat Shrinkable Sleeves**

Where it is not possible to bolt the cell terminals directly to assemble a battery, separate non-corroding lead or copper connectors of suitable size shall be provided to enable connection of the cells. Copper connections shall be suitably lead coated to

withstand corrosion due to sulphuric acid at a very high rate of charge or discharge. Nuts and bolts for connecting the cells shall be made of copper, brass or stainless steel. Copper or brass nuts and bolts shall be effectively lead coated to prevent corrosion. Stainless steel bolts and nuts can be used without lead coating.

All inter cell connectors shall be protected with heat shrinkable silicon sleeves for reducing the environmental impact including a corrosive environment.

1.2.9. **Flame Arrestors**

Each cell shall be equipped with a Flame Arrestor to defuse the Hydrogen gas escaped during charge and discharge. Material of the flame arrestor shall not affect the performance of the cell.

1.2.10. **Battery Bank Stand**

All batteries shall be mounted in a suitable metallic stand/frame. The frame shall be properly painted with the acid resistant paint. The suitable insulation shall be provided between stand/frame and floor to avoid the grounding of the frame/stand.

1.2.11. **Capacity Requirements**

When the battery is discharged at 10 hour rate, it shall deliver 80% of C (rated capacity, corrected at 27º Celsius) before any of the cells in the battery bank reaches 1.85V/cell.

The battery shall be capable of being recharged from the fully exhausted condition (1.75V/cell) within 10 hrs up to 90% state of charge. All the cells in a battery shall be designed for continuous float operation at the specified float voltage throughout the life.

The capacity (corrected at 27ºCelcius) shall also not be less than C and not more than 120% of C before any cell in the battery bank reaches 1.75V/cell. The battery voltage shall not be less than the following values, when a fully charged battery is put to discharge at C/10 rate:

(a) After Six minutes of discharge : 1.98V/cell
(b) After Six hours of discharge : 1.92V/cell
(c) After 8 hours of discharge : 1.85V/cell
(d) After 10 hours of discharge : 1.75V/cell

Loss in capacity during storage at an average ambient temperature of 35º Celcius for a period of 6 months shall not be more than 60% and the cell/battery shall achieve 85% of its rated capacity within 3 charge/discharge cycles and full rated capacity within 5 cycles, after the storage period of 6 months. Voltage of each cell in the battery set shall be within 0.05V of the average voltage throughout the storage period. Ampere hour efficiency shall be better than 90% and watt hour efficiency shall be better than 80%.

1.2.12. **Expected Battery Life**

The battery shall be capable of giving 1200 or more charge/discharge cycles at 80% Depth of discharge (DOD) at an average temperature of 27º Celsius. DOD (Depth of Discharge) is defined as the ratio of the quantity of electricity (in Ampere-hour) removed from a cell or battery on discharge to its rated capacity. The battery sets shall have a minimum expected life of 20 years at float operation.

1.2.13. **Routine Maintenance of Battery system**

For routine maintenance of battery system, the contractor shall supply 1 set of following tools:

a) Torque wrench.
b) Cell test voltmeter(-3-0-+3) volts with least count of 0.01Volt.

1.2.14. **Type Test of Battery**

1.2.14.1. Contractor shall submit type test reports of following tests as per IEC 60896-21 & IEC 60896-22, 2004. The type test reports shall be submitted in accordance with the requirements stipulated in clause no. 9.2 of Technical Specification, Section 2: GTR except that the requirement of tests having been conducted within last five years as mentioned therein shall not be applicable.

S.No.	Description of test
1.	Gas emission
2.	High current tolerance
3.	Short circuit current and d.c. internal resistance
4.	Protection against internal ignition from external spark sources
5.	Protection against ground short propensity
6.	Content & durability of required markings
7.	Material identification
8.	Valve operation
9.	Flammability rating of materials
10.	Intercell connector performance
11.	Discharge Capacity
12.	Charge retention during storage
13.	Float service with daily discharges for reliable mains power
14.	Recharge behaviour
15.	Service life at an operating temperature of 40^0 C for brief duration exposure time.
16.	Impact of a stress temperature of 60^0 C for brief duration exposure time with 3 h rate discharge test.
17.	Abusive over-discharge
18.	Thermal runaway sensitivity
19.	Low temperature sensitivity
20.	Dimensional sensitivity at elevated internal pressure and temperature
21.	Stability against mechanical abuse of units during installation

Tests shall be conducted in accordance with IEC 60896-21 & IEC 60896-22, 2004

1.2.14.2. List of Factory & Site Tests for Battery

Sl. No.	Test	Factory Tests	Site Tests
1.	Physical Verification		√
2.	C/10 Capacity test on the cell	√	
3.	8 Hrs. Charge and 15 minutes discharge test at full rated load		√

1.2.15. **Installation and commissioning**

1.2.15.1. Manufacturer of Battery shall supervise the installation and commissioning and perform commissioning tests as recommended in O&M manual / or relevant standards. All necessary instruments, material, tools and tackles required for installation, testing at site and commissioning are to be arranged by Battery manufacturer/ Contractor

1.2.16. Contractor shall be submitted following documents for approval:

a) Data sheet as per Annexure-I
b) GA of cell and layout drawing
c) Discharge Data for 10 Hour, 8 Hour, 3 Hour, 2 Hour, 1 Hour, 15 Minutes and One Minute indicating capacity factors for end cell voltage of 1.75 V & 1.85 V.
d) Temperature correction factors
e) Installation and commissioning Instructions
f) O & M Manual

1.3. Battery Charger

The DC system for 220/110 V DC is unearthed and for 48 V DC is +ve earthed. The Battery Chargers as well as their automatic regulators shall be of static type and shall be compatible with offered VRLA batteries. All battery chargers shall be capable of continuous operation at the respective rated load in float charging mode, i.e. Float charging the associated Lead-Acid Batteries at 2.13 to 2.27 Volts per cell while supplying the DC load. The chargers shall also be capable of Boost charging the associated DC Battery at 2.28 to 2.32 volts per cell at the desired rate.
Charger shall regulate the float/boost voltage in case of prescribed temperature rise of battery as per manufacturer's recommendation to avoid thermal runaway. Necessary temperature sensors shall be provided in mid location of battery banks and shall be wired up to the respective charger for feedback control. The manufacturer shall demonstrate this feature during testing of each charger.

1.3.1. All Battery Chargers shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/current control, whether automatic or manual. When on automatic control mode during Float charging, the Charger output voltage shall remain within $\pm$1% of the set value, for AC input voltage variation of $\pm$10%, frequency variation of $\pm$2.5%, a combined voltage and frequency variation of $\pm$10%, and a DC load variation from zero to full load.

1.3.2. All battery chargers shall have a constant voltage characteristics throughout the range (from zero to full load) at the floating value of the voltage so as to keep the battery fully charged but without harmful overcharge.

1.3.3. All chargers shall have load limiters having drooping characteristic, which shall cause, when the voltage control is in automatic mode, a gradual lowering of the output voltage when the DC load current exceeds the Load limiter setting of the Charger. The Load-limiter characteristics shall be such that any sustained overload or short circuit in DC System shall not damage the Charger, nor shall it cause blowing of any of the Charger fuses. The Charger shall not trip on overload or external short circuit.

1.3.4. Uniform and step less adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the Charger panel covering the entire float charging output range specified. Step less adjustments of the Load-limiter setting shall also be possible from 80% to 100% of the rated output current for Charging

mode.

1.3.5. During Boost Charging, the Battery Charger shall operate on constant current mode (when automatic regulator is in service). It shall be possible to adjust the Boost charging current continuously over a range of 50 to 100% of the rated output current for Boost charging mode.

1.3.6. The Charger output voltage shall automatically go on rising, when it is operating on Boost mode, as the Battery charges up. For limiting the output voltage of the Charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for Boost Charging mode.

1.3.7. The Charger manufacturer may offer an arrangement in which the voltage setting device for Float charging mode is also used as output voltage limit setting device for Boost charging mode and the Load-limiter of Float charging mode is used as current setting device in boost charging mode.

1.3.8. Suitable filter circuits shall be provided in all the chargers to limit the ripple content (Peak to Peak) in the output voltage to 1%, irrespective of the DC load level, when they are not connected to a Battery.

1.3.9. **MCCB**

All Battery Chargers shall have 2 Nos. MCCBs on the input side to receive cables from two sources. Mechanical interlock should be provided such that only one shall be closed at a time. It shall be of P2 duty and suitable for continuous duty. MCCB's should have auxiliary contacts for annunciation.

1.3.10. **Rectifier Transformer**

The rectifier transformer shall be continuously rated, dry air cooled (A.N) and of class F insulation type. The rating of the rectifier transformer shall have 10% overload capacity.

1.3.11. **Rectifier Assembly**

The rectifier assembly shall be fully/half controlled bridge type and shall be designed to meet the duty as required by the respective Charger. The rectifier shall be provided with heat sink having their own heat dissipation arrangements with natural air cooling. Necessary surge protection devices and rectifier type fast acting HRC fuses shall be provided in each arm of the rectifier connections.

1.3.12. **Instruments**

One AC voltmeter and one AC ammeter alongwith selector switches shall be provided for all chargers. One DC voltmeter and DC ammeter (with shunt) shall be provided for all Chargers. The instruments shall be flush type, dust proof and moisture resistant. The instruments shall have easily accessible means for zero adjustment. The instruments shall be of 1.5 accuracy class. In addition to the above a centre zero voltmeter with selector switch shall also be provided for 220/110 V chargers for testing purpose.

1.3.13. **Air Break Switches**

One DC output switch shall be provided in all chargers. They shall be air break type suitable for 500 volts AC/ 250 DC. The contacts of the switches shall open and close

with a snap action. The operating handle of the switch shall be fully insulated from circuit. `ON' and `OFF' position on the switch shall be clearly indicated. Rating of switches shall be suitable for their continuous load. Alternatively, MCCB's of suitable ratings shall also acceptable in place of Air Break Switch.

1.3.14. **Fuses**

All fuses shall be HRC Link type. Fuses shall be mounted on fuse carriers which are in turn mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type base. In such case one insulated fuse pulling handle shall be supplied for each charger. Fuse rating shall be chosen by the Bidder depending on the circuit requirement. All fuses in the chargers shall be monitored. Fuse failure annunciation shall be provided on the failure of any fuse.

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1.3.15. **Blocking Diode**

Blocking diode shall be provided in the positive pole of the output circuit of each charger to prevent current flow from the DC Battery into the Charger.

1.3.16. **Annunciation System**

Audio-visual indications through bright LEDs shall be provided in all Chargers for the following abnormalities:

a) AC power failure
b) Rectifier/chargers fuse blown.
c) Over voltage across the battery when boost charging.
d) Abnormal voltage (High/Low)
e) Any other annunciation if required.

Potential free NO Contacts of above abnormal conditions shall also be provided for common remote indication "CHARGER TROUBLE" in Owner's Control Board. Indication for charger in float mode and boost mode through indication lamps shall be provided for chargers. A potential free contact for float/boost mode shall be provided for external interlocks.

1.3.17. **Name Plates and Marking**

The name plates shall be white with black engraved letters. On top of each Charger, on front as well as rear sides, larger and bold name plates shall be provided to identify the Charger. Name plates with full and clear inscriptions shall also be provided on and inside of the panels for identification of the various equipments and ease of operation and maintenance.

1.3.18. **Charger Construction**

The Chargers shall be indoor, floor-mounted, self-supporting sheet metal enclosed cubicle type. The Contractor shall supply all necessary base frames, anchor bolts and hardware. The Chargers shall be fabricated from 2.0mm cold rolled sheet steel and shall have folded type of construction. Removable gland plates for all cables and lugs for power cables shall be supplied by the Contractor. The lugs for power cables shall be made of electrolytic copper with tin coat. Power cable sizes shall be advised to the Contractor at a later date for provision of suitable lugs and drilling of gland plates. The Charger shall be tropicalised and vermin proof. Ventilation louvers, if provided shall be backed with screens. All doors and covers shall be fitted with synthetic rubber gaskets. The chargers shall have hinged double leaf doors provided on front and on backside for adequate access to the Charger's internals. All the charger cubicle doors shall be properly earthed. The degree of protection of

Charger enclosure shall be at least IP-42 as per IEC:- 60947 Part 1.

1.3.18.1. All indicating instruments, control switches and indicating lamps shall be mounted on the front side of the Charger.

1.3.18.2. Each Charger shall be furnished completely wired upto power cable lugs and terminal blocks and ready for external connections. The control wiring shall be carried out with PVC insulated, 1.5 sq.mm. stranded copper wires. Control terminals shall be suitable for connecting two wires, with 2.5 sq.mm stranded copper conductors. All terminals shall be numbered for ease of connections and identification. Each wire shall bear a ferrule or tag on each end for identification. At least 20% spare terminals shall be provided for control circuits.

1.3.18.3. The insulation of all circuits, except the low voltage electronic circuits shall withstand test voltage of 2 KV AC for one minute. An air clearance of at least ten (10) mm shall be maintained throughout for such circuits, right up to the terminal lugs. Whenever this clearance is not available, the live parts shall be insulated or shrouded.

1.3.19. **Painting**

All sheet steel work shall be pre-treated, in tanks, in accordance with IEC/International Standards. Degreasing shall be done by alkaline cleaning. Rust and scale shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be in accordance with IEC/International Standards. Welding shall not be done after phosphating. The phosphating surfaces shall be rinsed and passivated prior to application of stoved lead oxide primer coating. After primer application, two coats of finishing synthetic enamel paint of shade-692 (smoke grey) shall be applied, unless required otherwise by the Owner. The inside of the chargers shall be glossy white. Each coat of finishing synthetic enamel paint shall be properly staved. The paint thickness shall not be less than fifty (50) microns.

1.3.20. **TESTS**

1.3.20.1. Battery chargers shall conform to all type tests as per relevant International Standard. Performance test on the Chargers as per Specification shall also be carried out on each Charger as per specification. Rectifier transformer shall conform to all type tests specified in IEC: 60146 and short circuit test as per IEC:60076. Following type tests shall be carried out for compliance of specification requirements:

i) Voltage regulation test
ii) Load limiter characteristics test
iii) Efficiency tests
iv) High voltage tests
v) Temperature rise test
vi) Short circuit test at no load and full load at rated voltage for sustained short-circuit.
vii) Degree of protection test
viii) Measurement of ripple by oscilloscope.
ix) Temperature compensation feature demonstration

1.3.20.2. The Contractor may be required to demonstrate to the OWNER that the Chargers conform to the specification particularly regarding continuous rating, ripple free output, voltage regulation and load limiting characteristic, before despatch as well as after installation at site. At site the following tests shall be carried out :

i) Insulation resistance test
ii) Checking of proper annunciation system operation.

1.3.20.3. If a Charger fails to meet the specified requirements, the Contractor shall replace the same with appropriate Charger without affecting the commissioning schedule of the Sub-station, and without any extra cost to the OWNER.

1.3.20.4. The Contractor shall present for inspection, the type and routine test certificates for the following components whenever required by the OWNER.

(i) Switches.
(ii) Relays/ MCCBs
(iii) Instruments.
(iv) DC fuses.
(v) SCR.
(vi) Diodes.
(vii) Condensers.
(viii) Potentiometers.
(ix) Semiconductor
(x) Annunciator.
(xi) Control wiring
(xii) Push buttons and contactors.

Makes of above equipment shall be subject to Owner's approval.

Annexure-I

BATTERY SYSTEM DATA SHEETS

S.No.	Description of Data	Unit	220 V/ 110 V	48 V
1	General Data			
a)	Battery Type:			
	Grid alloy: Pure lead(Pb), lead calcium (Pb-Ca), lead antimony (Pb-Sb), or lead selenium (Pb-Se) or other pl. specify			
	Cell type: Absorbed glass mat or gel cell or other please specify			
	Seller's type number			
	Number of positive plates per cell			
b)	Does each battery and battery [rack]/ [cabinet] meet the seismic requirements	[Yes] [No]		
c)	Manufacturer's Designed Life of Battery	Yrs.		
d)	Recommended Battery Charger Data:			
	Floating voltage range	V		
	Boost charge	V		
	Current rating	Amps.		
	Recharge time	hr		
e)	Heat Released During:			
	Discharge duty cycle	Watt		
	Float charge	Watt		
	Boost Charge	Watt		
f)	Maximum Amount of Hydrogen Gas Evolved			
	During Battery-Boost Charge (2.33 V per cell) at Maximum Battery Temperature	(Litre /h)		
	Hydrogen Gas Evolution at Float	(Litre /h)		
g)	Time Battery may be Stored Without a Freshening Charge	months		
h)	Temperature Compensation Provided and its Details			

S.No.	Description of Data	Unit	220 V/ 110 V	48 V
2.	Physical Description.			
a)	Battery Cell:			
	Size (L x W x H)	mm		
	Weight	Kg		
	Volume of electrolyte gal	L		
	Jar cover material			
	Jar container material			
	Separator material			

	Retainer material					
	Limiting-oxygen index (LOI)					
b)	Battery [Rack] [Cabinet]:					
	Outline or catalog number					
	Quantity of [racks][cabinets] for the battery					
	Description (tier or step type)					
c)	Total Net Weight of Battery Including [Racks] [Cabinets]	kg				
d)	Total Shipping Weight of Each Battery Jar and Associated Equipment	kg				
e)	Connectors:					
	Intercell:					
	Type					
	Material					
	No. per connection					
	Inter-[Tier] [Step]:					
	Type					
	Material					
	No. per connection					
	Terminal Detail:					
	Type					
	Material					
f)	Terminal Lugs for Power Cable:					
g)	Torque Data:		**Initial Torque Value**	**Re-torque Value**	**Initial Torque Value**	**Re-torque Value**
	Intercell Connectors					
	Inter-[Tier] [Step]:					

S.No.	**Description of Data**	**Unit**	**220 V/ 110 V**	**48 V**
3.	Performance Data.			
	Battery String Designation No. [1] [ ]			
	Float Voltage Without Boost	V/cell		
	Float Voltage With Boost	V/cell		
	Boost Charge Voltage	V/cell		
	Recommended Frequency of Boost Charge			
	Recommended Duration of Boost Charge			
	Open-Circuit Voltage	V/cell		
	Short-Circuit Current at Battery Terminals at Float Voltage at (27°C):			
	Battery Discharge Characteristics	A or A /positive plate		
	Guaranteed Amp-Hour Capacity (at	AH		

	the 10-hr rate) to Specified Final Voltage			
	One-minute	A/cell		
	Fifteen-minute	A/cell		
	One-hour	A/cell		
	Two-hour	A/cell		
	Three-hour	A/cell		
	Eight-hour	A/cell		
	Ten-hour	A/cell		
4.	Required operating environment.			
	Battery Room Ambient Temperature Range	(°C to °C)		
	Battery Room Ambient Design Temperature	°C		
	Battery Room Minimum/Maximum Design Temperature	(°C to °C)		
	Maximum temperature at which battery can be stored	°C		

TECHNICAL SPECIFICATION

VOL-II, SEC-IX

LIGHTING SYSTEM

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SECTION - IX
LIGHTING SYSTEM

1.0 LIGHTING SYSTEM

1.1 LIGHTING SYSTEM FOR SUBSTATION

The scope of work comprises of design, engineering, testing, supply, installation, testing and commissioning of various lighting fixtures complete with lamps, supports and accessories, ceiling fans complete with electronic regulators, exhaust fans for toilets and pantry & accessories, lighting panels, lighting poles complete with distribution boxes, galvanized rigid steel /rigid PVC conduits, lighting wires, G.I. Earthwire, receptacles, tag block & telephone socket, switchboards, switches, junction boxes, pull out boxes complete with accessories, for control room cum administrative building, switchyard panel room if applicable, Fire Fighting pump house, Substation, security room, Main Gate and street lighting.

The entire control room building, fire fighting pump house and Security room lighting shall be done by LED based low power consumption luminaries to achieve desired lux level specified. The bidder shall quote on lumpsum basis on the basis of design criteria specified for each control room building, Security room and fire fighting pump house.

1.1.1 SYSTEM DESCRIPTION

The lighting system shall comprise of the following:

1.1.2 AC Normal Lighting

AC lights will be connected to AC lighting panels. All the lights connected to the AC lighting system in different areas will be connected to the main lighting distribution boards.

1.1.3 AC Emergency Lighting

This system will be available in control room building, Fire fighting pump house , & switchyard. AC lighting load will be connected to this system which will be normally 'ON'. The lighting panels of this system will be connected to the Emergency lighting board which is fed from diesel generator during the emergency. 25% of lighting fixtures shall be connected on AC emergency lighting.

1.1.4 D.C. Emergency lighting

A few DC emergency lighting fixtures operated on the DC system will be provided in the strategic locations including staircase, corridors, electrical rooms, Battery charger room, LT switchgear room in control room building, and Fire fighting pump house so that the operating personnel can safely find their way even during emergency of a total AC failure. These lights will be normally 'OFF' and will be switched 'ON' automatically when under voltage occurs in the AC main lighting

distribution board. GLS lamp down lighters in false ceiling area and Bulkhead fixtures in non false ceiling area to be used.

1.1.5 **Exit Lightings**

All Exit lightings in the buildings shall be fed by DC lighting panels. All necessary wiring and its termination shall be in the contractor's scope.

1.1.6 The lighting layout for and around Control Room Cum Administrative Office Building & Fire fighting Pump House indicating the type & BOQ for items shall be prepared and submitted by the contractor for owner's approval during detailed engineering.
The lux levels to be maintained in the switchyard shall be as per following:

Sl No	Area	Average Lux Level
1.	Control Room Building, Firefighting pump house, Security room	**SN. Area Average Lux level at floor level** i) Control Room & Conference room - 350 Lux ii) Battery room, Passage, Pantry, Toilets, Corridors etc. - 100 Lux iii) All other rooms - 200 Lux
2.	Switchyard	-50 lux on main Equipments (i.e,Transformer, Reactor ISO, CB, CT, CVT, SA, Capacitor Bank) at first level (Equipment connections level.) -20 lux on balance area of switchyard and street / Road at ground level. --10 lux (Area between fence and peripheral roads around the switchyard). The lighting between the fence and the peripheral road around switchyard shall be done by providing the lighting fixtures on lighting pole of suitable height, if required.

The minimum lux level to average lux level ratio should not be less than 0.6 (i.e Emin/Eav>0.6). The maintenance factor for indoor illumination design shall be considered as 0.8. The surface reflectance for ceiling/wall/floor shall be 50/30/10

For achieving the specified lux levels in the switchyard, the contractor can provide luminaries of 1x400 W/1x250 W and 2x400 W/ 2x250 W flood light as per requirement.

The contractor shall submit detailed calculation for reaching the above Lux level. Contractor shall conform the Lux levels at different locations of the switch yard and street lighting by measurement.

In addition to the normal lighting provided in the switchyard area to maintain the desired lux levels, high beam fixtures(Type SF4- 8 nos) on swivel support shall be

provided in strategic locations near equipment's for new substations which shall be kept normally OFF and these shall be switched ON in case of maintenance work.

1.1.7 Ceiling fans (1400 mm sweep, AC 230 volts) shall be provided in , fire fighting pump house and non AC rooms in the control room building and all the rooms in Security building as per the requirements. Wall mounted fans shall be provided in the conference room, control room, shift manager and substation incharge rooms in control room building. Exhaust fans shall be provided in toilets and pantry.

1.1.8 One no. of aluminum ladder of each size shall be supplied by the contractor for maintenance purpose.

1.1.9 The following specific areas are included in the scope of lighting:

(i) Switchyard Area.
(ii) Switchyard Control Room cum Administrative Office Building
(iii) Fire fighting pump house
(iv) Street lighting (peripheral) inside switchyard fencing (Street lighting shall be done using street lighting poles)
v) DG area lighting
vi) LT Transformer area
vii) Security Room
viii) Residential quarters, if applicable
ix) GIS building(including panel rooms), if applicable

1.1.10 **For Outdoor Illumination**

The switchyard and street lighting design including lux level calculations, surface illuminance diagram at varying equipment surface levels , detailed drawings showing the lighting layout and Electrical distribution diagram and BOQ for items shall be prepared by the Contractor and submitted for approval. The above layout drawings will include disposition and location of lighting fixtures, receptacles, etc.

1.1.11 **For Indoor Illumination**

The conduit layout drawing for substation buildings, Electrical distribution diagram for substation buildings, & for substation yard etc. shall be prepared by the Contractor. All wiring including telephone wiring (tinned two pair copper) shall be in concealed conduit. Concealed MS junction boxes for sockets and light points shall be provided in all the rooms of Control Room cum Administrative Office Building and Fire Fighting pump house. In case where false ceiling surface conducting is permissible, all down run conduits will be concealed in wall below the false ceiling.

1.1.12 Each cable run shall be tagged with number that appear in the cable schedules. Cables shall be tagged at their entrance and/or exit from any piece of equipment, junction or pull box, floor opening etc.

1.1.13 The tag shall be made up of aluminum with the number punched on it and securely attached to the cable by not less than two turns of G.I. wire. Cable tags shall be rectangular in shape for power cables and circular shape for control cables.

1.1.14 Location of cables laid directly under ground shall be indicated clearly by cable marker made of galvanised iron plate embedded in concrete block.

1.1.15 The location of underground cable joints if any, shall be clearly indicated with cable marker with an additional inscription "cable joint".

1.1.16 The marker, which is a concrete block, shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change of direction. It shall also be located on both sides of the road or drain crossing.

2.0 DESCRIPTION OF ITEMS

2.1 DESCRIPTION OF ITEMS FOR SUBSTATION LIGHTING

The Contractor shall supply and install the following equipment and accessories in accordance with the specification.

2.1.1 LIGHTING PANELS

2.1.1.1 OUTDOOR

AC lighting panel with 400V, 63A, 3 phase 4 wire bus and one no. 63A, TPN, MCB with neutral unit as incomer and 20A, SP MCB as outgoing feeders, the details are as follows.

Type Of Panel	Description	Detail Of Outgoing Feeders
ACP 2	Outdoor	6 nos- 20 A single pole MCB and 3 No. 32 A Triple pole MCB with Neutral and suitable timer and contactor for automatic switching.
ACP 3	Outdoor Street lighting Panel	3 nos.-32A Triple pole MCB with Neutral with suitable timer and contactor for automatic switching

Note: The number of outgoing feeders indicated above are the minimum.

2.1.1.2 INDOOR

415 V indoor AC lighting panel ,63 A 3 phase 4 wire bus and one number 63 amp FP MCB with 300ma 63 A FP RCCB. Flush mounted with per phase isolation and LED indication lamps. The DB will be flush mounted and double door type.

Type Of Panel	Description	Detail Of Outgoing Feeders
ACP 1	Indoor	18 nos outgoing ,16 Amps SP MCB

220V DC indoor type change over board and 220V DC 32A two wire bus and one 32A contractor backed up by 32A double pole MCB as incomer. The panel shall have local push button controls. Following are the various types of panels required with control timer.

Type Of Panel	Description	Detail Of Outgoing Feeders
DCP	Indoor	6 nos outgoing ,16 Amps DP MCB

2.1.1.3 **Sub-Lighting Panels**

Type Of Panel	Description	Detail Of Outgoing Feeders
SLP	Outdoor	4 pole 32A Isolator suitable for 400V, 50 cycles AC supply, with LILO facility using 8 nos terminal blocks suitable for cable upto 16 mm sq. cable Enclosure shall be suitable for outdoor use with IP-55 degree of protection as per IEC:60529.

2.1.2 **Lighting Fixtures**

Please Refer Annexure-1

2.1.3 **RECEPTACLES**

	Description	Detail Of Outgoing Feeders
RO	Outdoor	15A, 230V, Receptacle 2 pole, 3- pin type
RP	Outdoor	63A, 400V, Interlocked switch socket, receptacle
RI	Indoor	5/15A, 230V, Receptacle 3-pin type (Modular)

2.1.4 (a) **SWITCH BOARDS**

Modular type switches, 5/15 Amp. Receptacles.

2.1.4 (b) **CONDUITS AND ACCESSORIES**

Galvanised Rigid steel or Rigid PVC conduits of 20/25 /32 mm for Lighting and Telephone wiring

2.1.5 **JUNCTION BOXES -** with 5 Nos.of terminal blocks

2.1.6 **LIGHTING POLES -** (Type A1 poles & Type E1 poles)

2.1.7 **FANS-**1400 mm Sweep with Electronic regulator and 450 mm Wall Mounted fans

2.1.8 **MAINTENANCE EQUIPMENT**

i) A type Aluminium ladder of 3 mtr. vertical height.

ii) Cartwheel mounted aluminium ladder Vertical Extendable from 5.1m to 11m.

2.1.9. **RECEPTACLES**

a) All receptacles shall be of cast steel/aluminium, heavy duty type, suitable for fixing on wall/column and complete with individual switch.

b) In general the receptacles to be installed are of the following types:

i) **Type RO**-15A, 230V, 2 pole, 3 pin type with third pin grounded, metal clad with gasket having cable gland entry suitable for 2Cx6 sq.mm. PVC/aluminium armoured cable and a metallic cover tied to it with a metallic chain and suitable for installation in moist location and or outdoor. The switch shall be of rotary type. Receptacles shall be housed in an enclosure made out of 2 mm thick Gl sheet with hinged doors with padlocking arrangements. Door shall be lined with good quality gasketing. This shall conform to IP-55.

ii) **Type RI-**The 5/15 amp 6 pin receptacles with switches will be of Modular type with flush type switches and electroplated metal enclosures of approved make

iii) **Type RP** - 63A, 415V, 3 phase, 4 pin interlocked plug and switch with earthing contacts. Other requirements shall be same as type RO. The receptacle shall be suitable for 3.5C x 35/3.5Cx70 sq.mm. aluminium conductor cable entry and shall also be suitable for loop-in and loop out connection of cables of identical size. Receptacle shall be suitable for outdoor application. Receptacles shall be housed in a box made out of 2mm thick G.I. sheet, with hinged door with padlocking arrangement. Door shall be lined with good quality gasketing. This shall conform to IP-55.

2.1.10. **LIGHTING PANELS (L.P.)**

2.1.10.1 Each panel shall be provided with one incoming triple pole MCB with neutral link and outgoing miniature circuit breakers as per clause 2.0. The panels shall conform to IEC: 60439.

2.1.10.2 **Constructional Features**

a) Panels shall be sheet steel enclosed and shall be dust, weather and vermin proof.

Sheet steel used shall be of thickness not less than 2.00 mm (cold rolled) smoothly finished, levelled and free from flaws. Stiffners shall be provided wherever necessary. The indoor lighting panels will be ready made DB of minimum 1.6 mm sheet thickness.

b) The panels shall be of single front construction, front hinged and front connected, suitable for either floor mounting on channels, sills or on walls/columns by suitable M.S. brackets. Indoor panels in control room shall be flush mounted.

c) Panels shall have a dead front assembly provided with hinged door(s) and out door panels will be with padlocking arrangement with single key supplied in duplicate.

d) All out door panels, removable covers, doors and plates shall be gasket all around with neoprene gaskets.

e) The outdoor panels shall be suitable for cable/conduit entry from the top and bottom. Suitable removable cable gland-plate shall be provided on the top and bottom of panels. Necessary number of double compression cable gland shall be supplied, fitted on to this gland plate. The glands shall be screwed on top and made of tinned brass.

f) The panels shall be so constructed as to permit free access to connection of terminals and easy replacement of parts.

g) Each panel shall have a caution notice fixed on it.

h) Each panel will be provided with directory holder in which printed and laminated as built circuit directory would be kept inside a document holder/pasted at site.

i) Each Outdoor lighting panel shall be provided with one no. 'ON' indicating lamp for each phase alongwith fuses. For indoor lighting panels din mounted phase indication lamps will be provided, mounted alongside of the MCB

j) **Main Bus Bars**

Bus bars shall be of aluminium alloy conforming to IEC: 60114/60105 and shall have adequate cross-section to carry the rated continuous and withstand short circuit currents. Maximum operating temperature of the bus bars shall not exceed 85 deg. C. The bus bars shall be able to withstand a fault level of 9 kA for 1 sec. for AC panels and 4 KA for 1 sec. for DC panels. The Indoor lighting panels shall have copper bus bar

2.1.10.3 **JUNCTION BOXES**

a) The junction boxes shall be concealed type for indoor lighting and suitable for mounting on columns, lighting poles, structures etc., for outdoor lighting.

b) Junction boxes shall be of square/rectangular type of 1.6 mm sheet steel with minimum 6 mm thick pressure diecast aluminium material LM-6 and shall have bolted cover with good quality gasket lining.

c) The junction box and cover of sheet steel construction shall be hot dip galvanised.

d) The junction boxes shall be complete with conduit knockouts/threaded nuts and provided with terminal strips .The junction boxes shall be suitable for termination of Cable glands of dia. 20 mm, 25 mm, 32 mm, 40 mm on all sides. The junction boxes shall be provided with 4 way terminals suitable for two numbers 10 sq. mm. wire & for street lighting/switchyard lighting suitable for 2 numbers 4C x 16 Sq.mm Al. cable.

e) The junction boxes shall have the following indelible markings

(i) Circuit Nos. on the top.
(ii) Circuit Nos. with ferrules (inside) as per drawings.
(iii) DANGER sign in case of 400 volt junction box.

f) The junction boxes shall be weather proof type with gaskets conforming to IP 55 as per IEC: 60529.

2.1.10.4 **Occupancy Sensors:**

Sufficient number of occupancy sensors shall be provided in the stairs area and corridors of control room cum administrative building. Each occupancy sensor shall be used for indoor use with time delay programmable in the minimum range of 1 sec. to 2 Hour to control the illumination in the area.

2.2 DESCRIPTION OF FCOMMON ITEMS FOR LIGHTING

2.2.1 LIGHTING FIXTURES AND ACCESSORIES

2.2.1.1 General

All lighting fixtures and accessories shall be designed for continuous operation under atmospheric conditions existing at site, without reduction in the life or without any deterioration of materials, internal wiring.

2.2.1.2 Temperature Rise

All lighting fixtures and accessories shall be designed to have a low temperature rise according to the relevant International standard. The design ambient temperature shall be taken as 50 deg.C.

2.2.1.3 Supply Voltage

Lighting fixtures and accessories meant for 230V A.C. operation shall be suitable for operation on 230V A.C. 50Hz, supply voltage variation of ± 10%, frequency variation of ± 2.5% and combined voltage and frequency variation of ± 10%.

Lighting fixture and accessories meant for 220/110V DC operation shall be suitable for operation on 220/110V DC with variation between 190 to 230 Volts for 220V

and 95 to 115 for 110V.

2.2.1.4 **Lighting Fixtures**

a) The lighting fixtures shall be Philips or equivalent International make except for fixtures type 'DSM' & 'HL' for which make has been specified elsewhere in this Section. The different types of lighting fixtures are also indicated elsewhere in this Section.

b) All fixtures shall be designed for minimum glare. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection.

c) All lighting fixtures shall be complete with fluorescent tubes / incandesent lamps/mercury vapour/sodium vapour lamps as specified and shall be suitably wired up.

d) All flourescent lamp fixture shall be complete with all accessories like ballasts, power factor improvement capacitors, lamps, starters, holders etc.

e) High beam fixtures shall be suitable for pendant mounting and flood lights shall have suitable base plate / frame for mounting on steel structural member. Hook mounted high beam fixtures are not acceptable.

f) Each lighting fixture shall be provided with an earthing terminal suitable for connection to 16 SWG GI earthing conductors.

g) All light reflecting surfaces shall have optimum light reflecting co-efficient such as to ensure the overall light output as specified by the manufacturer.

h) Height of fixtures should be such that it is easy to replace the lamps with normal ladder/stool. In case the ceiling height is very high, the fixtures may be placed on the walls for ground lighting.

2.2.1.5 **ACCESSORIES**

2.2.1.5.1 **Lamp holders and Starter Holders**

(a) Lamp holders/starter holders for fluorescent tubes shall be of the spring loaded, low contact resistance, bi-pin rotor type, resistant to wear and suitable for operation at the specified temperature, without deterioration in insulation value, contact resistance or retention of the lamp/starter. They shall hold the lamp/starter in position under normal condition of shock and vibration.

(b) Lamp holders/starter for incandescent lamps and HPMV/HPSV lamps shall be of screwed type, manufactured in accordance with relevant standard and designed to give long and satisfactory service.

2.2.1.5.2 **Ballasts**

a) All HPSV/HPMV/Metal halide lamp fixtures shall be provided with wire wound ballasts. All fluorescent fixtures shall be provided with high frequency electronic ballasts. The Ballasts shall be designed, manufactured and supplied in accordance with relevant standard and function satisfactorily under site condition specified. The ballasts shall be designed to have a long service life and low power loss.

b) Ballasts shall be mounted using self-locking anti-vibration fixing and shall be easy to remove without dismantling the fixtures. They shall be totally enclosed units.

c) The wire-wound ballasts shall be of the inductive, heavy duty type, filled with thermosetting insulating moisture repellent polyester compound filled under pressure or vacuum. The ballast wiring shall be of copper wire. They shall be free from hum. Ballasts which produce humming sound shall be replaced free of cost by the Contractor. Ballasts for high pressure mercury vapour/ HPSV lamps shall be provided with suitable tapping's to set the voltage within the range specified. End connections and taps shall be brought out in a suitable terminal block, rigidly fixed to the ballast enclosure.

d) Separate ballast for each lamp shall be provided in case of multi-lamp fixtures.

e) High frequency electronic ballasts shall be capable of satisfactory performance in adverse environment like that of EHV substation. Ballasts shall consist of AC/DC converter, high frequency power oscillator and low pass filter. The ballasts shall be suitable for use of nominal voltage of 230V +/- 10%, 50 Hz supply. The filter circuit shall suppress the feedback of high frequency signals to the mains. The ballast shall be rated for 36/40W fluorescent fixtures. The ballasts shall confirm to IEC 68-2-6FC, IEC 60929 for performance, IEC 60928 for safety and EN 55015, EN 55022A for RFI and EN 61003.

2.2.1.5.3 **Capacitors**

a) The capacitors shall have a constant value of capacitance and shall be connected across the supply of individual lamp circuits.

b) Power factor of fluorescent lamp fixtures with HF electronic ballast shall not be less than 0.90 and that of High pressure Sodium Vapour, Mercury Vapour and Metal Halide lamp fixtures shall not be less than 0.85. The capacitors shall be suitable for operation at supply voltage as specified and shall have a value of capacitance so as to correct the power factors of its corresponding lamp circuit to the extent of 0.98 lag.

c) The capacitors shall be hermetically sealed in a metal enclosure.

2.2.1.5.4 **Lamps**

a) General Lighting Services (GLS) lamps shall be provided with screwed caps and shall

be of 'clear' type unless otherwise specified.

b) The Bidder shall furnish typical wiring diagram for Fluorescent, HPMV & HPSV fitting including all accessories. The diagram shall include technical details of accessories i.e. starters, chokes, capacitors etc.

c) Flexible conduits if required, for any fixture shall be deemed to be included in Contractor's scope.

2.2.1.5.5 **SWITCH AND SWITCHBOARD**

(a) All Switch board/boxes, 5/15 Amp Receptacles and electronic fan regulators located in office/building areas shall be modula**r** flush mounted type or brick wall with only the switch knob projecting outside.

(b) Switch boards/boxes shall have conduit knock outs on all the sides.

(c) The exact number of switches including regulator for fans and layout of the same in the switchboard shall be to suit the requirement during installation.

(d) The maximum number of luminaires, controlled by one no 6 amp switch would 4 nos. For DC fixtures there will be no switch and the same shall be directly controlled from DC LP

(e) The luminaires shall be wired in such a fashion that luminaires on each phase are evenly distributed all over the room.

2.2.1.5.6. **CONDUITS & CONDUIT ACCESSORIES**

a) The conduits shall conform to IEC: 61386 or IEC: 61035 or IEC: 60614 as applicable. All steel conduits shall be seemed by welding, shall be of heavy gauge and shall be hot dip galvanised.

b) Flexible conduits wherever required shall be made with bright, cold rolled annealed and electro-galvanised mild steel strips or PVC/Plastic.

c) All conduits accessories shall conform to relevant IEC and shall be hot dip galvanized or High quality virgin PVC.

2.2.1.5.7 **TERMINAL BLOCKS**

Each terminal shall be suitable for terminating upto 2 Nos. 10 sq.mm. stranded Aluminium Conductors without any damage to the conductors or any looseness of connections. Terminal strips provided in street - lighting poles shall be suitable for terminating upto 2 nos. 4C x 16 sq. mm aluminium cables.

2.2.1.5.8 **PULL OUT BOXES**

a) The pull out boxes shall be concealed type for indoor lighting and suitable for mounting on column, structures etc., for outdoor lighting. The supply of bolts, nuts

and screws required for the erection shall be included in the installation rates.

b) The pull out boxes shall be circular of cast iron or 16 SWG sheet steel and shall have cover with good quality gasket lining.

c) The pull out boxes and cover shall be hot dip galvanised.

d) The pull out boxes shall be completed with conduit knock outs/threaded hubs and provided at approximately 3 meters intervals in a conduit run.

2.2.1.5.9 **Residual Current Circuit Breakers (RCCB)**

For indoor panels 63A 4pole 300 ma RCCB conforming IEC 13947 will be provided along with incomer.

2.2.1.5.10 **Miniature Circuit Breaker (MCB)**

a) The miniature circuit breakers shall be suitable for manual closing, opening, automatic tripping under overload and short circuit. The MCBs shall also be trip free. MCB of Type C tripping characteristics as per IEC: 60898 will be used for Switchyard lighting.

b) Single pole as well as three pole versions shall be furnished as required in the Schedule of Lighting Panels.

c) The MCBs and panel MCCB together shall be rated for full fault level. In case the MCB rating is less than the specified fault level the bidder shall co-ordinate these breaker characteristics with the backup MCCB in such a way that if fault current is higher than breaker rating, the MCCB should blow earlier than the breaker. If the fault current is less than MCB breaking capacity, MCB shall operate first and not the incomer MCCB.

d) The MCBs shall be suitable for housing in the lighting panels and shall be suitable for connection with stranded copper wire connection at both the incoming and outgoing side by copper lugs or for bus bar connection on the incoming side.

e) The terminals of the MCBs and the 'open' 'close' and 'trip' conditions shall be clearly and indelibly marked.

f) The tenderer shall check and co-ordinate the ratings of MCBs with respect to starting characteristics of discharge lamps. The vendor has to furnish overload and short circuit curve of MCB as well as starting characteristics curves of lamps for Employer's approval.

g) The MCB shall generally conform to IEC: 60898.

2.2.1.5.11 **Contactors**

Contactors shall be of the full voltage, direct-on line air break, single throw, electro-

magnetic type. They shall be provided with atleast 2-'NC' and 2'NO' auxiliary contacts. Contactor shall be provided with the three element, positive acting, ambient temperature compensated time lagged, hand reset type thermal overload relay with adjustable settings to suit the rated current. Hand reset button shall be flush with the front of the cabinet and suitable for resetting with starter compartment door closed. The Contactor shall be suitable for switching on Tungsten filament lamp also. The bidder shall check the adequacy of the Contactors rating wire with respect to lighting load.

2.2.1.5.12 **Push Buttons**

All push buttons shall be of push to actuate type having 2 'NO' and 2 'NC' self reset contacts. They shall be provided with integral escutcheon plates engraved with their functions. Push buttons shall be of reputed make.

2.2.1.5.13 **Labels**

a) The lighting panels shall be provided on the front with panel designation labels on a 3 mm thick plastic plate of approved type. The letter shall be black engraved on white back ground.

b) All incoming and outgoing circuits shall be provided with labels. Labels shall be made of non-rusting metal or 3 ply lamicold. Labels shall have white letters on black or dark blue background.

2.2.1.5.14 **Earthing Terminals**

Panels shall be provided with two separate and distinct earthing terminals suitable to receive the earthing conductors of size 50x6 G.S. Flat.

2.2.1.5.15 Type test reports for following tests on all lighting panels shall be submitted for approval as per clause 9.2 of Section 2: GTR.

(i) Wiring continuity test
(ii) High voltage (2.5 KV for 1 minute) and insulation test
(iii) Operational test
(iv) Degree of protection (not less than IP-55 test on outdoor Lighting Panels and IP-52 test on indoor Lighting Panels as per IEC: 60947 (part 1)
(v) Heat run test

2.2.1.5.16. **LIGHTING POLES**

a) The Contractor shall supply, store and install the following types of steel tubular lighting poles required for street lighting.

i) Type A1 Street Lighting Pole - for one fixture

ii) Type E1 Post top lantern pole - for one fixture

b) Street/flood light poles shall conform to the enclosed drawings. In front of control

room building , and Fire Fighting Buildings, decorative post top lantern (Type E1) poles and Bollards shall be installed.

c) Lighting poles shall be complete with fixing brackets and junction boxes. Junction boxes should be mounted one meter above ground level.

d) The lighting poles shall be coated with bituminous preservating paint on the inside as well as on the embedded outside surface. Exposed outside surface shall be coated with two coats of metal primer (comprising of red oxide and zinc chromate in a synthetic medium).

e) The galvanised sheet steel junction box for the street lighting poles shall be completely weather proof conforming to IP-55 and provided with a lockable door and HRC fuse mounted on a fuse carrier and fuse base assembly. The fuses & junction box shall be as specified in the specification. However, terminals shall be stud type and suitable for 2 nos. 16 sq.mm. cable.

f) Wiring from junction box at the bottom of the pole to the fixture at the top of the pole shall be done through 2.5 sq. mm wire.

g) Distance of centre of pole from street edge should be approximately 1000 to 1200 mm.

h) Earthing of the poles should be connected to the switchyard main earth mat wherever it is available and the same should be earthed through 3M long, 20 mm dia, earth electrode.

2.2.1.5.17 **CEILING & WALL MOUNTED FANS AND REGULATORS**

a) The contractor shall supply and install 1400 mm sweep ceiling fans complete with electronic regulator and switch, suspension rod, canopy and accessories. The wall mounted fans shall be of 400 mm sweep

b) The contractor shall supply and install the switch, electronic regulator and board for mounting switch and electronic regulator for celling fans. The regulator will be housed in common switchboard for lighting and shall be of similar make and model as that of modular switches.

c) Winding of the fans and regulators shall be insulated with Class-E insulating material. Winding shall be of copper wire.

d) Electronic regulator with stepped control shall be provided.

2.2.1.5.18 **LIGHTING WIRES**

a) The wiring used for lighting shall be standard products of reputed manufacturers.

b) The wires shall be of 1100 V grade, PVC insulated product of reputed manufacturers.

c) The conductor sizes for wires used for point wiring beyond lighting panels shall be 2.5 sq.mm, 4 sq.mm, 6 sq.mm and 1.5 sq.mm stranded copper wire.

d) The wires used for connection of a lighting fixture from a nearest junction box or for loop-in loop-out connection between two fluorescent fixtures shall be single core copper stranded conductor, 1100V grade flexible PVC insulated cords, unsheathed, conforming to IEC:60502 with nominal conductor cross sectional areas of 2.5 sq. mm.

e) The wires shall be colour coded as follows:

Red for R - Phase
Yellow for Y - Phase
Blue for B - Phase
Black for Neutral
White for DC (Positive)
Grey for DC (Negative)

2.2.1.5.19 **LIGHTING SYSTEM INSTALLATION WORKS**

2.2.1.5.19.1 **General**

In accordance with the specified installation instructions as shown on manufacturer's drawings or as directed by Employer, Contractor shall unload, erect, install, test and put into commercial use all the electrical equipment included in the contract. Equipment shall be installed in a neat, workmanship manner so that it is level, plumb square and properly aligned and oriented. Tolerances shall be as established in manufacturers drawing or as stipulated by Purchaser.

All apparatus, connections and cabling shall be designed so as to minimise risk of fire or any damage which will be caused in the event of fire.

2.3.1.5.19.2 **Conduit System**

a) Contractor shall supply, store and install conduits required for the lighting installation as specified. All accessories/fittings required for making the installation complete, including but not limited to pull out boxes (as specified in specification ordinary and inspection tees and elbow, checknuts, male and female bushings (brass or galvanised steel), caps, square headed make plugs, nipples, gland sealing fittings, pull boxes, conduits terminal boxes, glands, gaskets and box covers, saddle terminal boxes, and all steel supporting work shall be supplied by the Contractor. The conduit fittings shall be of the same material as conduits. The contractor shall also supply 20 mm PVC conduit and accessories for telephone wiring.

b) All unarmoured cables/wires shall run within the conduits from lighting panels to lighting fixtures, receptacles, etc.

c) Size of conduit shall be suitably selected by the Contractor.

d) Conduit support shall be provided at an interval of 750 mm for horizontal runs and

1000 mm for vertical runs.

e) Conduit supports shall be clamped on the approved type spacer plates or brackets by saddles or U-bolts. The spacer plates or brackets in turn, shall be securely fixed to the building steel by welding and to concrete or brick work by grouting or by nylon rawl plugs. Wooden plug inserted in the masonary or concrete for conduit support is not acceptable.

f) Where conduits are along with cable trays they shall be clamped to supporting steel at an interval of 600 mm.

g) For directly embedding in soil, the conduits shall be coated with an asphalt-base compound. Concrete pier or anchor shall be provided wherever necessary to support the conduit rigidly and to hold it in place.

h) For long conduit run, pull boxes shall be provided at suitable intervals to facilitate wiring.

i) Conduit shall be securely fastened to junction boxes or cabinets, each with a lock nut inside and outside the box.

j) Conduits joints and connections shall be made through water-tight and rust proof by application of a thread compound which insulates the joints. White lead is suitable for application on embedded conduit and red lead for exposed conduit.

k) The entire metallic/PVC conduit system, shall be embedded, electrically continuous and thoroughly grounded. Where slip joints are used, suitable bounding shall be provided around the joint to ensure a continuous ground circuit.

l) Conduits and fittings shall be properly protected during construction period against mechanical injury. Conduit ends shall be plugged or capped to prevent entry of foreign material.

2.2.1.5.19.3 **Wiring**

a) Wiring shall be generally carried out by PVC insulated wires in conduits. All wires in a conduit shall be drawn simultaneously. No subsequent drawings of wires is permissible.

b) Wires shall not be pulled through more than two equivalent 90 deg. bends in a single conduit run. Where required, suitable junction boxes shall be used.

c) Wiring shall be spliced only at junction boxes with approved type terminal strip.

d) For lighting fixtures, connection shall be teed off through suitable round conduit or junction box, so that the connection can be attended without taking down the fixture.

e) For vertical run of wires in conduit, wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/junction box.

f) Maximum two wires can be terminated to each way of terminal connections.

g) Separate neutral wires are to be provided for each circuit.

h) AC and DC wiring should not run through the same conduit.

2.2.1.5.19.4 **Lighting Panels**

a) The lighting panels shall be erected at the locations to be finalised during detailed engineering.

b) Suitable foundations/supporting structures for all outdoor type lighting panels shall be provided by the Contractor.

2.2.1.5.19.5 **Foundation & civil works**

a) Foundation for street lighting poles, panel foundation and transformer foundation shall be done by the Contractor.

b) All final adjustment of foundation levels, chipping and dressing of foundation surfaces, setting and grouting of anchor bolts, sills, inserts and flastening devices shall be carried out by the Contractor including minor modification of civil works as may be required for erection.

c) Any cutting of masonary / concrete work, which is necessary shall be done by the Contractor at his own cost and shall be made good to match the original work.

ANNEXURE-1

SI. No.	Type of Lighting Fixture	Description	Philips Catalogue No
1	F1	2x28W T5 type fluorescent lamps in industrial reflector type fixture, complete with accessories and suitable for pendent /surface mounting.	TMS 122/228 HF

2	FF	2x28 T5 energy efficient fluorescent lamps with low glare, mirror optics suitable for recess mounting type lighting fixture.	TBS 088/228 C5 HF
3	FL	2x28W T5 energy efficient fluorescent lamps with low glare mirror optics suitable for pendent/surface mounting with all accessories	TCS 398/228 D6 HF
4	TL	Sleek and Functional electronic decobatten suitable for use with 1x'TLD'36W fluorescent lamp with dual tone end caps. Pre-phosphated & powder coated CRCA steel channel complete with all electrical accessories like electronic ballast, lamp holders all prewired up to a terminal block	TMS500/136 HF
5	IB	60/100w GLS lamp in Bulkhead fixtures with Cast Aluminium alloy body, suitable for column, wall,and ceiling mounting finished stove enameled silver grey outside	NXC101
6	BL	Aesthetic wall/ceiling mounted luminaire suitable for 1x PL-C 13W OR 11W CFL. Low loss O.C. Copper ballast.Built in high gloss anodized reflector. Twin finish UV stabilised SAN diffuser for protection & elimination of lamp glare.	FMC21/113
7	SL	Aesthetic ceiling mounted luminaire for Ecotone crystal/Décor CFL of 2x9W or 1x18W. ABS housing pre-wired with porcelain lampholder. Pre-phospated plated CRCA gear tray.	FL343/118

8	BH	Bulkhead luminaire suitable for use with PL-S 9W CFL. Single piece pressure die-cast aluminium & cover retaining Frame. Opal acrylic cover along with a gasket made of E.P.R..	FXC 101/109
9	BLD	2X9 Or 1x18 watt CFL bollard light for landscape lighting having FRP/LLDPE housing	FGC202 /118
10	DLR	2x18 watt CFL Downlighter with HF ballast suitable for recess mounting	FBH145/218L HF
11	DSM	1X13 WATT surface mounted CFL	FCS100/113
12	IF	Incandescent GLS lamp down light	DN622
13	SF1	1 X 400W HPSV lamps in high flood lighting fixture with integral control gear	SWF 330/1X400
14	SF2	2 X 400W HP sodium Vapour lamps in high flood lighting, non-integral control gear:	RVP302/2x400W
15	SF3	1 X 250W HPSV lamps in high flood lighting fixture with integral control gear:	SWF 330/1X250
16	SF4	150W HP Metal halide MHN-TD lamp in flood lighting fixture with integral control gear.	SWF230/150 MHN-TD
17	SF5	125 HP MV Lamp in weather proof post top lantern for mounting on pole top	HPC-101/125 HPF
18	SC	150W SON-T Tubular Sodium Vapour lamp in street lighting	SRX-51/150

TECHNICAL SPECIFICATION

VOL-II, SEC-IX

LT TRANSFORMER

LT TRANSFORMER

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LT TRANSFORMER

1.0 INTENT

This specification is intended to cover outdoor type oil filled 33/0.433KV, **315** & 250 **KVA** transformers.

2.0 SCOPE OF WORK

2.1 Scope of Supply

- Transformers as listed above, with insulating oil, all materials and accessories, and complete in all respects.
- Gland plates, power cable, lugs, anchor bolts and hardwares.
- Mandatory & optional spares and special maintenance equipment's if any.

2.2 Scope of Service

The scope includes but is not limited to the following items of work to be performed for all equipment and materials furnished under this chapter:

a) Design, manufacturing, shop testing, packing & despatch

b) Transportation inclusive of insurance and delivery, FOR site basis

c) Unloading, handling, storing, transportation at site up to foundations, oil filling and treatment, erection, testing and commissioning

d) Civil Works

e) Supply of external cables and termination as required.

f) Fire protection system.

3.0 General Information

3.1 All temperature indicators, Buchholz relays and other auxiliary devices shall be suitable for 220/110 V DC Control supply. All alarm and trip Contacts shall also be suitable for connection in 220/110V DC Circuits.

3.2 Bidders may specifically note that transformers offered shall conform to dynamic short circuit test and dielectric test as per IEC: 60076. Test report for the same shall be submitted during detail engineering for approval.

4.0 TECHNICAL REQUIREMENTS

4.1 Core

The core shall be constructed from high grade, non-aging, cold rolled grain-oriented silicon steel laminations. The maximum flux density in any part of the cores and yoke at normal voltage and frequency shall be such that the flux density at any tap position with 10% voltage variation from the voltage corresponding to the tap shall not exceed 1.9 Wb/sq-m.

4.2 Windings

The conductor shall be of electrolytic copper, free from scales and burrs.

4.3 Insulating Oil

The oil supplied with transformer shall be unused and have the parameters for unused new oil conforming to IEC: 60296 while tested at oil Contractor's premises, No inhibitors shall be used in oil. Ten percent extra oil shall be supplied for topping up after commissioning in nonreturnable containers suitable for outdoor storage.

4.4 Terminal Arrangement

a) Bushing terminals shall be provided with suitable terminal connectors of approved type and size for **cable** /overhead conductors termination of HV side and cable termination on LV side.

b) The neutral terminals of 433V winding shall be brought out on a bushing along with the 433 volt phase terminals to form a 4 wire system for the 415 volt. Additional neutral bushing shall also be provided for earthing.

4.5 Off Circuit Tap Changing Equipment

The tap change switch shall be three phase, hand operated for simultaneous switching of similar taps on the three phases by operating an external hand wheel.

4.6 Marshalling Box

A metal enclosed, weather, vermin & dust proof marshalling box shall be provided with each transformer to accommodate temperature indicators, terminal blocks etc. It shall have a degree of protection of IP 55 as per IS: 13947 / IEC: 60947 Part-1.

4.7 Cable boxes

Whenever cable connections are required, suitable cable boxes shall be provided and shall be air insulated. They shall be of sufficient size to accommodate Purchaser's cables and shall have suitable removable side/top cover to facilitate cable termination and inspection. Cable boxes shall be dust & vermin proof.

5.0 Inspection and Testing

a) The Contractor shall draw up and carry out a comprehensive inspection and testing program during manufacture and commissioning of the transformer. The programme shall be duly approved by the Purchaser.

b) The Contractor shall carryout all routine tests on all the transformers as per relevant standards. Type test report shall be submitted for approval during detail engineering.

6.0 Inspection

6.1 Tank and Accessories

a) Physical and dimensional check of transformer tank and accessories.

b) Crack detection of major strength weld seams by dye penetration test.

6.2 Core

a) Physical inspection and check of quality of varnish, if used.

b) Sample testing of core material for checking specific loss, bend properties, magnestisation characteristics and thickness.

c) Check on completed core for measurement of iron loss and check for any hot spot by exciting the core so as to induce the designed value of flux density in the core.

d) HV Test

6.3 Insulating Material

a) Sample checks for physical properties of the material

b) Check for dielectric strength

c) Check for the reaction of hot oil on insulating material

6.4 Winding

a) Sample check on winding conductor for mechanical properties and electrical conductivity and on installation covering.

b) Sample check on insulation paper for pH value, Bursting strength, Electric strength.

6.5 **Assembled Transformer**

a) Check complete transformer against approved outline drawing provision for all fittings, finish etc.

b) Jacking test on all the assembled transformers.

6.6 **Oil**

All Standard tests in accordance with relevant Standards shall be carried out on oil samples taken from the transformer before and after testing of the transformer.

The contractor shall also prepare a comprehensive inspection and testing programme for all bought out sub-contracted items and shall submit the same to the Purchaser for approval. Such programme shall include the following components:

a) Buchholz Relay
b) Winding temperature Indicator
c) Bushings
d) Marshaling Box
e) Tap changer switch
f) Oil temperature indicator

7.0 **Factory Test**

7.1 All standard routine tests in accordance with latest issue of IS:2026 / IEC: 60076 shall be carried out on each transformer.

7.2 The transformer shall conform to all the type tests in accordance with latest issues of IS:1180, IS:2026 / IEC: 60076. The manufacturer shall submit type tests & additional test reports as listed above as already carried out on transformers of identical design for owner's acceptance. In such a case validity of type test reports shall be in line with clause 9.2 of Chapter 2-GTR of technical specifications. Following parameters in general shall be ensured for establishment of identical design as per IEC 60076, Part-V.

a) Same Voltage ratio, KVA rating, vector group & impedance.
b) Same conceptual design of core and winding.
c) Same arrangement and geometrical sequence of the main windings.
d) Same type of winding conductors.

e) Same type of main windings.
f) Absorbed power at short circuit (i.e. rated power/per unit short circuit impedance) between 30% and 130% of that relating to the reference transformer.
g) Axial forces and winding stresses occurring at short circuit not exceeding 120% of those relating to the reference transformer.
h) Same manufacturing process.
i) Same Clamping and winding support arrangement..

7.3 In addition to all type and routine tests, transformer shall also conform to following additional type tests as per IS:2026 / IEC: 60076.

a) Measurement of zero sequence impedance

b) Short circuit test

c) Measurement of acoustic noise level. This shall conform to NEMA standard publication TR-1.

d) Measurement of capacitance and tan delta of transformer winding.

e) Test on oil samples as per IS 60296

7.4 All auxiliary equipment shall be tested as per the relevant IS Test Certificates shall be submitted for bought out items.

7.5 High voltage withstand test shall be performed on auxiliary equipment and wiring after complete assembly.

7.6 Tank Tests:
i) Routine Tests: As per IEC: 60076 Part-1 including
ii) Vacuum Tests: As per IEC: 60076 Part-1
iii) Pressure Test: As per IEC: 60076 Part-1

7.7 In addition to the above, the following checks should be carried out at manufacturer's works before despatch for all transformers:

a) Check for interchangeability of components of similar transformers and for mounting dimensions.

b) Check for proper packing and preservation of accessories like radiators, bushings explosion vent, dehydrating breather, Buchholz relay, conservator etc.

c) Check for proper provision of bracings to arrest the movements of core and winding assembly inside the tank.

d) Test for gas tightness and derivation of leakage rate. To ensure adequate reserve gas capacity during transit and storage.

7.8 The Contractor shall submit a detailed inspection and testing programme for field activities, covering areas right from the receipt of material stage upto commissioning stage as per IS : 1886 - Code of practice for installation and maintenance of transformers. The indicative checks and tests are given below.

a) Physical checks on each transformer on receipt at site for any damage or short supply.
b) Tests on oil samples
c) Oil leakage test
d) Physical checks for colour of silica in breather
e) Check for oil level in breather housing, conservator tank, etc.
f) Check for correct operation of all protections and alarms.
g) Insulation Resistance Measurement for Main Winding, control wiring etc.
h) Continuously observe the transformer operation at no load for 24 hours.

8.0 **Fittings**

The following fittings shall be provided with each transformer covered under this specification.

i) Conservator with drain plug and oil filling hole with blanking plate
ii) Plain oil Gauge
iii) Silica gel Breather
iv) Pressure Relief vent
v) Pocket on tank cover for Thermometer
vi) Valves
vii) Earthing Terminals
viii) Rating & Terminal Marking Plates
ix) Lifting Lugs
x) Rollers
xi) Air Release Plug

The fittings listed above are only indicative and any other fittings which generally are required for satisfactory operation of transformer are deemed to be included.

9.0 **Spare Parts**

9.1 The list of spares for outdoor type transformers covered under this chapter shall be as specified in Chapter 1- PSR

9.2 In addition, the Bidder shall also recommend optional spare parts and maintenance equipment necessary for three (3) years of successful operation of the equipment. The prices of these shall be indicated in respective schedules and these shall not be considered for the purpose of evaluation.

10.0 Technical Specification

S No	Description	Unit	Parameters	
1	Rated Capacity	kVA	250	**315**
2	Rated Voltage			
a)	HV	kV	33	33
b)	LV	kV	0.433	0.433
3	Type of Winding		Two Winding	
4	Service		Outdoor	
5	No of Phases	No.	Three	
6	Frequency	Hz	50	
7	Type of Cooling		ONAN	ONAN
8	Impedance at 75 Deg C	%	5	5
9	Tolerance on Impedance	%	±10	±10
10	Duty		Continuous	Continuous
11	Overload		IEC:60076-7	IEC:60076-7
12	Max. Temp. Rise over an ambient of **40 Deg C**			
a)	Oil (Temperature rise measurement by thermometer)	^{0}C	50	
b)	Winding Temperature rise measurement by resistance method)	^{0}C	55	
13	Windings			
a)	System Apparent Short circuit level (kA)		As per IEC: 60076-Part 1	
b)	Winding Connection			
(i)	HV		Delta	Delta
(ii)	LV		Star	Star
14	Vector Group		Dyn11	
15	Insulation		Uniform	

S No	Description	Unit	Parameters	
16	Insulation Level	kVrms		
a)	Power Frequency Test Level			
(i)	HV	kVrms	95	95
(ii)	LV	kVrms	2	
17	Basic Impulse Level			
(i)	HV	kVp	250	250
(ii)	LV	kVp	-	-
18	Highest voltage (kV) for each winding	kV	52	52
19	Method of earthing		Solidly earthed	
20	Tap changer			
a)	(i) Tap Change		+5% to -10% in step of 2.5% on HV side	
b)	(ii) Tap control		Off Circuit Tap Change Switch	
21	HV Bushing			
a)	Rated Voltage	kV	52	52
b)	Rated current	A	100	100
c)	Basic Impulse Level (kVp)	kVp	250	250
d)	Wet & Dry Power frequency Withstand Voltage	kVrms	95	95
e)	Min. Total Creepage Distance	mm	1300	1300
f)	Mounting		Tank / Transformer Body	
22	LV & Neutral Bushing			
a)	Rated Voltage	kV	1.1	1.1
b)	Rated current	A	1000	1000
c)	Basic Impulse Level (kVp)	kVp	-	-
d)	Wet & Dry Power frequency Withstand Voltage	kVrms	2	2
e)	Mounting		Tank / Transformer Body	
23	Terminal Details			

S No	Description	Unit	Parameters	
a)	HV		**Suitable for 33kV Cable** or Over Head Conductor	Suitable for 33kV Cable or Over Head Conductor
b)	LV & Neutral		Cable Box	
24	Min. Clearance in Air	mm		
a)	Ph-Ph (HV/LV)	mm	530/25	530/25
b)	Ph-Earth (HV/LV)	mm	480/25	480/25

TECHNICAL SPECIFICATION

VOL-II, SEC-XI

FIRE PROTECTION

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SECTION – XI
FIRE PROTECTION

1.00.00 **INTENT OF SPECIFICATION**

This section covers the design and performance requirements of the following types of fire protection systems;

a. Hydrant System

b. High Velocity Water (H.V.W) Spray System

c. Fire Detection and alarm System

d. Portable Fire Extinguishers

e. Wheel/ Trolley mounted Fire Extinguishers

1.00.01 It is not the intent to completely specify all details of design and construction. Nevertheless, the system design and equipment shall conform in all respects to high standard of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the Owner. The system design shall also conform to NFPA norms.

1.00.02 The scope of work include complete earthwork (i.e. excavation, backfilling etc.) for the entire buried piping for the system, valve pits and pipe supports for buried, entrenched and overground piping.

1.00.03 The equipment offered shall comply with the relevant latest International Standards **unless specified otherwise**. The Deluge valves, HVW spray nozzles & quartzoid bulb detectors shall have the approval of any of the following agencies;

a. UL of USA.
b. F M of USA
c. LPCB of UK or
d. VDS of Germany,

1.00.04 Ambient temperature for design of all equipment shall be considered as 50°C.

1.00.05 The piping and instruments diagram for Hydrant and HVW spray system for 400kV switchyard is enclosed at Appendix-I. respectively. The successful bidder shall prepare detailed layout and piping drawing based on this drawing and other drawings such as road, drainage, cable trench, switch yard layout, etc. as furnished by the Employer during detailed engineering.

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2.00.00 **DESIGN AND CONSTRUCTION**

2.01.00 **Hydrant System**

Hydrant system of fire protection essentially consists of a large network of pipe, both under ground and over ground which feeds pressurised water to a number of hydrant valves, indoor (if applicable) as well as outdoor. These hydrant valves are located at strategic locations near buildings, Transformers and Reactors. Hose pipes of suitable length and fitted with standard accessories like branch pipes, nozzles etc., are kept in Hose boxes. In case of emergency, these hoses are coupled to the respective hydrant valves through instantaneous couplings and jet of water is directed on the equipment on fire. Hydrant protection shall be provided for the following in all substations of voltage levels 132kV and above (This is not applicable for extension of existing 220kV and 132kV substations where Hydrant system is not available). At least one hydrant post shall be provided for every 60m of external wall measurement of buildings.

a) Control room building

b) L.T. Transformer area.

c) Fire Fighting pump House.

d) Stores

e) Transformers

f) Shunt Reactors/ Bus Reactors.

2.01.01 A warning plate shall be placed near the hydrant points for the transformers and reactors substations to clearly indicate that water shall be sprayed only after ensuring that the power to the transformer/ reactor which is on fire is switched off and there are no live parts within 20metres of distance from the personnel using the hydrant.

2.02.00. **HIGH VELOCITY WATER (H.V.W) SPRAY SYSTEM**

H.V.W. spray type fire protection essentially consists of a network of projectors and an array of heat detectors around the Transformer/Reactor to be protected. On operation of one or more of heat detectors, Water under pressure is directed to the projector network through a Deluge valve from the pipe network laid for this system. This shall be provided for transformers and reactors in all 132kV & above substations (This is not applicable for extension of existing 220kV and 132kV substations where HVWS system is not available). Wet detection initiation system shall be employed for automatic operation.

The system shall be designed in such a way that the same can be extended to protect additional Transformer/ Reactor to be installed in future. However, for the purpose of design it shall be assumed that only one Transformer/ Reactor will be on fire. The main header pipe size in the yard shall be 200mmNB(for 220kV & 132kV switchyard). Branch to the equipment (shall not be more than 20metres length) shall be of the same size as of deluge valve.

2.02.01 The Electrical clearance between the Emulsifier system pipe work and live parts of the protected equipment shall not be less than the values given below :

1.	245 kV bushing	2150 mm
2.	145 kV bushing	1300 mm
3.	52 kV bushing	630 mm
4.	36 kV bushing	320 mm

2.02.02 System shall be designed in such a way that the Water pressure available at any spray nozzle shall be between 3.5bar and 5.0bar and shall be demonstrated through hydraulic calculations. Water shall be applied at a minimum rate of 10.2 LPM/M^2 of the surface area of the transformer / Reactor including radiator, conservator, oil pipes, bushing turrets, etc. (including bottom surface for transformer). The nozzle arrangement shall ensure direct impingement of water on all exterior surfaces of transformer tank, bushing turrets, conservator and oil pipes, except underneath the transformer, where horizontal spray may be provided.

2.02.03 **Deluge Valve**

Deluge Valve shall be water pressure operated manual reset type. The Deluge valve shall be closed water tight when water pressure in the heat detector pipe work is healthy and the entire pipe work shall be charged with water under pressure upto the inlet of the Deluge valve. On fall of water pressure due to opening of one or more heat detectors, the valve shall open and water shall rush to the spray water network through the open Deluge valve. The valves shall be manually reset to initial position after completion of operation. Each Deluge Valve shall be provided with a water motor gong which shall sound an alarm when water after passing through the Deluge valve, is tapped through the water motor.

Each Deluge valve shall be provided with a local panel with provision of opening of Deluge valve from local and remote from control room/ remote centre. In addition to this, each valve shall be provided with local operation latch.

Deluge valves of 100mmNB size shall be used if the flow requirement is ≤ 200m^3/hr and 150mmNB size shall be used for flow requirement >200m^3/hr.

Test valves shall simulate the operation of Deluge valves and shall be of quick opening type. The general construction shall conform to requirements under clause no.7.00.00 for piping, valves and specialities.

2.02.04 **High Velocity Spray Nozzles (Projectors)**

High velocity spray system shall be designed and installed to discharge water in the form of a conical spray consisting of droplets of water travelling at high velocity, which shall strike the burning surface with sufficient impact to ensure

the formation of an emulsion. At the same time the spray shall efficiently cut off oxygen supply and provide sufficient cooling.

2.02.05 Minimum set point of the heat detectors used in the HVW spray system shall be 79°C. The optimum rating shall, however, be selected by the Bidder, keeping in mind the maximum and minimum temperature attained at site.

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2.03.00 **Fire Detection and alarm System**

This system shall be provided for control room building and Switchyard panel rooms of substations**.**

2.03.01 Suitable fire detection system using smoke detectors and/or heat detectors shall be provided for the entire building, including corridor and toilets. Fire detectors shall be located at strategic locations in various rooms of the building. Each Switchyard panel room shall be considered a separate zone. Adequate number of extra zones shall be provided for Switchyard panel rooms for future bays identified in Single line diagram of the substation. The operation of any of the fire detectors/ manual call point should result in the following;

1. A visual signal exhibited in the annunciation panels indicating the area where the fire is detected.
2. An audible alarm sounded in the panel, and
3. An external audible alarm sounded in the building, location of which shall be decided during detailed engineering.
4. If the zone comprises of more than one room, a visual signal shall be exhibited on the outer wall of each room.

2.03.02 Each zone shall be provided with two zone cards in the panel so that system will remain healthy even if one of the cards becomes defective.

2.03.03 Coverage area of each smoke detector shall not be more than 80 m^2 and that of heat detectors shall not be more than 40 m^2. Ionisation type smoke detectors shall be provided in all areas except pantry room where heat detectors shall be provided. If a detector is concealed, a remote visual indication of its operation shall be provided. Manual call points (Break glass Alarm Stations) shall be provided at strategic locations in the control room building. All cabling shall be done through concealed conduits.

2.03.04 Cables used should be exclusively for fire detection and alarm system and shall be 2Cx1.5sq.mm Cu. cables. Un-armoured PVC insulated FR cables conforming to latest IEC / International standards shall be used.

2.04.00 Portable and Wheel/ Trolley mounted Fire Extinguishers

2.04.01 Portable Fire Extinguishers (4.5 Kg Capacity)

Adequate number of portable fire extinguishers of pressurised water, dry chemical powder, and Carbon dioxide type shall be provided in suitable locations in control room building and FFPH building as indicated in the drawing. In

addition to this one (1) CO2 type fire extinguisher of 4.5kg capacity shall be provided for each Switchyard panel room. These extinguishers will be used during the early phases of fire to prevent its spread and costly damage.

The design, construction & testing of portable fire extinguishers shall meet the requirements as per clause 10.00.00.

2.04.02 Wheel/ Trolley mounted Fire Extinguishers

Wheel/Trolley mounted Mechanical foam type (50 Litre Capacity), DCP and CO^2 fire extinguishers of 22.5 Kg capacity, conforming to latest international standards, shall be provided for the protection of the following:

1. Transformers and reactors in 220kV and 132 kV substations where Hydrant/HVWS system is not available. Two (2) nos. for each 220kV or 132kV transformer and reactor.

2. LT transformers in all substations. One (1) no. for each LT transformer.

The design, construction & testing of Mechanical foam type 50 litre capacity shall meet the requirements of relevant International Codes and clause 10.00.00 of this specification.

2.05.00 Water Supply System

For **220kV and 132kV** level substations water for hydrant & HVW system shall be supplied by one electrical motor driven pump of rated capacity **273m3/hr**. at 70MWC head, with another pump of same capacity , driven by diesel engine, shall be used as standby. Water storage tank with two compartments of adequate capacity shall be provided. Pumps shall work under positive suction head. Annunciations of the hydrant & HVW spray systems shall be provided in fire water pump house and repeated in control room. Provision for sending data to remote control centre shall also be available.

The outdoor piping for the system in general shall be laid above ground on concrete pedestals with proper supporting arrangement. However, at road/rail crossings, in front/access of buildings, places where movement of cranes/vehicles is expected and at any other place where above ground piping is not advisable, the pipes shall be laid underground. Such locations shall be finalised during detailed engineering.

The whole system will be kept pressurised by providing combination of air vessel and jockey pump of $10.8M^3$/hr. capacity at 80MWC. The capacity of air vessel shall not be less than $3m^3$. Minor leakage will be met by Jockey pump. One additional jockey pump shall be provided as standby. All pumps shall be of horizontal centrifugal type. Pumps and air vessel with all auxiliary equipment will be located in firewater pump house. A pressure relief valve of suitable rating shall be provided in water header to release excess pressure due to atmospheric

temperature variations.

Operation of all the pumps shall be automatic and pumps shall be brought into operation at preset pressure. Fire pumps shall only be stopped manually. Manual start/stop provision shall be provided in local control panel.

2.05.01 The general design of the fire fighting pump sets shall meet the requirements under clauses no.5.00.00 for Horizontal centrifugal pumps, no.6.00.00 for Diesel engines and no.12.00.00 for Electrical motors.

2.05.02 Each pump shall be provided with a nameplate indicating suction lift/delivery head, capacity and number of revolutions per minute.

2.05.03 Design, construction, erection, testing and trial operation of piping, valves, strainers, hydrant valves, hoses, nozzles, branch pipes, hose boxes, expansion joints etc. shall conform to the requirements of clause no. 7.00.00.

2.06.00 **Instrumentation and Control System**

2.06.01 All instruments like pressure indicators, differential pressure indicators, pressure switches, level indicators, level switches, temperature indicators, alarms and all other instruments and panels as indicated in the specification and drawings and those needed for safe and efficient operation of the whole system shall be furnished according to the requirements of clause 11.00.00. Pump running/ fails to start signal shall be taken from the pressure switch immediately after the discharge of the pump.

2.06.02 **Control Panel**

Power feeder for motors will be from switchgear board located in control building but control supply for all local control panels, annunciation panels, battery charger units, space heaters etc. shall be fed from the AC and DC distribution boards located in pump house. These AC & DC distribution boards will be fed from the switchgears and DCDBs located in control building.

a) Panel for motor driven fire water pump

The panel shall be provided with the following:

1.	TPN switch	1 No.
2.	Auto/manual selection facility	
3.	Start/Stop facility with indication lamp	1 Set
4.	DOL starter with thermal O/L relay	1 Set
5.	Indicating lamp showing	1 Set

power ON

6.	Indication lamp with drive ON/OF	1 Set
7.	Indication lamp showing Motor Trip	1 No.

Additional provisions shall be made for controlling the following from the remote control centre:

1. Auto/manual selection facility

2. Start/Stop facility

Main power cable from breaker feeder of main switchboard shall be terminated in this panel and another cable shall emanate from this panel which shall be terminated at motor terminals.

b) Panel for Two nos. Jockey Pump 1No.

The panel shall be provided with the following :

1.	Fuse-switch unit for Jockey pumps	1 Set for each pump
2.	Auto/manual selection facility for eachpump	
3.	Selector switch for selecting either jockey pump	1 No.
4.	D.O.L. starter with overload relay self-resetting type, for all the drives.	1 No. each
5.	Start/stop push button for Jockey Pump with indication lamp with pad-locking arrangements in stop position	1 Set for each pump
6.	Indication lamp for trip indication	1 No. each for pump

Additional provisions shall be made for controlling the following from the remote control centre:

1. Auto/manual selection facility for each pump**.**

a) Panel for 2 Nos. battery charger 1 No.

& Diesel Engine driven fire water pump

The panel shall be provided with the following :

1.	Auto/Manual selection facility for Diesel Engine driven pump	1 No.
2.	Start/Stop facility with indication lamp	1 Set
3.	Indicating lamp showing drive ON/OFF	1 Set
4.	D.C. Voltmeter/Ammeter in the battery charger circuit	1 No. each
5.	Battery charger will be as per specification described	1 Set
6.	Selector switch for selecting either of battery chargers for the battery sets.	1 No.
7.	Selector switch for selecting either set of batteries for Diesel engine starting.	1No.
8.	Selector switch for boost charging/Trickle charging of battery set.	1 Set

Additional provisions shall be made for controlling the following from the remote control centre:

1. Manual Start/Stop of Diesel Engine

d) Individual local control panel is to be considered for each transformer/ Reactor deluge system wherever these equipment are envisaged. This panel shall contain push buttons with indicating lamps for spray ON/OFF operation in the valve operation circuit. Push buttons shall be concealed behind glass covers, which shall be broken to operate the buttons. Provision shall be made in the panel for the field signal for the annunciations such as spray ON and fire in the Transformer/Reactor. A signal for spray ON shall also be provided in the control room fire alarm panel for employer's event logger. Remote operation facility to open the Deluge valve from control room/ remote centre shall also be provided.

2.06.03 **Annunciation Panels**

a) Location: Fire Water Pump House

i) Indicating lamps showing power supply "ON".

ii) Annunciation windows complete with buttons. Details are as follows:

Sl.No.	Description	Number
1.	Electric motor driven fire water pump running	1
2.	Electric motor driven fire water pump fails to start	1
3.	Diesel engine driven fire water pump running.	1
4.	Diesel engine driven water pump fails to start	1
5.	Jockey pump-1 running	1
6.	Jockey pump-1 fails to start	1
7.	Jockey pump-2 running	1
8.	Jockey pump-2 fails to start	1
9.	Fire in Transformer/ Reactor	1 for each equipment
10.	Deluge system operating for Transformer/Reactor	1 for each equipment
11.	Header pressure low	1
12.	Fire in smoke detection system zone (Common Fire Signal)	1
13.	Water storage tank water level low	2
14.	High speed diesel tank level low	1
15.	Spare	10

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b) **Location: Substation Control Room**

i) Indication lamp showing power supply 'ON'

ii) Provision shall be made in the panel for a signal for spray ON for each Transformer/Reactor for owner's use for event logger.

iii) Each Switchyard panel room shall be considered as separate zone for fire detection and alarm system.

iv) Following annunciations shall be provided.

Sl.No.	Description	Number
1.	Fire in Transformer/ Reactor	1 for each equipment
2.	Diesel engine driven fire water pump in operation	1
3.	Motor driven fire water pump in operation	1
4.	Jockey pump in operation	1
5.	Fire fighting Water storage tank level Low	2
6.	Fire/Fault (zone alarm module)	1+1(duplicate) For each zone as applicable
7.	Spare windows complete in all respect, with relays	10
8.	Spare zone alarm modules required for the	Number of future A/c Kiosks bays identified as per SLD

c) Each annunciation panel shall be provided with a hooter**.** A hooter in parallel to the hooter in fire panel shall be provided in the security room of substation for alert in case of fire.

d) Indication for fault in respective areas shall also be provided. Each zone alarm module shall exhibit 'FIRE' and 'FAULT' conditions separately.

e) **Provision for sending data to Remote Control Unit for the following**

(i) Fire in Switchyard Panel Room (Switchyard Panel room shall be considered as separate zone for fire detection and alarm system).

(ii) Fire in Transformer/Reactor (1 for each equipment)

(iii) Diesel engine driven fire water pump in operation.

(iv) Motor driven fire water pump in operation

(v) Fire/Fault in Control Room.

(vi) Water Storage tank level (low and very low for each storage tank).

(vii) High Speed Diesel tank level (low & very low)

(viii) AC Mains Supply Healthy/Fail for Main Pump & Jockey Pump

(ix) DC Control Supply Healthy/Fail for Main Pump & Jockey Pump

(x) DC Control Supply Healthy/Fail for Diesel Engine driven pump.

2.06.04 The control and interlock system for the fire protection system shall meet the following requirements:

1. **Electric Motor Driven Fire water Pump**

Pump should start automatically when the System header pressure is low.

Pump should be stopped manually only. Pump should also be started manually if required from local control panel.

2. **Diesel Engine Driven Standby Pump**

The pump should automatically start under any of the following conditions:

a) System Header pressure low.

b) Electric motor operated fire water pump fails to start.

Pump should be stopped manually only. Pump should also be started manually if required from the local control panel. The battery set which is connected for starting of Diesel engine shall not be subjected to boost charge.

3. **Jockey Pump**

It shall be possible to select any one of the Jockey pumps as main and the other as standby. Main Jockey pump shall start automatically when water pressure in header falls below the set value. If the main jockey pump fails to start then the standby should start. Jockey pump shall stop automatically when the pressure is restored to its normal value.

Manual starting/stopping shall be possible from the local control panel.

3.00.00 **TESTS**

3.01.00 **Shop Tests**

3.01.01 **Shop tests of all major equipment centrifugal pumps, diesel engines, electrical drive motors, piping, valves and specialties, pressure and storage vessels, MCC, electrical panels, controls, instrumentation etc. shall be conducted as specified in various clauses and as per applicable standards/codes.**

3.01.02 Shop tests shall include all tests to be carried out at Contractor's works, works of his sub-contractor and at works where raw materials supplied for manufacture of equipment are fabricated. The tests to be carried out shall include but not be limited to the tests described as follows :

a) Materials analysis and testing.

b) Hydrostatic pressure test of all pressure parts, piping, etc.

c) Dimensional and visual check.

d) Balancing test of rotating components.

e) Response of heat/smoke detectors.

f) Performance characteristics of HVW spray nozzles (projectors).

g) Flow rate and operational test on Flow control valves.

h) Operational test of alarm valve (water-motor gang).

i) Calibration tests on instruments and tests on control panel.

j) Destruction/burst tests on 2% or minimum one (1) no. of hoses and portable type fire extinguishers for each type as applicable. Any fraction number shall be counted as next higher integer.

k) Performance test on fire extinguishers as required in the code.

3.01.03 In the absence of any Code/Standard, equipment shall be tested as per mutually agreed procedure between the supplier and the Employer.

3.01.04 A comprehensive visual and functional check for panels would be conducted and will include a thorough check up of panel dimensions, material of construction, panel finish, compliance with tubing and wiring specifications, quality of work-manship, proper tagging & locations of instruments/accessories. The wiring check shall be complete point to point ring out and check for agreement with installation drawings and equipment vendor prints of the complete system and an inspection of all field connection terminals and levelling.

3.01.05 All test certificates and reports shall be submitted to the Employer for approval.

3.01.06 The Employer's representative shall be given full access to all tests. The manufacturer shall inform the Employer allowing adequate time so that, if the Employer so desires, his representatives can witness the test.

3.02.00 **Pre-commissioning Tests**

3.02.01 **General**

a) All piping and valves, after installation will be tested hydraulically at a pressure of 16kg/cm^2 for a period of 30 minutes to check against leak tightness.

b) All manually operated valves/gates shall be operated throughout 100% of the travel and these should function without any trouble whatsoever, to the satisfaction of the Employer.

c) All pumps shall be run with the specified fluid from shut off condition to valve wide open condition. Head developed will be checked from the discharge pressure gauge reading. During the test, the pumps and drives shall run smoothly without any undue vibration, leakage through gland, temperature rise in the bearing parts, noise, flow pulsation etc.

d) All pressure vessels should be tested hydraulically at the specified test pressure, singly or in the system.

e) Painting shall be checked by dry type thickness gauges.

f) Visual check on all structural components, welding, painting etc. and if doubt arises, these will be tested again.

g) All test instruments and equipment shall be furnished by the Contractor to the satisfaction of the Employer.

h) Automatic starting of all the fire pumps by operating the test valves.

i) Automatic operation of the Jockey pump

j) Operation of the Deluge valve by breaking a detector as well as manual and remote operation of the deluge valve.

k) Operation of entire annunciation system.

Replacement of fused/damaged quartzoid bulb detectors during the test shall be responsibility of contractor.

3.02.02 After erection at site, the complete HVW spray protection and hydrant system shall be subject to tests to show satisfactory performance for which detailed

procedure shall be submitted for Employer's approval.

Full flow tests with water shall be done for the system piping as a means of checking the nozzle layout, discharge pattern and coverage, any obstructions and determination of relation between design criteria and actual performance, also to ensure against clogging of the smaller piping and the discharge devices by foreign matter carried by the water.

Rigidity of pipe supports shall also be checked during the water flow.

3.02.03 All the detectors installed shall be tested for actuation by bringing a suitable source of heat/smoke near the detector and creating a stream of hot air/ smoke over the detector. The exact procedure of this test shall be detailed out by the Employer to the successful Bidder.

4.00.00 **SPARE PARTS**

The Contractor shall indicate in his scope of supply all the mandatory spares in the relevant schedules. The list of mandatory spares is indicated in 'Section - Projects'.

5.00.00 **HORIZONTAL CENTRIFUGAL PUMPS**

This clause covers the design, performance, manufacturing, construction features and testing of horizontal centrifugal pumps used for the purpose of fire fighting.

5.01.00 The materials of the various components shall conform to the applicable BS/ASTM/DIN Standards.

5.01.01 In case of any contradiction with the aforesaid standards and the stipulations as per the technical specification as specified hereinafter, the stipulations of the technical specification shall prevail.

5.02.00 **General Performance Requirements**

5.02.01 The pump set shall be suitable for continuous operation at any point within the "Range of operation".

5.02.02 Pumps shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum being at shut off.

5.02.03 Pumps shall be capable of furnishing not less than 150% of rated capacity at a head of not less than 65% of the rated head. The shut off head shall not exceed 120% of rated head. Range of operation shall be 20% of rated flow to 150% of rated flow.

5.02.04 The pump-motor set shall be designed in such a way that there is no damage due to the reverse flow through the pump which may occur due to any mal-operation of the system.

5.02.05 **Drive Rating**

The drive rating shall not be less than the maximum power requirement at any point within the "Range of Operation" specified.

During starting under reverse flow condition, the motor shall be capable of bringing the pump to rated speed at normal direction with 90% rated voltage at motor terminals.

5.02.06 Pump set along with its drive shall run smooth without undue noise and vibration. Acceptable peak to peak vibration limits shall guided by applicable standards.

5.02.07 The Contractor under this specification shall assume full responsibility in the operation of the pump and drive as one unit.

5.03.00 **Design & Construction**

5.03.01 Pump casing may be axially or radially split. The casing shall be designed to withstand the maximum pressure developed by the pump at the pumping temperature.

5.03.02 Pump casing shall be provided with adequate number of vent and priming connections with valves, unless the pump is made self-venting & priming. Casing drain, as required, shall be provided complete with drain valves.

5.03.03 Under certain conditions, the pump casing nozzles will be subjected to reactions from external piping. Pump design must ensure that the nozzles are capable of withstanding external reactions not less than those specified in API-610.

5.03.04 Pump shall preferably be of such construction that it is possible to service the internals of the pump without disturbing suction and discharge piping connections.

5.03.05 **Impeller**

The impeller shall be secured to the shaft and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft impellers shall be secured to the shaft by an additional locknut or cap screw. All screwed fasteners shall tighten in the direction of normal rotation.

5.03.06 **Wearing Rings**

Replaceable type wearing rings shall be furnished to prevent damage to impeller and casing. Suitable method of locking the wearing ring shall be used.

5.03.07 **Shaft**

Shaft size selected shall take into consideration the critical speed, which shall be at least 20% away from the operating speed. The critical speed shall also be atleast 10% away from runaway speed.

5.03.08 **Shaft Sleeves**

Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the

outer faces of gland packing or seal and plate so as to distinguish between the leakage between shaft & shaft sleeve and that past the seals/gland.

5.03.09 Shaft sleeves shall be securely fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.

5.03.10 **Bearings**

Bearings of adequate design shall be furnished for taking the entire pump load arising from all probable conditions of continuous operation throughout its "Range of Operation" and also at the shut-off condition. The bearing shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point.

Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearing housing.

5.03.11 **Stuffing Boxes**

Stuffing box design shall permit replacement of packing without removing any part other than the gland. Stuffing boxes shall be sealed/cooled by the fluid being pumped and necessary piping, fittings, valves, instruments, etc. shall form an integral part of the pump assembly.

5.03.12 **Shaft Couplings**

All shafts shall be connected with adequately sized flexible couplings of suitable design. Necessary guards shall be provided for the couplings.

5.03.13 **Base Plates & Sole Plate**

A common base plate mounting both for the pump and drive shall be furnished.

The base plate shall be of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the pumping unit so mounted as to minimise misalignment caused by mechanical forces such as normal piping strain, hydraulic piping thrust etc. Suitable drain taps and drip lip shall be provided.

5.03.14 Material of Construction

All materials used for pump construction shall be of tested quality. Material of construction of the major parts of the pumps shall be as given below or superior as per relevant latest International standards:

a)	Casing	Casting Grade 17 of BS 1452
b)	Impeller	Bronze Grade LG2-C of BS1400
c)	Wearing ring	Bronze Grade LG2-C of BS1400
d)	Shaft	Mild Steel.

e)	Shaft sleeve	Bronze Grade LG2-C of BS1400
f)	Stuffing box	2.5% Nickel CI Grade 17 of BS 1452
g)	Gland	--- do ---

5.03.15 **Balancing**

All rotating components shall be statically and dynamically balanced at shop.

5.03.16 All the components of pumps of identical parameters supplied under this specification shall be interchangeable.

5.04.00 **Tests and Inspection**

5.04.01 The manufacturer shall conduct all routine tests required to ensure that the equipment furnished conform to the requirements of this specification and are in compliance with the requirements of applicable Codes and Standards. The particulars of the proposed tests and the procedures for the tests shall be submitted to the Employer/Engineer for approval before conducting the tests.

5.04.02 Where stage inspection is to be witnessed by Employer, in addition to above, the Bidder shall submit to the Employer/Engineer at the beginning of the contract, the detailed PERT-Chart showing the manufacturing programme and indicating the period where Employer or his authorised inspecting agency are required at the shop.

5.04.03 **Material of Construction**

All materials used for pump construction shall be of tested quality. Materials shall be tested as per the relevant standards and test certificates shall be made available to the Employer/Engineer.

5.04.04 Where stage inspection is to be witnessed by Employer, all material test certificates shall be correlated and verified with the actual material used for construction before starting fabrication, by Employer's Inspector who shall stamp the material. In case mill test certificates for the material are not available, the Contractor shall carry out physical and chemical tests at his own cost from a testing agency approved by the Employer, as per the requirements of specified material standard. The samples for physical and chemical tests shall be drawn up in presence of Employer's inspector who shall also witness the tests.

5.04.05 Shaft shall be subjected to 100% ultrasonic test and machined portion of the impeller shall be subject to 100% DP test. On finished shaft DP test will also be carried out.

5.04.06 **Hydraulic test at shop**

All pressure parts shall be subjected to hydraulic testing at a pressure of 150% of maximum pressure generated by the pump at rated speed or 200% of total dynamic head whichever is higher, for a period not less than one (1) hour.

5.04.07 **Performance test at shop**

Pumps shall be subjected to routine tests to determine the performance of the pumps. These tests shall be conducted in presence of Employer/Engineer's representative as per the requirements of the ASME Power Test Code PTC 8.2/BS-599/I.S.S., latest edition. Routine tests shall be done on all the pumps.

5.04.08 Performance tests shall be conducted to cover the entire range of operation of the pumps. These shall be carried out to span 150% of rated capacity upto pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point and the two extremities of the Range of operation specified.

5.04.09 Tests shall preferably be conducted alongwith the actual drives being supplied.

5.04.10 The Bidders shall submit in his proposal the facilities available at his works to conduct performance testing. If because of limitations of available facilities, a reduced speed test or model test has to be resorted to establish pump performance, the same has to be highlighted in the offer.

5.04.11 In case of model testing, the stipulations of latest edition of apllicable standards shall be binding. Prototype or model tests, however, shall be conducted with the suction condition identical to the field conditions i.e. sigma values of prototype and model is to be kept same.

5.04.12 Prior to conducting model testing, calculations establishing model parameters, sizes and test procedure will be submitted to Employer/Engineer for approval.

5.04.13 All rotating components of the pumps shall be subjected to static and dynamic balancing tests.

5.04.14 The Employer or his authorised representative shall have full access to all tests. Prior to performance tests, the Contractor shall intimate the Employer allowing adequate time so that if the Employer so desires, his representative can witness the test.

5.04.15 Report and test certificates of the above tests shall be submitted to the Employer/Engineer for approval.

5.04.16 **Pre commissioning tests.**

After installation, pumps offered may be subjected to testing at field also by Employer. If the performances at field are not found to meet the requirement, then the equipment shall be rectified by the Contractor without any extra cost. Prior to performance testing, the procedure for such tests will be mutually agreed between Employer and Contractor. The Contractor shall furnish all necessary instruments, accessories and personnel for testing. Prior to testing, the calibration curves of all instruments and permissible tolerance limit of instruments shall be mutually agreed upon.

6.00.00 **DIESEL ENGINES**

This Clause covers the design, performance, manufacturing construction features and testing of compression ignition diesel engines, used primarily for driving

centrifugal pumps, used for the purpose of fire fighting.

6.01.00 **Design and Construction**

General

6.01.01 The diesel engine shall be of multicylinder type four-stroke cycle with mechanical (airless) injection, cold starting type.

6.01.02 The continuous engine brake horse power rating (after accounting for all auxiliary power consumption) at the site conditions shall be atleast 20% greater than the requirement at the duty point of pump at rated RPM and in no case, less than the maximum power requirement at any condition of operation of pump.

6.01.03 Reference conditions for rated output of engine shall be as per ISO:3046, part I.

6.01.04 The engine shall be designed with regard to ease of maintenance, repair, cleaning and inspection.

6.01.05 All parts subjected to substantial temperature changes shall be designed and supported to permit free expansion and contraction without resulting in leakage, harmful distortion or misalignment.

6.01.06 **Starting**

The engine shall be capable of both automatic and manual start. The normal mode of starting is automatic but in the event of failure of automatic start or at the discretion of the operator, the engine can be started manually from the LCP.

Since the fire pumping unit driven by the diesel engine is not required to run continuously for long periods and the operation will not be frequent, special features shall be built into the engine to allow it to start within a very short period against full load even if it has remained idle for a considerable period.

6.01.07 If provision for manual start (cranking) is provided, all controls/ mechanisms, which have to be operated during the starting process, shall be within easy reach of the operator.

6.01.08 Automatic cranking shall be effected by a D.C. motor having high starting torque to overcome full engine compression. Starting power will be supplied from either of the two (2) sets of storage batteries. The automatic starting arrangement shall include a 'Repeat Start' feature for 3 attempts. The battery capacity shall be adequate for 3 (three) consecutive starts without recharging with a cold engine under full compression.

6.01.09 The batteries shall be used exclusively for starting the diesel engine and be kept fully charged all the time in position. Arrangement for both trickle and booster charge shall be provided.

Diesel engine shall be provided with two (2) battery charger units of air-cooled design. The charger unit shall be capable of charging one (1) set of battery at a time. Provision shall, however, be made so that any one of the charger units can be utilised for charging either of the two (2) batteries.

6.01.10 For detail design of battery and battery charger, sub- section Electrical may be referred to.

6.01.11 **Governing System:**

The engine shall be fitted with a speed control device, which will control the speed under all conditions of load.

6.01.12 The governor shall offer following features:

a) Engine should be provided with an adjustable governor capable of regulating engine speed within 5% of its rated speed under any condition of load between shut-off and maximum load conditions of the pumps. The governor shall be set to maintain rated pump speed at maximum pump load.

b) Engine shall be provided with an over speed shut- down device. It shall be arranged to shut-down the engine at a speed approximately 20% above rated engine speed and for manual reset, such that the automatic engine controller will continue to show an over speed signal until the device is manually reset to normal operating position (Vol.II, NFPA, 1978).

6.01.13 The governor shall be suitable for operation without external power supply.

6.01.14 **Fuel System**

The diesel engine will run on High Speed Diesel.

6.01.15 The engine shall be provided with fuel oil tank of 250 litres capacity. The fuel oil tank shall preferably be mounted near the engine. No fuel oil tank will be provided by the Employer.

6.01.16 The fuel oil tank shall be of welded steel constructed to relevant standards for mild steel drums. The outlet of the tank shall be above the inlet of fuel injection pump of the diesel engine to ensure adequate pressure at suction of injection pump.

6.01.17 The fuel oil tank shall be designed in such a way that the sludge and sediment set-tles down to the tank bottom and is not carried to the injection pump. A small sump shall be provided and fitted with drain plug to take out sludge/sediment and to drain oil. Adequate hand holes (greater than 80 mm size) shall be provided to facilitate maintenance.

6.01.18 Pipeline carrying fuel oil shall be gradually sloped from the tank to the injection pump. Any valve in the fuel feed pipe between the fuel tank and the engine shall be placed adjacent to the tank and it shall be locked in the open position. A filter shall be incorporated in this pipeline, in addition to other filters in the fuel oil system. Pipe joints shall not be soldered and plastic tubing shall not be used. Reinforced flexible pipes may also be used.

6.01.19 The complete fuel oil system shall be designed to avoid any air pocket in any part of the pipe work, fuel pump, sprayers/injectors, filter system etc. No air relief cock is permitted. However, where air relief is essential, plugs may be used.

6.01.20 A manual fuel pump shall be provided for priming and releasing of air from the fuel pipelines.

6.01.21 **Lubricating Oil System**

Automatic pressure lubrication shall be provided by a pump driven by the crank shaft, taking suction from a sump and delivering pressurised oil through cooler and fine mesh filters to a main supply header fitted in the bed plate casing. High pressure oil shall be supplied to the main and big end bearings, cam-shaft bearings, cam-shaft chain and gear drives, governor, auxiliary drive gears etc. Valve gear shall be lubricated at reduced pressure through a reducing valve and the cams by an oil bath.

6.01.22 **Cooling Water System**

Direct cooling or heat exchanger type cooling system shall be employed for the diesel engine. Water shall be tapped from the fire pump discharge. This water shall be led through duplex strainer, pressure breakdown orifice and then after passing through the engine, the water at the outlet shall be taken directly to the sump through an elevated funnel.

6.02.00 **Testing & Inspection**

6.02.01 The manufacturer shall conduct all tests required, to ensure that the equipment furnished conforms to the requirement of this sub-section and in compliance with requirements of applicable codes. The particulars of the proposed tests and the procedure for the tests shall be submitted to the Employer for approval before conducting the tests.

6.02.02 At manufacturer's works, tests shall be carried out during and after completion of manufacture of different component/parts and the assembly as applicable. Following tests shall be conducted.

6.02.03 Material analysis and testing.

6.02.04 Hydrostatic pressure testing of all pressure parts.

6.02.05 Static and dynamic balance tests of rotating parts at applicable over-speed and determination of vibration level.

6.02.06 MPI/DPT on machined parts of piston and cylinder.

6.02.07 Ultrasonic testing of crankshaft and connecting rod after heat treatment.

6.02.08 Dimensional check of close tolerance components like piston, cylinder bore etc.

6.02.09 Calibration tests of all fuel pumps, injectors, standard orifices, nozzles, instruments etc.

6.02.10 Over speed test of the assembly at 120% of rated speed.

6.02.11 Power run test.

6.02.12 Performance test of the diesel engine to determine its torque, power and specific

fuel consumption as function of shaft speed. Performance test of the engine shall be carried for 12 hours out of which 1 hour at full load and one hour at 110% overload.

6.02.13 Measurement of vibration & noise.

(i) Measurement of vibration

The vibration shall be measured during full load test as well as during the overload test and limit shall be 100 microns.

(ii) Measurement of noise level

The equivalent 'A' weighted sound level measured at a distance of 1.5 M above floor level in elevation and 1.0 M horizontally from the base of the equipment, expressed in dB to a reference of 0.0002 microbar shall not exceed 93 dBA.

Above tests for vibration shall be repeated at site as pre-commissioning tests.

6.02.14 Adjustment of speed governor as per BS:5514.

6.02.15 Diesel engine shall be subjected to routine tests as per BS:5514.

7.00.00 **PIPING, VALVES AND SPECIALITIES**

This clause covers the design, manufacture, shop testing, erection, testing and commissioning of piping, valves and specialities.

7.02.00 **Scope**

The piping system which shall include but not be limited to the following:

7.02.01 Plain run of piping, bends, elbows, tees, branches, laterals, crosses, reducing unions, couplings, caps, expansion joints, flanges, blank flanges, thrust blocks, anchors, hangers, supports, saddles, shoes, vibration dampeners, sampling connections, hume pipes etc.

7.02.02 Gaskets, ring joints, backing rings, jointing material etc. as required. Also all welding electrodes and welding consumables including special ones, if any.

7.02.03 Instrument tapping connections, stubs etc.

7.02.04 Gate and globe valves to start/stop and regulate flow and swing check valves for one directional flow.

7.02.05 Basket strainers and Y-type strainers

7.02.06 Bolts, nuts, fasteners as required for interconnecting piping, valves and fittings as well as for terminal points. For pipe connections into Owner's R.C.C. works, Bidder will furnish all inserts.

7.02.07 Painting, anti-corrosive coatings etc. of pipes and equipment.

Adequate number of air release valves shall be provided at the highest points in the piping system to vent any trapped air in the system.

7.03.00 **Design**

7.03.01 Material of construction of various pipes shall be as follows :

(a) **Buried Pipes**

Mild steel black pipes as per ASTM A53 medium grade suitably lagged on the outside to prevent soil corrosion, as specified elsewhere.

(b) **Overground Pipes normally full of water**

Mild steel black pipes as per ASTM A53 medium grade.

(c) Overground pipes normally empty, but periodic charge of water and for detector line for HVW System**.**

Mild steel galvanised pipes as per ASTM A53 medium grade.

7.03.02 All fittings to be used in connection with steel pipe lines upto a size of 80 mm shall be as per ASTM A53 Mild steel tubulars and other wrought steel pipe fittings, Heavy grade. Fittings with sizes above 80 mm upto 150 mm shall be fabricated from ASTM A53 Heavy grade pipes or steel plates having thickness not less than those of ASTM A53 Heavy grade pipes. Fittings with sizes above 150 mm shall be fabricated as per ASTM A53 standard. All fitting used in GI piping shall be threaded type. Welding shall not be permitted on GI piping.

7.03.03 Pipe sizes shall not be less than the sizes indicated in the attached drawings.

7.03.04 For steel pipeline, welded construction should be adopted unless specified otherwise.

7.03.06 All piping system shall be capable of withstanding the maximum pressure arising from any condition of operation and testing including water hammer effects.

7.03.09 Gate/sluice valve shall be used for isolation of flow in pipe lines and **construction** shall be as per BS 5150. Valves shall be of rising spindle type and of PN 1.6 class

7.03.10 Gate Valves shall be provided with the following :

(a) Hand wheel.

(b) Position indicator.

(c) Locking facility (where necessary).

7.03.11 Gate valves shall be provided with back seating bush to facilitate gland removal during full open condition.

7.03.12 Globe valves shall be provided with contoured plug to facilitate regulation and control of flow. All other requirements should generally follow those of gate

valve.

7.03.13 Non-return valves shall be swing check type. Valves will have a permanent "arrow" inscription on its body to indicate direction of flow of the fluid.

7.03.14 Whenever any valve is found to be so located that it cannot be approached manually from the nearest floor/gallery/platform hand wheel with floor stand or chain operator shall be provided for the same.

7.03.15 Valves below 50 mm size shall have screwed ends while those of 50 mm and higher sizes shall have flanged connections.

7.03.14 **Basket Strainer**

a) Basket strainers shall be of 30mesh and have the following materials of construction :

Body: Fabricated mild steel (Tested Quality). Strainer Wires: stainless steel (AISI : 316), 30 SWG, suitably reinforced.

b) Inside of basket body shall be protected by two (2) coats of heavy duty bitumastic paint.

c) Strainers shall be Simplex design. Suitable vent and drain connections with valves shall be provided.

d) Screen open area shall be at least 4 times pipe cross sectional area at inlet.

e) Pressure drop across strainer in clean condition shall not exceed 1.5 MWC at 410M3/hr (for 765kV/400kV substations) and 1 MWC at 273M3/hr flow (for 220kV & 132kV substations). Pressure drop test report of strainer of same design shall be furnished.

7.03.15 **Y-type On-line Strainer**

Body shall be constructed of mild steel (tested quality). Strainer wires shall be of stainless steel AISI:316, 30 SWG, 30 mesh.

Blowing arrangement shall be provided with removable plug at the outlet. Screen open area shall be atleast 4 times pipe cross-sectional area at inlet.

Pressure drop test report of strainer of same design shall be furnished.

7.03.16 **Hydrant Valve (Outdoor) and Indoor Hydrant Valves (Internal Landing Valves).**

The general arrangement of outdoor stand post assembly, consisting of a column pipe and a hydrant valve with a quick coupling end shall be as per TAC requirement.

Materials of construction shall be as follows or superior :

a) Column pipe M.S. ASTM A53 med. grade.

b) Hydrant Valve

i)	Body	Stainless steel.
ii)	Trim	Leaded tin bronze.
iii)	Hand Wheel	Cast Iron.
iv)	Washer, gasket, etc.	Rubber.
v)	Quick coupling connection	Leaded tin bronze
vi)	Spring	Phosphor Bronze.
vii)	Cap and chain	Leaded tin bronze

The general design of hydrant valve shall conform to relevant latest international standards.

7.03.17 **Hoses, Nozzles, Branch pipes and Hose boxes**

(a) Hose pipes shall be of reinforced rubber-lined canvas construction with nominal size of 63 MM (2 1/2") and lengths of 15 metre or 7.5 metre, as indicated elsewhere.

(b) Hosepipes shall be capable of withstanding an internal water pressure of not less than 35**.7** kg/cm2 without bursting. It must also withstand a working pressure of 8.5 kg/cm2 without undue leakage or sweating.

(c) Each hose shall be fitted with instantaneous spring lock type couplings at both ends. Hose shall be fixed to the coupling ends by copper rivets and the joint shall be reinforced by 1.5 mm galvanised mild steel wires and leather bands.

(d) Branch pipes shall be constructed of copper and have rings of leaded tin bronze at both ends. One end of the branch pipe will receive the quick coupling while the nozzles will be fixed to the other end.

(e) Nozzles shall be constructed of leaded tin bronze.

(f) Suitable spanners of approved design shall be provided in adequate numbers for easy assembly and dismantling of various components like branch pipes, nozzles, quick coupling ends etc.

(g) Hose pipes fitted with quick coupling ends, branch pipes, nozzles spanner etc. will be kept in a hose box, which will be located near point of use.

(h) All instantaneous couplings, as mentioned under clause Nos.3.03.19, 3.03.20 and 3.03.21 above shall be of identical design (both male and female) so that

any one can be interchanged with another. One male, female combination shall get locked in by mere pushing of the two halves together but will provide leak tightness at a pressure of 8 kg/cm^2 of water. Designs employing screwing or turning to have engagement shall not be accepted.

7.04.00 **Fabrication & Erection**

7.04.01 The contractor shall fabricate all the pipe work strictly in accordance with the related approved drawings.

7.04.02 **End Preparation**

(a) For steel pipes, end preparation for butt welding shall be done by machining.

(b) Socket weld end preparation shall be sawing/machining.

(c) For tees, laterals, mitre bends, and other irregular details cutting templates shall be used for accurate cut.

7.04.03 **Pipe Joints**

(a) In general, pipes having sizes over 25 mm shall be joined by butt welding. Pipes having 25 mm size or less shall be joined by socket welding/screwed connections. Galvanised pipes of all sizes shall have screwed joints. No welding shall be permitted on GI pipes. Screwed joints shall have tapered threads and shall be assured of leak tightness without using any sealing compound.

(b) Flanged joints shall be used for connections to vessels, equipment, flanged valves and also on suitable straight lengths of pipe line of strategic points to facilitate erection and subsequent maintenance work.

7.04.04 **Overground Piping**

(a) Piping to be laid overground shall be supported on pipe rack/supports. Rack/supports details shall have to be approved by Employer/Engineer.

(b) Surface of overground pipes shall be thoroughly cleaned of mill scale, rust etc. by wire brushing. Thereafter one (1) coat of **red oxide primer** shall be applied. Finally two (2) coats of synthetic enamel paint of approved colour shall be applied.

7.04.05 **Buried Pipe Lines**

(a) Pipes to be buried underground shall be provided with protection against soil corrosion by coating and wrapping with two coats of coal tar hot enamel paint and two wraps of reinforced fibre glass tissue. The total thickness of coating and wrapping shall not be less than 3 mm. Alternatively corrosion resistant tapes can also be used for protection of pipes against corrosion.

(b) For Coating and wrapping, holiday testing to be performed inline with latest ASTM standards.

(c) Buried pipelines shall be laid with the top of pipe one meter below ground

level.

(d) At site, during erection, all coated and wrapped pipes shall be tested with an approved Holiday detector equipment with a positive signalling device to indicate any fault hole breaks or conductive particle in the protective coating.

7.05.00 **General Instruction for Piping Design and Construction**

7.05.01 While erecting field run pipes, the contractor shall check, the accessibility of valves, instrument tapping points, and maintain minimum headroom requirement and other necessary clearance from the adjoining work areas.

7.05.02 Modification of prefabricated pipes, if any, shall have to be carried out by the contractor at no extra charge to the Employer.

7.05.03 **Welding**

(i) Welding shall be done by qualified welders only.

(ii) Before welding, the ends shall be cleaned by wire brushing, filing or machine grinding. Each weld-run shall be cleaned of slag before the next run is deposited.

(iii) Welding at any joint shall be completed uninterrupted. If this cannot be followed for some reason, the weld shall be insulated for slow and uniform cooling.

(iv) Welding shall be done by manual oxyacetylene or manual shielded metal arc process. Automatic or semi-automatic welding processes may be done only with the specific approval of Employer/ Consultant.

(v) As far as possible welding shall be carried out in flat position. If not possible, welding shall be done in a position as close to flat position as possible.

(vi) No backing ring shall be used for circumferential butt welds.

(vii) Welding carried out in ambient temperature of 5°C or below shall be heat-treated.

(viii) Tack welding for the alignment of pipe joints shall be done only by qualified welders. Since tack welds form part of final welding, they shall be executed carefully and shall be free from defects. Defective welds shall be removed prior to the welding of joints.

Electrodes size for tack welding shall be selected depending upon the root opening.

(ix) Tacks should be equally spaced as follows **:**

for 65 NB and smaller pipes : 2 tacks

for 80 NB to 300 NB pipes : 4 tacks

for 350 NB and larger pipes : 6 tacks

(x) Root run shall be made with respective electrodes/filler wires. The size of the electrodes/filler wires. The size of the electrodes shall not be greater than 3.25 mm (10 SWG) and should preferably be 2.3 mm (12 SWG). Welding shall be done with direct current values recommended by the electrode manufacturers.

(xi) Upward technique shall be adopted for welding pipes in horizontally fixed position. For pipes with wall thickness less than 3 mm, oxyacetylene welding is recommended.

(xii) The root run of butt joints shall be such as to achieve full penetration with the complete fusion of root edges. The weld projection shall not exceed 3 mm inside the pipe.

(xiii) On completion of each run craters, weld irregularities, slag etc. shall be removed by grinding or chipping.

(xiv) Fillet welds shall be made by shielded metal arc process regardless of thickness and class of piping. Electrode size shall not exceed 10 SWG. (3.25 mm). At least two runs shall be made on socket weld joints.

7.06.00 **Tests at Works**

7.06.01 **Pipes**

(i) Mechanical and chemical tests shall be performed as required in the codes/standards.

(ii) All pipes shall be subjected to hydrostatic tests as required in the codes/standards.

(iii) 10% spot Radiography test on welds of buried pipes shall be carried out as per ASME VIII.

7.06.02 **Valves**

(i) Mechanical and chemical tests shall be conducted on materials of the valve as required in the codes/standards.

(ii) All valves shall be tested hydrostatically for the seat as well as required in the code/standards for a period of ten minutes.

(iii) Air test shall be conducted to detect seat leakage.

(iv) Visual check on the valve and simple operational test in which the valve will be operated thrice from full open to full close condition.

(v) No repair work on CI valve body, bonnet or wedge shall be allowed.

7.06.03 **Strainers**

(i) Mechanical and chemical tests shall be conducted on materials of the strainer.

(ii) Strainers shall be subjected to a hydrostatic test pressure of 1.5 times the design pressure or 10 kg/cm2g whichever is higher for a period of one hour.

7.06.04 **Hydrant valves and Indoor Hydrant Valves (Internal Landing Valves)**

(i) The stand post assembly along with the hydrant valve (valve being open and outlet closed) shall be pressure tested at a hydrostatic pressure of 21 kg/cm2g to detect any leakage through defects of casting.

(ii) Flow test shall be conducted on the hydrant valves at a pressure of 7 kg/cm2g and the flow through the valve shall not be less than 900 litres/min.

(iii) Leak tightness test of the valve seat shall be conducted at a hydrostatic test pressure of 14 kg/cm2g.

7.06.05 **Hoses, Nozzles, Branch Pipes and Hose Boxes**

Reinforced rubber-lined canvas hoses shall be tested hydrostatically. Following tests shall be included as per relevant latest International standard.

a) Hydrostatic proof pressure test at 21.4 kgf/cm2g

b) Internal diameter

The branch pipe, coupling and nozzles shall be subjected to a hydrostatic test pressure of 21 kg/cm2g for a period of $2^1/_2$ minutes and shall not show any sign of leakage or sweating.

Dimensional checks shall be made on the hose boxes and nozzle spanners.

8.00.00 **AIR VESSELS**

8.01.00 Air vessels shall be designed and fabricated of mild steel as class-II vessels as per BS 5500 for a pressure of 14kg/cm^2 and shall be minimum 3 m^3 capacity.

8.02.00 Inside surface of the tank shall be protected by anti-corrosive paints/coatings/linings as required.

8.03.00 Outside surfaces of the vessels shall be provided with one (1) coat of red lead primer with two (2) coats of synthetic enamel paint of approved colour and characteristics.

8.04.00 **Tests & Inspection**

8.04.01 Air vessels shall be hydraulically tested at 21kg/cm2 for a period not less than one (1) hour.

8.04.02 All materials used for fabrication shall be of tested quality and test certificates shall be made available to the Owner.

8.04.03 Welding procedure and Welder's qualification tests will be carried out as per relevant international Standard.

8.04.04 NDE tests, which will include 100% Radiography on longitudinal seams and spot Radiography for circumferential seams, for pressure vessel will be carried out.

9.00.00 **HEAT DETECTORS/FIRE DETECTORS AND SPRAY NOZZLES**

9.00.01 **Intent of Specification**

This specification lays down the requirements of the smoke detectors, heat detectors and spray nozzles for use in various sub-systems of the fire protection system.

9.00.02 **Codes and Standards**

All equipment supplied shall conform to internationally accepted codes and standards.

9.01.00 **Heat Detectors**, **Quartzoid bulb type.** (Used in HVW spray system)

a) Heat detectors shall be of any approved and tested type. Fusible chemical pellet type heat detectors are however not acceptable.

b) Temperature rating of the heat detector shall be selected by the Bidder taking into consideration the environment in which the detectors shall operate. Minimum set point shall, however, be 79oC.

c) Heat detectors shall be guaranteed to function properly without any maintenance work for a period of not less than twenty five (25) years.

d) The heat detectors shall be mounted on a pipe network charged with water at suitable pressure. On receipt of heat from fire, the heat detector will release the water pressure from the network. This drop in water pressure will actuate the Deluge valve.

9.02.00 **HVW Spray Nozzles (Projectors)**

High velocity water spray system shall be designed and installed to discharge water in the form of a conical spray consisting of droplets of water travelling at high velocity which shall strike the burning surface with sufficient impact to ensure the formation of an emulsion. At the same time the spray shall efficiently cut off oxygen supply and provide sufficient cooling. Integral non-ferrous strainers shall be provided in the projectors ahead of the orifice to arrest higher size particle, which are not allowed to pass through the projectors.

9.03.00 **Fire Detectors (Used in fire detection and alarm system)**

9.03.01 Fire detectors shall be approved by FOC-London or similar international author-

ities.

9.03.02 Both smoke and heat type fire detectors shall be used. Bidder shall clearly indicate the mode of operation of detectors in his proposal.

9.03.03 The set point shall be selected after giving due consideration for ventilating air velocity and cable insulation.

9.03.04 Fire detectors shall be equipped with an integral L.E.D. so that it shall be possible to know which of the detectors has been operated. The detectors, which are to be placed in the space above the false ceiling or in the floor void shall not have the response indicators on the body but shall be provided with remote response indicators.

9.03.05 Approval from competent authority shall be made available for ionisation type smoke detectors. All required accessories shall also be included in the scope of supply.

9.03.06 Fire detectors shall be guaranteed to function properly without any maintenance work for a period of not less than ten (10) years.

10.00.00 PORTABLE AND WHEEL/ TROLLEY MOUNTED FIRE EXTINGUISHERS

10.00.01 This specification lays down the requirement regarding fire extinguishers of following types:

Portable fire extinguishers.

a) Pressurised water type.

b) Dry chemical powder type

c) Carbon Dioxide type

Wheel/ Trolley mounted fire extinguishers.

a) Mechanical foam type
b) Dry chemical powder type
c) Carbon Dioxide type

10.00.02 All the extinguishers offered by the Bidder shall be of reputed make.

10.01.00 Design and Construction

10.01.01 All the portable extinguishers shall be of freestanding type and shall be capable of discharging freely and completely in upright position.

10.01.02 Each extinguisher shall have the instructions for operating the extinguishers on its body itself.

10.01.03 All extinguishers shall be supplied with initial charge and accessories as required.

10.01.04 Portable type extinguishers shall be provided with suitable clamps for mounting

on walls or columns.

10.01.05 All extinguishers shall be painted with durable enamel paint of fire red colour conforming to relevant International Standards.

10.01.06 Pressurisation of water type fire extinguishers shall either be done by compressed air or by using gas cartridge. Both constant air pressure and the gas pressure type shall conform to their latest relevant International standards.

10.01.07 Dry chemical powder type portable extinguisher and trolley mounted extinguisher shall conform to its latest relevant International standards.

10.01.08 Carbon Dioxide type portable extinguisher and Carbon Dioxide type trolley mounted extinguisher shall conform to their latest relevant International standards.

10.01.09 Wheel/ trolley mounted fire extinguishers of 50 litre capacity Mechanical foam type shall conform to its **latest relevant International standards.**

10.02.00 **Tests and Inspection**

10.02.01 A performance demonstration test at site of five (5) percent or one (1) number whichever is higher, of the extinguishers shall be carried out by the Contractor. All consumable and replaceable items require for this test would be supplied by the Contractor without any extra cost to Employer.

10.02.02 Performance testing of extinguisher shall be in line of applicable International Standards. In case where no International Standard is applicable for a particular type of extinguisher, the method of testing shall be mutually discussed and agreed to before placement of order for the extinguishers.

10.03.00 **Painting**

Each fire extinguisher shall be painted with durable enamel paint of fire red colour conforming to relevant International Standards.

11.00.00 **INSTRUMENTS**

11.00.01 **Intent of Specification**

The requirements given in the sub-section shall be applicable to all the instruments being furnished under this specification.

11.00.02 All field mounted instruments shall be weather and dust tight, suitable for use under ambient conditions prevalent in the subject plant. All field mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance can be achieved.

11.01.00 **Local Instruments**

Pressure/ Differential Gauges & Switches.

11.01.01 The pressure sensing elements shall be continuous 'C' bourdon type.

11.01.02 The sensing elements for all gauges/switches shall be properly aged and factory tested to remove all residual stresses. They shall be able to withstand atleast twice the full scale pressure/vacuum without any damage or permanent deformation.

11.01.03 For all instruments, connection between the pressure sensing element and socket shall be braced or hard soldered.

11.01.04 Gauges shall be of 150 mm diameter dial with die-cast aluminium, stoved enamel black finish case, aluminium screwed ring and clear plastic crystal cover glass. Upper range pointer limit stop for all gauges shall be provided.

11.01.05 All gauges shall be with stainless steel bourdon having rotary geared stainless steel movements.

11.01.06 Weatherproof type construction shall be provided for all gauges. This type of construction shall be fully dust tight, drip tight, weather resistant and splash proof with anti-corrosive painting conforming to NEMA- 4.

11.01.07 All gauges shall have micrometer type zero adjuster.

11.01.08 Neoprene safety diaphragm shall be provided on the back of the instruments casing for pressure gauges of ranges 0-10 Kg/cm^2 and above.

11.01.09 Scales shall be concentric, white with black lettering and shall be in metric units.

11.01.10 Accuracy shall be $\pm$ 1.0 percent of full range or better.

11.01.11 Scale range shall be selected so that normal process pressure is approximately 75 percent of full scale reading. For pressure gauges and pressure switches, the range shall not be less than 0 -16 Kg/cm^2

11.01.12 All gauges shall have 1/2 inch NPT bottom connection.

11.01.13 All instruments shall conform to their **latest relevant International standards.**

11.01.14 All instruments shall be provided with 3 way gauge isolation valve or cock. Union nut, nipple and tail pipe shall be provided wherever required.

11.01.15 Switch element contact shall have two (2) NO and two (2) NC contacts rated for 240 Volts, 10 Amperes A.C. or 220 Volts, 5 Amperes D.C. Actuation set point shall be adjustable throughout the range. ON-OFF differential (difference between switch actuation and de-actuation pressures) shall be adjustable. Adjustable range shall be suitable for switch application.

11.01.16 Switches shall be sealed diaphragm, piston actuated type with snap action switch element. Diaphragm shall be of 316 SS.

11.01.18 Necessary accessories shall be furnished.

11.02.00 **Timers**

11.02.01 The timers shall be electro-mechanical type with adjustable delay on pick-up or reset as required.

11.02.02 Each timer shall have two pairs of contacts in required combination of NO and NC.

11.03.00 **Level Gauges/Indicator/Switches**

11.03.01 **Level Gauges**

i) Gauge glasses shall be used for local level indication wherever shown in the flow diagram.

ii) Gauge glasses, in general, shall be flag glass type with bolted cover. Body and cover material shall be of carbon steel with rubber lining.

iii) Level coverage shall be in accordance with operating requirements. Maximum length of a single gauge glass shall not exceed 1.4 M. Should a larger gauge glass be required, multiple gauges of preferably equal length shall be used with 50 mm overlap in visibility.

iv) Reflex type gauge glasses shall be used for colourless liquids and transparent type gauge glasses shall be used for all liquids having colour.

v) Each gauge glass shall be complete with a pair of offset valves. Valves shall have union bonnet, female union level connection, flanged tank connection, and vent and drain plug.

vi) Offset valves shall have corrosion resistant ball-check to prevent fluid loss in the event of gauge glass breakage. Valve body shall have a working pressure of 200 percent of the maximum static pressure at the maximum process fluid temperature. Valve body materials shall be of carbon steel with rubber lining.

11.03.02 **Level Indicators**

i) Float type mechanical level gauges with linear scale type indicator shall be offered for measuring level of tanks wherever shown in the flow diagram.

ii) AISI-316 stainless steel float, guide rope and tape shall be used. Housing shall be of mild steel painted with anti-corrosive painting.

iii) The scale indicator shall be provided at a suitable height for ease of reading.

iv) Accuracy shall be + 1% of scale range or better.

11.03.03 **Level Switches**

i) Level switches shall be of ball float operated magnetic type complete with cage.

ii) Materials of construction shall be suitable for process and ambient conditions. The float material shall be AISI-316 stainless steel.

iii) Actuating switches shall be either hermetically sealed mercury type or snap acting micro-switches. Actuation set point shall be adjustable. ON-OFF differential (difference between switch actuation and de-actuation levels) shall be adjustable. Adjustable range shall be suitable for switch application. All switches shall be repeatable within + 1.0 percent of liquid level change required to activate switch. Contacts shall be rated for 50 watts resistive at 240 V A.C. Number of contacts shall be two NO and two NC for each level switch.

11.04.00 **Solenoid Valves**

11.04.01 The body of the valves shall be Forged brass or stainless steel.

11.04.02 The coil shall be continuous duty, epoxy moulded type Class-F, suitable for high temperature operation.

11.04.03 The enclosure shall be watertight, dust-tight and shall conform to NEMA-4 Standard.

11.04.04 The valves shall be suitable for mounting in any position.

11.05.00 **Switches, Lamps, Meters Etc.**

All electrical components on the panel namely push buttons, switches, lamps, meters etc. shall meet the requirements of sub-section Electrical enclosed with the specification.

11.06.00 All local instruments shall be inspected by Employer/Consultant as per the agreed quality plan.

11.07.00 Makes of control panel and local instruments, accessories shall be as per Employer's approval.

12.00.00 **ELECTRIC MOTORS**

12.01.00 **General**

12.01.01 This clause covers the requirements of three phase squirrel cage induction motors and single-phase induction motors.

12.01.02 The motors to be furnished, erected and commissioned as covered under this specification shall be engineered, designed, manufactured, erected, tested as per the requirements specified herein. These requirements shall however be read along with the requirements of the respective driven equipment being supplied under the specification of which this specification forms a part.

12.01.03 The motor supplied under this specification shall conform to the standards specified in GTR.

12.01.04 Terminal point for all motors supplied under this specification shall be at the respective terminal boxes.

12.01.05 Materials and components not specifically stated in this specification but are necessary for satisfactory operation of the motor shall be deemed to be included in the scope of supply of this specification.

12.01.06 Notwithstanding anything stated in this motor specification, the motor has to satisfy the requirement of the mechanical system during normal and abnormal conditions. For this the motor manufacturer has to co-ordinate with the mechanical equipment supplier and shall ensure that the motor being offered meets the requirements.

12.02.00 **Codes & Standards**

12.02.21 The design, manufacture, installation and performance of motors shall conform to the provisions of latest Electricity Act and Electricity Rules. Nothing in these specifications shall be construed to relieve the Contractor of his responsibility.

12.02.22 In case of contradiction between this specifications and IEC, the stipulations of this specification shall be treated as applicable.

12.02.23 National Electrical code for hazardous location and relevant NEMA standard shall also be applicable for motors located in hazardous location.

12.03.00 **Design Features**

12.03.01 **Rating and type**

(i) The induction motors shall be of squirrel cage type unless specified otherwise.

(ii) The motors shall be suitable for continuous duty in the specified ambient temperature.

(iii) The MCR KW rating of the motors for 50oC ambient shall not be less than the power requirement imposed at the motor shaft by the driven equipment under the most onerous operation conditions as defined elsewhere, when the supply frequency is 51.5 Hz (and the motor is running at 103% of its rated speed).

(iv) Motors shall be capable of giving rated output without reduction in the expected life span when operated continuously in the system having the following particulars :

a) Rated terminal voltage

From 0.2 to 200 KW	400V (3 Phase, solidly earthed)
Below 0.2 KW	230 V (1 Phase, solidly earthed)

Variation in voltage $\pm$ 6%.

b) Frequency 50 Hz $\pm$ 3%.

c) Any combination of (a) & (b)

12.03.02 Enclosure

Motors to be installed outdoor and semi-outdoor shall have hose proof enclosure equivalent to IP-55. For motors to be installed indoor, the enclosure shall be dust proof equivalent to IP-54.

12.03.03 **Cooling method**

Motors shall be TEFC (totally enclosed fan cooled) type.

12.03.04 **Starting requirements**

(i) **Induction motor**

a) All induction motors shall be suitable for full voltage direct on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.

b) Motors shall be capable of withstanding the electro-dynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.

c) The starting current of the motor at rated voltage shall not exceed six (6) times the rated full load current subject to tolerance as given in IEC 60034.

d) Motors when started with the driven equipment imposing full starting torque under the supply voltage condition specified under Clause 12.03.01 (iv) (a) shall be capable of withstanding at least two successive starts with coasting to rest between starts and motor initially at the rated load operating temperature. The motors shall also be suitable for three equally spread starts per hour, the motor initially at a temperature not exceeding the rated operating temperature.

e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than the starting time with the driven equipment at minimum permissible voltage (clause 12.03.04 (i) (a) by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speeds lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

12.03.05 **Running requirements**

(i) When the motors are operating at extreme condition of voltage and frequency given under clause no.12.03.01 (iv) the maximum permissible temperature rise over the ambient temperature of 50°C shall be within the limits specified in IEC 60034 after adjustment due to increase ambient

temperature specified herein.

(ii) The double amplitude of motor vibration shall be within the limits specified in IEC/International standards. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

(iii) All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.

(iv) Induction motors shall be so designed as to be capable of withstanding the voltage and torque stresses developed due to the difference between the motor residual voltage and incoming supply voltage during fast changeover of buses. The necessary feature incorporated in the design to comply with this requirement shall be clearly indicated in the proposal.

(v) Motors shall be capable of developing the rated full load torque even when the supply voltage drops to 70% of rated voltage. Such operation is envisaged for a period of one second. The pull out torque of the induction motors to meet this requirement shall not be less than 205% of full load torque.

(vi) The motors shall be capable of withstanding for 10 seconds without stalling or abrupt change in speed (under gradual increase of torque) an excess torque of 60 percent of their rated torque, the voltage and frequency being maintained at their rated value.

(vii) Guaranteed performance of the motors shall be met with tolerances specified in respective standards.

12.04.00 **Construction Features**

12.04.01 **Stator**

(i) **Stator frame**

The stator frames and all external parts of the motors shall be rigid fabricated steel or of casting. They shall be suitably annealed to eliminate any residual stresses introduced during the process of fabrication and machining.

(ii) **Stator core**

The stator laminations shall be made from suitable grade magnetic sheet steel varnished on both sides. They shall be pressed and clamped adequately to reduce the core and teeth vibration to minimum.

(iii) **Insulation and winding**

All insulated winding conductor shall be of copper. The overall motor winding insulation for all 400 volts motors shall be of epoxy thermosetting type i.e., class 'F' but limited to class-B operating from temperature rise consideration. Other motors may be of conventional class-B type. The windings shall be suitable for successful operation in hot, humid, tropical climate with the ambient temperature of 50°C.

12.04.02 **Rotor**

(i) Rotors shall be so designed as to keep the combined critical speed with the driven equipment away from the running speed by atleast 20%.

(ii) Rotors shall also be designed to withstand 120% of the rated speed for 2 minutes in either direction of rotation.

12.04.03 **Terminal box leads**

(i) For motors of 400 Volts and below a single terminal box may be provided for power and accessories leads.

(ii) Terminal boxes shall be of weatherproof construction designed for outdoor service. To eliminate entry of dust and water, gaskets of neoprene or approved equivalent shall be provided at cover joints and between box and motor frame.

(iii) Terminal box shall be suitable for top and bottom entry of cables.

(iv) Unless otherwise approved, the terminal box shall be capable of being turned through 360o in steps in 90o.

(v) The terminals shall be complete with all accessories for connecting external cables. They shall be designed for the current carrying capacity and shall ensure ample phase to phase to ground clearances.

(vi) Suitable tinned brass compression type cable glands and cable lugs shall be supplied by the Contractor to match Employer's cable.

(vii) Terminal box for single core cable shall be of non- magnetic material.

(viii) Marking of all terminals shall be in accordance with IEC / International standard..

12.04.04 **Rating Plates**

(i) Rating plates shall be provided for all motors giving the details as called for in IEC 60034 (for three phase squirrel cage induction motors).

(ii) In addition to above, the rating plate shall indicate the following:

a) Temperature rise in oC under normal working conditions.

b) Phase sequence corresponding to the direction of rotation for the application.

c) Bearing identification number (in case of ball/ roller bearing) and recommended lubricants.

12.04.05 **Other Constructional Features**

(i) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of Employer's earthing conductor to be specified to the successful Bidder.

(ii) Motor weighing more than 25 kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

12.05.00 **Paint and Finish**

12.05.01 Motor external parts shall be finished and painted to produce a neat and durable surface, which would prevent rusting and corrosion. The equipment shall be thoroughly degreased, all sharp edges and scales removed and treated with one coat of primer and two coats of grey enamel paint.

12.05.02 Motor fans shall also be painted to withstand corrosion.

12.05.03 All fasteners used in the construction of the equipment shall be either of corrosion resistant material or heavy cadmium plated.

12.05.04 Current carrying fasteners shall be either of stainless steel or high tensile brass.

12.06.00 **Tests at Manufacturers Works**

12.06.01 Motors shall be subject to routine tests in accordance with IEC 60034.

12.06.02 In addition, the following tests shall also be carried out :

a) 20% over speed test for 2 minutes on all rotors.

b) Measurement of vibration.

c) Measurement of noise level.

d) Phase sequence and polarity checks relative to mechanical rotation.

12.06.03 **Tests after installation at site**

(i) After installation and commissioning at site, the motors alongwith the driven equipment shall be subject to tests to ascertain their conformity with the requirement of this specification and those of the driven equipment specification and the performance data quoted by the Bidder.

(ii) In case of non-conformity of the motor with these specifications and performance requirement, the Engineer may at his discretion reject or ask for necessary rectification/replacement as detailed in general Terms and Conditions of Contract (GCC) Volume-I.

13.00.00 **BATTERY & BATTERY CHARGERS**

This clause covers the design, performance, manufacturing, construction features and testing of Battery and Battery charger used primarily for starting the diesel engine driving the fire water pumps. Battery Chargers shall be housed in Diesel Engine Panel.

13.01.00 **General Information**

13.01.01 The equipment specified hereinafter are required for starting the diesel engines and other operation of the plant as required.

13.01.02 For each diesel engine there shall be two (2) sets of Battery and two (2) sets of Battery Charger.

13.01.03 The D.C. voltage shall be obtained normally after necessary rectification by battery charger. The Battery Charging system shall be capable of meeting the following requirements:

13.01.04 Float charging the Battery.

13.01.05 Boost Charging the Battery.

13.01.06 The battery shall be large enough to crank the engine **3** times without charging in between and without getting drained to an extent which will affect its life.

13.01.07 The Bidder shall indicate the battery voltage and battery capacity in Ampere-Hour at ten (10) hour discharge rate. The battery voltage at any time during operation shall not be less than the minimum voltage required for operation of the D.C. loads.

13.02.00 **General Design**

The Battery shall be located indoor

13.02.01 **Battery**

(i) The cells shall be lead-acid type. The Battery shall be automotive type.

(ii) The cells shall be sealed in type with anti-splash type vent plug.

(iii) The cell terminal posts shall be provided with connector bolts and nuts, effectively coated with lead to prevent corrosion. Lead or lead coated copper connectors shall be furnished to connect up cells of battery set.

(iv) Positive and Negative terminal posts shall be clearly and indelibly marked for easy identification.

(v) The electrolyte shall be of battery grade Sulphuric Acid. Water for storage batteries conforming to relevant standards shall be used in the preparation of the electrolyte.

13.02.02 **Battery Charger**

(i) The Bidder shall furnish the battery charging scheme complete with all necessary accessories such as transformers, switches, fuses, starters, contactors, diodes, ammeters, voltmeters and other devices as required for trouble free operation. All devices and equipment shall conform to relevant International Standard or shall be Superior to it.

(ii) The scheme of the battery charger shall be such that the battery can be charged automatically as well as manually.

(iii) The boost charger shall have sufficient capacity to restore a fully discharged Battery to a state of full charge in eight (8) hours with some spare margin over maximum charging rate. Suitable provision shall be kept so that, for a particular engine, any of the two (2) charger units can be used for charging any of the two (2) batteries.

(iv) The instruments, switches and lamps shall be flush/semi-flush mounted on the front panel. Name plate of approved type shall be provided for each of these equipment.

(v) The panel shall be complete with internal wiring and input-output terminal block. Terminal blocks shall be clip on type of suitable rating. All equipment and wire terminals shall be identified by symbols corresponding to applicable schematic/wiring diagram.

(vi) Space heaters of adequate capacity shall be provided to prevent moisture condensation in the panel.

13.03.00 **Testing**

13.03.01 The Battery Charger shall also be subjected to the following tests at manufacturer's works as per IEC 60146.

13.03.02 Insulation test.

13.03.03 Connection checking.

13.03.04 Measurement of voltage regulation.

13.03.05 Auxiliary of devices.

13.03.06 Alternating current measurement.

13.03.07 Performance test.

13.03.08 Temperature rise test.

13.03.09 Following acceptance tests shall be carried out in batteries as per IEC/International standard.

a) Marking and packing

b) Verification of dimensions

c) Test for capacity

d) Test for voltage during discharge

Battery and battery charger shall be checked for auto charging and providing sufficient power for three consecutive starting kicks to diesel engine within five minutes with A.C. supply switched off.

14.00.00 CONTROL & ANNUNCIATION PANELS

14.01.00 Intent of Specification

The following requirement shall be applicable to the control and annunciation panels furnished under these specifications.

14.02.00 General Information

14.02.01 The equipment specified herein are required for controlling, metering, monitoring and indication of electrical systems of the plant offered.

14.02.02 The selection and design of all the equipment shall be so as to ensure reliable and safe operation of the plant and shall be subjected to approval by the Employer.

14.02.03 The reference ambient temperature outside the panel shall be taken as 50oC and relative humidity 100%.

14.03.00 Equipment to be Furnished

Control & annunciation panels shall be furnished complete with all accessories and wiring for safe and trouble free operation of the plant. Details are included in sub-section General.

14.04.00 Constructional Details

14.04.01 The panel frames shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness not less than 2.5 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary.

14.04.02 Panels shall be of free standing type and shall be provided with hinged door with locking arrangement. The access doors, cutest and covers shall be equipped with neoprene/synthetic rubber gaskets (conforming to IEC 60149) all around and the latches sufficiently strong to hold them in alignment when closed. The panels to be installed outdoor or semi outdoor shall have a degree of protection of IP:55 and those installed indoor shall have a degree of protection of IP:52 as per IEC 60947.

14.04.03 If a panel consists of a number of panels, each panel should be mounted side by side and bolted together to form a compact unit, when two panels meet, the joints shall be smooth, close fittings and un-obstructive.

14.04.04 Removable eye bolt or lifting lugs shall be provided on all panels to facilitate easy lifting.

14.04.05 The heights of all operating equipment on the panel shall be between 800 mm to 1600 mm from the finished floor level. The proper supporting arrangement shall be provided by the Contractor.

14.04.06 Cable entries to the panel may be from bottom or top. The cable entry required will be intimated to the successful Bidder. A suitable removable gland plate of 3 mm thick shall be mounted not less than 200 mm above the floor level.

14.04.07 All equipment mounted on the front face of the panels shall be flush or semi-flush type. All equipment shall be so located that their terminal and adjustment are readily accessible for inspection or maintenance and their removal and replacement can be done without interruption of service to other equipment. The contractor shall submit the panel general arrangement drawings clearly bringing out internal mounting details, dimensions of equipment, clearance between the equipment and the edges of the panel, for approval.

14.05.00 **Name Plates and Labels**

14.05.01 Each panel shall be provided with prominent, engraved identification plates for all front mounted equipment. Panel identification name plate shall be provided at front and rear as required.

14.05.02 All name plates shall be of non-rusting metal or 3 ply lamicold, with white engraved lettering on black background. Inscription and lettering sizes shall be subjected to Employer's approval.

14.05.03 Suitable plastic sticker labels shall be provided for easy identification of all equipment located inside the panel. These labels shall be positioned so as to be clearly visible and shall give the device number, as mentioned in the wiring drawings.

14.06.00 **AC/DC Power Supply**

14.06.01 The Employer will provide one feeder each for AC and DC to the panel. The Contractor shall make for his own arrangements for providing these power supplies to different panels.

14.06.02 The Contractor shall provide suitable isolating switch fuse unit in the control panel for receiving the above incoming AC and DC supplies. Fuse and link shall be provided for isolating of individual circuit without disturbing other circuits.

14.07.00 **Wiring**

14.07.01 All inter panel wiring and connections between panels (if there is group of panels) including all bus wiring for AC & DC supplies shall be provided by the Contractor.

14.07.02 All internal wiring shall be carried out with 1100 V grade, single core, 1.5 square mm or larger stranded copper wires having colour-coded PVC insulation. CT circuits shall be wired with 2.5 square mm copper wires, otherwise similar to the above.

14.07.03 Extra-flexible wire shall be used for wiring to devices mounted on moving parts such as doors.

14.07.04 Spare contacts of auxiliary relays, timers and switches shall be wired out to the terminal blocks as required by the Employer/Engineer at the time of detailed engineering.

14.08.00 **Terminal Blocks**

14.08.01 Terminal Blocks shall be of 650V grade, rated for 10 Amps and in one-piece moulding. It shall be complete with insulating barriers, clip-on-type terminals, and identification strips. Marking on terminal strip shall correspond to the terminal numbering on wiring diagrams. It shall be similar to 'Elmex-Standard' type terminals.

14.08.02 Terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal block.

14.08.03 The terminal blocks shall have at least 20% spare terminals.

14.09.00 **Grounding**

A continuous copper bus 25 x 3 mm size shall be provided along the bottom of the panel structure. It shall run continuously throughout the length of the panel and shall have provision at both ends for connection to the station grounding grid (25 x 6 mm MS Flat).

14.10.00 **Space Heater and Lighting**

14.10.01 Space heaters shall be provided in the panels for preventing harmful moisture condensation.

14.10.02 The space heaters shall be suitable for continuous operation on 230V AC, 50 Hz, single phase supply and shall be automatically controlled by thermostat. Necessary isolating switches and fuses shall also be provided.

14.10.03 Free standing panel shall have a 230V AC, plug point and a fluorescent light operated by door switch.

14.11.00 **Control and Selector Switches**

14.11.01 Control and selector switches shall be of rotary type, with escutcheon plates clearly marked to show the function and positions.

14.11.02 Control/selector switches shall be spring return or stay put type as per the requirements. Handles of control/selector switches shall be black in colour. Shape and type of handles shall be to the approval of the Employer.

14.11.03 The contact ratings shall be at least the following:

i)	Make and carry continuously	10 Amp.
ii)	Breaking current at 220/110V DC	1Amp. (Inductive)
iii)	Breaking current at 240V DC	5 Amp. at 0.3 p.f. lagging

14.12.00 **Push Buttons**

14.12.01 Push buttons shall be spring return, push to actuate type and rated to continuously carry and break 10A at 230V AC and 0.5A (Inductive) at 220/110V DC. The push buttons shall have at least 1 NO and 1 NC contact. All contact faces

shall be of silver or silver alloy.

14.12.02 All push buttons shall be provided with integral escutcheon plates marked with its function.

14.12.03 The colour of buttons shall be as follows :

Green For motor START, Breaker CLOSE, Valve/ damper OPEN.

Red For motor TRIP, Breaker OPEN, Valve/ damper CLOSE.

Black For all annunciation functions, overload reset and miscellaneous.

14.12.04 Red push buttons shall always be located to the left of green push buttons. In case of clinker grinder etc. the push buttons would be black-red-green from left to right.

14.13.00 **Indicating Lamps**

14.13.01 Indicating lamps shall be of the panel mounting, filament type and of low-watt consumption. Lamps shall be provided with series resistors preferably built-in-the lamps assembly. The lamps shall have escutcheon plates marked with its function, wherever necessary.

14.13.02 Lamp shall have translucent lamp covers of the following colours:

Red for motor OFF, Valve/damper OPEN, Breaker CLOSED.

Green for motor ON, Valve/damper CLOSED, Breaker OPEN.

White for motor AUTO-TRIP.

Blue for all healthy conditions (e.g. control supply, lub oil pressure and also for spring charged).

Amber for all ALARM conditions (e.g. pressure low, over load and also for 'service' and 'Test' position indication).

14.13.03 Bulbs and lamps covers shall be easily replaceable from the front of the panel.

14.13.04 Indicating lamps should be located directly above the associated push button/control switches. Red lamps shall variably be located to the right of the green lamp. In case a white lamp is also provided, it shall be placed between the red and green lamps. Blue and amber lamps should normally be located above the red and green lamps.

14.14.00 **Fuses**

14.14.01 All fuses shall be of HRC cartridge plug-in-type and shall be of suitable rating, depending upon circuit requirements.

14.14.02 All fuses shall be mounted on fuse carriers, which shall be mounted on fuse-bases.

14.15.00 **Contactors**

14.15.01 Contactors shall be of air break, electromagnetic type rated as per requirement.

14.15.02 Operating coils of AC contactors shall be of 230V AC or 220/110V DC as required. AC contactors shall operate satisfactorily between 85% to 110% of the rated voltage. The Contactor shall not drop out at 70% of the rated voltage.

14.15.03 DC contactors shall have a coil voltage of 220/110V DC and shall be suitable for satisfactory continuous operation at 80% to 110% of the rated voltage.

14.16.00 **Relays and Timers**

14.16.01 All auxiliary relays & timers shall be of proven design and of reputed make. Contacts of relays and timers shall be of solid silver or silver cadmium oxide or solid silver faced. Timers shall have the provision to adjust the delay on pick-up or reset as required.

14.16.02 All relays and timers shall have at least two NO and two NC contacts.

14.16.03 All relays and timers shall be suitable for 230V AC and 220/110V DC as required. DC relays shall operate satisfactorily between 70% to 110% and AC relays shall be suitable for voltage variation between 80% to 110%.

14.17.00 **Indication Instruments**

14.17.01 All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96 mm square size with 90 degree scales and shall have an accuracy class of 2.0 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.

14.17.02 All instruments shall be compensated for temperature errors and factory calibrated to directly read the primary quantities. Means shall be provided for zero adjustment removing or dismantling the instruments.

14.17.03 All instruments shall have white dials with black numerals and lettering. Black knife edge pointer with parallax free dials will be preferred.

14.17.04 Ammeters provided on motor feeders shall have a compressed scale at the upper current region to cover the starting current.

14.18.00 **Annunciation System**

14.18.01 The annunciation system shall be complete with all necessary relays, flashers and other accessories required for the proper operation of the equipment and shall be completely solid state. The control circuit shall be mounted on plug-in type glass epoxy printed circuit boards. Audible alarms for the system shall be mounted inside the panel. One set of acknowledge, test and reset push buttons shall be mounted on the panel.

14.18.02 Indications shall be engraved on Acrylic inscription plate window and shall be visible clearly when the indication lamp is lighted (black letters on white background). Each window shall be provided with two lamps.

14.18.03 Audible hooter shall sound when a trouble contact operates and shall continue to sound until the acknowledge button is pressed. In addition to the hooters provided on annunciation panels, a hooter shall be provided outside FFPH which shall sound in any fire alarm condition.

14.18.04 Indication lamps shall flash when trouble contact operates and shall continue flashing until acknowledge button is pressed.

14.18.05 After acknowledge button is pressed, the hooter and flashing shall stop but the indication lamp shall remain lighted.

14.18.06 After trouble is cleared indication lamps shall be ready and shall go off only when reset.

14.18.07 Silencing the hooter in conjunction with one trouble contact shall not stop and hooter sounding if another trouble contact operates.

14.18.08 When test button is pressed, all lamps shall flash and hooter shall sound.

14.18.09 Annunciator systems shall operate on 220/110V DC Systems as applicable.

14.18.10 The annunciation system shall include alarm for AC control system failure (working on DC supply), DC supply failure (working on AC supply) and test facilities for these alarms.

14.18.11 List of annunciations required on the panels has been listed elsewhere. The Contractor shall also provide additional annunciations if desired by the Employer/Engineer during Vendor drawing review stage and for such additional annunciations no extra charges shall be claimed by the Contractor, if the number of such additions are within 10% of the number stipulated in this specification.

14.18.12 20% spare windows shall be provided on the panel.

14.19.00 **Painting**

14.19.01 **Painting procedure adopted shall conform to requirements given in GTR**. The paint thickness shall not be less than **60** microns. Finished parts shall be coated by peelable compound by spraying method to protect the finished surface from scratches, grease, dirt and oily spots during testing, transportation handling and erection.

14.20.00 **Tests**

14.20.01 Following tests/inspection shall be carried out by the Contractor in the presence of Employer's representative :

(A) Factory Tests

1. Compliance with approved drawings, data and specification.

2. Visual check for workmanship.

3. Wiring continuity and functional checks.

4. Calibration of instruments, relays and metres wherever required by inspector.

5. HV test

6. Insulation resistance measurement before and after HV test.

(B) Inspection/Testing at site :

1. IR test before and after HV test

2. HV Test

3. Functional Testing.

(C)

1. The Fire detection and annunciation panel shall be subjected to functional tests.

2. The Annunciation System shall be routine tested

TECHNICAL SPECIFICATION

VOL-II, SEC-XII

POWER AND CONTROL CABLE

Table of contents

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SECTION - XII
POWER AND CONTROL CABLE

1. POWER & CONTROL CABLES[FOR WORKING VOLTAGES UP TO AND INCLUDING 1100 V]

CRITERIA FOR SELECTION OF POWER & CONTROL CABLES

1.1.1. Aluminium conductor XLPE insulated armoured cables shall be used for main power supply purpose from LT Aux. Transformers to control room, between distribution boards and for supply for colony lighting from control room.

1.1.2 Aluminium conductor PVC insulated armoured power cables shall be used for various other applications in switchyard area/control room except for control/protection purposes.

1.1.3 For all control/protection/instrumentation purposes PVC insulated armoured control cables of minimum 2.5 sq. mm. size with stranded Copper conductors shall be used.

1.1.4 Employer has standardised the sizes of power cables for various feeders. Bidders are to estimate the quantity of cables and quote accordingly. The sizes of power cables to be used per feeder in different application shall be as follows:

S.No.	From	To	Cable size	Cable type
1.	Main Switch Board	LT Transformer	2-1C X 630 mm^2 per phase 1-1C X 630 mm^2 for neutral	XLPE
2.	Main Switch Board	AC Distribution Board	2-3½C X 300 mm^2	XLPE
3.	Main Switch Board	Oil Filtration Unit	1-3½C X 300 mm^2	XLPE
4.	Main Switch Board	Colony Lighting	1-3½C X 300 mm^2	XLPE
5.	Main Switch Board	HVW pump LCP	1-3½C X 300 mm^2	XLPE
6.	Main Switch Board	Main Lighting distribution board	2-3½C X 300 mm^2	XLPE
7.	AC Distribution Board	D.G. Set AMF Panel	2-3½C X 300 mm^2	XLPE
8.	AC Distribution Board	Emergency Lighting distribution board	1-3½C X 70 mm^2	PVC
9.	AC Distribution Board	ICT MB	1-3½C X 70 mm^2	PVC
10.	AC Distribution Board	Bay MB	1-3½C X 70 mm^2	PVC
11.	Bay MB	AC Kiosk	1- 3 ½ x 70 mm^2	PVC

12.	AC Distribution Board	Battery Charger	1-3½C X 70 mm^2	PVC
13.	DCDB	Battery	2-1C X 150 mm^2	PVC
14.	DCDB	Battery Charger	2-1C X 150 mm^2	PVC
15.	DCDB	Protection/PLCC panel	1-4C X 16 mm^2	PVC
16.	Main Lighting DB	Lighting panels(Indoor)	1-3½C X 35 mm^2	PVC
17.	Main Lighting DB	Lighting panels (outdoor)	1-3½C X 70 mm^2	PVC
18.	Main Lighting DB	Receptacles (Indoor)	1-3½C X 35 mm^2	PVC
19.	Main Lighting DB	Receptacles (Outdoor)	1-3½C X 70 mm^2	PVC
20.	Lighting Panel	Sub lighting panels	1-4C X 16 mm^2	PVC
21.	Lighting Panel	Street Lighting Poles	1-4C X 16 mm^2	PVC
22.	Lighting Panel/ Sub lighting panels	Lighting Fixtures (Outdoor)	1-2C X 6 mm^2	PVC
23.	Bay MB	Equipments	1-4C X 16 mm^2 /1-4C X 6 mm^2 /1-2C X 6 mm^2	PVC

1.1.5 Bidder may offer sizes other than the sizes specified in clause 1.1.4. In such case and for other application where sizes of cables have not been indicated in the specification, sizing of power cables shall be done keeping in view continuous current, voltage drop & short-circuit consideration of the system. Relevant calculations shall be submitted by bidder during detailed engineering for purchaser's approval.

1.1.6 Cables shall be laid as per relevant IEC/International Standards.

1.1.7 While preparing cable schedules for control/protection purpose following shall be ensured:

1.1.7.1 Separate cables shall be used for AC & DC.

1.1.7.2 Separate cables shall be used for DC1 & DC2.

1.1.8 For different cores of CT & CVT separate cable shall be used

1.1.9 Atleast one (1) cores shall be kept as spare in each copper control cable of 4C, 5C or 7C size whereas minimum no. of spare cores shall be two (2) for control cables of 10 core or higher size.

1.1.10 For control cabling, including CT/VT circuits, 2.5 sq.mm. size copper cables shall be used per connection. However, if required from voltage drop/VA burden consideration additional cores shall be used. Further for potential circuits of energy meters separate connections by 2 cores of 2.5 sq.mm. size shall be provided.

1.1.11 Technical data requirement sheets for cable sizes are being enclosed at Annex-I.

1.2. **TECHNICAL REQUIREMENTS**

1.2.1. General

1.2.1.1. The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground buried installation with uncontrolled back fill and chances of flooding by water.

1.2.1.2. They shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operating conditions. The XLPE /PVC insulated L.T. power cables of sizes 240 sq. mm. and above shall withstand without damage a 3 phase fault current of at least 45 kA for at least 0.12 second, with an initial peak of 105 kA in one of the phases at rated conductor temperature (70 degC for PVC insulated cables and 90 degC for XLPE insulated cables). The armour for these power cables shall be capable of carrying 45 kA for at least 0.12 seconds without exceeding the maximum allowable temperature of PVC outer sheath.

1.2.1.3. The XLPE insulated cables shall be capable of withstanding a conductor temperature of 250°C during a short circuit without any damage. The PVC insulated cables shall be capable of withstanding a conductor temperature of 160°C during a short circuit.

1.2.1.4. The Aluminium/Copper wires used for manufacturing the cables shall be true circular in shape before stranding and shall be uniformly good quality, free from defects. All Aluminium used in the cables for conductors shall be of H2 grade. In case of single core cables armours shall be of H4 grade Aluminium.

1.2.1.5. The fillers and inner sheath shall be of non-hygroscopic, fire retardant material, shall be softer than insulation and outer sheath shall be suitable for the operating temperature of the cable.

1.2.1.6. Progressive sequential marking of the length of cable in metres at every one metre shall be provided on the outer sheath of all cables.

1.2.1.7. Strip wire armouring method shall not be accepted for any of the cables. For control cables only round wire armouring shall be used.

1.2.1.8. The cables shall have outer sheath of a material with an oxygen index of not less than 29 and a temperature index of not less than 250°C.

1.2.1.9. All the cables shall pass fire resistance test as per IS: 1554 (Part-I) / IEC: 60502 (Part-I)

1.2.1.10. The normal current rating of all PVC insulated cables shall be as per IS: 3961 / IEC: 60502.

1.2.1.11. Repaired cables shall not be accepted.

1.2.1.12. Allowable tolerance on the overall diameter of the cables shall be plus or minus 2 mm.

1.2.2. XLPE Power Cables

1.2.2.1. The XLPE insulated cables shall be of FR type, C1 category conforming to IS: 7098 (Part-I) / IEC: 60502 (Part-I) and its amendments read alongwith this specification. The conductor shall be stranded aluminium circular/sector shaped and compacted. In multicore cables, the core shall be identified by red, yellow, blue and black coloured strips or colouring of insulation. A distinct inner sheath shall be provided in all multicore cables. For XLPE cables, the inner sheath shall be of extruded PVC to type ST-2 of IS: 5831 / IEC: 60502. When armouring is specified for single core cables, the same shall consist of aluminium wires/strips. The outer sheath shall be extruded PVC to Type ST-2 of IS: 5831 / IEC: 60502 for all XLPE cables.

1.2.3. PVC Power Cables

1.2.3.1. The PVC (70°C) insulated power cables shall be of FR type, C1 category, conforming to IS: 1554 (Part – I) / IEC: 60502 (Part-I) and its amendments read alongwith this specification and shall be suitable for a steady conductor temperature of 70°C. The conductor shall be stranded aluminium. The Insulation shall be extruded PVC to type-A of IS: 5831 / IEC: 60502. A distinct inner sheath shall be provided in all multicore cables. For multicore armoured cables, the inner sheath shall be of extruded PVC. The outer sheath shall be extruded PVC to Type ST-1 of IS: 5831 / IEC: 60502 for all cables.

1.2.4. PVC Control Cables

1.2.4.1. The PVC ***(70°C) insulated*** control cables shall be of FR type C1 category conforming to IS: 1554 (Part – I) / IEC: 60502 (Part-1) and its amendments, read alongwith this specification. The conductor shall be stranded copper. The insulation shall be extruded PVC to type A of IS: 5831 / IEC: 60502. A distinct inner sheath shall be provided in all cables whether armoured or not. The over sheath shall be extruded PVC to type ST-1 of IEC: 60502 and shall be grey in colour.

1.2.4.2. Cores shall be identified as per IS: 1554 (Part – I) / IEC: 60502 (Part-1) for the cables up to five (5) cores and for cables with more than five (5) cores the identification of cores shall be done by printing legible Hindu Arabic Numerals on all cores as per IS: 1554 (Part – I) / IEC: 60502 (Part-1).

2. HV POWER CABLES[FOR WORKING VOLTAGES FROM 3.3 kV AND INCLUDING 33 kV]

2.1.1. *HV* POWER CABLE FOR AUXILIARY POWER SUPPLY

The HV cable of 1Cx185 mm^2 (Aluminium Conductor) or 1Cx120mm^2 (Copper Conductor) of voltage class as specified for 315 kVA LT transformer for interconnecting 315kVA LT transformer to the PDD/SEB feeder shall be, XLPE insulated, armoured cable conforming to IS: 7098 (Part-II) / IEC: 60502 (Part-2). Terminating accessories shall conform to IS: 17573 / IEC 61442-1997/IEC60502-4 1998.

2.1.2. Bidder may offer sizes other than the sizes specified in clause 2.1. In such case sizing of power cables shall be done keeping in view continuous current, voltage drop & short-circuit consideration of the system. Relevant calculations shall be submitted by bidder during detailed engineering for purchaser's approval.

2.2. **Constructional Requirements**

Cable shall have compacted circular Aluminium conductor, Conductor screened with extruded semi conducting compound, XLPE insulated, insulation screened with extruded semi conducting compound, armoured with non-magnetic material, followed by extruded PVC outer sheath (Type ST-2), with FR properties.

2.4 Progressive sequential marking of the length of cable in metres at every one metre shall be provided on the outer sheath of the cable.

2.5 The cables shall have outer sheath of a material with an Oxygen Index of not less than 29 and a Temperature index of not less than 250°C.

2.6 Allowable tolerance on the overall diameter of the cables shall be plus or minus 2 mm.

3 CABLE DRUMS

3.1 Cables shall be supplied in returnable wooden or steel drums of heavy construction. Wooden drum shall be properly seasoned sound and free from defects. Wood preservative shall be applied to the entire drum.

3.2 Standard lengths for each size of power and control cables shall be 500/1000 meters. The cable length per drum shall be subject to a tolerance of plus or minus 5% of the standard drum length. The owner shall have the option of rejecting cable drums with shorter lengths. Maximum, One (1) number non standard lengths of cable size(s) may be supplied in drums for completion of project.

3.3 A layer of water proof paper shall be applied to the surface of the drums and over the outer most cable layer.

3.4 A clear space of at least 40 mm shall be left between the cables and the lagging.

3.5 Each drums shall carry the manufacturer's name, the purchaser's name, address and contract number and type, size and length of the cable, net and gross weight stencilled on both sides of drum. A tag containing the same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

3.6 Packing shall be sturdy and adequate to protect the cables, from any injury due to mishandling or other conditions encountered during transportation, handling and storage. Both cable ends shall be sealed with PVC/Rubber caps so as to eliminate ingress of water during transportation and erection.

4 TYPE TESTS

4.1 All cables shall conform to all type, routine and acceptance tests listed in the relevant IS / IEC.

4.2 XLPE INSULATED POWER CABLES (For working voltages up to and including 1100V):-

4.2.1 Following type tests (on one size in a contract) as per IS: 7098 (Part I) / IEC: 60502 (Part 1) including its amendments shall be carried out as a part of acceptance tests on XLPE insulated power cables for working voltages up to and including 1100 V:

a) Physical tests for insulation
   i) Hot set test
   ii) Shrinkage test
b) Physical tests for outer sheath
   i) Shrinkage test
   ii) Hot deformation
   iii) Heat shock test
   iv) Thermal stability

4.2.2 Contractor shall submit type test reports as per clause no. 9.2 of Technical Specification, Chapter 2: GTR for the following tests-

a) Water absorption (gravimetric) test.
b) Ageing in air oven
c) Loss of mass in air oven
d) Short time current test on power cables of sizes 240 sqmm and above on
   i) Conductors.
   ii) Armours.
e) Test for armouring wires/strips.
f) Oxygen and Temperature Index test.
g) Flammability test.

4.3 PVC INSULATED POWER & CONTROL CABLES (For working voltages up to and including 1100V)-

4.3.1 Following type tests (on one size in a contract) as per IS: 1554 (Part I) / IEC: 60502 (Part 1) including its amendments shall be carried out as a part of acceptance tests on PVC insulated power & control cables for working voltages up to and including 1100 V:

a) Physical tests for insulation and outer sheath
   i) Shrinkage test
   ii) Hot deformation
   iii) Heat shock test
   iv) Thermal stability
b) High voltage test.

4.3.2 Contractor shall submit type test reports as per clause no. 9.2 of Technical Specification, Chapter 2: GTR for the following-

a) High voltage test.
b) Ageing in air oven.
c) Loss of mass in air oven.
d) Short time current test on power cables of sizes 240 sqmm and above on

i) Conductors.
ii) Armours.

e) Test for armouring wires/strips.
f) Oxygen and Temperature Index test.
g) Flammability test.

4.4 XLPE INSULATED HV POWER CABLES(For working voltages from 3.3 kV and including 33 kV)-

4.5

4.4.1 Contractor shall submit type test reports as per clause no. 9.2 of Technical Specification, Chapter 2: GTR for XLPE insulated HV power cables IS: 7098 (Part II) / (as per IEC: 60502 Part-2).

4.5 Terminating/jointing accessories as per IEC 60840:1999/ IEC62067

TECHNICAL SPECIFICATION
VOL-II, SEC-XIII

AIR CONDITIONING

TABLE OF CONTENTS

Clause No.	Description
1	General
2	Air Conditioning System for Control Room Building
3	Air conditioning system for switchyard panel rooms

SECTION – XIII
AIR CONDITIONING SYSTEM

1 GENERAL

1.1 This specification covers supply, installation, testing and commissioning and handing over to PDD, J&K of Air conditioning system for the control room building and relay panel rooms.

1.2 Air conditioning units for control room building shall be set to maintain the inside DBT at 24 ◦ C ± 2°C and the air conditioning system for relay panel rooms shall be set to maintain DBT inside relay panel rooms below 24°C.

1.3 Controllers shall be provided in Control room and Battery room for controlling and monitoring the AC units in these rooms as detailed in clause no.2.3.4.

1.4 Each relay panel room shall be provided with temperature transducer to monitor the temperature of the panel room. The Temperature transducer shall have the following specification:

Sensor	:	Air temperature sensor (indoor use)
Output	:	4 to 20mA
Temperature range	:	-5°C to 60°C
Resolution	:	0.1°C
Accuracy	:	0.5°C or better.

2 AIR CONDITIONING SYSTEM FOR CONTROL ROOM BUILDING.

2.1 Air conditioning requirement of control room building shall be met using a combination of following types Air Conditioning units as required.

a) Ductable Split unit of 8.5TR.
b) Cassette type split AC units of 3TR.
c) High wall type split AC units of 2TR.

2.2 **Scope**

The scope of the equipment to be furnished and services to be provided under the contract are outlined hereinafter and the same is to be read in conjunction with the provision contained in other sections/ clauses. The scope of the work under the contract shall be deemed to include all such items, which although are not specifically mentioned in the bid documents and/or in Bidder's proposal, but are required to make the equipment/system complete for its safe, efficient, reliable and trouble free operation.

2.2.1 Required number of Ductable split type AC units of 8.5 TR capacity with air cooled outdoor condensing unit with semi hermetic/hermetic compressors

including refrigerant pipes, controls, thermostats, filters, outlet dampers, etc.

2.2.2 Required number of Cassette type split AC units of 3TR capacity each complete with air cooled outdoor condensing unit having hermetically sealed compressor unit with cordless remote controller.

2.2.3 Required number of High wall type split AC units of 2TR capacity each complete with air cooled outdoor condensing unit having hermetically sealed compressor and high wall type indoor evaporator unit with cordless remote controller.

2.2.4 Copper refrigerant piping complete with insulation between the indoor and outdoor units as required.

2.2.5 First charge of refrigerant and oil shall be supplied with the unit.

2.2.6 GSS/Aluminium sheet air distribution ducting for distributing conditioned dehumidified air along with supply air diffusers and return air grilles with volume control dampers and necessary splitters etc., suitable fixtures for grilles/diffusers and supports for ducting complete with insulation.

2.2.7 Local start/stop facility for local starting/ stopping of all electrical equipment/ drives.

2.2.8 All instruments and local control panels alongwith controls and interlock arrangements and accessories as required for safe and trouble free operation of the units.

2.2.9 PVC drain piping from the indoor units upto the nearest drain point.

2.2.10 Supply and erection of Power and control cable and earthing.

2.2.11 MS Brackets for outdoor condensing units, condensers as required.

2.3 **Technical specifications.**

2.3.1 **Ductable split type AC units.**

2.3.1.1 Each Split Air conditioner shall have an indoor unit and an outdoor unit, designed to provide free delivery of conditioned air to the conditioned space. The indoor unit shall be suitable for mounting on the ceiling concealed above the false ceiling. Outdoor unit can be placed on the roof. Each unit shall include a primary source of refrigeration for cooling and dehumidification, means for circulation and cleaning air.

2.3.1.2 Cabinet

The cabinets housing the components of indoor units & outdoor units shall be of heavy gauge sheet steel and suitable for floor mounting/mounting from

ceiling. The access panels shall be of easily removable type. The entire casing shall be lined with 25mm thick insulation of totally flame proof type. Suitable drain connection shall be provided for removal of condensate collected inside a tray under cooling coil.

2.3.1.3 Compressor

The compressor shall be Semi hermetically/hermetically sealed type and complete with drive motor. The compressor shall be mounted on spring inside the lower most section of the unit so that it is easily accessible for servicing.

2.3.1.4 Condenser

Air cooled condenser of adequate surface area shall be offered. The air cooled condenser shall be made of copper tubes with external fins.

2.3.1.5 Air Handling Fan

The air handling fan shall be centrifugal type complete with belt drive and electric motor.

2.3.1.6 Filter

Pre-filter at the suctions to remove dust particles down to 10 micron size with 90% efficiency and fine filters to remove dust particles down to 5 micron size with 99% efficiency at the outlet. All filters shall be of panel type.

2.3.1.7 Cooling Coil

Cooling coils shall be of direct expansion type and made of heavy gauge copper with aluminium fins. Rows shall be staggered in the direction of air flow. Separate tubings from the distributor shall feed refrigerant uniformly to different sections of the coil.

2.3.1.8 Refrigerant Piping

Refrigerant piping shall be of heavy gauge copper, heavy class seamless M.S. pipe complete with thermostatic expansion valve, liquid strainer, dehydrator, liquid line shut off valve, high and low pressure gauges.

2.3.1.9 Condensate Trays

An adequate method of condensate removal shall be provided. Condensate tray of adequate size, made of corrosion-resistant material or suitably treated with corrosion-resistant coating shall be provided. The tray shall be adequately insulated to avoid condensation over its external surface.

2.3.1.10 Refrigerant Strainer

A refrigerant strainer shall be provided in the liquid line immediately before the expansion device.

2.3.1.11 Vibration Isolator

A minimum of six 25 thick neoprene rubber pads shall be supplied for each unit.

2.3.1.12 Cooling capacity of 8.5TR unit shall not be less than 102000 btu/hr.

2.3.2 **Cassette type split AC units**.

The Cassette type AC units shall be complete with indoor evaporator unit, outdoor condensing units and cordless remote control units.

2.3.2.1 Outdoor unit shall comprise of hermetically/ semi hermetically sealed compressors mounted on vibration isolators, fans and copper tube aluminium finned coils all assembled in a sheet metal casing. The casing and the total unit shall be properly treated and shall be weatherproof type. They shall be compact in size and shall have horizontal discharge of air.

2.3.2.2 Indoor units shall be of 4-way, ceiling mounted cassette type. The indoor unit shall be compact and shall have elegant appearance. They shall have low noise centrifugal blowers driven by suitable motors and copper tube aluminium finned cooling coils. Removable and washable polypropylene filters shall be provided. They shall be complete with multi function cordless remote control unit with special features like programmable timer, sleep mode etc.

2.3.2.3 Cooling capacity of 3TR AC units shall not be less than 36000btu/hr. and their EER shall not be less than 2.7.

2.3.3 **High wall type split AC units**

2.3.3.1 The split AC units shall be complete with indoor evaporator unit, outdoor condensing units and cordless remote control units.

2.3.3.2 Outdoor unit shall comprise of hermetically/semi hermetically sealed compressors mounted on vibration isolators, propeller type axial flow fans and copper tube aluminium finned coils all assembled in a sheet metal casing. The casing and the total unit shall be properly treated and shall be weatherproof type. They shall be compact in size and shall have horizontal discharge of air.

2.3.3.3 The indoor units shall be high wall type. The indoor unit shall be compact and shall have elegant appearance. They shall have low noise centrifugal blowers driven by suitable motors and copper tube aluminium finned cooling coils. Removable and washable polypropylene filters shall be provided. They shall be complete with multi function cordless remote control unit with special features like programmable timer, sleep mode and soft dry mode etc.

2.3.3.4 Cooling capacity of 2TR AC units shall not be less than 22000btu/hr. and shall have energy efficiency rating of 3star or above.

2.3.4 Controllers shall be provided in Control room and Battery room, one controller for each room, to control and monitoring of AC units and shall have the following facilities;

- Standby units shall come in to operation automatically when the running main unit fails
- Main and standby units shall be changed over periodically which shall be finalised during detailed engineering.
- Following alarms shall be provided:

  a. Compressor On/OFF condition of each unit
  b. Compressor failure of each unit
  c. Power OFF to AC unit
  d. High temperature in room.

2.4 **Warranty**

All compressors shall have minimum 5 years Warranty from the date of commissioning.

TECHNICAL SPECIFICATION

VOL-II, SEC-XIV

DG SET

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SECTION - XIV
DIESEL GENERATOR SET

1.1. SCOPE OF SUPPLY

1.1.1. The scope covers supply of Diesel Generator set of stationary type having a net electrical output of 250kVA/**100kVA**(as applicable) capacity at specified site conditions of 50° C ambient temperature and 100% relative humidity on FOR site basis. DG set shall be equipped with:

(i) Diesel engine complete with all accessories.
(ii) An alternator directly coupled to the engine through coupling, complete with all accessories.
(iii) Automatic voltage regulator.
(iv) Complete starting arrangement, including two nos. batteries & chargers.
(v) Base frame, foundation bolts etc.
(vi) Day tank of 990 Litre Capacity.
(vii) Engine Cooling and lubrication system.
(viii) Engine air filtering system.
(ix) Exhaust silencer package.
(x) Set of GI pipes, valves, strainers, unloading hose pipes as required for fuel transfer system from storage area to fuel tank including electrically driven fuel pump.
(xi) All lubricants, consumable, touch up paints etc. for first filing, testing & commissioning at site. The fuel oil for first commissioning will also be provided by the contractor.
(xii) AMF panel for control, metering and alarm.
(xiii) Enclosure for silent type D.G. Set

1.2. SCOPE OF SERVICE

1.2.1. The Contractor shall provide following services:

a) Design, manufacture, shop testing including assembly test.
b) Despatch, transportation to site.
c) Erection, testing & commissioning with all equipments / materials required for the purpose.
d) Drawings, data, design calculations and printed erection, operation & maintenance manual.
e) Certification and compliance for meeting noise level & emission parameters and other requirements in accordance with latest Notification of MOEF.

1.3. TECHNICAL REQUIREMENTS

1.3.1. The rating of DG sets are as follows :

DG set net output after considering deration for engine and alternator separately due to temperature rise in side the enclosure and on account of power reduction due to auxiliaries shall be 250kVA/**100kVA** (as applicable), 1500RPM, 0.8Pf, 400V, 3 phase, 50Hz. The above ratings are the minimum requirements.

1.3.1.1. DG sets shall also be rated for 110% of full load for 1 hour in every twelve hrs. of continuous running.

1.3.2. The output voltage, frequency and limits of variation from open circuit to full load shall be as follows :

a) Voltage variation — ±10% of the set value provision shall exist to adjust the set value between 90% to 110% of nominal Generator voltage of 400V.

b) Frequency — 50Hz ±2.5%

1.3.3. The Diesel Generator and other auxiliary motor shall be of H class with temperature rise limited to Class-F for temperature rise consideration.

1.3.4. NOISE LEVEL & EMISSION PARAMETERS : These shall be as per latest Notification of MOEF

1.4. **PLANT DESIGN**

1.4.1. **DIESEL ENGINE**

1.4.1.1. The engine shall comply with the IS: 10002/BS 5514/ISO 3046; latest edition

1.4.1.2. Diesel engine shall be turbo charged multi-cylinder V-type in line type with mechanical fuel injection system.

1.4.1.3. The engine with all accessories shall be enclosed in an enclosure to make it work silently (within permissible noise level) without any degradation in its performance.

1.4.1.4. The Diesel Engines shall be directly water cooled. Cooling of water through radiator and fan as envisaged.

1.4.1.5. The fuel used shall be High Speed Diesel oil (HSD) or Light Diesel Oil (LDO).

1.4.2. **AIR SUCTION & FILTRATION**

1.4.2.1. Suction of air shall be from indoor for ventilation and exhaust flue gasses will be let out to outside atmosphere, Condensate traps shall be provided on the exhaust pipe.

1.4.2.2. Filter shall be dry type air filter with replaceable elements.

1.4.3. **FUEL AND LUBRICATING OIL SYSTEM**

1.4.3.1. The engine shall have closed loop lubricating system. No moving parts shall require lubrication by hand prior to the start of engine or while it is in operation.

1.4.4. **ENGINE STARTING SYSTEM**

1.4.4.1. Automatic electric starting by DC starter motor shall be provided.

1.4.5. **FUEL INJECTION AND REGULATOR**

1.4.5.1. The engine shall be fitted with electronic governor.

1.4.5.2. The engine shall be fitted with a heavy, dynamically balanced fly wheel suitable for constant speed governor duty.

1.4.6. **ALTERNATOR**

1.4.6.1. The alternator shall comply with IS: 4722/IEC 60034; latest edition.

1.4.6.2. The alternator shall be of continuously rated duty, suitable for 400 V, 3 Phase, 50 Hz. Power development having brush-less, synchronous, self-excited, self-regulating system.

1.4.6.3. The alternator shall be drip-proof, screen protected as per IP-23 degree of Protection.

1.4.6.4. The rotor shall be dynamically balanced to minimize vibration.

1.4.6.5. The alternator shall be fitted with shaft mounted centrifugal fan.

1.4.6.6. It shall have the winding of class H but limited to Class-F for temperature rise consideration.

1.4.6.7. The Alternator regulator shall be directly coupled to the engine and shall be complete with the excitation system, automatic voltage regulation of +/- 1%, voltage adjusting potentiometer and under/over speed protection.

1.4.7. **TERMINAL BOX**

1.4.7.1.1. Six (6) output terminals shall be provided in alternator terminal box. Terminals shall be Suitable for 1 No. of single core, 630 mm^2 XLPE cables per phase for 250kVA DG set and 3½Core 300 mm^2 XLPE cable for 100kVA DG set. The neutral shall be formed in AMF panel. The generator terminal box shall be suitable to house necessary cables and should be made of non-magnetic material.

1.4.7.2. The alternator with all accessories shall be enclosed in a enclosure to make it work Silently (within permissible noise level)

1.4.8. **COUPLING**

1.4.8.1. The engine and alternator shall be directly coupled by means of self-aligning flexible flange coupling to avoid misalignment.

1.4.8.2. The coupling shall be provided with a protecting guard to avoid accidental contract.

1.4.9. **MOUNTING ARRANGEMENT**

1.4.9.1. The engine and alternator shall be mounted on a common heavy duty, rigid fabricated steel base frame constructed from ISMC of suitable sections.

1.4.9.2. Adequate number of anti-vibration mounting pads shall be fixed on the common base frame on which the engine and the alternator shall be mounted to isolate the vibration from passing on to the common base frame or the foundation of the D.G. Set.

1.4.10. **PERIPHERALS**

1.4.10.1. **FUEL TANK**

1.4.10.1.1. The Fuel tank of 990 Litre capacity shall be provided on a suitably fabricated steel platform. The tank shall be complete with level indicator marked in litres, filling inlet with removable screen, an outlet, a drain plug, an air vent, an air breather and necessary piping. The tank shall be painted with oil resistant paint and shall be erected in accordance with **Indian Explosive act.** Fuel tank shall be kept outside of enclosure. The fuel piping shall be carried out to connect the D.G set kept inside.

1.4.10.1.2. For transferring fuel to Fuel tank transfer pump is envisaged. The capacity of transfer pump shall be adequate to fill the day tank in about 30 minutes. Fuel pump shall be electrically driven.

1.4.10.2. **BATTERY and BATTERY CHARGER**

1.4.10.2.1. Two nos. 24V batteries complete with all leads, terminals and stand shall be provided. Each battery shall have sufficient capacity to give 10 nos. successive starting impulse to the diesel engine.

1.4.10.2.2. The battery charger shall be complete with transformer, suitable rating (400 V, 3 Ph., 50 Hz./230V, 1Ph., 50 Hz) rectifier circuit, charge rate selector switch for "trickle"/'boost' charge, D.C. ammeter & voltmeter, annunciation panel for battery charge indication / loading / failures.

1.4.10.2.3. The charger shall float and Boost Charge the battery as per recommendation of manufacturer of battery. The charger shall be able to charge a fully discharged battery to a state of full charge in 8 Hrs. with 25% spare capacity.

1.4.10.2.4. Manual control for coarse and fine voltage variation shall be provided. Float charger shall have built-in load limiting features.

1.4.10.2.5. Ripple shall not be more than 1% (r.m.s) to get smooth DC voltage shall be provided.

1.4.10.2.6. Charger shall be provided with Out-put Voltmeter & Ammeter.

1.4.10.2.7. Changeover scheme for selecting battery and battery charger by changeover switch should be provided.

1.5. **CONTROL AND INSTRUMENTATION**

1.5.1. Each D.G. Set shall be provided with suitable instruments, interlock and protection arrangement, suitable annunciation and indications etc. for proper start up, control, monitoring and safe operation of the unit. One local AMF control panel alongwith each D.G. set shall be provided by the Supplier to accommodate these instruments, protective relays, indication lamps etc. The AMF Panel shall have IP-52 degree of Protection as per IS: 12063/IEC: 60529.

1.5.2. The D.G. sets shall be provided with automatic start facility to make it possible to take full load within 30 seconds of Power Supply failure.

1.5.3. Testing facility for automatic operation of D.G. Set shall be provided in AMF panel.

1.5.4. A three attempt starting facility using two impulse timers and summation timer for engine shall be proved and if the voltage fails to develop within 40 sec. from receiving the first impulse, the set shall block and alarm to this effect shall be provided in the AMF panel.

1.5.5. Following instruments shall be provided with Diesel Engine

a) Lub. oil pressure gauge
b) Water temperature thermometers
c) Engine tachometer/HR
d) Any other instruments necessary for DG Set operation shall be provided.

1.5.6. DG set shall be capable of being started/ stopped manually from remote as well as local. (Remote START/STOP push button shall be provided in 400V ACDB). However, interlock shall be provided to prevent shutting down operation as long as D.G. Circuit breaker is closed.

1.5.7. The diesel generator shall commence a shutdown sequence whenever any of the following conditions appear in the system :

a) Overspeed
b) Overload
~~c)~~ High temperature of engine and cooling water~~.~~
d) High temperature inside enclosure
e) Low lube oil pressure
f) Generator differential protection
g) Short circuit protection
h) Under voltage
i) Over voltage
j) Further interlocking of breaker shall be provided to prevent parallel operation of DG set with normal station supply.

1.5.8. Following indication lamps for purposes mentioned as under shall be provided in AMF panel :

1.5.8.1. Pilot indicating lamp for the following :

a) Mains ON
b) Alternator ON
c) Charger ON/OFF
d) Breaker ON/OFF
e) Main LT Supply ON/OFF

1.5.8.2. Visual annunciation shall be provided for set shut down due to :

a) engine overheating
b) low oil pressure
c) lack of fuel
d) Set failed to start in 30 secs after receiving the first start impulse
e) high cooling water temperature
f) Low level in daily service fuel tank
g) Overspeed trip
h) Audio & visual Annunciation for alternator fault.

1.5.9. Thermostatically controlled space heaters and cubicle illumination operated by Door Switch shall be provided in AMF panel. Necessary isolating switches and fuses shall also be provided.

1.5.10. AMF panel shall have facility for adjustment of speed and voltage including fine adjustments in remote as well as in local mode.

Following shall also be provided in AMF panel:

a) Frequency meter

b) 3 Nos. single phase CT's for metering

c) 3 Nos. (Provided by LT swgr. manufacturer) single phase CT's with KPV 300V & RCT 0.25 ohm for differential protection of DG Set on neutral side only for

d) 250kVA/100kVA.

e) .One (1)DC Ammeter (0-40A)

f) One (1)DC Voltmeter (0-30V)

g) One (1)Voltmeter Selector switch

h) One (1)AC Ammeter

i) One (1)AC Voltmeter

j) Three (3)Timers (24V DC)

k) Two (2)Auto/Manual Selector Switch

l) Two (2)Auto/test/Manual Selector Switch

m) Eleven (11) Aux. Contactors suitable for 24V DC

n) One (1)Motorised potentiometer for voltage adjustment

o) Two (2) Set Battery charger as specified in Technical Specification

p) One (1)Set Phase & Neutral busbars.

q) Any other item required for completion of Control scheme shall be deemed to be included.

1.6. **D.G. SET ENCLOSURE**

1.6.1. **General requirements**

1.6.1.1. Diesel engine, alternator, AMF panel, Batteries and Chargers shall be installed outdoor in a suitable weather-proof enclosure which shall be provided for protection from rain, sun, dust etc. Further, in addition to the weather proofing, acoustic enclosures shall also be provided such that the noise level of acoustic enclosure DG set shall meet the requirement of MOEF The diesel generator sets should also conform to Nepal Environment (Protection) Rules. An exhaust fan with louvers shall be installed in the enclosure for temperature control inside the enclosure. The enclosure shall allow sufficient ventilation to the enclosed D.G. Set so that

the body temperature is limit to 50°C. The air flow of the exhaust fan shall be from inside to the outside the shelter. The exhaust fan shall be powered from the DG set supply output so that it starts with the starting of the DG set and stops with the stopping of the DG set. The enclosure shall have suitable viewing glass to view the local parameters on the engine.

1.6.1.2. Fresh air intake for the Engine shall be available abundantly; without making the Engine to gasp for air intake. A chicken mess shall be provided for air inlet at suitable location in enclosure which shall be finalised during detailed engineering.

1.6.1.3. The Enclosure shall be designed and the layout of the equipment inside it shall be such that there is easy access to all the serviceable parts.

1.6.1.4. Engine and Alternator used inside the Enclosure shall carry their manufacturer's Warranty for their respective Models and this shall not degrade their performance.

1.6.1.5. Exhaust from the Engine shall be let off through Silencer arrangement to keep the noise level within desired limits. Interconnection between silencer and engine should be through stainless steel flexible hose/ pipe.

1.6.2. All the Controls for Operation of the D.G. Set shall be easily assessable. There should be provision for emergency shut down from outside the enclosure.

1.6.3. Arrangement shall be made for housing the Battery set in a tray inside the Enclosure.

1.6.4. **CONSTRUCTION FEATURES:**

1.6.4.1. The enclosure shall be fabricated from at least 14 Gauge CRCA sheet steel and of Modular construction for easy assembling and dismantling. The sheet metal components shall be pre-treated by Seven Tank Process and Powder coated (PURO Polyester based) both-inside and outside – for long life. The hard-ware and accessories shall be high tensile grade. Enclosure shall be given a lasting anti-rust treatment and finished with pleasant environment friendly paint. All the hardware and fixtures shall be rust proof and able to withstand the weather conditions.

1.6.4.2. Doors shall be large sized for easy access and provided with long lasting gasket to make the enclosure sound proof. All the door handles shall be lockable type.

1.6.4.3. The Enclosure shall be provided with anti-vibration pads (suitable for the loads and vibration they are required to carry) with minimum vibration transmitted to the surface the set is resting on.

1.6.4.4. High quality rock wool of required density and thickness shall be used with fire retardant thermo – setting resin to make the Enclosure sound proof.

1.6.5. Provision for Neutral/Body Earthing

1.6.5.1. Points shall be available at two side of the enclosure with the help of flexible copper wires from alternator neutral, and electrical panel body respectively. The earthing point shall be isolated through insulator mounted on enclosure.

1.7. **INSTALLATION ARRANGEMENT**

1.7.1. DG set enclosed in enclosure shall be installed on Concrete Pedestal 300mm above FGL.

1.8. **DOCUMENTS**

1.8.1. Following drawings and data sheet shall be submitted for approval:
(i) Data sheet for Engine, Alternator, Battery, AMF panel and Enclosure
(ii) GA drawing of DG set
(iii) Layout of DG set in the enclosure along with sections
(iv) GA and schematic of AMF panel
(v) Arrangement of inclined roof and pedestal.

1.8.2. The D G Set shall be supplied with
(i) D G Set test certificate
(ii) Engine Operation & maintenance Manual.
(iii) Engine Parts Catalogue.
(iv) Alternator Operation, maintenance & Spare parts Manual.
(v) Alternator test certificate.

1.9. **TESTS**

a) The Diesel generator sets shall be tested for routine and acceptance tests as per the relevant IEC standards.

1.10. **COMMISSIONING CHECKS**

In addition to the checks and test recommended by the manufacturer, the Contractor shall carryout the following commissioning tests to be carried out at site.

1. Load Test

The engine shall be given test run for a period of atleast 6 hours. The set shall be subjected to the maximum achievable load as decided by Purchaser without exceeding the specified DG Set rating:

During the load test, half hourly records of the following shall be taken:

a) Ambient temperature.
b) Exhaust temperature if exhaust thermometer is fitted.
c) Cooling water temperature at a convenient point adjacent to the water output from the engine jacket.
d) Lubricating oil temperature where oil cooler fitted.
e) Lubricating oil pressure.
f) Colour of exhaust gas
g) Speed
h) Voltage, wattage and current output.
i) Oil tank level

The necessary load to carry out the test shall be provided by the purchaser.

2. Insulation Resistance Test for Alternator

Insulation resistance in mega-ohms between the coils and the frame of the alternator when tested with a 500V megger shall not be less than IR=2 x (rated voltage in KV)+1

3. Check of Fuel Consumption

   A check of the fuel consumption shall be made during the load run test. This test shall be conducted for the purpose of proper tuning of the engine.

4. Insulation Resistance of Wiring

   Insulation resistance of control panel wiring shall be checked by 500V Megger. The IR shall not be less than one mega ohm.

5. Functional Tests

   a) Functional tests on control panel.
   b) Functional test on starting provision on the engine.
   c) Functional tests on all Field devices.
   d) Functional tests on AVR and speed governor.

6. Measurement of Vibration

   The vibration shall be measured at load as close to maximum achievable load and shall not exceed 250microns.

7. Noise Level shall be less than 75dBA at a distance of one meter.

8. The tests shall be carried out with the DG set operating at rated speed and at maximum achievable load. Necessary correction for Test environment condition & background noise will be applied as per applicable IEC/International Standards.

TECHNICAL SPECIFICATION

VOL-II, SEC-XV

SWITCHYARD ERECTION

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ANNEXURE-B	STANDARD TECHNICAL DATASHEET FOR AAC/ACSR CONDUCTORS, GS EARTHWIRE AND ALUMINIUM TUBE
ANNEXURE-C	CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

SECTION – XV
SWITCHYARD ERECTION

1.0 **GENERAL**

The detailed scope of work includes design, engineering, manufacture, testing at works, supply on FOR destination site basis, insurance, handling, storage, erection testing and commissioning of various items and works as detailed herein.

This Section covers the description of the following items.

A. Supply of

- String insulators and hardware
- AAC / ACSR conductor
- Galvanised Steel Earthwire
- Aluminium Tubular Bus Bars
- Spacers
- Bus post insulators
- Earthing & Earthing materials
- Lightning protection materials
- Cabling material
- Other items

B. Erection Of all items

1.1 **String Insulators & Hardware**

The insulators for suspension and tension strings shall conform to IEC-60383 and long rod insulators shall conform to IEC-60433. Insulator hardware shall conform to IS: 2486 or equivalent international standard. Composite long rod insulator shall conform to IEC: 61109.

1.1.1 **Construction Features**

1.1.1.1 **For porcelain insulators**

a) Suspension and tension insulators shall be wet process porcelain with ball and socket connection. Insulators shall be interchangeable and shall be suitable for forming either suspension or tension strings. Each insulator shall have rated strength markings on porcelain printed and applied before firing.

b) Porcelain used in insulator manufacture shall be homogeneous, free from

laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.

c) Glazing of the porcelain shall be uniform brown colour, free from blisters, burrs and other similar defects.

1.1.1.2 **For glass insulators**

It shall be made of toughened glass. Glass used for the shells shall be sound, free from defects, flows bubbles, inclusions, etc. and be of uniform toughness over its entire surface. All exposed glass surfaces shall be smooth.

1.1.1.3 When operating at normal rated voltage there shall be no electric discharge between conductor and insulator which would cause corrosion or injury to conductors or insulators by the formation of substances due to chemical action. No radio interference shall be caused when operating at normal rated voltage.

1.1.1.4 The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. All ferrous parts shall be hot dip galvanized. The zinc used for galvanizing shall be of grade Zn-99.95. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfections such as flux, ash, rust stains bulky white deposits and blisters.

1.1.1.5 Bidder shall make available data on all the essential features of design including the method of assembly of discs and metal parts, number of discs per insulator string insulators, the manner in which mechanical stresses are transmitted through discs to adjacent parts, provision for meeting expansion stresses, results of corona and thermal shock tests, recommended working strength and any special design or arrangement employed to increase life under service conditions.

1.1.1.6 Clamps for insulator strings and Corona Control rings shall be of aluminum alloy as stipulated for clamps and connectors.

1.1.1.7 Insulator hardware shall be of forged steel. Malleable cast iron shall not be accepted except for insulator disc cap. The surface of hardware must be clean, smooth, without cuts, abrasion or projections. No part shall be subjected to excessive localized pressure. The metal parts shall not produce any noise generating corona under operating conditions.

1.1.1.8 The tension Insulator hardware assembly shall be designed for minimum 12000 kg tensile load. Earth wire tension clamp shall be designed for minimum 1000 kg tensile load with a factor of safety of two (2).

1.1.1.9 The tension string assemblies shall be supplied alongwith suitable turn buckle. Sag compensation springs if required may also be provided.

1.1.1.10 All hardware shall be bolted type.

1.2 Long Rod Porcelain Insulators

1.2.1 As an alternative to disc insulator, Bidder can offer long rod porcelain insulators

strings, with suitable hardware. The combination should be suitable for application specified and should offer the identical/equivalent parameters as would be available from insulator string comprising disc insulators and hardware combination.

1.2.2 All constructional features specified at Clause 1.1.1 of this Section shall also apply to the long rod insulator string.

1.3 **Tests**

In accordance with the stipulations of the specification, the suspension and tension strings, insulator and hardware shall be subjected to the following type tests, acceptance tests and routine tests:

1.3.1 **Type Tests on Insulator Strings:** The test reports for following type tests shall be submitted for approval as per clause 9.0 of Section 2 - GTR.

a) Power frequency voltage withstand test with corona control rings under wet condition as per IEC- 60383.

b) Lightning Impulse voltage withstand test with corona control rings under dry condition as per IEC-60383

c) Voltage distribution test (Dry)

The voltage across each insulator unit shall be measured by sphere gap method. The result obtained shall be converted into percentage. The voltage across any disc shall not exceed ~~13% for 220KV suspension and tension insulator strings~~, 20% and 22% for 132KV suspension and tension insulator strings respectively.

e) Corona Extinction Voltage test (Dry) :- (As per Annexure – C)

~~The sample assembly when subjected to power frequency voltage shall have a corona extinction voltage of not less than 156kV (rms) for 220kV line to earth under dry condition. There shall be no evidence of Corona on any part of the sample. The atmospheric condition during testing shall be recorded and the test results shall be accordingly corrected with suitable correction factor as stipulated in IEC 60383~~.

f) RIV Test (Dry)

~~Under the conditions as specified under (e) above the insulator string alongwith complete hardware fittings shall have a radio interference voltage level below 1000 microvolts at 1 MHz when subjected to 50 Hz AC line to earth voltage of 156kV for 220kV string under dry conditions. The test procedure shall be in accordance with IEC 60437~~.

g) Mechanical strength test

The complete insulator string alongwith its hardware fitting excluding arcing horn, corona control ring, grading ring, tension/suspension clamps

shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. The load shall be held for five minutes and then removed. After removal of the load, the string components shall not show any visual deformation and it shall be possible to dismantle them by hand. Hand tools may be used to remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

1.3.2 **Type Tests on Insulators**

Type test report for Thermal Mechanical Performance tests as per IEC - 60575, Clause 3 / IEC: 61109, clause 5.1 (for composite long rod insulators) shall be submitted for approval as per clause 9.2 of Section 2 - GTR.

1.3.3 **Acceptance Tests for Insulators:**

a) Visual examination as per IEC-60383/ IEC-61109 clause no. 7.2 (for composite long rod insulators).

b) Verification of Dimensions as per IEC- 60383.

c) Temperature cycle test as per IEC- 60383.

d) Puncture Test as per IEC-60383 (Applicable only for porcelain insulators).

e) Galvanizing Test as per IEC- 60383.

f) Mechanical performance test as per IEC-60575 Cl. 4 / IEC-61109 clause no. 7.2 (for composite long rod insulators).

g) Test on locking device for ball and socket coupling as per IEC-60372(2).

h) Porosity test as per IEC- 60383 (Applicable only for porcelain insulators).

i) Thermal shock test as per IEC-60383 (Applicable only for glass insulators)

1.3.4 **Acceptance Test on Hardware Fitting**

a) Visual Examination as per Cl. 5.10 of IS: 2486 (Part-I).

b) Verification of Dimensions as per Cl. 5.8 of IS: 2486 (Part-I)

c) Galvanising / Electroplating tests as per Cl. 5.9 of IS: 2486 (Part-I).

d) Slip strength test as per Cl 5.4 of IS- 2486 (part-I)

e) Shore hardness test for the Elastometer (if applicable as per the value guaranteed by the Bidder).

f) Mechanical strength test for each component (including corona control rings and arcing horns).

The load shall be so applied that the component is stressed in the same way as it would be in actual service and the procedure as given in 1.3.1 (g) above should be followed.

g) Test on locking devices for ball and socket coupling as per IEC -60372(2).

1.3.5 **Routine Test on Insulator**

a) Visual Inspection as per IEC-60383

b) Mechanical Routine Test as per IEC-60383

c) Electrical Routine Test as per IEC-60383

1.3.6 **Routine Test on hardware Fittings**

a) Visual examination as per clause 5.10 of IS: 2486 (Part-I) / IEC-61109 (for composite long rod insulators).

b) Mechanical strength Test as per clause 5.11 of IS: 2486 (Part-I) / IEC-61109 (for composite long rod insulators).

1.3.7 **Test during manufacture on all Components as applicable on insulator**

a) Chemical analysis of zinc used for galvanising:

Samples taken from the zinc ingot shall be chemically analyzed. The purity of zinc shall not be less than 99.95%.

b) Chemical Analysis, mechanical hardness tests and magnetic particle inspection for malleable casting:

The chemical analysis, hardness tests and magnetic particle inspection for malleable casting will be as per the internationally recognized procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding tests will be as discussed and mutually agreed to by the Contractor and Owner in Quality Assurance Program.

1.3.8 Test during manufacture on all components as applicable on hardware fittings:

a) Chemical analysis of zinc used for galvanising:

Samples taken from the zinc ingot shall be chemically analyzed. The purity of zinc shall not be less than 99.95%

b) Chemical analysis, hardness tests and magnetic particle for forgings:

The chemical analysis, hardness tests and magnetic particle inspection for forgings will be as per the internationally recognized procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding tests will be as discussed and mutually agreed to by the Contractor and Owner in Quality Assurance Programme.

c) Chemical analysis and mechanical hardness tests and magnetic particle inspection for fabricated hardware:

The chemical analysis, hardness tests and magnetic particle inspection for fabricated hardware will be as per the internationally recognized procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding tests will be as discussed and mutually agreed to by the Contractor and Owner in Quality Assurance programme.

1.4 Parameters

1.4.1 Disc Insulators

Sl. No.	Description	For 220/132kV
a)	Type of insulators	Anti Fog type
b)	Size of insulator units (mm)	255x145 or 280x145
c)	Electro mechanical strength	120 kN
d)	Creepage distance of individual insulator units (minimum and as required to meet total creepage distance)	430 mm
e)	Markings	
i)	For Porcelain insulators	Markings on porcelain
ii)	For toughened glass insulators	Markings shall be done on initial parts
f)	Power frequency puncture withstand voltage	1.3 times the actual wet flashover voltage

1.4.2 INSULATOR STRING

Sl. No.	Description	220kV	132kV
a)	Power frequency withstand voltage of the complete string with corona control ring (wet) – KV rms	460	275
b)	Lightning impulse withstand Voltage of string with corona control rings (dry) - kVp	± 1050	± 650
c)	Switching surge withstand voltage of string with corona	NA	NA

	control rings (wet) - kVp		
d)	Minimum corona extinction voltage level of string with Corona Control rings (dry) - kV rms	156	NA
e)	Maximum RIV level in micro volts of string with Corona Control rings at 508 kV (rms) for 765 kV, 320 kV (rms) for 400 kV string and 156 kV for 220 kV string across300 Ohms resistor at 1 MHz	1000	NA
f)	Minimum total creepage distance of the insulator string (mm)	6125	3625
g)	Total no. of discs per strings	15	10

For tension application, double insulator strings for 220 KV and single insulator strings for 132 kV system shall be used. For suspension purpose single suspension insulator string shall be used for 220 KV & 132 kV system

1.4.2.1 **INSULATOR STRING (33 KV)**

a) Power frequency withstand voltage of the complete string with Corona Control ring (wet) - kV rms : 75

b) Lightning impulse withstand Voltage of string with corona control rings (dry) – kVp : ±170

c) Power frequency puncture with-stand voltage for a string insulator : 1.3 times actual wet flashover voltage of the unit

d) Total creepage distance of the complete insulator string (mm) : 900

f) Total no. of discs per strings : 5 (S/T & S/S)

1.5 **COMPOSITE LONG ROD INSULATOR**

As an alternative to disc insulator/long rod porcelain, Bidder can also offer composite long rod insulators with suitable hardware.

1.5.1 **Details of Composite Long Rod Insulators**

1.5.1.1 Contractor shall offer such composite insulators which have proven use under foggy/ humid operational conditions in polluted industrial environment combined with smoke and dust particles. The Bidder shall furnish evidence in the form of certification from the power utilities that the similar type of product supplied to them had been performing satisfactory. The Bidder shall also submit certified test report for an accelerated ageing test of 5000 hours such as that described in Appendix-C of IEC-61109 or test at multiple stresses of 5000 hrs. as described in Annexure –B of IEC-62217.

1.5.1.2 Insulators shall have sheds of the "open aerodynamic profile without any under ribs" with good self-cleaning properties. Insulator shed profile, spacing projection etc. shall be strictly in accordance with the recommendation of IEC-60815.

1.5.2 Ball and socket shall be 20 mm designation for 120 kN ~~& 24 mm designation for 210 kN~~ Insulators in accordance with the standard dimensions stated in IEC:60120. Insulators shall be interchangeable and shall be suitable for forming either suspension or tension strings. Each insulator shall have rated strength markings on each composite insulator rod unit. no negative tolerance shall be applicable to creepage distance of composite insulators

1.5.3 All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/sq.m. and shall be in accordance with the latest edition of equivalent International standard. The zinc used for galvanizing shall be of purity of 99.95%. The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least six successive dips each lasting for one (1) minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

1.5.4 **Materials**

1.5.4.1 **Core**

It shall be a glass-fiber reinforced (FRP rod) epoxy resin rod of high strength. The rod shall be resistant to hydrolysis. Glass fibers and resin shall be optimized. The rod shall be electrical grade corrosion resistant (ECR), boron free glass and shall exhibit both high electrical integrity and high resistance to acid corrosion.

1.5.4.2 **Housing & Weathersheds**

The FRP rod shall be covered by a sheath of a silicone rubber compound of a thickness of minimum 3mm. The housing & weathersheds should have silicon content of minimum 30% by weight. It should protect the FRP rod against environmental influences, external pollution and humidity. It shall be extruded or directly molded on the core. The interface between the housing and the core must be uniform and without voids. The strength of the bond shall be greater than the tearing strength of the polymer. The manufacturer shall follow non-destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core.

The weathersheds of the insulators shall be of alternate shed profile. The weathersheds shall be vulcanized to the sheath (extrusion process) or molded as part of the sheath (injection moulding process) and free from imperfections. The vulcanization for extrusion process shall be at high temperature and for injection moulding shall be at high temperature & high pressure. Any seams/ burrs protruding axially along the insulator, resulting from the injection moulding process shall be removed completely without causing any damage to the housing. The track resistance of housing and shed material shall be class 1A4.5 according to IEC60587. The strength of the weathershed to sheath interface shall be greater than the tearing strength of the polymer. The composite insulator shall be capable of high pressure washing.

1.5.4.3 **End Fittings**

End fittings transmit the mechanical load to the core. They shall be made of malleable cast iron/ spheroidal graphite or forged steel. They shall be connected to the rod by means of a controlled compression technique. The manufacturer shall have in-process Acoustic emission arrangement or some other arrangement to ensure that there is no damage to the core during crimping. This verification shall be in-process and done on each insulator. The system of attachment of end fitting to the rod shall provide superior sealing performance between housing and metal connection. The gap between fitting and sheath shall be sealed by a flexible silicone rubber compound. The sealing shall stick to both housing and metal end fitting. The sealing must be humidity proof and durable with time.

End fittings shall have suitable provisions for fixing grading rings at the correct position as per design requirements.

1.5.4.4 **Grading Rings**

Grading rings shall be used at both ends of each composite insulator unit for reducing the voltage gradient on and within the insulator and to reduce radio and TV noise to acceptable levels. The size and placement of the metallic grading rings shall be designed to eliminate dry band arcing/corona cutting/ exceeding of permissible electrical stress of material.

1.5.2 **Tests and Standards**

1.5.2.1 **Type Tests**

The test reports for following type tests on long rod units, components, materials or complete strings shall be submitted for approval as per clause 9.2 of Section 2 - GTR.

1.5.2.1.1 On the complete composite Long Rod Insulator String with Hardware Fittings:-

a) Power frequency voltage withstand test with corona control rings/grading ring and arcing horns (if provided) under wet condition as per IEC:60383-1993/

b) Switching surge voltage withstand test under wet condition as per IEC:60383-1993.

c) Impulse voltage withstand test under dry condition as per IEC:60383-1993

d) ~~Corona and RIV test under dry condition.~~

~~The sample assembly when subjected to power frequency voltage shall have a corona extinction voltage of not less than 156kV (rms) for 220kV line to earth under dry condition. There shall be no evidence of Corona on any part of the sample. The atmospheric condition during testing shall be recorded and the test results shall be accordingly corrected with suitable correction factor as stipulated in IEC 60383.~~

~~Under the conditions as specified above the insulator string alongwith complete hardware fittings shall have a radio interference voltage level below 1000 microvolts at 1 MHz when subjected to 50 Hz AC line to earth voltage of 156kV for 220kV under dry conditions. The test procedure shall be in accordance with IEC 60437.~~

e) Mechanical Strength test

The complete insulator string alongwith its hardware fitting excluding arcing horn, corona control ring, grading ring, tension/suspension clamps shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. The load shall be held for five minutes and then removed. After removal of the load, the string components shall not show any visual deformation and it shall be possible to dismantle them by hand. Hand tools may be used to remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

f) Salt-fog pollution withstand test as per IEC: 60507. The salinity level for composite long rod insulators shall be 160 Kg/m3 NACL.

1.5.2.1.2 **On Composite Insulator Units**

a) Tests on interfaces and connections of metal fittings as per IEC: 61109-2008.

b) Assembled core load time test as per IEC: 61109-2008.

c) Damage limit proof test and test of tightness of interface between end firings and insulator housing as per IEC: 61109-2008

d) High Pressure washing test

The washing of a complete insulator of each E&M rating is to be carried out at 3800 kPa with nozzles of 6 mm diameter at a distance of 3m from nozzles to the insulator, The washing shall be carried out for 10minutes. There shall be no damage to the sheath or metal fitting to housing interface.

e) Brittle fracture resistance test

The test arrangement shall be according to Damage limit proof test with simultaneous application of 1N-HNO3 acid directly in contact with naked FRP rod. The contact length of acid shall not be less than 40mm and thickness around the core not less than 10mm.The rod shall withstand 80% of SML for 96 hours.

f) Dye penetration test as per IEC: 61109-2008

g) Water diffusion test as per IEC: 61109-2008

h) Tracking and erosion test as per IEC: 61109-2008.

i) Hardness test as per IEC: 61109-2008.

j) Accelerated weathering test as per IEC: 61109-2008.

k) Flammability test as per IEC: 61109-2008.

l) Silicone content test

Minimum content of silicone as guaranteed by supplier shall be verified through FT-IR spectroscopy & TGA analysis or any other suitable method mutually agreed between Employer & Supplier in Quality Assurance Programme.

m) Recovery of Hydrophobicity test

1. The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the HC classification. Dry the sample surface.

2. Treat the surface with corona discharges to destroy the hydrophobicity. This can be done utilizing a high frequency corona tester, Holding the electrode approximately 3mm from the sample surface, slowly move the electrode over an area approximately 1" x 1". Continue treating this area for 2 – 3 minutes, operating the tester at maximum output.

3. Immediately after the corona treatment, spray the surface with water and record the HC classification. The surface should be hydrophilic, with an HC value of 6 or 7. If not, dry the surface and repeat the corona treatment for a longer time until an HC of 6 or 7 is obtained. Dry the sample surface.

4. Allow the sample to recover and repeat the hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC 1 – HC 2 within 24 to 48 hours, depending on the material and the intensity of the corona treatment.

n) Torsion test

Three complete insulators of each E&M rating shall be subjected to a torsional load of 55Nm. The torsional strength test shall be made with test specimen adequately secured to the testing machine. The torsional load shall be applied to the test specimen through a torque member so constructed that the test specimen is not subjected to any cantilever stress. The insulator after torsion test must pass the Dye Penetration Test as per IEC 61109.

o) Accelerated ageing test of 5000hrs as described in appendix-C of IEC 61109 or Test at multiple stresses of 5000 hrs as described in Annex-B of IEC -62217

1.5.2.2 **Acceptance Tests:**

1.5.2.2.1 **For Composite Long Rod Insulators**

a.	Verification of dimensions	IEC : 61109-2008
b.	Galvanizing test	IEC : 60383
c.	Verification of end fittings	IEC : 61109-2008
d.	Recovery of Hydrophobicity	As per above
e.	Verification of tightness of interface between end fittings and insulator housing	

	and of specified mechanical load	IEC : 61109-2008
f.	Silicone content test	As per above
g.	Brittle fracture resistance test	As per above
h.	Dye penetration test	IEC : 61109-2008
i.	Water diffusion test	IEC : 61109-2008

In the event of failure of the sample to satisfy the acceptance test(s) specified in 4.2 above, the retest procedure shall be as per IEC 61109.

1.5.2.3 **Routine Tests**

1.5.2.3.1 **For Composite Long Rod Insulator Units**

a)	Visual Examination	As per IEC:61109-2008
b)	Mechanical routine test	As per IEC:61109 -2008

1.5.3 **Guaranteed Technical Particulars**

1.5.3.1 **Electrical system Data**

Sl.	**Parameters**	**Unit**	**System Voltage**	
1.	Nominal Voltage	kV	~~**220**~~	**132**
2.	Maximum system voltage	kV	~~245~~	145
3.	BIL (Impulse)	kV (Peak)	~~±1050~~	±650
4.	Power frequency withstand voltage (Wet)	kV (rms)	~~460~~	275
5.	Switching surge withstand voltage (Wet)	kV (rms)	~~NA~~	NA
6.	Minimum Corona extinction voltage at 50 Hz AC system under dry condition	kV (rms) phase to earth	~~156~~	NA
7.	Radio interference voltage at one MHz for phase to earth voltage of 508 KV under dry condition.	Micro Volts	~~1000 (Max)~~	NA
8.	Minimum creepage distance .	mm	~~6125~~	3625
9.	Electromechanical strength of Insulator Unit.	kN	~~120~~	120

2.0 **AAC / ACSR CONDUCTOR**

2.1 **Details of AAC Conductor**

2.1.1 The contractor shall supply the conductor as per the standard guaranteed technical particulars enclosed in Annexure-B of the technical specification, Section – Switchyard Erection and separate approval is not required during detailed engineering.

Owner has also standardised the guaranteed technical particulars for the conductors which are enclosed in Annexure-E of the technical specification, Section – Switchyard Erection. The contractor shall supply the conductor as per the standard guaranteed technical particulars.

2.1.2 The details of the AAC Bull conductor are tabulated below:

Sl. No.	**Description**	**Unit**	**AAC BULL**
a)	Stranding and wire diameter	mm	61/4.25
b)	Number of Strands		
	1st Aluminium Layer	Nos.	1
	2nd Aluminium Layer	Nos.	6
	3rd Aluminium Layer	Nos.	12
	4th Aluminium Layer	Nos.	18
	5th Aluminium Layer	Nos.	24
c)	Total sectional area	Sq.mm	865.36
d)	Overall diameter	mm	38.25
e)	Approximate weight	kg/ km	2400
f)	Calculated d.c. resistance at 20oC	ohm/km	0.0334
g)	Minimum UTS	kN	139

2.1.3 The details of Aluminium strand are as follows:

Sl. No.	**Description**	**Unit**	**AAC BULL**
a)	Minimum breaking load of strand before stranding	KN	2.23
b)	Minimum breaking load of strand after stranding	KN	2.12
c)	Maximum D.C. resistance of strand at 20 deg. Centigrade	Ohm/KM	3.651

2.2 **Details of ACSR Conductor**

2.2.1 The details of the ACSR Moose conductors shall be as per the standard guaranteed technical particulars enclosed in Annexure-A are tabulated below:

ACSR MOOSE CONDUCTOR:

Sl. No.	Description	Unit	ACSR MOOSE
a)	Stranding and wire diameter	mm	54/3.53 (Al)+

			7/3.53 (Steel)
b)	Number of Strands		
	Steel centre	Nos.	1
	1st Steel Layer	Nos.	6
	1st Aluminium Layer	Nos.	12
	2nd Aluminium Layer	Nos.	18
	3rd Aluminium Layer	Nos.	24
c)	Sectional area of Aluminium	Sq. mm	528.5
d)	Total sectional area	Sq. mm	597.00
e)	Overall diameter	mm	31.77
f)	Approximate weight	kg/ km	2004
g)	Calculated d.c. resistance at 20oC	ohm /km	0.05552
h)	Minimum UTS	kN	161.2

2.2.2 The details of Aluminium strand are as follows:

ACSR MOOSE CONDUCTOR:

Sl. No.	Description	Unit	ACSR MOOSE
a)	Minimum breaking load of strand before stranding	KN	1.57
b)	Minimum breaking load of strand after stranding	KN	1.49
c)	Maximum D.C. resistance of strand at 20 deg. Centigrade	Ohm /KM	2.921

2.2.3 The details of steel strand are as follows:

ACSR MOOSE CONDUCTOR:

Sl. No.	**Description**	**Unit**	**ACSR MOOSE**
a)	Minimum breaking load of strand before stranding	KN	12.86
b)	Minimum breaking load of strand after stranding	KN	12.22
c)	Minimum number of twists to be withstood in torsion test when tested on a gauge length of 100 times diameter of wire	Nos.	18 (Before stranding) 16 (Before stranding

2.3 Workmanship

2.3.1 The finished conductor shall be smooth, compact, uniform and free from all imperfections including kinks (protusion of wires), wire cross over, over riding, looseness (wire being dislocated by finger/hand pressure and/or unusual bangle noise on tapping), material inclusions, white rust, powder formation or black spot (on account of reaction with trapped rain water etc.), dirt, grit etc.

2.3.2 All the Aluminium and steel strands shall be smooth, uniform and free from all imperfections, such as spills and splits, diemarks, scratches, abrasions, etc., after drawing.

2.3.3 The steel strands shall be hot dip galvanised and shall have a minimum zinc coating of 260 gms/sq.m. after stranding of the uncoated wire surface. The zinc coating shall be smooth, continuous and of uniform thickness, free from imperfections and shall withstand minimum three dips in standard Preece test. The finished strands and the individual wires shall be of uniform quality and have the same properties and characteristics as prescribed in ASTM designation: B 498-74.

2.3.4 The steel strands shall be preformed and post formed in order to prevent spreading of strands in the event of cutting of composite core wire. Care shall be taken to avoid, damages to galvanisation during pre-forming and post-forming operation.

2.4 Joints in Wires

2.4.1 Aluminium Wires

Joints in aluminium wires shall be as per relevant International standard.

2.4.2 Steel Wires

There shall be no joint of any kind in the finished wire entering into the manufacture of the strand. There shall also be no strand joints or strand splices in any length of the completed stranded steel core of the conductor.

2.5 Tolerances

The manufacturing tolerances shall be as per relevant International standard.

A. AAC Bull and AAC Tarantala conductor:

a)	Diameter of Aluminium and Steel Strands						
		AAC BULL			AAC TARANTALA		
		Standard	Maximum	Minimum	Standard	Maximum	Minimum
	Aluminium	4.25 mm	4.29 mm	4.21 mm	5.23	5.28	5.18

b)	Lay ratio of Conductor					
			AAC BULL		AAC TARANTALA	
			Maximum	Minimum	Maximum	Minimum
	Aluminium	6 wire layer	16	10	16	10
		12 wire layer	16	10	16	10
		18 wire layer	16	10	16	10
		24 wire layer	14	10	-	-

B. ACSR Bersimis and ACSR Moose conductor:

a)	Diameter of Aluminium and Steel Strands						
		ACSR BERSIMIS			ACSR MOOSE		
		Standard	Maximum	Minimum	Standard	Maximum	Minimum
	Aluminium	4.57 mm	4.61 mm	4.53 mm	3.53 mm	3.55 mm	3.51 mm
	Steel	2.54 mm	2.57 mm	2.51 mm	3.53 mm	3.60 mm	3.46 mm
b)	Lay ratio of Conductor						
			ACSR BERSIMIS		ACSR MOOSE		
			Maximum	Minimum			
	Steel	6 wire layer	18	13	18	16	
	Aluminium	8/12 wire layer	17	10	14	12	
		14/18 wire layer	16	10	13	11	
		20/24 wire layer	14	10	12	10	

2.6 Materials

2.6.1 Aluminium

The aluminium strands shall be hard drawn from electrolytic aluminium rods having purity not less than 99.5% and a copper content not exceeding 0.04%.

2.6.2 Steel

The steel wire strands shall be drawn from high carbon steel wire rods and shall conform to the following chemical composition:

Element	% Composition
Carbon	0.50 to 0.85
Manganese	0.50 to 1.10
Phosphorous	Not more than 0.035
Sulphur	Not more than 0.045
Silicon	0.10 to 0.35

2.6.3 **Zinc**

The zinc used for galvanising shall be electrolytic High Grade Zinc of 99.95% purity.

2.7 **Standard Length**

2.7.1 The conductor shall be supplied as required. No joint shall be allowed within a single span of stringing, jumpers and equipment interconnection.

2.8 Tests :

2.8.1 The following type, acceptance & routine tests and tests during manufacturing shall be

carried out on the conductor.

2.8.2 **Type Tests**

In accordance with the stipulation of specification, the following type tests reports of the conductor shall be submitted for approval as per clause 9.2 of Section 2 -GTR.

a) UTS test on stranded conductor.

b) Corona extinction voltage test (dry)

(c) Radio Interference voltage test (dry)

(d) DC resistance test on stranded conductor

2.8.3 **Acceptance Tests**

a) Visual check for joints, scratches etc. and lengths of conductor

b) Dimensional check on steel and aluminium strands

c) Check for lay ratios of various layers

d) Galvanising test on steel strands

e) Torsion and Elongation test on steel strands

f) Breaking load test on steel and aluminium strands

g) Wrap test on steel and aluminium strands

h) DC resistance test on aluminium strands

i) UTS test on welded joint of aluminium strands

NOTE:

All the above tests except test mentioned at (a) shall be carried out on aluminium and steel strands after stranding only.

2.8.4 **Routine Tests**

a) Check to ensure that the joints are as per specification.

b) Check that there are no cuts, fins etc. on the strands.

c) All acceptance test as mentioned in Clause 2.8.3 above to be carried out on each coil.

2.8.5 **Tests During Manufacture**

a) Chemical analysis of zinc used for galvanising

b) Chemical analysis of aluminium used for making aluminium strands

c) Chemical analysis of steel used for making steel strands

2.8.6 **Sample Batch for Type Testing**

The Contractor shall offer material for selection of samples for type testing, only after getting quality assurance plans approved from Owner's Quality Assurance Department. The sample shall be manufactured strictly in accordance with the Quality Assurance Plan approved by Owner.

3.0 Galvanised Steel Earth wire

3.1 Details of Earth wire

3.1.1 The contractor shall supply the earthwire as per the standard guaranteed technical particulars enclosed in Annexure-E of the technical specification, Section – Switchyard Erection and separate approval is not required during detailed engineering.

Owner has also standardised the guaranteed technical particulars for the earthwire which are enclosed in Annexure-E of the technical specification, Section – Switchyard Erection. The contractor shall supply the earthwire as per the standard guaranteed technical particulars.

3.1.2 The basic details of the earth wire are tabulated below:

Sl.No.	Description	Unit	Value
1.	Stranding & Wire diameter	mm	7/3.66 (steel)

2.	Strands a) Steel Core b) Outer layer	 No. No.	 1 (one) 6 (six)
3.	Total sectional area	Sq. mm.	73.65

Other technical details are furnished in of Annexure -E of this Specification.

3.2 Workmanship

3.2.1 All steel strands shall be smooth, uniform and free from all imperfections, such as spills and splits, die marks, scratches, abrasions and kinks after drawing and also after stranding.

3.2.2 The finished material shall have minimum brittleness as it will be subjected to appreciable vibration while in use.

3.2.3 The steel strands shall be hot dip qalvanised (and shall have minimum Zinc coating of 275 gms/sq.m) after stranding of the uncoated wire surface. The zinc coating shall be smooth, continuous, of uniform thickness, free from imperfections and shall withstand three and a half dips after stranding in standard Preece test. The steel wire rod shall be of such quality and purity that, when drawn to the size of the strands specified and coated with zinc, the finished strands shall be of uniform quality and have the same properties and characteristics as prescribed in ASTM designation B498-74.

3.2.4 The steel strands shall be preformed and post formed in order to prevent spreading of strands while cutting of composite earth wire. Care shall be taken to avoid damage to galvanisation during preforming and postforming operation.

3.2.5 To avoid susceptibility towards wet storage stains (white rust), the finished material shall be provided with a protective coating of boiled linseed oil.

3.3 Joints in Wires

There shall be no joint of any kind in the finished steel wire strand entering into the manufacture of the earth wire. There shall be no strand joints or strand splices in any length of the completed stranded earth wire.

3.4 Tolerances

The manufacturing tolerance to the extent of the following limits only shall be permitted in the diameter of the individual steel strands and lay length of the earth wire:

	Standard	Maximum	Minimum
Diameter	3.66 mm	3.75 mm	3.57 mm
Lay length	181 mm	198 mm	165 mm

3.5 **Materials**

3.5.1 Steel

The steel wire strands shall be drawn from high carbon steel rods and shall conform to the following requirements as to the chemical composition.

Element	% Composition
Carbon	Not more than 0.55
Manganese	0.4 to 0.9
Phosphorous	Not more than 0.04
Sulphur	Not more than 0.04
Silicon	0.15 to 0.35

3.5.2 Zinc

The zinc used for galvanising shall be electrolytic High Grade Zinc of 99.95% purity. It shall conform to and satisfy all the requirements of IS: 209 -1979/ Equivqlent BS standard.

3.6 Standard Length

3.6.1 The earth wire shall be supplied in standard drum length of manufacturer.

3.8 **TESTS**

3.8.1 The following type, routine & acceptance tests and tests during manufacturing shall be carried out on the earthwire.

3.8.2 **TYPE TESTS**

In accordance with the stipulation of specification, the following type tests reports of the earthwire shall be submitted for approval as per clause 9.2 of Section 2 - GTR.

a) UTS test

b) DC resistance test

3.8.3 **ACCEPTANCE TESTS**

a) Visual check for joints, scratches etc. and length of Earthwire

b) Dimensional check

c) Galvanising test

d) Lay length check

e) Torsion test

f) Elongation test

g) Wrap test

h) DC resistance test

i) Breaking load test

j) Chemical Analysis of

steel

3.8.4 **ROUTINE TESTS**

a) Check that there are no cuts, fins etc. on the strands.

b) Check for correctness of stranding.

3.8.5 **TESTS DURING MANUFACTURE**

a) Chemical analysis of zinc used for galvanising

b) Chemical analysis of steel

3.8.6 **SAMPLE BATCH FOR TYPE TESTING**

The Contractor shall offer material for sample selection for type testing, only after getting quality assurance programme approved by the Owner. The samples for type testing shall be manufactured strictly in accordance with the Quality Assurance Programme approved by the Owner.

4.0 **TUBULAR BUS CONDUCTORS**

4.1 **General**

The contractor shall supply the aluminum tubes as per the standard guaranteed technical particulars enclosed in Annexure- E of the technical specification, Section – Switchyard Erection and separate approval is not required during detailed engineering.

Owner has also stardardised the guaranteed technical particulars for the aluminum tube which are enclosed in Annexure- E of the technical specification, Section – Switchyard Erection. The contractor shall supply the aluminum tube as per the standard guaranteed technical particulars.

4.2 **Constructional Features**

4.2.1 For outside diameter (OD) & thickness of the tube there shall be no minus tolerance, other requirements being as per relevant International standard.

4.2.2 The aluminum tube shall be supplied in suitable cut length to minimize wastage.

4.2.3 The welding of aluminum tube shall be done by the qualified welders duly approved by the owner.

4.3 **Tests**

In accordance with stipulations of the specification, Routine tests shall be conducted on tubular bus conductors. Also the wall thickness and ovality of the tube shall be measured. In addition to the above tests, 0.2% proof tests on both parent metal and Aluminum tube after welding shall be conducted.

4.4 **Technical Parameters**

Sl. No.	Description	4" AL. TUBE
1.	Size	4" IPS (EH Type)
2.	Outer diameter	114.2 mm
3.	Thickness	8.51 mm
4.	Cross-sectional area	2825.61 sq.mm
5.	Weight	7.7 kg/m

5.0 **EARTHING CONDUCTORS**

5.0 **General**

The conductor of earthing grid shall consist of mild steel rod of minimum size (dia) 40 mm. All conductors above ground level and earthing leads shall be of galvanized steel.

6.0 **SPACERS**

6.1 **General**

The spacers are to be located at a suitable spacing to limit the short circuit forces as per IEC -60865. Wherever Employer's 220kV & 132kV standard gantry structures are being used, the spacer span(s) for different conductor / span configurations and corresponding short circuit forces shall be as per Annexure-D. For strung buses, flexible type spacers shall be used whereas for jumpers and other connections rigid type spacers shall be used.

Wherever Employer's 220kV & 132kV standard gantry structures are not being used, necessary spacer span calculation shall be provided by the contractor during detailed engineering for the approval of Employer.

6.2 **Constructional Features**

6.2.1 No magnetic material shall be used in the fabrication of spacers except for GI bolts and nuts.

6.2.2 Spacer design shall be made to take care of fixing and removing during installation and maintenance.

6.2.3 The design of the spacers shall be such that the conductor does not come in contact with any sharp edge.

6.3 **Tests**

Each type of spacers shall be subjected to the following type tests, acceptance tests and routine tests:

6.3.1 Type Tests: Following type test reports shall be submitted for approval as per clause 9.2 of - GTR.

a) **Clamp slip tests**

The sample shall be installed on test span of twin conductor bundle string or quadruple conductor bundle string (as applicable) at a tension of 44.2 kN. One of the clamps of the sample when subjected to a longitudinal pull of 2.5 kN parallel to the axis of the conductor shall not slip on the conductor. The permanent displacement between the conductor and the clamp of sample measured after removal of the load shall not exceed 1.0 mm. Similar tests shall be performed on the other clamps of the same sample.

b) Fault current test.

c) Corona Extinction Voltage Test (Dry).

This test shall be performed on 220 kV equipment as per procedure mentioned at Annexure - C, Minimum Corona Extinction voltage shall be 156 kV (rms) line to earth for 220 kV spacers.

d) RIV Test (Dry)

This test shall be performed as per procedure mentioned at Annexure - C, Maximum RIV level at 156 kV (rms) line to earth for 220 kV spacers shall be 1000 micro volts, across 300 ohm resistor at 1 MHz

e) Resilience test (if applicable)

f) Tension Test

g) Log decremant test (if applicable)

h) Compression test

i) Galvanising test

6.3.2 **Acceptance Test**

a) Visual examination

b) Dimensional verification

c) Movement test

d) Clamp slip test

e) Clamp bolt torque test (if applicable)

f) Assembly torque test

g) Compression test

h) Tension test

i) Galvanising test

j) Hardness test for neoprene (if applicable)

The shore hardness of different points on the elastometer surface of cushion grip clamp shall be measured by shore hardness meter. It shall be between 65 to 80.

k) Ultimate Tensile Strength Test

The UTS of the retaining rods shall be measured. It shall not be less than 35 kg/Sq. mm.

6.3.3 **Routine test**

a) Visual examination

b) Dimensional verification

7.0 **BUS POST INSULATORS**

The post insulators shall conform in general to latest IEC-60168, IEC 60273 and IEC-60815.

7.1 **Constructional Features**

7.1.1 Post type insulators shall consist of a porcelain part permanently secured in a metal base to be mounted on the supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand any shocks to which they may be subjected to by the operation of the associated equipment. Only solid core insulators will be acceptable.

7.1.2 Porcelain used shall be homogeneous, free from lamination, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.

7.1.3 Glazing of the porcelain shall be of uniform brown in colour, free from blisters, burrs and other similar defects.

7.1.4 The insulator shall have alternate long and short sheds with aerodynamic profile, The shed profile shall also meet the requirements of IEC-60815 for the specified pollution level.

7.1.5 When operating at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or injury to conductors or insulators by the formation of substance produced by chemical action.

7.1.6 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.

7.1.7 All ferrous parts shall be hot dip galvanised. The zinc used for galvanising shall be grade Zn 99.95. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfections such as flux ash, rust stains, bulky

white deposits and blisters. The metal parts shall not produce any noise generating corona under the operating conditions.

7.1.8 a) Every bolt shall be provided with a steel washer under the nut so that part of the threaded portion of the bolts is within the thickness of the parts bolted together.

b) Flat washer shall be circular of a diameter 2.5 times that of bolt and of suitable thickness. Where bolt heads/nuts bear upon the beveled surfaces they shall be provided with square tapered washers of suitable thickness to afford a seating square with the axis of the bolt.

c) All bolts and nuts shall be of steel with well formed hexagonal heads forged from the solid and shall be hot dip galvanised. The nuts shall be good fit on the bolts and two clear threads shall show through the nut when it has been finally tightened up.

7.1.9 Bidder shall make available data on all the essential features of design including the method of assembly of shells and metals parts, number of shells per insulator, the manner in which mechanical stresses are transmitted through shells to adjacent parts, provision for meeting expansion stresses, results of corona and thermal shock tests, recommended working strength and any special design or arrangement employed to increase life under service conditions.

7.2 **Tests**

In accordance with the stipulations of the specification, the post insulators shall be subject to type, acceptance, sample and routine tests as per IEC-60168.

7.2.1 In addition to acceptance/sample/routine tests as per IEC-60168, the following tests shall also be carried out.

a) Ultrasonic test as an acceptance test

b) Soundness test, metallurgical tests and magnetic test on MCI caps and pedestal tests as acceptance test.

c) All hot dip galvanised components shall be subject to check for uniformity of thickness and weight of zinc coating on sample basis.

d) The bending test shall be carried out at 50% minimum failing load in four directions as a routine test and at 100% minimum failing load in four directions as an acceptance test.

e) Acceptance norms for visual defects allowed at site and also at works shall be agreed in the Quality plan.

7.2.2 In accordance with the stipulation of specification, the following type tests reports of the post insulators shall be submitted for approval as per clause 9.2 of Section 2 - GTR.

a) Power frequency withstand test (dry & wet)

b) Lightning impulse test (dry)

c) Measurement of R.I.V (Dry)

d) Corona extinction voltage test (Dry)

.

e) Test for deflection under load

f) Test for mechanical strength.

7.3 **Technical Parameters of Bus Post Insulators.**

Sl. No.	Description	245 kV	145 kV
a)	Type	Solid Core	Solid Core
b)	Voltage Class (kV)	245	145
c)	Dry and wet one minute power frequency withstand voltage(kV rms)	460	275
d)	Dry lightning impulse withstand Voltage (kVp)	± 1050	±650
e)	Wet switching surge withstand voltage (kVp)	—-	—-
f)	Max. radio interference voltage (in microvolts) at voltage of 508 kV (rms) , 305 kV (rms) and 156 (rms) for 765 kV, 400 kV &220 kV respectively between phase to earth.	500	500
g)	Corona extinction voltage (kV rms) (min.)	156	105
h)	***Cantilever Strength***		
(i)	Total minimum cantilever strength (Kg)	800	600
(ii)	***Total minimum breaking strength (Kg)***	***1000***	***720***
i)	Minimum torsional moment	As per IEC-273	As per IEC-273
j)	Total height of insulator (mm)	2300	
k)	P.C.D Top (mm)	127	***127***
	Bottom (mm)	254	***254***
l)	No. of bolts		
	Top	4	***4***
	Bottom	8	***8***
m)	Diameter of bolt/holes (mm)		
	Top	M16	***M16***
	Bottom dia	18	***18***
n)	Pollution level as per IEC-815	Heavy(III)	Heavy(III)
o)	Minimum total creepage distance for Heavy Pollution (mm)	6125	3165

7.3.1 33kV Bus Post Insulators.

a) Type Solid Core

b) Voltage class (kV) 36

c) Dry and wet one minute power 70

	frequency withstand voltage(kV rms)	
d)	Dry lightning impulse withstand Voltage (kVp)	±170
e)	Total minimum cantilever strength (Kg)	450
f)	Minimum torsional moment	As per IEC-273
g)	Total height of insulator (mm)	As per requirement
h)	Pollution level as per IEC-815	Heavy(III)
i)	Minimum creepage distance for Heavy Pollution (mm)	900

7.3.2 If corona extinction voltage is to be achieved with the help of corona ring or any other similar device, the same shall be deemed to be included in the scope of the Contractor. Material of Corona ring shall be aluminium/aluminium alloy of 63401W grade or equivalent.

8.0 EARTHING SYSTEM

8.1 GENERAL

This specification covers the design, supply, delivery, installation and testing of the complete earthing system as described below.

The complete station earthing work shall be in accordance with the recommendation in the "Guide for Safety in Substation EARTHING" IEEE No. 80 and the requirements of this section.

8.2 EARTHING INSTALLATION FEATURES

8.2.1 The installation shall be complete in all respects for efficient and trouble free service. All work shall be carried out in a first class neat workman like manner. earthing conductors shall be handled carefully to avoid kinking and cutting of the conductors during laying and installation. All exposed earth conductors runs shall be taken in a neat manner, horizontal, vertical and parallel to building walls or columns and shall not be laid haphazardly.

8.2.2 For all connections made to equipment or to the structures, the earthing conductor, connectors and equipment enclosures shall have good clean contact surfaces. Earthing conductor connection to all electrical equipment, switchgear, transformers, motors, panels, conduit system, equipment enclosures, cable trays, distribution boards, equipment frames, bases, steel structure, etc. shall be by pressure type or bolting type connectors.

8.2.3 All lap, cross and tee connections between two earthing conductors shall be made by thermo welding process or compression type connector. The various joints shall have adequate mechanical strength as well as necessary electrical conductivity not

less than that of the parent conductors of the joints. All accessories for earthing installation shall be of quality and design approved by the Employer. The earthing connection between earthing pad of equipment/structures shall be made by two earthing leads.

8.2.4 Earth conductors, when crossing underearth trenches, directly laid underearth pipe and equipment foundation, if any, shall be at least 300mm below the bottom elevation of such trenches/pipes.

8.2.5 The terminals for connecting earth mat and equipment shall be terminated whenever necessary. The new earthing shall be bonded with existing earthing network at the existing Substations.

8.3 EARTHING CONDUCTOR

8.3.1 Main Earth Grid

The main earth system shall consist of a earthing grid buried minimum 0.6 meter below grade level. The earthing grid shall consist of Mild steel rod of minimum size (dia.) 40 mm.

8.3.2 Earth Electrodes

The earth electrodes shall be 40mm diameter and 3.0 meter long (min.) of mild steel. These shall be driven into earth and connected to the main earth grid.

8.3.3 Risers

The risers shall consist of Galvanised steel of adequate size (75 x12mm for Main equipment, column 7 aux. structure 50 x 6mm for Panels, MOM boxes, outdoor cable trench etc.) connected at one end to the main earth mat and at the other end to the equipment.

8.4 DESIGN REQUIREMENTS

8.4.1 The Contractor shall measure the soil resistivity in presence of the Employer. Based on the resistivity the contractor shall calculate the total length of buried earth conductor, number of earthing electrode and their depth and spacing to achieve a earthing system resistance of less than 1.0 (One) Ohm.

8.4.2 The Contractor shall calculate the cross-section considering the maximum fault level of 40 kA and 31.5KA for 220kV and 132kV respectively.

8.4.3 The Contractor shall submit the details of calculations of the earthing system for the employers approval. The earthing system shall be of single earthing system for the whole substation i.e. all earthing shall be connected to main earthing grid.

8.5 TESTS

On completion of the installation, either wholly or in sections, it shall be tested in compliance with relevant Code by the Contractor in presence of the Employer. The cost of any test including labor, material and equipment charges shall be borne by the Contractor. If the earth grid resistance cannot be obtained as per his design, then additional earthing conductors shall be buried in the earth, or if necessary, buried in treated soil to obtain the required low earth resistance without any additional cost.

8.6 **LIGHTNING PROTECTION**

The outdoor equipment of the substation and the substation building shall be protected against lightning. The lightning protection shall be achieved by installing Lightning mast and/or an overhead lightning shield system of galvanized steel wire of 7/3.66 mm, which shall be connected to the main earthing grid by steel conductor of 7/3.66 mm. Lighting mast with electrode length of 2.5mtr (maximum) may be used in switchyard area for lighting protection as per requirement. The above electrode may be connected to the main earthing grid by steel conductor of 7/3.66 mm up to LM base and then connected to 75 x12mm G.S Flat. The design of the lightning protection system shall be subject to the approval of the Employer.

8.7 **DRAWINGS**

After award of the Contract, the Contractor shall furnish the earthing layout drawing with dimensions showing the location of earthing grids, electrodes, test link chambers and risers, backed up by necessary calculations for Employer's approval. The work shall have to be started at site only after getting approval from the Employer. If alteration is required for any work done before getting Employer's approval, the same shall have to be done by the Contractor at no extra cost to the Employer.

9.0 **Main Bus Bars (Applicable for Aluminium tube)**

The brief description of the bus switching scheme, bus bar layout and equipment connection to be adopted are indicated elsewhere in the specification. The bus bar arrangements are shown in drgs. enclosed with the bid documents.

9.1 The Contractor shall furnish supporting calculations where applicable for the bus bars/conductors to show adequacy of design parameters for:

a) Fibre-stress

b) Cantilever strength of post insulators

c) Aeolain vibrations

d) Vertical deflection of bus bars

e) Short circuit forces in bundle conductor and spacer location for each span of ACSR conductor stringing as per layout drawings.

9.1.1 The welds in the aluminium tubes shall be kept to the minimum and there shall not be more than one weld per span. The procedure and details of welding shall be subject to Owner's approval. Material for welding sleeve shall be same as that of Aluminium tube. Welding sleeve shall be of 600mm length

9.1.2 Corona bells shall be provided wherever the bus extends beyond the clamps and on free ends, for sealing the ends of the tubular conductor against rain and moisture and to reduce the electrostatic discharge loss at the end points. There shall be a small drain hole in the corona bell. The material of Corona bell shall be Aluminium

alloy similar to that of clamps & connectors.

9.1.3 To minimise the vibrations in the aluminium tubes, damping conductor shall be provided inside the aluminium tubes. For this purpose, the cut pieces of ACSR conductor which otherwise are considered wastages, shall be used as damping conductor.

9.1.4 Details of past experience of the persons proposed to be employed for Aluminium tube welding and the test reports of the welded pieces to prove the electrical and mechanical characteristics shall also be furnished along with the bid. Welding at site shall be done by adopting a qualified procedure and employing qualified welders as per ASME-Section IX.

10.0 BAY EQUIPMENT

10.1 The disposition of various bay equipments shall be as per single line diagrams and layout drawings.

10.2 Bay Marshalling Kiosk:-

One no. of bay marshalling kiosk shall be provided for each 220 kV and 132 kV bay under present scope. In addition to the requirements specified elsewhere in the specification, the bay marshalling kiosk shall have two distinct compartments for the following purpose:-

(i) To receive two incoming 400V, 3 phase, 63Amps, AC supply with auto changeover and MCB unit and distribute minimum six outgoing 400V, 3 phase, 16 Amps AC supplies controlled by MCB.

(ii) To distribute minimum ten outgoing 230V, 10 Amps single phase supplies to be controlled by MCB to be drawn from above 3 phase incomers.

(iii) 200 nos. terminal blocks in vertical formation for interlocking facilities for substations without automation system.

(iv) Necessary Terminal Blocks for terminating cables from ACDB and switchyard panel rooms.

11.0 EQUIPMENT ERECTION DETAILS

11.1 For equipment interconnection, the surfaces of equipment terminal pads, Aluminium tube, conductor & terminal clamps and connectors shall be properly cleaned. After cleaning, contact grease shall be applied on the contact surfaces of equipment terminal pad, Aluminium tube/conductor and terminal clamps to avoid any air gap in between. Subsequently bolts of the terminal pad/terminal connectors shall be tightened and the surfaces shall be cleaned properly after equipment interconnection.

11.2 Muslin or leather cloth shall be used for cleaning the inside and outside of hollow insulators.

11.3 All support insulators, circuit breaker interrupters and other fragile equipment shall preferably be handled with cranes having suitable booms and handling capacity.

11.4 Bending of Aluminium tube and compressed air piping if any should be done by a bending machine and through cold bending only. Bending shall be such that inner diameter of pipe is not reduced.

11.5 Cutting of the pipes wherever required shall be such as to avoid flaring of the ends. Hence only a proper pipe cutting tool shall be used. Hack saw shall not be used.

11.6 Handling of equipment shall be done strictly as per manufacturer's/supplier's instructions/instruction manual.

11.7 Handling equipment, sling ropes etc. should be tested periodically before erection for strength.

11.8 The slings shall be of sufficient length to avoid any damage to insulator due to excessive swing, scratching by sling ropes etc.

12.0 **STORAGE**

12.1 The Contractor shall provide and construct adequate storage shed for proper storage of equipments, where sensitive equipments shall be stored indoors. All equipments during storage shall be protected against damage due to acts of nature or accidents. The storage instructions of the equipment manufacturer/Owner shall be strictly adhered to.

13.0 **CABLING MATERIAL**

13.1 **CABLE TAGS AND MARKERS**

13.1.1 Each cable and conduit run shall be tagged with numbers that appear in the cable and conduit schedule.

13.1.2 The tag shall be of aluminium with the number punched on it and securely attached to the cable conduit by not less than two turns of 20 SWG GI wire. Cable tags shall be of rectangular shape for power cables and of circular shape for control cables.

13.1.3 Location of cables laid directly underearth shall be clearly indicated with cable marker made of galvanised iron plate.

13.1.4 Location of underearth cable joints shall be indicated with cable marker with an additional inscription "Cable joints".

13.1.5 The marker shall project 150 mm above earth and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road and drain crossings.

13.1.6 Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each

duct/conduit entry and at each end & turning point in cable tray/trench runs. Cable tags shall be provided inside the switchgear, motor control centres, control and relay panels etc., wherever required for cable identification, where a number of cables enter together through a gland plate.

13.2 **Cable Supports and Cable Tray Mounting Arrangements**

13.2.1 The Contractor shall provide embedded steel inserts on concrete floors/walls to secure supports by welding to these inserts or available building steel structures.

13.2.2 The supports shall be fabricated from standard structural steel members.

13.2.3 Insert plates will be provided at an interval of 750 mm wherever cables are to be supported without the use of cable trays, such as in trenches, while at all other places these will be at an interval of 2000 mm.

13.2.4 Vertical run of cables on equipment support structure shall be supported on perforated cable trays of suitable width which shall be suitably bolted/clamped with the equipment support structure.

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13.3 **Cable Termination and Connections**

13.3.1 The termination and connection of cables shall be done strictly in accordance with cable and termination kit manufacturer's instructions, drawing and/or as directed by the Owner.

13.3.2 The work shall include all clamping, fittings, fixing, plumbing, soldering, drilling, cutting, taping, heat shrinking (where applicable), connecting to cable terminal, shorting and EARTHING as required to complete the job.

13.3.3 Supply of all consumable material shall be in the scope of Contractor.

13.3.4 The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for drilling of gland plates, painting and touching up. Holes shall not be made by gas cutting.

13.3.5 Control cable cores entering control panel/switchgear/MCCB/MCC/ miscellaneous panels shall be neatly bunched, clamped and tied with nylon strap or PVC perforated strap to keep them in position.

13.3.6 The Contractor shall tag/ferrule control cable cores at all terminations, as instructed by the Owner. In panels where a large number of cables are to be terminated and cable identification may be difficult, each core ferrule may include the complete cable number as well.

13.3.7 Spare cores shall be similarly tagged with cable numbers and coiled up.

13.3.8 All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively closed.

13.3.9 Double compression type nickel plated (coating thickness not less than 10 microns) brass cable glands shall be provided by the Contractor for all power and control cables to provide dust and weather proof terminations.

13.3.10 They shall comprise of heavy duty brass casting, machine finished and nickel plated, to avoid corrosion and oxidation. Rubber components used in cable glands shall be neoprene and of tested quality. Cable glands shall be of approved make.

13.3.11 The cable glands shall also be suitable for dust proof and weather proof termination. The test procedure, if required, has to be discussed and agreed to between Owner and cable gland manufacturer.

13.3.12 If the cable-end box or terminal enclosure provided on the equipment is found unsuitable and requires modification, the same shall be carried out by the Contractor, as directed by the Owner.

13.3.13 Crimping tool used shall be of approved design and make.

13.3.14 Cable lugs shall be tinned copper solderless crimping type conforming to IS-8309 & 8394/ Equivqlent International standard. Bimetallic lugs shall be used depending upon type of cables used.

13.3.15 Solderless crimping of terminals shall be done by using corrosion inhibitory compound. The cable lugs shall suit the type of terminals provided.

13.4 **STORAGE AND HANDLING OF CABLE DRUMS**

13.4.1 Cable drums shall be unloaded, handled and stored in an approved manner and rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum.

14.0 **DIRECTLY BURIED CABLES**

14.1 The Contractor shall construct the cable trenches required for directly buried cables. The scope of work shall include excavation, preparation of sand bedding, soil cover, supply and installation of brick or concrete protective covers, back filling and ramming, supply and installation of route markers and joint markers. The Bidder shall ascertain the soil conditions prevailing at site, before submitting the bid.

14.2 The cable (power and control) between LT station, control room, DG set location and fire lighting pump house shall be laid in the buried cable trenches. In addition to the above, for lighting purpose also, buried cable trench can be used in outdoor area.

14.3 Cable route and joint markers and RCC warning covers shall be provided wherever required. The voltage grade of cables shall be engraved on the marker.

15.0 **INSTALLATION OF CABLES**

15.1 Cabling in the control room shall be done on ladder type cable trays for vertical runs while cabling in switchyard area shall be done on angles in the trench.

15.2 All cables from bay cable trench to equipment's including and all interpole cables (both power and control) for all equipment, shall be laid in PVC pipes of minimum 50 mm nominal outside diameter which shall be buried in the earth at a depth of

250mm below finish formation level. Separate PVC pipes shall be laid for control and power cables. Cable pull boxes of adequate size shall be provided if required.

15.3 Cables shall be generally located adjoining the electrical equipment through the pipe insert embedded in the floor. In the case of equipments located away from cable trench either pipe inserts shall be embedded in the floor connecting the cable trench and the equipment or in case the distance is small, notch/opening on the wall shall be provided. In all these cases necessary bending radius as recommended by the cable manufacturer shall be maintained.

15.4 Cable racks and supports shall be painted after installation with two coats of metal primer (comprising of red oxide and zinc chromate in a synthetic medium) followed by two finishing coats of aluminium paint.

15.5 Suitable arrangement should be used between fixed pipe / cable trays and equipment terminal boxes, where vibration is anticipated.

15.6 Power and control cables in the cable trench shall be laid in separate tiers. The order of laying of various cables shall be as follows, for cables other than directly buried.

a) Power cables on top tiers.

b) Control instrumentation and other service cables in bottom tiers.

15.7 Single core cables in trefoil formation shall be laid with a distance of three times the diameter of cable between trefoil centre lines. All power cables shall be laid with a minimum centre to centre distance equal to twice the diameter of the cable of higher size of cables.

15.8 Trefoil clamps for single core cables shall be of pressure die cast aluminium (LM-6), Nylon -6 or fibre glass and shall include necessary fixing GI nuts, bolts, washer etc. These are required at every 2 metre of cable runs.

15.9 Power and control cables shall be securely fixed to the trays/supports with self locking type nylon ties with deinterlocking facility at every 5 metre interval for horizontal run. Vertical and inclined cable runs shall be secured with 25 mm wide and 2 mm thick aluminium strip clamps at every 2m.

15.10 Cables shall not be bent below the minimum permissible limit. The permissible limits are as follows:

Table of Cable and	Minimum bending radius
Power cable	12 D
Control cable	10 D

D is overall diameter of cable

15.11 Where cables cross roads, drains and rail tracks, these shall be laid in reinforced spun concrete or steel pipes buried at not less than one metre depth.

15.12 In each cable run some extra length shall be kept at a suitable point to enable one (for LT cables)/two (for H.T. cables) straight through joints to be made in case the cable develop fault at a later date.

15.13 Selection of cable drums for each run shall be so planned as to avoid using straight through joints. Cable splices will not be permitted except where called for by the drawings, unavoidable or where permitted by the Owner. If straight through joints are unavoidable, the Contractor shall use the straight through joints kit of reputed make.

15.14 Control cable terminations inside equipment enclosures shall have sufficient lengths so that changing of termination in terminal blocks can be done without requiring any splicing.

15.15 Metal screen and armour of the cable shall be bonded to the earthing system of the station, wherever required by the Owner.

15.16 Rollers shall be used at intervals of about two metres while pulling cables.

15.17 All due care shall be taken during unreeling, laying and termination of cable to avoid damage due to twist, kinks, sharp bends, etc.

15.18 Cable ends shall be kept sealed to prevent damage. In cable vault, fire resistant seal shall be provided underneath the panels.

15.19 Inspection on receipt, unloading and handling of cables shall generally be in accordance with relevant international standard.

15.20 Wherever cable pass through floor or through wall openings or other partitions, GI/PVC wall sleeves with bushes having a smooth curved internal surface so as not to damage the cable, shall be supplied, installed and properly sealed by the Contractor at no extra charges.

15.21 Contractor shall remove the RCC/Steel trench covers before taking up the work and shall replace all the trench covers after the erection-work in that particular area is completed or when further work is not likely to be taken up for some time.

15.22 Contractor shall furnish three copies of the report on work carried out in a particular week, indicating cable numbers, date on which laid, actual length and route, testing carried out, terminations carried out, along with the marked up copy of the cable schedule and interconnection drawing wherever any modifications are made.

15.23 Contractor shall paint the tray identification number on each run of trays at an interval of 10 m.

15.24 In case the outer sheath of a cable is damaged during handling/installation, the Contractor shall repair it at his own cost to the satisfaction of the Owner. In case any other part of a cable is damaged, the same shall be replaced by a healthy cable at no extra cost to the Owner, i.e. the Contractor shall not be paid for installation and removal of the damaged cable.

15.25 All cable terminations shall be appropriately tightened to ensure secure and reliable

connections. The Contractor shall cover the exposed part of all cable lugs whether supplied by him or not with insulating tape, sleeve or paint.

15.26 **Cable trays**

i) The cable trays shall be of G.S.sheet and minimum thickness of sheet shall be 2mm.

ii) The Contractor shall perform all tests and inspection to ensure that material and workmanship are according to the relevant standards.

A 2.5 metre straight section of 300mm, 600mm wide cable tray shall be simply supported at two ends. A uniform distributed load of 76 kg/m shall be applied along the length of the tray. The maximum deflection at the mid-span shall not exceed 7mm.

15.27 **Conduits, Pipes and Duct Installation**

15.27.1 Contractor shall supply and install all rigid conduits, mild steel pipes, flexible conduits, hume pipes etc. including all necessary sundry materials such as tees, elbows, check nuts, bushing, reducers, enlargers, coupling cap, nipples, gland sealing fittings, pull boxes etc. as specified and to be shown in detailed drawing. The size of the conduit/pipe shall be selected on the basis of 40% fill criterion.

15.27.2 Contractor shall have his own facility for bending, cutting and threading the conduits at site. Cold bending should be used. All cuts & threaded ends shall be made smooth without leaving any sharp edges. Anticorrosive paint shall be applied at all field threaded portions.

15.27.3 All conduit/pipes shall be extended on both sides of wall/floor openings. The fabrication and installation of supports and the clamping shall be included in the scope of work by Contractor.

15.27.4 When two lengths of conduits are joined together through a coupling, running threads equal to twice the length of coupling shall be provided on each conduit to facilitate easy dismantling of two conduits.

15.27.5 Conduit installation shall be permanently connected to earth by means of special approved type of earthing clamps. GI pull wire of adequate size shall be laid in all conduits before installation.

15.27.6 Each conduit run shall be painted with its designation as indicated on the drawings such that it can be identified at each end.

15.27.7 Embedded conduits shall have a minimum concrete cover of 50 mm.

15.27.8 Conduit run sleeves shall be provided with the bushings at each end.

15.27.9 Metallic conduit runs at termination shall have two locknuts and a bushing for connection. Flexible conduits shall also be suitably clamped at each end with the help of bushings. Bushings shall have rounded edges so as not to damage the cables.

15.27.10 Where embedded conduits turn upwards from a slab or fill, the termination

dimensions shown on the drawings, if any, shall be taken to represent the position of the straight extension of the conduit external to and immediately following the bend. At least one half of the arc length of the bend shall be embedded.

15.27.11 All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed in an approved manner to prevent damage to threaded portions and entrance of moisture and foreign material.

15.27.12 For underearth runs, Contractor shall excavate and back fill as necessary.

15.27.13 Contractor shall supply, unload, store and install conduits required for the lighting installation as specified. All accessories/fittings required for making the installation complete, including but not limited to pull out boxes, ordinary and inspection tees and elbow, checknuts, male and female bushings (brass or galvanised steel), caps, square headed male plugs, nipples, gland sealing fittings ,pull boxes, conduits terminal boxes, gaskets and box covers, saddle terminal boxes, and all steel supporting work shall be supplied by the Contractor. The conduit fittings shall be of the same material as conduits.

15.27.14 All unarmoured cables shall run within the conduits from lighting panels to lighting fixtures, receptacles etc.

15.27.15 Size of conduit for lighting shall be selected by the Contractor during detailed engineering.

15.27.16 Exposed conduits shall be run in straight lines parallel to building columns, beams and walls. Unnecessary bends and crossings shall be avoided to present a neat appearance.

15.27.17 Conduit supports shall be provided at an interval of 750mm for horizontal runs and 1000mm for vertical runs.

15.27.18 Conduit supports shall be clamped on the approved type spacer plates or brackets by saddles or U- bolts. The spacer plates or brackets in turn, shall be securely fixed to the building steel by welding and to concrete or brick work by grouting or by nylon rawl plugs. Wooden plug inserted in the masonary or concrete for conduit support is not acceptable.

15.27.19 Embedded conduits shall be securely fixed in position to preclude any movement. In fixing embedded conduit, if welding or brazing is used, extreme care should be taken to avoid any injury to the inner surface of the conduit.

15.27.20 Spacing of embedded conduits shall be such as to permit flow of concrete between them.

15.27.21 Where conduits are placed alongwith cable trays, they shall be clamped to supporting steel at an interval of 600mm.

15.27.22 For directly embedding in soil, the conduits shall be coated with an asphalt-base compound. Concrete pier or anchor shall be provided wherever necessary to support the conduit rigidly and to hold it in place.

15.27.23 Conduit shall be installed in such a way as to ensure against trouble from trapped condensation.

15.27.24 Conduits shall be kept, wherever possible, at least 300mm away from hot pipes, heating devices etc. when it is evident that such proximity may reduce the service life of cables.

15.27.25 Slip joints shall be provided when conduits cross structural expansion joints or where long run of exposed conduits are installed, so that temperature change will cause no distortion due to expansion or contraction of conduit run.

15.27.26 For long conduit run, pull boxes shall be provided at suitable intervals to facilitate wiring.

15.27.27 Conduit shall be securely fastened to junction boxes or cabinets, each with a lock nut inside and outside the box.

15.27.28 Conduits joints and connections shall be made thoroughly water-tight and rust proof by application of a thread compound which insulates the joints. White lead is suitable for application on embedded conduit and red lead for exposed conduit.

15.27.29 Field bends shall have a minimum radius of four (4) times the conduit diameter. All bends shall be free of kinks, indentations of flattened surfaces. Heat shall not be applied in making any conduit bend. Separate bends may be used for this purpose.

15.27.30 The entire metallic conduit system, whether embedded or exposed, shall be electrically continuous and thoroughly earthed. Where slip joints are used, suitable bounding shall be provided around the joint to ensure a continuous earth circuit.

15.27.31 After installation, the conduits shall be thoroughly cleaned by compressed air before pulling in the wire.

15.27.32 Lighting fixtures shall not be suspended directly from the junction box in the main conduit run.

16.0 JUNCTION BOX

a) The Contractor shall supply and install junction boxes complete with terminals as required. The brackets, bolts, nuts, screws etc. required for erection are also included in the scope of the Contractor.

b) Junction boxes having volume less than 1600 cubic centimeters may be installed without any support other than that resulting from connecting conduits where two or more rigid metallic conduits enter and accurately position the box. Boxes shall be installed so that they are level, plumb and properly aligned to present a pleasing appearance.

c) Boxes with volumes equal to or greater than 1600 cubic cm, and smaller boxes terminating on less than two rigid metallic conduits or for other reasons not rigidly held, shall be adequately supported by auxiliary steel of standard steel shapes or plates to be fabricated and installed. The Contractor shall perform all drilling, cutting, welding, shimming and bolting required for attachment of supports.

17.0 TESTING AND COMMISSIONING

17.1 An indicative list of tests for testing and commissioning is given below. Contractor shall perform any additional test based on specialities of the items as per the field Q.P./instructions of the equipment Contractor or Owner without any extra cost to the Owner. The Contractor shall arrange all equipments instruments and auxiliaries required for testing and commissioning of equipments alongwith calibration certificates and shall furnish the list of instruments to the Owner for approval.

17.2 **GENERAL CHECKS**

(a) Check for physical damage.

(b) Visual examination of zinc coating/plating.

(c) Check from name plate that all items are as per order/specification.

(d) Check tightness of all bolts, clamps and connecting terminals using torque wrenches.

(e) For oil filled equipment, check for oil leakage, if any. Also check oil level and top up wherever necessary.

(f) Check earth connections for quality of weld and application of zinc rich paint over weld joint of galvanised surfaces.

(g) Check cleanliness of insulator and bushings.

(h) All checks and tests specified by the manufacturers in their drawings and manuals as well as all tests specified in the relevant code of erection.

(i) Check for surface finish of grading rings (Corona control ring).

(j) Pressure test on all pneumatic lines at 18.5 times the rated pressure shall be conducted.

17.3 **STATION EARTHING**

a) Check soil resistivity

b) Check continuity of grid wires

c) Check earth resistance of the entire grid as well as various sections of the same.

d) Check for weld joint and application of zinc rich paint on galvanised surfaces.

e) Dip test on earth conductor prior to use.

17.4 **AAC/ ACSR STRINGING WORK, TUBULAR BUS WORK AND POWER CONNECTORS**

a) Physical check for finish

b) Electrical clearance check

c) Testing of torque by torque wrenches on all bus bar power connectors and other accessories.

d) Millivolt drop test on all power connectors.

e) Sag and tension check on conductors.

17.5 **ALUMINIUM TUBE WELDING**

a) Physical check

b) Millivolt drop test on all joints.

c) Dye penetration test & Radiography test on 10% sample basis on weld joints.

c) Test check on 5% sample joints after cutting the weld piece to observe any voids etc.

17.6 INSULATOR

Visual examination for finish, damage, creepage distance etc.

17.7 All pre/commissioning activities and works work for substation equipment shall be carried out in accordance with owner's ''Pre- Commissioning procedures and formats for substation bay equipments" by the contractor. This document shall be provided to the successful contractor during detailed engineering stage.

ANNEXURE – A

A. SHORT CIRCUIT FORCES AND SPACER SPAN FOR 220 kV GANTRY STRUCTURE

Sl. No.	Max. Span	Conductor Configuration	Ph-Ph Spacing	Normal Tension	SCF per Phase	Spacer span
I.	**For Fault Level of 40 kA for 1 sec.**					
1.	54 mtr	QUAD ACSR	4.5 mtr	4 T	5.00 T	2.5 mtr
2.	54 mtr	TWIN ACSR	4.5 mtr	2 T	3.50 T	2.5 mtr
3.	74 mtr	TWIN ACSR	4.5 mtr	4 T	5.00 T	2.5 mtr
4.	54 mtr	QUAD ACSR	4.0 mtr	4 T	5.70 T	2.5 mtr
5.	54 mtr	TWIN ACSR	4.0 mtr	2 T	3.50 T	2.5 mtr
6.	74 mtr	TWIN ACSR	4.0 mtr	4 T	5.70 T	2.5 mtr
7.	48 mtr	QUAD ACSR	4.0 mtr	4 T	5.30 T	2.5 mtr
8.	52 mtr	QUAD ACSR	4.0 mtr	4 T	5.35 T	2.5 mtr
9.	68 mtr	TWIN ACSR	4.0 mtr	4 T	5.20 T	2.5 mtr
10.	56 mtr	QUAD ACSR	4.0 mtr	4 T	5.50 T	2.5 mtr
11.	72 mtr	TWIN ACSR	4.0 mtr	4 T	5.27 T	2.5 mtr

NOTE: ACSR conductor as mentioned above indicates that it is suitable for ACSR MOOSE conductor.

B. SHORT CIRCUIT FORCES AND SPACER SPAN FOR 132 kV GANTRY STRUCTURE

Sl. No.	Max. Span	Conductor Configuration	Ph-Ph Spacing	Normal Tension	SCF per Phase	Spacer span
I.	**For Fault Level of 31.5kA for 1 sec.**					
1.	36 mtr	Twin Moose/ Zebra ACSR	3 mtr	1 T	2.15 T	2.5 mtr
2.	31.5 mtr	Twin Moose/ Zebra ACSR	2.7mtr	1 T	2.15 T	2.5 mtr
3.	48 mtr	Single Moose/ Zebra ACSR	3 mtr	1 T	2.05 T	NA
4.	42 mtr	Single Moose/ Zebra ACSR	2.7 mtr	1 T	2.03 T	NA

ANNEXURE-B

STANDARD TECHNICAL DATA SHEETS FOR AAC/ACSR CONDUCTORS, GS EARTHWIRE AND ALUMINIUM TUBE

1.0 GENERAL

Owner has stardardised the guaranteed technical particulars for the following AAC/ACSR conductors, Galvanised steel earthwire and aluminum tube. The contractor shall supply the conductors as per the standard GTP mentioned below. Any deviation to the following GTP shall be clearly brought out by the bidder in their bid.

1.1 Guaranteed Technical Particulars (GTP) for conductors:

A. GTP of ACSR MOOSE conductor:

Sl.	Description	Unit	ACSR MOOSE
1.0	**Applicable Standard**	IEC-61089	
2.0	**Raw Materials**		
2.1	Aluminium		
a)	Minimum purity of Aluminium	%	99.50
b)	Maximum copper content	%	0.04
2.2	Steel wires/ rods		
a)	Carbon	%	0.50 to 0.85
b)	Manganese	%	0.50 to 1.10
c)	Phosphorous	%	Not more than 0.035
d)	Sulphur	%	Not more than 0.045
e)	Silicon	%	0.10 to 0.35 (Max.)
2.3	Zinc		
a)	Minimum purity of Zinc	%	99.95
3.0	**Aluminium strands after stranding**		
3.1	Diameter		
a)	Nominal	mm	3.53
b)	Maximum	mm	3.55
c)	Minimum	mm	3.51
3.2	Minimum Breaking load of strand		
a)	Before stranding	KN	1.57
b)	After stranding	KN	1.49
c)	*Maximum D.C. resistance of strand at 20 deg. Centigrade*	*Ohm/ KM*	*2.921*
3.3	Maximum resistance of 1 m length of strand at 20 deg. C	Ohm	0.002921

ANNEXURE-B

Sl.	Description	Unit	ACSR MOOSE
1.0	**Applicable Standard**	IEC-61089	
2.0	**Raw Materials**		
2.1	Aluminium		
4.0	**Steel strand after stranding**		
4.1	Diameter		
a)	Nominal	mm	3.53
b)	Maximum	mm	3.60
c)	Minimum	mm	3.46
4.2	Minimum Breaking load of strand		
a)	Before stranding	KN	12.86
b)	After stranding	KN	12.22
4.3	Galvanising		
a)	Minimum weight of zinc coating per sq.m.	gm	260
b)	Minimum number of dips that the galvanised strand can withstand in the standard preece test	Nos.	2 dips of one minute & 1 dip of half minute
c)	Min. No. of twists in guage length equal 100 times the dia. of wire which the strand can withstand in the torsion test (after stranding)	Nos	16 (After stranding) 18 (Before stranding)
5.0	ACSR Conductor		
5.1.a)	Stranding		Al -54/3.53 mm+ Steel-7/3.53 mm
b)	Number of Strands		
i.	Steel centre	Nos.	1
ii.	1st Steel Layer	Nos.	6
iii.	1st Aluminium Layer	Nos.	12
iv.	2nd Aluminium Layer	Nos.	18
v.	3rd Aluminium Layer	Nos.	24
5.2	Sectional Area of aluminium	Sq. mm	528.50
5.3	Total sectional area	Sq. mm	597.00
5.4	Approximate Weight	Kg/m	2.004
5.5	Diameter of the conductor	mm	31.77
5.6	UTS of the conductor	kN	161.20 (Min.)
5.7	Lay ratio of the conductor	mm	Max Min
a)	Outer Steel layer	mm	18 16

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Sl.	Description	Unit	ACSR MOOSE
1.0	**Applicable Standard**	IEC-61089	
2.0	**Raw Materials**		
2.1	Aluminium		
b)	8/12 wire Aluminium layer	mm	14 12
c)	14/ 18 wire Aluminium layer	mm	13 11
d)	20/24 wire Aluminium layer	mm	12 10
5.8	DC resistance of the conductor at 20°C	ohm/ km	0.05552
5.9	Standard length of the conductor	m	1800
5.10	Tolerance on Standard length	%	(+/-) 5
5.11	Direction of lay of outer layer	-	Right Hand
5.12	Linear mass of the conductor		
a)	Standard	kg/ km	2004
b)	Minimum	kg/ km	1965
c)	Maximum	kg/ km	2045
5.13	Modulus of Elasticity (Final State)	Kg/sq.mm	6860
5.14	Co-efficient of Linear Expansion	Per Deg. C	$19.3x10^{-6}$
5.15	Minimum Corona Extinction Voltage	KV (rms)	320
5.16	RIV at 1 Mhz under dry condition	Micro volts	Max. 1000 at 320 kV (rms)
6.0	**Drum Dimensions**		
a)	Flange Diameter	mm	1800
b)	Traverse width	mm	950
c)	Barrel Diameter	mm	650
d)	Flange thickness	mm	50x50

1.2 Guaranteed technical particulars of Galvanised Steel Earthwire

	Description	Unit	Standard Values
1.0	**Raw Materials**		
1.1	**Steel wires / rods**		
a)	Carbon	%	Not more than 0.55
b)	Manganese	%	0.40 to 0.90
c)	Phosphorous	%	Not more than 0.04

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d)	Sulphur	%	Not more than 0.04
e)	Silicon	%	0.15 to 0.35
1.2	**Zinc**		
a)	Minimum purity of Zinc	%	99.95
2.0	**Steel strands**		
2.1	**Diameter**		
a)	Nominal	mm	3.66
b)	Maximum	mm	3.74
c)	Minimum	mm	3.58
2.2.	**Minimum breaking load of strand**		
a)	After stranding	KN	10.58
2.3	**Galvanising**		
a)	Minimum weight of zinc coating per sq.m. after stranding	gms.	275
b)	Minimum number of dips that the galvanized strand can withstand in the standard preece test	Nos.	3 dips of 1 minute and one dip of ½ minute
c)	Minimum number of twists in a gauge length equal to 100 times diameter of wire which the strand can withstand in the torsion test, after stranding	Nos.	18
3.0	**Stranded Earth wire**		
3.1	**UTS of Earth wire**	KN	68.4 (min.)
3.2	**Lay length of outer steel layer**		
a)	Standard	mm	181
b)	Maximum	mm	198
c)	Minimum	mm	165
3.3	**Maximum DC resistance of earth wire at 20^0 C**	Ohm/km	3.375
3.4	**Standard length of earth wire**	M	2000 or actual quantity whichever is less.
3.5	**Tolerance on standard length**	%	±5
3.6	**Direction of lay for outside layer**		Right hand
3.7	**Linear mass**		
a)	Standard	Kg/km	583
b)	Maximum	Kg/km	552

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c)	Minimum	Kg/km	600
3.8	**Overall diameter**	mm	10.98

1.3 Guaranteed Technical Parameters of Aluminum Tube

A. GTP for 3" IPS & 4" IPS AL. TUBE

Sl. No.	Description	3" AL. TUBE	4" AL. TUBE
1.	Size	3" IPS (EH Type)	4" IPS (EH Type)
2.	Material	Aluminium Alloy 6101 T6 confirms to 63401 WP (range 2) of IS 5082 : 1998/Equivqlent BS standard	
3.	Chemical Composition		
i)	Cu	0.05 Max	
ii)	Mg	0.4 to 0.9	
iii)	Si	0.3 to 0.7	
iv)	Fe	0.5 Max	
v)	Mn	0.03 Max	
Vi)	Al	Remainder	
4.	Outer diameter	88.90 mm	114.2 mm
5.	Tolerance on outer diameter	*+2.2 mm, - 0.0 mm*	*+2.2 mm, - 0.0 mm*
6.	Thickness	7.62 mm	8.51 mm
7.	Tolerance on thickness	*+2.2 mm, - 0.0 mm*	*+2.2 mm, - 0.0 mm*
8.	Cross-sectional area	1945.76 sq.mm	2825.61 sq.mm
9.	Weight	5.25 kg/m	7.7 kg/m
10.	Moment of Inertia	*1621589.99 mm^4*	*3972577.97 mm^4*
11.	Section Modulus	*36481.21 mm^3*	*69572.29 mm^3*
12.	Minimum Ultimate Tensile Strength	20.5 Kg/sq.mm	
13.	Temperature co-efficient of resistance	0.00364 per Deg.C	
14.	Minimum Electrical Conductivity at 20 deg.C	55% of IACS	
15.	Linear Temperature Co-efficient of Expansion (20 Deg.C -200 Deg.C)	0.000023	
16.	Modulus of Elasticity	6700 Kg/sq.mm	
17.	Minimum Elongation on 50 mm	10%	
18.	Thermal Conductivity at 100 Deg.C	0.43 Calories/sec/sq.mm/cm/deg.C	
19.	Minimum 0.2% proof stress	17.34 Kg/sq.mm	
20	Minimum Yield point	17.50 Kg/sq.mm	17.50 Kg/sq.mm
21	Minimum Breaking Strength	20.42 Kg/sq.mm	20.42 Kg/sq.mm

ANNEXURE-C

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1. General

Unless otherwise stipulated, all 220kV & 132kV equipment together with its associated connectors, where applicable, shall be tested for external corona both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and by measurement of radio interference voltage (RIV).

2. Test Levels:

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

3. Test Methods for RIV:

3.1 RIV tests shall be made according to measuring circuit as per International Special-Committee on Radio Interference (CISPR) Publication 16-1(1993) Part -1. The measuring circuit shall preferably be tuned to frequency with 10% of 0.5 Mhz but other frequencies in the range of 0.5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be in microvolts.

3.2 Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107-1964, except otherwise noted herein.

3.3 In measurement of, RIV, temporary additional external corona shielding may be provided. In measurements of RIV only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.

3.4 Ambient noise shall be measured before and after each series of tests to ensure that there is no variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100% and 110% of the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 220 KV is listed in the detailed specification together with maximum permissible RIV level in microvolts.

3.5 The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.

3.6 The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to voltage read by noisel meter.

4. Test Methods for Visible Corona

The purpose of this test is to determine the corona extinction voltage of apparatus, connectors etc. The test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltage, when the test voltage is raised and lowered to determine their precise values.The test voltage shall be raised to 110% of RIV test voltage and maintained there for five minutes. In case corona inception does not take place at 110%, test shall be stopped, otherwise test shall be continued and the voltage will then be decreased slowly until all visible corona disappears. The procedure shall be repeated at least 4

times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purposes of determining compliance with the specification shall be the lowest of the four values at which visible corona (negative or positive polarity) disappears. Photographs with laboratory in complete darkeness shall be taken under test conditions, at all voltage steps i.e. 85%, 100%, and 110%. Additional photographs shall be taken at corona inception and extinction voltages. At least two views shall be photographed in each case using Panchromatic film with an ASA daylight rating of 400 with an exposure of two minutes at a lens aperture of f/5.6 or equivalent. The photographic process shall be such that prints are available for inspection and comparison with conditions as determined from direct observation. Photographs shall be taken from above and below the level of connector so as to show corona on bushing, insulators and all parts of energised connectors. The photographs shall be framed such that test object essentially, fills the frame with no cut-off.

In case corona inception does not take place at 110%, voltage shall not be increased further and corona extinction voltage shall be considered adequate.

4.1 The test shall be recorded on each photograph. Additional photograph shall be taken from each camera position with lights on to show the relative position of test object to facilitate precise corona location from the photographic evidence.

4.2 In addition to photographs of the test object preferably four photographs shall be taken of the complete test assembly showing relative positions of all the test equipment and test objects. These four photographs shall be taken from four points equally spaced around the test arrangement to show its features from all sides. Drawings of the laboratory and test set up locations shall be provided to indicate camera positions and angles. The precise location of camera shall be approved by Purchaser's inspector, after determining the best camera locations by trial energisation of test object at a voltage which results in corona.

4.3 The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.

4.4 However, both test shall be carried out with the same test set up and as little time duration between tests as possible. No modification on treatment of the sample between tests will be allowed. Simultaneous RIV and visible corona extinction voltage testing may be permitted at the discretion of Purchaser's inspector if, in his opinion, it will not prejudice other test.

5. Test Records:

In addition to the information previously mentioned and the requirements specified as per CISPR or NEMA 107-1964 the following data shall be included in test report:

a) Backearth noise before and after test.

b) Detailed procedure of application of test voltage.

c) Measurements of RIV levels expressed in micro volts at each level.

d) Results and observations with regard to location and type of interference sources detected at each step.

e) Test voltage shall be recorded when measured RIV passes through 100 microvolts in each direction.

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f) Onset and extinction of visual corona for each of the four tests required shall be recorded

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STRUCTURE

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SECTION-XVI
STRUCTURE

1.0 GENERAL

The scope of specification covers design, fabrication, trial assembly, supply and erection of galvanized steel structures for towers, girders, lightning masts and equipment support structures. Structures shall be lattice or Pipe type structure fabricated from structural steel conforming to relevant Indian standard Codes (IS Codes)/ equivalent International Standards.

Line diagrams of Towers, girders, Lightning mast, equipment support structures for 220kV structures enclosed with the tender document are for information only. However, **The line diagram of all structures of 220 kV, 132kV and 33 kV for new switch yards shall be prepared by the contractor based on their design during detailed engineering stage**. The fabrication drawing/line diagram of structures for extension of existing switch yards shall be furnished by Employer to the successful bidder progressively during detailed engineering stage. The bidder shall mention in their bid for the type of proposed structure i.e. Pipe or lattice type structure. The fabrication drawings, proto corrected drawings along with Bill of Material (BOM) for all the structures (Both Gantry and Equipment support structures) shall be prepared by the contractor during detailed engineering for submission to Employer for their approval. Support structure for circuit breaker shall also be designed by the Manufacturer/Contractor.

It is the intent of the Employer to provide structures which allow interchangeability of equipments at a later stage. Accordingly, Contractor is expected to design the equipment support structures with the provision of stool. Stools shall be provided by the Contractor between the equipment and its support structure to match the bus bar height. The top of stool shall be connected to the equipment and the bottom of the stool shall be connected to the Base support structure.

The scope shall include supply and erection of all types of structures including bolts, nuts, washers, step bolts, inserts in concrete, gusset plates, equipment mounting bolts, structure earthing bolts, foundation bolts, spring washers, fixing plates, ground mounted marshalling boxes (AC/DC Marshalling box & equipment control cabinets), structure mounted marshalling boxes and any other items as required to complete the job.

The connection of all structures to their foundations shall be with base plates and embedded anchor/foundation bolts. All steel structures and anchor/foundation bolts, fasteners (Nuts,bolts,washers) shall be fully galvanized as per relevant Indian standard Codes (IS Codes) / equivalent International Standards. The weight of the zinc coating shall be at least 610 grams /sq. m for anchor bolts/foundation bolts and for structural members. One additional nut shall be provided below the base plate which may be used for the purpose of leveling.

Contractor shall provide suitable arrangement on the equipment support structures wherever required to suit fixation of accessories such as marshalling boxes, MOM boxes, Control Cabinets, Junction box, surge counter, etc. in the equipment structure fabrication drawings.

2.0 DESIGN REQUIREMENTS FOR STRUCTURES

2.1 For design of steel structures loads such as dead loads, live loads, wind loads etc.

shall be based on relevant Indian standard Codes (IS Codes) / equivalent International Standards.

2.2 For materials and permissible stresses, relevant Indian standard Codes (IS Codes) / equivalent International Standards. Shall be followed in general. However, additional requirements given in following paragraphs shall be also considered.

2.3 Minimum thickness of galvanized lattice structure member shall be as follows:

Members	Min Thickness (mm)
Leg members, Ground wire	5
Peak members\/Main members	5
Other members	4
Redundant members	4

2.4 Maximum slenderness ratios for leg members, other stressed members and redundant members for compression force shall be as per relevant Indian standard Codes (IS Codes) / equivalent International Standards.

2.5 Minimum distance from hole center to edge shall be 1.5 x bolt diameter. Minimum distance between center to center of holes shall be 2.5 x bolt diameter.

2.6 All bolts shall be M16 or higher as per design requirement.

2.7 **Step Bolts**

In order to facilitate inspection and maintenance, the tower structures shall be provided with climbing devices. Each tower shall be provided with M16 step bolts 175mm long spaced not more than 450mm apart, staggered on faces on diagonally opposite legs extending from about 0.5 meters above plinth level to the top of the tower. The step bolt shall conform to relevant Indian standard Codes (IS Codes) / equivalent International Standards. Ladders along with safety guard shall be provided for the Lightning Mast Tower.

2.8 **Design Criteria**

a) All gantry structures shall be designed for the worst combination of dead loads, live loads, wind loads and Seismic forces as per relevant Indian standard Codes (IS Codes) / equivalent International Standards. (latest), loads due to deviation of conductor, load due to unbalanced tension in conductor, torsional load due to unbalanced vertical and horizontal forces, erection loads, short circuit forces including “snatch” in the case of bundled conductors etc. Short circuit forces shall be calculated considering a fault level of 40.0 kA for 220kV, 31.5KA for 132kV and 25KA for 33kV or as applicable. Relevant Indian standard Codes (IS Codes) / equivalent International Standards. May be followed for evaluation of short circuit forces.

b) Switchyard gantry structures shall be designed for the two conditions i.e. normal condition and short circuit condition. In both conditions the design of all structures shall be based on the assumption that stringing is done only on one side i.e. all the three (phase) conductors broken on the other side.
Factor of safety of 2.0 under normal conditions and 1.5 under short circuit condition shall be considered on all external loads for the design of switchyard

structures.

c) Vertical load of half the span of conductors/string and the earth wires on either side of the beam shall be taken into account for the purpose of design. Weight of man with tools shall be considered as 150 kgs. for the design of structures.

d) Terminal/line take off gantries shall be designed for a minimum conductor tension of 2 metric tonnes per phase for 220 kv, 1 Metric tonne per phase for 132 kV and 0.50 Metric Tonne for 33 kV or as per requirements whichever is higher. The distance between terminal gantry and dead end tower shall be taken as 200 meters for 220kV, 150m for 132kV and 80 m for 33 kV switch yard. The design of these terminal gantries shall also be checked considering +/- 30 deg deviation of conductor in both vertical and horizontal planes. For other gantries the structural layout requirements shall be adopted in design.

e) The girders / beams shall be connected with lattice/Tower columns by bolted joints.

f). All equipment support structures shall be designed for the worst combination of dead loads, erection load. Wind load/seismic forces, short circuit forces and operating forces acting on the equipment and associated bus bars as per relevant Indian standard Codes (IS Codes) / equivalent International Standards.

g) If luminaries are proposed to be fixed on gantries/towers, then the proper loading for the same shall be considered while designing. Also holes for fixing the brackets for luminaries should be provided wherever required.

h) Foundation bolts shall be designed for the loads for which the structures are designed.

i) The height of Lightning Mast shall be as per approved structural layout and designed for diagonal wind condition. . The lightning mast shall be provided with platform for mounting of lighting fixtures and a structural steel ladder within its base up to the level of platform. The ladder shall be provided with protection rings The platforms shall also have protection railing. The details of lighting fixtures would be as per approved drawings of electrical fixtures.

3.0 DESIGN, DRAWINGS, BILL OF MATETRIALS AND DOCUMENTS

3.1 The Contractor shall submit design and line diagram of each structure for approval of Employer. Fabrication drawing based on approved line diagram shall be prepared by the contractor for approval of Employer. The BOM (Bill Of Material) shall be prepared by the contractor based on approved fabrication drawing. The Line diagram should indicate not only profile, but section, numbers and sizes of bolts and details of typical joints. In case Employer feels that any design or drawings are to be modified even after its approval, Contractor shall modify the designs & drawings and resubmit the same for approval.

3.2 The fabrication drawings shall indicate complete details of fabrication and erection including all erection splicing details and typical fabrication splicing details, lacing details, weld sizes and lengths. Bolt details and all customary details in accordance with standard structural engineering practice. The fabrication drawing and bill of material based on design/line diagram shall

be submitted to Employer for approval. Approved bill of materials prepared on the basis of fabrication drawing shall be the basis for payment.

3.3 Such approvals shall, however, not relieve the contractor of his responsibility for safety and durability of the structure and good connection and any loss occurring due to defective fabrication, design or workmanship shall be borne by the contractor.

3.4 The contractor shall submit editable soft copy of all designs preferably in Staad / excel form and drawings in AutoCAD to Employer`. The list of Indian standard codes relevant to steel structures have been given in Section-Civil section of technical specification This list is illustrative but not exhaustive. The contractor shall submit the copy of relevant portion of IS codes/equivalent International standard referred to Employer for reference if necessary during detailed engineering stage.

4.0 FABRICATION AND ERECTION

4.1 The fabrication and erection works shall be carried out generally in accordance with relevant Indian standard Codes (IS Codes) / equivalent International Standards. All materials shall be completely shop fabricated and finished with proper connection material and erection marks for ready assembly in the field.

4.2 The component parts shall be assembled in such a manner that they are neither twisted nor otherwise damaged and shall be so prepared that the specified camber, if any, is provided. In order to minimize distortion in member the component parts shall be positioned by using the clamps, clips, dogs, jigs and other suitable means and fasteners (bolts and welds) shall be placed in a balanced pattern. If the individual components are to be bolted, paralleled and tapered drifts shall be used to align the part so that the bolts can be accurately positioned.

4.3 Sample towers, beams and lightning masts and equipment support structures may be trial assembled in the fabrication shop to ensure fitment of various members and to avoid problems during erection.

4.4 For all structures, BOM along with fabrication drawings in hard and editable soft copies shall be submitted to Employer `as document for information. The responsibility of correctness of such fabrication drawing and BOM shall be fully with the contractor.

4.5 Approval of fabrication drawings and BOM shall, however, not relieve the Contractor of his responsibility for the safety and durability of the structure and good connections and any loss or damage occurring due to defective fabrication, design or workmanship shall be borne by the Contractor.

4.6 The Contractor should arrange on his own all plant and equipment, welding set, tools and tackles, scaffolding, trestles equipments and all other accessories and ancillaries required for carrying out erection without causing any stresses in the members which may cause deformation and permanent damage. Minor modification if any, required during erection shall be done at site with the approval of Employer.

5.0 BOLTING

i) Every bolt shall be provided with a washer under the nut so that no part of the threaded portion of the bolt is within the thickness of the parts bolted together.

ii) In case of fasteners, the galvanizing shall confirm to relevant Indian standard Codes (IS Codes) / equivalent International Standards. The spring washer shall be electro galvanized as per relevant Indian standard Codes (IS Codes) / equivalent International Standards.

6.0 WELDING

The work shall be done as per approved fabrication drawings which shall clearly indicate various details of joints to be welded, type of weld, length and size of weld, Symbols for welding on erection and shop drawings shall be according to relevant Indian standard Codes (IS Codes) / equivalent International Standards. Welding shall be carried out in accordance to relevant Indian standard Codes (IS Codes) / equivalent International Standards.

7.0 FOUNDATION BOLTS

7.1 Foundation bolts for the towers and equipment supporting structures and elsewhere shall be embedded in first stage concrete while the foundation is cast. The Contractor shall ensure the proper alignment of these bolts to match the holes in the base plate.

7.2 The Contractor shall be responsible for the correct alignment and leveling of all steel work on site to ensure that the towers/structures are plumb.

7.3 All foundation bolts for lattice structure, pipe structure are to be supplied by the Contractor.

7.4 All foundation bolts shall be fully galvanised so as to achieve minimum 610 grams Per Sq.m. of Zinc Coating as per relevant Indian standard Codes (IS Codes) / equivalent International Standards.

7.5 All foundation bolts and its material shall conform to relevant Indian standard Codes (IS Codes) / equivalent International Standards. All foundation bolts shall be provided with two number standard nuts, one check nut, one plain washer and MS plate at the bottom of foundation bolt.

8.0 STABILITY OF STRUCTURE

The Supplier shall be responsible for the stability of the structure at all stages of its erection at site and shall take all necessary measures by the additions of temporary bracings and guying to ensure adequate resistance to wind and also to loads due to erection equipment and their operations.

9.0 GROUTING

The method of grouting the column bases shall be subject to approval of Employer and shall be such as to ensure a complete uniformity of contact over the whole area of the steel base. No additional payment for grouting shall be admissible.

10.0 GALVANISING

10.1 All structural steel works (Gantry structures, Equipment support structures) and foundation bolts shall be galvanized after fabrication. The galvanization shall be done as per requirement relevant Indian standard Codes (IS Codes) / equivalent International Standards.

10.2 Zinc required for galvanizing shall have to be arranged by the Contractor/manufacturer. Purity of zinc to be used shall be 99.95% as per relevant Indian standard Codes (IS Codes) / equivalent International Standards.

10.3 The Contractor shall be required to make arrangement for frequent inspection by the owner as well as continuous inspection by a resident representative of the owner, if so desired for fabrication work.

11.0 TOUCH-UP PAINTING

Minor defects in hot dip galvanized members shall be repaired by applying zinc rich primer and two coats of enamel paint to the satisfaction of Employer before erection.

12.0 INSPECTION BEFORE DISPATCH

Each part of the fabricated steel work shall be inspected as per approved quality plans and certified by Employer or his authorized representative as satisfactory before it is dispatched to the erection site. Such certification shall not relieve the Contractor of his responsibility regarding adequacy and completeness of fabrication.

13.0 TEST CERTIFICATE

Copies of all test certificates relating to material procured by the Contractor for the works shall be submitted to Employer.

14.0 MODE OF MEASUREMENT

The measurement of the structure, fasteners (Nuts, Bolts, and Washers) and foundation bolts including its nuts washers and MS Plate at bottom shall be done as per Bid price schedule (BPS). The weight of all structural members, fasteners, step bolts and foundation bolts (Bolt, Nuts, washer and MS steel plates welded at bottom of bolt) shall be measured under one head in Metric Tonne.

15.0 SAFETY PRECAUTIONS

The Contractor shall strictly follow all precautions at all stages of fabrication, transportation and erection of steel structures. The stipulations contained in relevant Indian standard Codes (IS Codes) / equivalent International Standards. for Safety during erection of structural steel work shall also be adhered to.

16.0 MANUFACTURING QUALITY PLAN

The material specification shall also be as per relevant Indian standard Codes (IS Codes) / equivalent International Standards.

The Contractor shall prepare the manufacturing quality plan to accept/check the

material, galvanization and welding as per relevant international standards/IS codes within 1 month after award of work and submit the same to Employer for approval.

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SECTION-XVII
CIVIL WORKS

1.0 GENERAL

The intent of specification covers the following:

Design, engineering, drawing and construction of all civil works at sub-station. All civil works shall also satisfy the general technical requirements specified in other Sections of Specification and as detailed below. They shall be designed to the required service conditions/loads as specified elsewhere in this Specification or implied as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

All civil works shall be carried out as per applicable Standards and Codes. All materials shall be of best quality conforming to relevant national/International Standards and Codes. In case of any conflict between Standards/ Code and Technical Specification, the order of precedence shall be as under:

1.0.1 Technical specification,
1.0.2 BIS codes
1.0.3 CPWD specification.

The decision of engineer in charge in this regard shall be final and binding.

The Contractor shall furnish all design, drawings, labour, tools, equipment, materials, temporary works, constructional plant and machinery, fuel supply, transportation and all other incidental items not shown or specified but as may be required for complete performance of the Works in accordance with approved drawings, specifications and direction of Employer.

The work shall be carried out according to the design/drawings to be developed by the Contractor and approved by the Employer. For all buildings, structures, foundations etc. necessary layout and details shall be developed by the Contractor keeping in view the functional requirement of the substation facilities and providing enough space and access for operation, use and maintenance. Certain minimum requirements are indicated in this specification for guidance purposes only. However, the Contractor shall quote according to the complete requirements.

2.0 GEOTECHNICAL INVESTIGATION

The Contractor shall perform a detailed soil investigation to arrive at sufficiently accurate, general as well as specific information about the soil profile and the necessary soil parameters of the Site in order that the foundation of the various structures can be designed and constructed safely and rationally.

A detailed soil report including field data duly certified by site engineers of Employer will be submitted by the Contractor for specific approval of Employer**.** The report shall contain all soil parameters along with recommendation of soil consultant for type of foundation i.e. pile or open type, soil treatment if any etc. to be used for the design of civil foundations.

The Contractor may visit the site to ascertain the soil parameters. Any variation in soil data shall not constitute a valid reason for any additional cost & shall not affect the terms & conditions of the

contract. Field tests must be conducted covering entire substation area including all the critical locations i.e. Control Room Building, Lightning Mast. Towers, transformer/Reactor etc.

2.1 SCOPE OF WORK

This specification covers all the work required for detailed soil investigation and preparation of a detailed report. The work shall include mobilisation of necessary equipment, providing necessary engineering supervision and technical personnel, skilled and unskilled labour etc. as required to carry out field investigation as well as, laboratory investigation, analysis and interpretation of data and results, preparation of detailed Geo-technical report including specific recommendations for the type of foundations and the allowable safe bearing capacity for different sizes of foundations at different founding strata for the various structures of the substation. The Contractor shall make his own arrangement for locating the co-ordinates and various test positions in field as per the information supplied to him and also for determining the reduced level of these locations with respect to the benchmark indicated by the Employer.

All the work shall be carried out as per latest edition of the corresponding relevant Indian standard codes (I S Codes)/ equivalent International Standards. The Agency carrying out the soil investigation work must have the experience of carrying out soil investigation successfully in the relevant field. /RECTPCL/PDD, J&K shall assess the capability of the agency for soil investigation before commencement of soil investigation work.

2.1.1 Bore Holes

Bore holes of Minimum 150 mm diameter in accordance with the provisions of relevant international standards/Indian standards(IS) at the rate of minimum one number bore hole per hectare up to 25 meter depth(Minimum) or to refusal which ever occur earlier shall be drilled for new areas (220 kV Yards and 220/132/33 kV yards wherever applicable). In any case number of boreholes shall not be less than five. By refusal it shall mean that a standard penetration blow count (N) of 100 is recorded for 30 cm penetration. Number of boreholes may be increased in case soil strata are varying from borehole to borehole in order to have fair idea of soil profile. In case of deep pile foundations soil investigation is to be carried out up to 30 m depth from ground level or refusal whichever is earlier. In case rock is encountered, coring in all the boreholes shall be carried out up to 3 meter in rock.

Performing Standard Penetration Tests at approximately 0.5 m interval in the borehole starting from 0.5 m below ground level onwards and at every change of stratum. The disturbed samples from the standard penetrometer shall also be collected for necessary tests. Standard Penetration Test shall be performed as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

Undisturbed samples shall be collected in accordance with the recommendation of relevant Indian standard codes (I S Codes)/ equivalent International Standards. Or an alternative recognize method as agreed by Employer. Undisturbed samples shall be taken in cohesive material or weak cemented granular material where ever possible at 1.0 m interval or at each change in stratum.

The depth of Water Table, if encountered, shall be recorded in each borehole. In case the soil investigation is carried out in winter/summer, the water table for rainy season shall be collected from reliable sources and recorded in the report.

All samples, both disturbed and undisturbed, shall be identified properly with the borehole number and depth from which they have been taken.

The sample shall be sealed at both ends of the sampling tubes with wax immediately after the sampling and shall be packed properly and transported to the Contractor's laboratory without any damage or loss.

The logging of the boreholes shall be compiled immediately after the boring is completed and a copy of the bore log shall be handed over to the Executive Engineer-in-charge.

2.1.2 **Trial Pits**

Trial pits shall be carried out at minimum one location per hectare as directed by the Employer. In case hard rock is encountered in trial pit, test need not be carried out. Total area of substation plot (including of Switchyard, Township and Future area) shall be considered for arriving at number of Trial Pit to be excavated. Minimum number of trial pits shall be five and maximum number shall be ten. The trial pits shall be 2 m x 2 m in size extending to 4 m depths, or as specified by the Employer. Undisturbed samples shall be taken from the trial pits as per the direction of the Employer.

2.1.3 **Electrical Resistivity Test**

This test shall be conducted to determine the Electrical resistivity of soil required for designing safety-grounding system for the entire station area. The specifications for the equipment's and other accessories required for performing electrical resistivity test, the test procedure, and reporting of field observations shall confirm to relevant Indian standard codes (I S: 3043)/ equivalent International Standards. The test shall be conducted using Wagner's four electrode method as specified in relevant Indian standard codes (IS: 1892)/ equivalent International Standards. Unless otherwise specified at each test location, the test shall be conducted along two perpendicular lines parallel to the coordinate axis. On each line a minimum of 8 to 10 readings shall be taken by changing the spacing of the electrodes from an initial small value of 0.2 m up to a distance of 50.0 m.

2.1.4 **Plate load test**

Two number of Plate load tests shall be conducted each at the location of control room building and Substation area as applicable only to determine the bearing capacity, modulus of sub grade reaction and load/settlement characteristics of soil at shallow depths by loading a plane and level steel plate kept at the desired depth and measuring the settlement under different loads, until a desired settlement takes place or failure occurs. The specification for the equipment and accessories required for conducting the test, the test procedure, field observations and reporting of results shall conform to relevant IS:1888. Plate load test shall be performed at the proposed foundation depth below finished ground level for bearing capacity.

Undisturbed tube samples shall also be collected from the pit at 0.5 m depth and bottom of pit from natural ground level for carrying out laboratory tests.

The size of the pit in plate load test shall not be less than five times the plate size and shall be taken up to the specified depth. All provisions regarding excavation and visual examination of pit shall apply here.

Unless otherwise specified the reaction method of loading shall be adopted. Settlement shall be recorded from dial gauges placed at four diametrically opposite ends of the test plate.

The load shall be increased in stages. Under each loading stage, record of Time vs. Settlement shall be kept as specified in relevant Indian standard codes (I S: 1888)/ equivalent International Standards.
Backfilling of the pit shall be carried out as per the directions of the Employer**.** Unless otherwise specified the excavated soil shall be used for this purpose. In cases of gravel-boulder or rocky strata, respective relevant codes shall be followed for tests.

2.1.5 **Water Sample**

Representative samples of ground water shall be taken when ground water is first encountered before the addition of water to aid drilling of boreholes. The samples shall be of sufficient quantity for chemical analysis to be carried out and shall be stored in air-tight containers.

2.1.6 **Back Filling of Bore Holes**

On completion of each hole, the Contractor shall backfill all bore holes as directed by the Employer. The backfill material can be the excavated material.

2.1.7 **Laboratory Test**

The laboratory tests shall be carried out progressively during the field work after sufficient number of samples has reached the laboratory in order that the test results of the initial bore holes can be made use of in planning the later stages of the field investigation and quantum of laboratory tests.

All samples brought from field, whether disturbed or undisturbed shall be extracted/prepared and examined by competent technical personnel, and the test shall be carried out as per the procedures laid out in the relevant Indian standard codes (I S Codes)/ equivalent International Standards.

The following laboratory tests shall be carried out

a) Visual and Engineering Classification
b) Liquid limit, plastic limit and Shrinkage limits for C-Φ soils.
c) Natural moisture content, bulk density and specific gravity.
d) Grain size distribution analysis.
e) Swell pressure and free swell index determination.
f) California bearing ratio.
g) Consolidated drained test with pore pressure measurement.
h) Chemical tests on soil and water to determine the carbonates, sulphates, nitrates, chlorides, Ph value, and organic matter and any other chemical harmful to the concrete foundation.
i) In case rock is encountered, the soil test required for rock as per relevant Indian standard codes (I S Codes)/ equivalent International Standards including following tests shall also be conducted.
(i) UCC test.

(ii) Point load index test.
(iii) RQD / RMR tests shall be carried out in case of Rocky Strata.

2.1.8 **Test Results and Reports**

The Contractor shall submit the detailed report in two (2) copies wherein information regarding the geological detail of the site, summarised observations and test data, bore logs, and conclusions and recommendations on the type of foundations with supporting calculations for the recommendations. The contractor shall also submit the bearing capacity calculation in editable soft copy to Employer. Initially the contractor shall submit draft report and after the draft report is approved, the final report in four (4) copies shall be submitted. The field and laboratory test data shall bear the signatures of the Investigation Agency, Contractor and also site representative of Employer.

The report shall include, but not limited to the following: -

a) A plan showing the locations of the exploration work i.e. bore holes, trial pits. Plate load test, electrical resistivity test, CBR sample location etc.

b) **Bore Logs:** Bore logs of each bore holes clearly identifying the stratification and the type of soil stratum with depth. The values of Standard Penetration Test (SPT) at the depths where the tests were conducted on the samples collected at various depths shall be clearly shown against that particular stratum.

Test results of field and laboratory tests shall be summarised strata wise as well in combined tabular form. All relevant graphs, charts tables, diagrams and photographs, if any, shall be submitted along with report. Sample illustrative reference calculations for settlement, bearing capacity, pile capacity shall be enclosed.

Recommendations:

The report should contain specific recommendations for the type of foundation for the various structures envisaged at site. The Contractor shall acquaint himself about the type of structures and their functions from the Employer. The observations and recommendations shall include but not limited to the following:

a) Geological formation of the area, past observations or historical data, if available, for the area and for the structures in the nearby area, fluctuations of water table etc.
b) Recommended type of foundations for various structures. If piles are recommended the type, size and capacity of pile and groups of piles shall be given after comparing different types and sizes of piles and pile groups.
c) Allowable bearing pressure on the soil at various depths for different sizes of the foundations based on shear strength and settlement characteristics of soil with supporting calculations. Minimum factor of safety for calculating net safe bearing capacity shall be taken as 2.5 (Two & Half). Recommendation of liquefaction characteristics of soil if applicable shall be provided.
d) Recommendations regarding slope of excavations and dewatering schemes, if required.
e) Comments on the Chemical nature of soil and ground water with due regard to deleterious effects of the same on concrete and steel and recommendations for protective measures.

f) If expansive soil is met with, recommendations on removal or detainment of the same under the structure, road, drains, etc. and thickness of treatment shall be given. In the latter case detailed specification of any special treatment required including specification or materials to be used, construction method, equipment's to be deployed etc. shall be furnished. Illustrative diagram of a symbolic foundation showing details shall be furnished.

g) Recommendations for additional investigations beyond the scope of the present work, if considered such investigation as necessary.

f) In case of foundation in rocky strata, type of foundation and recommendation regarding rock anchoring etc. should also be given.

g) Geological Investigation reports shall be signed and stamped by qualified Geotechnical engineers.

3.0 CONTOUR SURVEY, SITE LEVELLING

3.1 CONTOUR SURVEY & SITE LEVELLING:

The land for construction of substation will be handed over to the successful bidder as on where basis progressively after award of work. The contractor shall carry out survey work by taking spot level at 05 m x 05 m grid interval with respect to temporary bench mark transferred from permanent bench mark in the locality if available either on bridge, government buildings of local authorities or any other permanent structure. The contractor shall submit the spot levels (in grid format) in editable soft copy in excel format and contour map with contour interval of 0.5 m in editable auto cad soft drawing.

The contractor will level the area required for construction of substation work either at single level, multi-level or gradual slope with the finished ground level as approved by Employer during detailed engineering based on highest flood level. The levelling area shall be decided by Employer during detailed Engineering stage.

The layout and levels of all structure etc. shall be made by the Contractor at his own cost from the general grids of the plot and benchmarks set by the Contractor and approved by Employer. The Contractor shall provide all assistance in instruments, materials and personnel to Employer for checking the detailed layout and shall be solely responsible for the correctness of the layout and levels.

3.2 SCOPE

This clause covers clearance of site, contour survey, site levelling, maintaining finished ground level by cutting/filling in all types of soil and soft/ disintegrated rock, supplying and compaction of fill material if required. Cutting/felling of trees and their disposal has not been envisaged under the present scope.

3.3 GENERAL

Site shall be cleared, surveyed and levelled/sloped by the contractor as per approved general arrangement drawing or levelling area decided during detailed engineering after award of work.

Work covered under this clause comprises the site clearance, survey work/setting out and making profiles (preparation of plot plan, setting up Bench Mark and taking spot levels at 05m x 05 m interval, preparation of contour plan with contour interval of 0.50 m), Earth work in Excavation & filling in

specified area with all lifts and leads and earth work in filling with borrowed earth with all leads and lifts (Borrow areas including payment of royalty for borrowed earth shall be arranged by the contractor at his own cost). During detailed engineering stage, the contractor will prepare the levelling proposal for optimum levelling and submit to Employer for approval. Contractor shall submit the hard copy and editable soft copy of levelling proposal (levelling quantity calculation in Excel form and levelling drawing in Auto CAD) to Employer for approval.

Filling material shall conform to relevant Indian standard codes (IS Codes)/ equivalent International Standards. Unsuitable filling material if any shall be removed and replaced by suitable fill material. The filling shall be compacted in layers to achieve 95% of standard Proctor's density at Optimum moisture contents (OMC). Cohesion less material shall be compacted to 70% relative density (minimum). Levelling/Filling shall be carried out as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

All materials involved in excavation shall be classified by Employer in the following groups:

All kinds of soils and soft/disintegrated rocks (Not requiring blasting):

The Soil Type I.e. Normal Soil or Soft/disintegrated Rock shall be identified as per soil investigation report and actual site conditions.

The material which can be quarried/excavated with pick, shovel, jumpers, scarifies, crowbars and mechanical implements and will include various types of soils, plain cement concrete, shingle, river/nallah boulders, soling of road/foot path, stone masonry, soft conglomerate and laterite stone, lime stone and hard conglomerate etc.

Hard Rocks: All kinds of rocks which can only be excavated by machines and requires blasting, chiselling in edging or in another agreed method and will also include reinforcement cement concrete.

The quantity of excavation in all types of soils and soft/disintegrated rock shall be worked out by using initial and final level and no void deduction shall be made to calculate net quantity of earth work with 95% compaction.
The volume of hard rock shall be computed on the basis of stack of excavated rubble after making 50 % deduction for voids.

The surface of excavation or filling shall be neatly dressed to the required formation level with tolerance of (±) 100 mm.

4.0 SITE PREPERATION, EXCAVATION, BACKFILL & DISPOSAL OF SURPLUS EARTH.

4.1 SITE PREPERATION

The layout and levels of all structure etc. shall be made by the Contractor at his own cost from the general grids of the plot and benchmarks set by the Contractor and approved by the Employer. The Contractor shall give all help in instruments, materials and personnel to the Employer for checking the detailed layout and shall be solely responsible for the correctness of the layout and levels.

4.2 **SCOPE**

This clause covers clearing of the site, maintaining the finished ground level with available surplus excavated suitable back fill material generated from foundation works etc.

4.3 **GENERAL**

1) The Contractor shall develop the site area to meet the requirement of the intended purpose. The site preparation shall conform to the requirements of relevant sections of this specification or as per stipulations of relevant Indian standard codes (I S Codes)/ equivalent International Standards.

2) The fill material shall be suitable for the above requirement. The fill shall be with such a material that the site so designed shall not be affected by erosion from wind and water from its final compacted position or the in-situ position of undisturbed soil.

3) Material unsuitable for founding of foundations shall be removed and replaced by suitable fill material to be approved by the Employer.

4) Backfill material around foundations or other works shall be suitable for the purpose for which it is used and compacted to the density described under Compaction. Excavated material not suitable or not required for backfill shall be disposed off in areas as directed by purchaser up to a maximum lead of 2 km.

4.4 **EXCAVATION AND BACKFILL**

SCOPE

This clause covers excavation for foundation works of Towers, Equipment support structures, Transformer/Reactor foundations, External Lighting poles, Cable trenches, Buildings, Car parking shed, Fire Wall, DG set, Water tanks, etc. backfilling of Foundations Works.

1. Excavation and backfill for foundations shall be in accordance with the relevant Indian standard codes (I S Codes)/ equivalent International Standards.

2. Whenever water table is met during the excavation, it shall be dewatered and water table shall be maintained below the bottom of the excavation level during excavation, concreting and backfilling.

3. When embankments are to be constructed on slopes of 15% or greater, benches or steps with horizontal and vertical faces shall be cut in the original slope prior to placement of embankment material. Vertical faces shall measure not more than 1 m in height.

4. Embankments adjacent to abutments, culverts, retaining walls and similar structures shall be constructed by compacting the material in successive uniform horizontal layers not exceeding 15 cm in thickness. (of loose material before compaction). Each layer shall be compacted as required by means of mechanical tampers approved by the Purchaser. Rocks larger than 10 cm in any direction shall not be placed in embankment adjacent to structures.

5. Earth embankments of roadways and site areas adjacent to buildings shall be placed in successive uniform horizontal layers not exceeding 20 cm in thickness in loose stage measurement and compacted to the full width specified. The upper surface of the embankment shall be shaped so as to provide complete drainage of surface water at all times.

4.5 **COMPACTION**

1. The density to which fill materials shall be compacted shall be as per relevant IS and as per direction of Employer. All compacted sand filling shall be confined as far as practicable. Backfilled earth shall be compacted to minimum 95% of the Standard Proctor's density at OMC. The sub grade for the roads and embankment filling shall be compacted to minimum 95% of the Standard Proctor's density at OMC. Cohesion less material sub grade shall be compacted to 70% relative density (minimum).

2. At all times unfinished construction shall have adequate drainage upon completion of the road's surface course, adjacent shoulders shall be given a final shaping, true alignment and grade.

3. Each layer of earth embankment when compacted shall be as close to optimum moisture content as practicable. Embankment material which does not contain sufficient moisture to obtain proper compaction shall be wetted. If the material contains any excess moisture, then it shall be allowed to dry before rolling. The rolling shall begin at the edges overlapping half the width of the roller each time and progress to the centre of the road or towards the building as applicable. Rolling will also be required on rock fills. No compaction shall be carried out in rainy weather.

4.6 **REQUIREMENT FOR FILL MATERIAL UNDER FOUNDATION**

The thickness of fill material under the foundations shall be such that the maximum pressure from the footing, transferred through the fill material and distributed onto the original undisturbed soil will not exceed the allowable soil bearing pressure of the original undisturbed soil. For expansive soils, the fill materials and other protections etc. to be used under the foundation is to be got approved by the Employer.

4.7 **DISPOSAL OF SURPLUS EARTH**

The surplus earth generated from foundation work shall be disposed away from levelling area boundary at low lying areas within 2Km lead. The surplus earth if disposed within substation main boundary, the same shall be spread in uniform layers and compacted with suitable compacting equipment to achieve 95% compaction at O.M.C.

5.0 STONE SPREADING AND ANTI-WEED TREATMENT

The layout of the area, where anti-weed treatment and stone spreading is to be done, shall be developed by the Contractor during detailed engineering and the same shall be submitted to the employer for approval. The Contractor shall arrange all labour, equipment and materials required for complete performance of the work in accordance with the drawings, specification and direction of the Employer.

Stone spreading over cement concrete layer shall be done in the areas of the switchyard under present scope of work. The cement concrete layer shall also be provided in future areas within the fenced area. However, the stone spreading in future areas shall be provided in case step potential

without stone layer is not well within safe limits.

The material required for site surfacing/stone filling shall be free from all types of organic materials and shall be of standard quality, and as approved by the Employer.

The material to be used for stone filling/site surfacing shall be stone aggregate of 40mm nominal size (ungraded single size) conforming to Table 2 of IS:383 – 1970. Hardness, flakiness shall be as required for wearing courses are given below:

i) Sieve Analysis limits (Gradation) (IS : 383 – Table – 2)

Sieve Size	% passing by weight
63mm	**100**
40mm	**85-100**
20mm	**0-20**
10mm	**0-5**

ii) Hardness: Abrasion value (IS:2386 Part-IV) – not more than 40% Impact value (IS: 2386 Part-IV) – not more than 30%.

iii) Flakiness Index: As per IS: 2386 Part – I maximum value is 25%.

iv) Frequency of test shall be conducted for sieve analysis, Hardness & Flakiness index as per latest SFQP available on POWERGRID website.

After all the structures/equipments are erected, antiweed treatment shall be applied in the switchyard where ever cement concrete is to be done and the area shall be thoroughly de-weeded including removal of roots. The recommendation of local agriculture or horticulture department may be sought where ever feasible while choosing the type of chemical to be used.

The antiweed chemical shall be procured from reputed manufacturers. The doses and application of chemical shall be strictly done as per manufacturer's recommendation. Nevertheless, the effectiveness of the chemical shall be demonstrated by the Contractor in a test area of 10MX10M (appx) and shall be sprinkled with water at least once in the afternoon every day after forty-eight hours of application of chemical. The treated area shall be monitored over a period of two to three weeks for any growth of weeds by the Engineer – in- charge. The final approval shall be given by Engineer – in –charge based on the results.

Engineer-in-charge shall decide final formation level so as to ensure that the site appears uniform devoid of undulations. The final formation level shall however be very close to the formation level indicated in the approved drawing.

After antiweed treatment is complete, the surface of the switchyard area shall be maintained, rolled/compacted to the lines and grades as decided by Engineer-in-charge. The sub grade shall be consolidated by using half ton roller/surface vibrator with suitable water sprinkling arrangement to form a smooth and compact surface. The roller shall run over the sub grade till the soil is evenly and densely consolidated and behaves as an elastic mass.

In areas that are considered by the Engineer-in-Charge to be too congested with foundations and structures for proper rolling of the site surfacing material by normal rolling equipments, the material shall be compacted by hand rammer, if necessary. Due care shall be exercised so as not to damage any foundation structures or equipment during rolling / compaction.

The sub grade shall be in moist condition at the time the cement concrete is placed. If necessary, it should be saturated with water for not less than 6 hours but not exceeding 20 hours before placing of cement concrete. If it becomes dry prior to the actual placing of cement concrete, it shall be sprinkled with water and it shall be ensured that no pools of water or soft patches are formed on the surface.

Over the prepared sub grade, 75mm thick base layer of cement concrete in 1:5:10 (1 cement: 5 fine aggregate: 10 stone aggregate 40mm nominal size) shall be provided in the area excluding roads, drains, cable trenches as per detailed engineering drawing. The Contractor shall have option to use graded stone aggregate 40mm nominal size in place of brick aggregate without any extra cost to employer. For easy drainage of water, the slope of 1:1000 is to be provided from the ridge to the nearest drain.

The ridge shall be suitably located at the centre of the area between the nearest drains. The above slope shall be provided at the top of base layer of cement concrete in 1:5:10. A layer of cement slurry of mix 1:6 (1cement: 6 fine aggregate) shall be laid uniformly over cement concrete layer. The cement consumption for cement slurry shall not be less than 150 kg for every 100 sq.m.

A final layer of 100mm thickness of stone aggregate of 40mm nominal size (conforming to relevant clause) shall be spread uniformly over cement concrete layer after curing is complete.

6.0 SITE DRAINAGE

Preparation of overall drainage layout, design, drawing and providing rain water drainage system within the substation boundary under the present scope including connection at one or more points to the outfall point located outside the substation boundary wall is in the scope of contractor. Invert level of drainage system at outfall point shall be decided in such a way that the water can easily be discharged outside the substation boundary wall. In case outfall point is more than 50M away from boundary wall, only 50 metre drain outside the boundary wall is in the scope of contractor. Outfall point shall be got approved from Employer before commencement of construction. While designing the drainage system following points shall be taken care of:

(a) The surface of the switchyard shall be sloped to prevent accumulation of water.
(b) Drain shall be constructed at suitable locations in such a way that substation is not flooded and roads are not affected with ponding of surface water. In the switchyard maximum spacing between two drains shall not be more than 100 meters. It will be ensured that no area is left undrained.
(c) The typical construction drawing for the section of drain is enclosed with the tender documents.
(d) Longitudinal slope shall not be less than 1 in 1000.
(e) The maximum velocity for pipe drains and open drains shall be limited to 2.4m/sec and 1.8m/sec respectively. However, minimum non-silting velocity of 0.6m/sec shall be ensured.
(f) Pipe drains shall be provided in areas of switchyard where movement of crane will be necessary in operating phase of the substation.

(g) For pipe drains, concrete pipe of class NP2 shall be used. However, for road crossings etc. higher strength pipe of class NP3 shall be provided. For rail crossings, RCC pipes of class NP4 shall be provided. For design of RCC pipes for drains and culverts, relevant Indian standard codes (I S Codes)/ equivalent International Standards. shall be followed.

(h) Two Nos. of portable pumps of 3 / 5 HP capacity for drainage of water shall be provided by the Contractor.

(i) Pipe drains shall be connected through manholes at an interval of max. 30m.

(j) If the invert level of outfall point is above the last drain point in the substation boundary, sump of suitable size has to be constructed with in the substation boundary.

(k) The drainage scheme and associated drawings shall be got approved from Employer before commencement of construction.

6.1 **RAINWATER HARVESTING:**

In addition to drainage of rainwater, the Contractor shall make arrangement for rainwater harvesting also. A drawing showing details of recharge structure for rainwater harvesting is enclosed with tender document and is also available on RECTPCL website.

Rainwater harvesting shall be done by providing recharge structures with bore wells. The contractor shall propose location of recharge structures within the sub-station considering the site conditions which is to be approved by RECTPCL before execution. Branch drains from the main drain carrying rainwater from entire switchyard shall be connected to the recharge structures.

7.0 ROADS

The typical construction drawings showing section detail for road, culverts as well as rail cum road are enclosed with the tender documents. The layout of roads shall be as per approved general arrangement drawing. Types of the roads in the scope of contract shall be either of RCC or as indicated in the GA drawing or in Bid Price Schedule.

The width of the road shall be either 5.5m wide or 3.75m as indicated in the GA drawing. Type of pavement either rigid pavement (RCC Road) or shall be as per tender documents.

The type & location of culverts i.e. the number and diameter of Hume pipes shall be as decided during detailed engineering. The invert level of Hume pipes of culverts shall match with the invert level of drain meeting the culvert.

100mm diameter RCC Hume pipe (NP-3) shall be provided across the road at every 100M interval along the road. In case NP3 pipe is not available, vendor may provide 100 dia UPVC pipe encased with 75 mm thick. concrete 1:2:4 all-round without any financial implication to RECTPCL.

Road within the switchyard area should have shoulder of 600mm wide on either side of road. Shoulder shall be smooth finished with well compacted 75mm thick PCC 1:4:8. The road leading to control room building and the roads outside switchyard fence area shall be provided with kerb stone and interlocking tiles on shoulder. Width of shoulder shall be 1.75m in case of 5.5m wide road and 1.3m in case of 3.75m wide road.

The shoulder of the road in case of substation extension shall match with the shoulder of the existing road in all respect.

Road leading towards the area of Autotransformer/Reactor shall be as short as possible. Road layouts shall be prepared with adequate turning radius, so that easy movement of vehicles is possible. Roads which are to be used for carrying transformers / reactors shall be provided with turning radius preferably 19.5M or more but not less than 16.5M. Turning radius of other roads may be decided at site depending on layout constraints

Contractor may use WMM instead of WBM with prior approval of employer without any additional financial implication to RECTPCL. Guidelines of IRC: 109-1997 shall be followed for Wet Mix Macadam (WMM) only. However, measurement of road shall be done as specified elsewhere in this specification.

In case of rigid pavements, RCC shall be laid and finished with screed board, vibration, vacuum dewatering process etc.

8.0 TRANSFORMERS/REACTOR FOUNDATION, RAIL TRACK/ RAIL CUM ROAD TRACK

The foundations of Transformer & Reactor shall be of block type foundation. Minimum reinforcement shall be governed by IS: 2974 and IS: 456. In case of Reactor Plan dimension of block should not be less than size of base of reactor.

The Contractor shall provide an RCC Rail cum road system integrated with the Autotransformer / Reactor foundation to enable installation and the replacement of any failed unit. The transfer track system shall be suitable to permit the movement of any failed unit fully assembled (including OLTC, bushings) with oil.

This system shall enable the removal of any failed unit from its foundation to the nearest road. If trench/drain crossings are required then suitable R.C.C. culverts shall be provided in accordance with I.R.C. standard / relevant IS.

The Contractor shall provide a pylon support system for supporting the firefighting system.

Each Autotransformer/Reactor including oil conservator tank and cooler banks etc. shall be placed in a self-sufficient pit surrounded by retaining walls (Pit walls). The clear distance of the retaining wall of the pit from the Autotransformer/Reactor shall be 20% of the Autotransformer/Reactor/ cooler bank height or 0.8m whichever is higher. The oil collection pit thus formed shall have a void volume equal to 200% volume of total oil in the Autotransformer/Reactor. In case of transformers of 132kV and below, where hydrant system for firefighting is not provided, volume of pit may be reduced to 130% of total oil volume. However, in case common oil pit is envisaged during detailed engineering, the individual oil collection pit thus formed shall have a void volume equal to 33% volume of total oil in the Autotransformer/Reactor. The common oil collection pit shall have a void volume equal to 200% volume of maximum total oil of either Autotransformer or Reactor.

The minimum height of the retaining walls of pit shall be 20 cm above the finished level of the ground to avoid outside water pouring inside the pit. The bottom of the pit shall have a uniform slope towards the sump pit. While designing the oil collection pit, the movement of the autotransformer / reactor must be taken into account.

The grating shall be made of MS flat of size 30mm x 5mm placed at 30mm centre to centre and 6mm dia MS bar at spacing of 150mm at right angle to each other.

Maximum length of grating shall be 2000mm and width shall not be more than 500mm. The gratings, supported on ISMB 150 mm, shall be placed at the formation level and will be covered with 100mm thick layer of stone aggregate having size 40mm to 60mm. All steel work used for grating and supports shall be painted with epoxy-based zinc phosphate primer (two packs) confirming to IS: 13238- 1991, thereafter with two or more coat of bituminous paint of approved quality shall be applied. Contractor shall have option to provide factory made electro forged MS grating made of specified size MS flat and round bars without any extra cost to employer.

Each oil collection pit shall be drained towards a sump pit of size 1000X750mm and 500mm deep below the floor level within the collection pit whose role is to drain water and oil due to leakage within the collection pit so that collection pit remains dry.

8.1 **MATERIALS**

Complete foundation shall be made of reinforced cement concrete and shall be designed as per guidelines for design of foundations given in clause 10.0 in the specification.

8.2 **DRAINAGE**

One 0.5/1.0 H.P pump for each pit shall be supplied and installed by the Contractor to evacuate the fire fighting & rain water from the sump pit in to the nearest drain.

9.0 FIRE PROTECTION WALLS

9.1 **GENERAL**

Fire protection walls shall be provided, if required, in accordance with Local Advisory Committee (LAC) recommendations. The scope of works covers design, preparation of drawing and construction of RCC fire protection walls. While designing the wall, following points may be taken care of:

9.2 **FIRE RESISTANCE**

The firewall shall have a minimum fire resistance of 4 hours. The partitions, which are made to reduce the noise level, shall have the same fire resistance. The walls of the building, which are used as firewalls, shall also have a minimum fire resistance of 4 hours.

The firewall shall be designed to protect against the effect of radiant heat and flying debris from an adjacent fire.

9.3 **DIMENSIONS**

The firewall shall extend 600 mm on each side of the Transformer /Reactors and 600 mm above the conservator tank or safety vent.

These dimensions might be reduced in special cases, as per the approval of owner where there is lack of space. A minimum of 2.0meter clearance shall be provided between the equipment's e.g. Transformer /Reactors and firewalls.

The building walls, which act as firewalls, shall extend at least 1 m above the roof in order to protect it.

9.4 **MATERIALS**

The firewall will be made of reinforced cement concrete as per the relevant Indian standard codes (I S Codes)/ equivalent International Standards.

10.0 CABLE TRENCHES AND CABLE TRENCH CROSSINGS

The typical construction drawings of cable trenches, cable trench crossing road and sump are enclosed with tender documents. The work covered under this clause comprises of design, drawing and construction of cable trenches and cable trench crossings. While designing, following points may be taken care of:

a). The cable trenches and pre-cast removable RCC cover (with lifting arrangement) shall be constructed using RCC of M25 (Minimum) grade as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

b). The cable trench walls shall be designed for the following loads.

(i) Dead load of 155 kg/m length of cable support + 75 Kg on one tier at the outer edge of tier.
(ii) Earth pressure + uniform surcharge pressure of 2T/m2.

c). Cable trench covers shall be designed for self-weight of top slab + concentrated load of 150 kg at centre of span on each panel.

d). Necessary sumps shall be provided and each sump shall be provided with pumps of 5 / 3 HP capacity, shall be supplied for pumping out water collected in cable trench. Cable trenches shall not be used as storm water drains.

e). The top of trenches shall be kept at least 100 mm above the finished ground level. The top of cable trench shall be such that the surface rainwater does not enter the trench.

f). All metal parts inside the trench shall be connected to the earthing system.

g). Trench wall shall not foul with the foundation. Suitable clear gap shall be provided.

h). The trench bed shall have a slope of 1/500 along the run & 1/250 perpendicular to the run.

i). Cable trenches shall be blocked at the ends if required with brick masonry in cement sand mortar 1:6 and plaster with 12mm thick 1:6 cement sand mortar.

J) Cable trench crossings shall be designed for critical load likely to be passed over the crossing. The cable trench crossing may be of either RCC box culvert type or RCC hume pipes embedded in plain concrete as per design of contractor.

11.0 FOUNDATION / RCC CONSTRUCTION

11.1 GENERAL

Work covered under this Clause of the Specification comprises the design ,drawing and construction of foundations and other RCC constructions for switchyard tower structures, bus supports, equipment supports, cable trenches, Transformer /Reactors, jacking pad, pulling blocks, fire protection walls, control cubicles, marshalling kiosks, auxiliary equipment's, Control Room Cum Administrative building, hall, Panel room, ,Security room, Parking shed ,RCC retaining wall, or for any other equipment or service and any other foundation required to complete the work. This clause is as well applicable to the other RCC constructions.

All foundation shall be of reinforced cement concrete. The design and construction of RCC structures shall be carried out as per IS: 456. Minimum 75mm thick lean concrete (1:4:8) shall be provided below all underground structures, foundations, trenches etc. to provide a base for construction

The switchyard foundation's plinths shall be minimum 300mm and buildings plinth shall be minimum 600 mm above finished ground level respectively. If the site is sloping, the foundation height will be adjusted to maintain the exact level of the top of structures to compensate such slopes.

The tower and equipment foundations shall be checked for a partial factor of safety of 2.2 for normal condition and 1.65 for short circuit condition.

The design and detailing of foundations shall be done based on the approved soil data and sub-soil conditions as well as for all possible critical loads and the combinations thereof. The Isolated/ Combined/ Strip footings / Raft or pile foundation as may be required based on soil/sub-soil conditions and superimposed loads shall be provided

The procedure used for the design of the foundations shall be the most critical loading combination of the steel structure and or equipment and/or superstructure and other conditions which produces the maximum stresses in the foundation or the foundation component and as per the relevant BIS Codes of foundation design. Detailed design calculations shall be submitted by the bidder showing complete details.

Necessary protection to the foundation work, if required shall be provided to take care of any special requirements for aggressive alkaline soil, black cotton soil or any other type of soil which is detrimental/harmful to the concrete foundations.

If pile foundations are adopted, the same shall be cast-in-situ bored or pre-cast or under reamed type

as per relevant parts of IS: 2911. Only RCC piles shall be provided. Necessary initial load test shall be carried out by the Contractor to establish the pile design capacity. Only after the design capacity of pile has been established, the Contractor shall take up the job of piling. Routine tests for the pile shall also be conducted as per IS: 2911/IS :10262. All the testing work shall be planned in such a way that these shall not cause any delay in project completion. RCC for pile works shall be Design Mix of minimum grade M-30.

The foundations shall be proportioned so that the estimated total and differential movements of the foundations are not greater than the movements that the structure or equipment is designed to accommodate.

11.2 **DESIGN**

While designing foundations, following may be taken care of:

All foundations except for external lighting poles shall be of reinforced cement concrete. The external lighting pole shall be embedded in plain cement concrete (1:2:4) foundation. The design and construction of RCC structures shall be carried out as per relevant IS: 456 and minimum grade of concrete shall be M-25 (Design Mix). Higher grade of concrete than specified above may be used at the discretion of Contractor without any additional financial implication to the Employer.

Limit state method or any other method as per relevant Indian standard codes (I S Codes)/ equivalent International Standards of design shall be adopted unless specified otherwise in the specification.

For detailing of reinforcement IS: 2502 and SP 34 shall be followed. Cold twisted deformed bars (Fe D = 500 N/mm^2) conforming to relevant Indian standard codes (I S Codes)/ equivalent International Standards shall be used as reinforcement. Two layers of reinforcement (on inner and outer face) shall be provided for wall & slab sections having thickness of 150 mm and above. Clear cover to reinforcement shall be as per relevant Indian standard codes (I S: 456)/ equivalent International Standards.

RCC water retaining structures like storage tanks, etc. shall be designed as uncracked section in accordance with relevant Indian standard codes (I S: 3370 Part I to IV)/ equivalent International Standards. However, water channels shall be designed as cracked section with limited steel stresses as per relevant IS.

The procedure used for the design of the foundations shall be the most critical loading combination of the steel structure and or equipment and/or superstructure and other conditions which produces the maximum stresses in the foundation or the foundation component and as per the relevant Indian standard codes (I S Codes)/ equivalent International Standards of foundation design. Detailed design calculations shall be submitted by the bidder showing complete details of piles/pile groups proposed to be used.

Design shall consider any sub-soil water pressure that may be encountered following relevant standard strictly.

Necessary protection to the foundation work, if required shall be provided to take care of any special requirements for aggressive alkaline soil, black cotton soil or any other type of soil which is detrimental/harmful to the concrete foundations.

RCC columns shall be provided with rigid connection at the base.

All sub-structures shall be checked for sliding and overturning stability during both construction and operating conditions for various combinations of loads. Factors of safety for these cases shall be taken as mentioned in relevant Indian standard codes (I S Codes)/ equivalent International Standards or as stipulated elsewhere in the Specifications. For checking against overturning, weight of soil vertically above footing shall be taken and inverted frustum of pyramid of earth on the foundation should not be considered.

Earth pressure for all underground structures shall be calculated using co-efficient of earth pressure at rest, co-efficient of active or passive earth pressure (whichever is applicable). However, for the design of substructures of any underground enclosures, earth pressure at rest shall be considered.

In addition to earth pressure and ground water pressure etc., a surcharge load of 2T/Sq.m shall also be considered for the design of all underground structures including channels, sumps, tanks, trenches, substructure of any underground hollow enclosure etc., for the vehicular traffic in the vicinity of the structure.

Following conditions shall be considered for the design of water tank in pumps house, channels, sumps, trenches and other underground structures:

a) Full water pressure from inside and no earth pressure & ground water pressure & surcharge pressure from outside (application only to structures which are liable to be filled up with water or any other liquid).

b) Full earth pressure, surcharge pressure and ground water pressure from outside and no water pressure from inside.

c) Design shall also be checked against buoyancy due to the ground water during construction and maintenance stages. Minimum factor of safety of 1.5 against buoyancy shall be ensured ignoring the superimposed loadings.

Base slab of any underground enclosure shall also be designed for empty condition during construction and maintenance stages with maximum ground water table (GWT). Minimum factor of safety of 1.5 against buoyancy shall be ensured ignoring the super-imposed loadings.

Base slab of any underground enclosure like water storage tank shall also be designed for the condition of different combination of pump sumps being empty during maintenance stages with maximum GWT. Intermediate dividing piers of such enclosures shall be designed considering water in one pump sump only and the other pumps sump being empty for maintenance.

The foundations shall be proportioned so that the estimated total and differential movements of the foundations are not greater than the movements that the structure or equipment is designed to accommodate.

The foundations of transformer/reactor and circuit breaker shall be of lock type foundation. Minimum reinforcement shall be governed by relevant Indian standard codes (I S Codes)/ equivalent International Standards.

The tower and equipment foundations shall be checked for a factor of safety as per relevant Indian standard codes (I S Codes)/ equivalent International Standards for two conditions i.e. Normal condition and short circuit condition against sliding, overturning and pull-out. The same factors shall be used as partial safety factor over loads in limit state design also.

11.3 **ADMIXTURES & ADDITIVES**

Only approved admixtures shall be used in the concrete for the Works. When more than one admixture is to be used, each admixture shall be batched in its own batch and added to the mixing water separately before discharging into the mixer. Admixtures shall be delivered in suitably labelled containers to enable identification.

Admixtures in concrete shall conform to relevant Indian standard codes (I S Codes)/ equivalent International Standards. The water proofing cement additives shall conform to relevant IS. Concrete Admixtures/ Additives shall be approved by Employer.

The Contractor may propose and the Employer may approve the use of a water-reducing set-retarding admixture in some of the concrete. The use of such an admixture will not be approved to overcome problems associated with inadequate concrete plant capacity or improperly planned placing operations and shall only be approved as an aid to overcoming unusual circumstances and placing conditions.

The water-reducing setting-retarding admixture shall be an approved brand as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

The water proofing cement additives shall be used as required/advised by Employer.

12.0 CHAINLINK FENCING AND GATE

12.1 **General**

Work covered under this clause comprises of design, drawing, supply, fabrication, erection, painting or galvanisation as specified etc. of switch yard Fencing and gate, construction of foundation of steel posts and toe wall. While providing switch yard fencing and gate, following points may be taken care of:

12.2 **Areas requiring Fencing**

Fencing shall be provided for complete switchyard as per drawing. Separate gate shall be provided for men and equipment.

Internal fence surrounding the various equipment's (if) mounted on ground or a height lower than 2.5m. Necessary gates shall be provided for each area so surrounded.

12.3 **Product materials**

The minimum requirements are as follows:

Chain link fence fabric (galvanization) in accordance to relevant Indian standard codes (I S: 2721)/ equivalent International Standards.

14.4 **Posts**

The posts shall be of medium M.S. tubes of 50mm diameter conforming to grade as per relevant international /IS Standard. The tubes shall also conform to relevant Indian standard codes (I S: 1161 / IS 806)/ equivalent International Standards. The length of tubular post shall be 2600 mm.

An M.S. base plate of size 160 X 160 X 6mm thick shall be welded with the tubular post. The post shall be provided on the top with M S plate.

The tubular post shall be welded with 8 number of M S flat of size 50 x 6mm – 75mm long at suitable locations. Two number of 13.5 mm diameter holes on each cleat shall be provided to bolt the fence fabric panel. The cleats shall be welded at equal spacing in such a way that 4 numbers of cleats are on one side and remaining 4 cleats are on the opposite side of the post. The cleats on the corner posts shall be welded in such a way that it suits the site requirement.

The whole assembly of tubular post shall be hot dip galvanized. The zinc coating shall be minimum 610 gram per sq. meter. The purity of zinc shall be 99.95% as per relevant IS.

12.5 **Fence Fabric & Fence Panel**

Chain link fencing shall be made of 3.15 mm diameter wire with 75 X 75 mm mesh size. Fence fabric shall be galvanised. Chain link fencing shall be fabricated in the form of panel 1300 X 2928 mm. An M.S. flat of at least 50x6 mm size shall be welded all-round fence fabric to form a panel. Four pairs of 13.5mm diameter holes on the vertical M S flat matching the spacing of holes in cleats fixed with pipe shall be provided to fix the fence panel with the tubular posts. A washer shall also be provided below each nut. The contractor, for fixing the panels, shall supply the 12mm diameter bolts including nuts and washers. All nuts, bolts and washers shall be hot dip galvanized.

The fence panel shall be provided with two or more coats of approved standard Zinc paint over approved standard steel primer.

12.6 **Installation**

1. Fence shall be installed along the switchyard line as shown in the approved drawings.
2. Post holes shall be excavated by approved method.
3. All posts shall be 3.0m apart measured parallel to ground surface.
4. Posts shall be set in 1:2:4 Plain Cement Concrete block of minimum 0.40x0.40x1.2m depth. 75mm thick plain cement concrete 1:4:8 shall be provided below concrete blocks. Posts shall be braced and held in plumb position and true alignment and elevation until concrete has set.
5. Fence fabric shall not be installed until concrete has cured a minimum of 7 days.

6. Fence fabric panel shall be fixed to the post at 4 nos. MS flat each of 50x6, 75 long through 2 nos. of bolts (12mm diameter) on each flat.

12.7 **Gate**

1. The gate shall be made of medium duty M.S. pipe conforming to relevant I.S. with welded joints. The main frame (outer frame) of the gate shall be made of 40mm dia. pipe and vertical pipes of 15mm dia. @ 125mm spacing (maximum) shall be welded with the main frame. Two number of 1.25 mm thick and 125 mm wide MS plates (Horizontal) @ 500 mm centre to centre distance shall be welded on each gate leaf. Gate leaves shall be fixed with a vertical post of 2700 mm long two steel channels-150 welded together. An 8 mm thick 200X 200 mm size MS plate shall be welded at the bottom of channel frame.
2. The gates shall be fabricated with welded joints to achieve rigid connections. The gate frames shall be painted with one coat of approved steel primer and two coats of synthetic enamel paint.
3. The gates shall be provided with suitable locking arrangement welded on 4 mm thick MS plate on the gate leaf.
4. The main gate shall be 5.0m wide and shall be of double leaf type (as shown in the drawing). Next to the main gate, a men gate (1.25m wide single leaf) shall also be provided.
5. Steel roller shall be provided with the gate.
6. Gate shall be installed in location as shown in approved G.A. drawing.
7. The vertical post of gate shall be embedded in PCC foundation of 500 X500X1250 mm deep size (1:2:4).

13.0 BUILDINGS

13.1 **GENERAL**

The scope includes the design, drawing, engineering and construction including anti-termite treatment, plinth protection, DPC of Building including sanitary, water supply, electrification, false ceiling etc. as applicable, complete of control room building, fire fighting building, Auxiliary building, Store and Security room. Electrification and air conditioning of building shall be provided as detailed in other sections of electrical portion.

13.2 **CONTROL ROOM CUM ADMINISTRATIVE BUILDING**

GENERAL

The scope includes design, engineering and construction, including anti-termite treatment, plinth protection, DPC, peripheral drains, water supply, plumbing, sanitation, fire-fighting, electrification etc. of Control Room Building.

The Control Room Building shall be of size carpet area 520 Sq. Mtr. approximately. It will be a double storeyed RCC Framed structure if constructed separately away from hall. It shall be so designed that most of the area of switchyard is visible from the Control Room.

The building auxiliary services like air conditioning systems, fire protection and detection systems and all other miscellaneous services shall be designed in accordance with the requirements as specified in relevant section or elsewhere in this Specification. The building shall be constructed as per the design

and drawings to be developed by the contractor. Tentative carpet area requirement for different rooms of control room cum administrative building is given as below for guidance to the contractor:

Component REQUIREMENTS

- Control Room
- ACDB & DCDB Room
- Battery Room
- Electrical Lab
- Conference Room with attached Toilet
- Telecom Room
- S/S-In-charge office with attached Toilet
- Room for executives
- Room for non-executives
- Lobby -Reception
- Corridor width
- Portico
- Common Toilet-Men
- Toilet for Women
- Janitor Room
- Pantry
- Provision of shaft for electrical, sanitary, water supply facilities shall also be kept.

However, the components of different rooms/utilities may change/deleted as per owner's decision.

13.3 **DESIGN CRITERIA**

The Building shall be designed:

1. To the requirements of the International standards/Indian Standards.
2. for the specified climatic and loading conditions.
3. To adequately suit the requirements of the equipment's and apparatus contained in the buildings and in all respects to be compatible with the intended use and occupancy.
4. with a functional and economical space arrangement.
5. To be aesthetically pleasing. Different buildings shall show a uniformity and consistency in architectural design, as far as possible.
6. To allow for easy access to the equipment's as well as maintenance of the equipment's.
7. Wherever access to the roof is required, RCC stair case shall be provided.

8. Fire retarding materials for walls, ceilings doors etc., which would prevent supporting or spreading of fire and wherever required, shall be decided by the bidder.
9. Suitable Expansion joints, wherever required, shall be provided as per Codal Provisions.
10. All the members of the buildings frame shall be designed for the worst combination of loads as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.
11. Permissible stresses for different load combinations shall be taken as per relevant Indian standard codes (I S Codes) / equivalent International Standards.
12. Seismic coefficient Method or Response spectrum method shall be used for seismic analysis of the building for Earthquake forces, as per relevant Indian standard codes (IS 1893)/equivalent International Standards.

13.4 **DESIGN LOADS**

1. Building structure shall be designed for the most critical combinations of dead loads, super-imposed loads, equipment loads, erection loads, wind loads, seismic loads, snow loading, if required etc. Any other incidental load, if anticipated, shall be duly accounted for in the design, and shall be clearly mentioned by the bidder.

2. Dead loads shall include the weight of structures complete with finishes, fixtures and partitions, and shall be taken as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

3. Super-imposed loads in different areas shall include live loads, minor equipment loads, cable trays, small pipe racks/hangers and erection, operation and maintenance loads, wherever these loads are expected. Equipment loads shall constitute, if applicable, all load of equipment's to be supported on the building frame.

AREA	Load
1. For Offices.	5.0 kN/m2
If higher than 5.0 kN/m2.	As per actual Requirement.
2. For Equipment Floors.	10.0 kN/m2
If higher than 10 kN/m2 (Based on Equipment weight and layout plans).	As per actual Requirement.
3. Staircases & Balconies.	5.0 kN/m2
4. Toilets.	2.0 kN/m2
5. Chequered Plate.	4.0 kN/m2
6. Corridors/Walkways.	3.0 kN/m2
7. Accessible Roofs.	1.5 kN/m2
8. Non-accessible Roofs.	0.75 kN/m2

4. Wind loads shall be calculated as per relevant Indian standard codes (I S Codes)/ equivalent International Standards. The Factors affecting the wind speed shall be taken based on the site conditions.
5. Earthquake loads shall be calculated as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

6. Wind forces and Seismic forces shall not be considered to act simultaneously.
7. Snow load shall be computed as per IS:875 part 4 (latest). When snow load is present in roofs, replace imposed load by snow loads in respective load combinations.
8. All the load combinations to create worst combinations of loads shall be as per relevant International standards/Indian Standards.
9. Floors/ Slabs shall be designed to carry loads imposed by equipment's, cables, piping, movement of maintenance trucks (if required) and any other load associated with the building. In general, floors shall be designed for live loads as per relevant Indian standard codes (I S Codes)/ equivalent International Standards. Cable and piping loads shall also be considered in addition to the live loads for floors where these loads are expected.

13.5 **FLOORS, WALLS & ROOFS**

1. All walls shall be non-load bearing in filled panel walls, in brickwork as per the specification. Minimum thickness of external walls shall be 230 mm with 1:6 cement sand mortar. Partition walls if any shall be of 115 mm thick brick masonry in cement sand mortar (1:4).

   All external walls shall be provided with insulation of 80 mm puff panels (wood look paint) as per specifications of puff panels with an air gap of 40mm fixed with suitable tie members, opening for windows/ventilators/exhaust fans shall be maintained and sealed on sides.
2. All Floor/Roof slabs shall be regular beam slab construction. However, sunken RCC slab shall be provided in toilet areas as per the requirement.
3. False ceiling as per requirement shall be provided as detailed in Table-1 (Detailed Finish Schedule).
4. Minimum height of skirting above finished floor level shall be 150 mm. The skirting material shall match with the floor finish.
5. Minimum height of the parapet walls shall be 750 mm.
6. Ground floor finish shall be laid over 20 mm thick cement sand mortar,100 mm thick plain cement concrete (PCC) 1:4:8 (1 cement: 4 sand : 8 stone aggregates),100 mm thick local sand filling. The earth below ground floor shall be well rammed before laying sand filling.
7. First floor details shall comprise of finish as per schedule, 20 mm cement sand mortar and 50 mm thick PCC(1:4:8) over RCC slab.

13.6 **DETAILS OF ROOF**

Roof of the Building shall consist of Cast-in-situ RCC slab treated with a water proofing system which shall be an integral cement-based treatment conforming to relevant Indian standard codes (I S Codes)/ equivalent International Standards. The water proofing treatment shall be of following operations:

(a) Applying and grouting a slurry coat of neat cement using 2.75 kg/m2 of cement admixed with proprietary water proofing compounds conforming to relevant Indian standard codes (I S Codes)/ equivalent International Standards. Over the RCC slab including cleaning the surface before treatment.

(b) Laying cement concrete using broken stone of size from 25mm to 100mm size with 50% of cement mortar 1:5 (1 cement: 5 coarse sand) admixed with proprietary water proofing compound conforming to relevant Indian standard codes (I S Codes)/ equivalent International Standards over 20mm thick layer of cement mortar of min 1:5 (Cement: 5 coarse sand) admixed with proprietary water proofing compound conforming to relevant Indian standard codes (I S Codes)/ equivalent International Standards to required slope and treating similarly the adjoining walls up to 300mm height including rounding of junctions of walls and slabs.

(c) After two days of proper curing applying a second coat of cement slurry admixed with proprietary water proofing compound conforming relevant Indian standard codes (I S Codes)/ equivalent International Standards.

(d) Finishing the surface with 20mm thick joint less cement mortar of mix 1:4 (1 cement: 4 course sand) admixed with proprietary water proofing compound conforming to relevant Indian standard codes (I S Codes)/ equivalent International Standards and finally finishing the surface with trowel with neat cement slurry and making of 300 x 300 mm square.

(e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by the Executive Engineer In charge.

(f) Average thickness of water proofing shall be 120 mm and minimum thickness at khurra shall be 65 mm.

13.7 **PARTITIONS**

Partitions wherever provided, shall be made of powder coated aluminium frame provided with 5.5 mm thick clear glass or pre-laminated board depending upon the location of partition.

13.8 **PLASTERING**

External surfaces of buildings shall have 18 mm thick plaster in two layers, with the under layer 12mm thick 1:5 cement sand plaster and the top layer 6 mm thick 1:6 cement sand plaster. Inside wall surfaces shall have 12/15 mm thick 1:6 cement sand plaster. Rough surfaces shall have 15mm and smooth surface shall have 12 mm thick cement sand plaster.

All RCC ceilings shall be provided with 6 mm thick cement sand (fine) plaster (1:3) except for areas with false ceiling.

13.9 **EXTERNAL PAINTING**

External surfaces of the Control Room Building shall be painted with acrylic exterior flat paint as per manufacturer's specification and approval of Employer.

13.10 **DOORS, WINDOWS AND VENTILATORS**

The schedule of doors, windows and ventilators of the Control Room Building shall be as per the detailed finish schedule given in Table-1 (Detailed Finish Schedule), and shall conform to the relevant Indian standard codes (I S Codes)/ equivalent International Standards. Rolling Steel shutters shall be provided as per the layout and requirements of the building. Main entrance door to control room building shall be made of powder coated aluminium frame with 5.5 mm thick glazing double hermetically door shall be provided with hydraulic door closer of approved make.

13.11 **CABLE TRENCH INSIDE CONTROL ROOM BUILDING**

All cable trenches inside the Control Room Building shall be covered with minimum 6mm thick steel chequered plate with suitable stiffeners.

13.12 **PLINTH PROTECTION**

750 mm wide and 50 mm thick plain cement concrete 1:2:4 (1 cement:2 sand:4 graded 20 mm nominal size stone aggregate) shall be laid over 75 mm thick dry-stone aggregates well rammed and consolidated with interstices filled with local sand including smooth finishing top.

13.13 **PLUMBING & SANITATION**

1. All plumbing and sanitation works shall be executed to comply with the requirements of the appropriate bye-laws, rules and regulations of the Local Authority having jurisdiction over such matters. The Contractor shall arrange for all necessary formalities to be met with regards to the inspection, testing, obtaining approval and giving notices etc.
2. Three Layered 'SINTEX' or an equivalent make PVC Roof water tank(s) of adequate capacity depending on the number of users for 24 hours storage shall be provided. However, a minimum of 2 nos. 1500 litre capacity shall be provided.
3. Chlorinated Polyvinyl chloride (CPVC) pipes having thermal stability for hot and cold-water supply including all CPVC plain and brass threading conforming to relevant Indian standard codes (I S Codes)/ equivalent International Standards shall be used for internal piping works for water supply.
4. Sand C.I. pipes with lead joints conforming to relevant Indian standard codes (I S Codes)/ equivalent International Standards shall be used for sanitary works above ground level and RCC pipes shall be used for sanitary works below ground.
5. Each toilet shall have the following minimum fittings:

(i) WC (Western type) 390 mm high along with toilet paper roll holder and all other fittings, in toilets attached to conference room and S/S In-charge office; and WC (Indian Type) Orissa Pattern (580 x 440 mm) with all fittings shall be provided in common toilets.
(ii) Urinal (430 x 260 x 350 mm size) with all fittings and built-in-sensor for automatic flush after use.
(iii) Wash basin (550 x 400 mm) with all fittings.
(iv) Bathroom mirror (600 x 450 x 6 mm thick) with hard board backing.
(v) CP brass towel rail (600 x 20 mm) with CP brass brackets.
(vi) Soap holder and liquid soap dispenser.
(vii) Automatic Hand Dryer.

6. Water cooler for drinking water with adequate water storage facility shall be provided which shall preferably be located near pantry and away from the toilet block.
7. One no. stainless steel kitchen sink with Drain board (510 x 1040 x 178 mm bowl depth) for pantry shall be provided.
8. All fittings, fasteners, gratings shall be chromium plated.
9. All sanitary fixtures and fittings shall be of approved quality and type, manufactured by reputed manufacturers. All items brought to site must bear identification marks of the Manufacturer.
10. Contractor shall provide necessary nos. of septic tank and soak pit of adequate capacity to treat the sewage/sullage from the buildings.
11. Contractor shall undertake all other activities required to complete and commission the building.

13.14 **BUILDING STORM WATER DRAINAGE**

1. The building design shall provide for the collection of storm water from the roof. This water shall be drained to the main drainage system of the Sub-station.

2. uPVC Rainwater down comer pipes conforming to relevant International standards/Indian Standards with water tight lead joints or medium class galvanized mild steel pipes conforms to relevant Indian standard codes (I S Codes)/ equivalent International Standards shall be provided to drain off the rain water from the roofs. These pipes shall be suitably concealed with masonry work or cement concrete or cladding material. The number and size of down comer pipes shall be governed by relevant Indian standard codes (I S Codes)/ equivalent International Standards.
3. All drains inside the buildings shall have minimum 40 mm thick grating covers; and in areas where heavy equipment loads are envisaged, Pre-Cast RCC covers shall be provided in place of steel grating.
4. Suitable arrangements for draining out water collected from equipment blow downs, leakages, floor washings, firefighting etc. shall be provided for each floor.

13.15 **DETAILED FINISH SCHEDULE**

The detailed finish schedule for all buildings is given below:

Table- 1: DETAILED FINISH SCHEDULE

Sl. No.	LOCATION	FLOORING & SKIRTING 150 MM HIGH	WALL (INTERNAL)	CEILING	DOOR, WINDOWS & VENTILATOR
1.	Control Room	Vitrified tiles 8mm thick size 600 x 600mm	Premium acrylic emulsion paint on smooth surface applied with plaster of Paris (2 mm thick)	White wash above False Ceiling*	Windows shall be powder coated aluminium frames of 5.5 mm double glass, hermetically sealed with air gap of 40 mm by using suitable patch fittings/spider fittings. The glass shall extend horizontally from column to column and vertically from sill level of 0.75 m to bottom of lintel/roof beam. All doors shall be glazed powder coated aluminium doors and frames with 5.5.mm Thick double glazing & hermetically sealed.
2.	Conferenc e Room	Vitrified tiles 8mm thick size 600 x 600mm	Premium acrylic emulsion paint on smooth surface applied with plaster of Paris (2 mm thick)	White wash above False Ceiling*	Windows shall be of powder coated aluminium frames with 5.5 mm Thick double glazing & hermetically sealed. All doors shall be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
3.	S/S In-charge Room.	Vitrified tiles 8mm thick size 600 x 600mm	Premium acrylic emulsion paint on smooth surface applied with plaster	White wash above False Ceiling*	Windows shall be of powder coated aluminium with 5.5mm Thick double glazing & hermetically sealed. All doors shall

Sl. No.	LOCATION	FLOORING & SKIRTING 150 MM HIGH	WALL (INTERNAL)	CEILING	DOOR, WINDOWS & VENTILATOR
			of Paris (2 mm thick)		be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
4	Office Rooms	Vitrified tiles 8mm thick size 600 x 600mm	Premium acrylic emulsion paint on smooth surface applied with plaster of Paris (2 mm thick)	White wash above False Ceiling*	Windows shall be of powder coated aluminium with 5.5mm Thick double glazing & hermetically sealed. All doors shall be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
5.	Electrical/ Electronic Test Lab./Telecom Room	Vitrified tiles 8mm thick size 600 x 600mm	Premium acrylic emulsion paint on smooth surface applied with plaster of Paris (2 mm thick)	White wash above False Ceiling*	Windows shall be of powder coated aluminium with 5.5mm Thick double glazing & hermetically sealed. All doors shall be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
6.	ACDB & DCDB Room	62mm thick cement concrete flooring with metallic hardener topping. Skirting shall be of cement sand plaster.	Oil bound washable distemper on smooth surface applied with plaster of Paris putty	Oil bound washable distemper on smooth surface applied with plaster of Paris putty	Steel door 45mm thick double sheet 18-gauge MS steel suitably reinforced and filled with mineral wool. Windows/ventilator shall be of powder coated aluminium with 4mm glazing.
7.	Battery Room	Vitrified tiles 8mm thick size 600 x 600mm	Premium acrylic emulsion paint on smooth surface applied with plaster of Paris (2 mm thick)	White wash above False Ceiling*	Steel door 45mm thick double sheet 18-gauge MS steel suitably reinforced and filled with mineral wool. Windows/ventilator shall be of powder coated aluminium with 4mm glazing.
8.	Reception /Lobby	Vitrified tiles 8mm thick size 600 x 600mm	Premium acrylic emulsion paint on smooth surface applied with plaster of Paris (2 mm thick)	Oil bound washable distemper on smooth surface applied	Windows shall be of powder coated aluminium with 5.5mm Thick double glazing & hermetically sealed. All doors shall be glazed powder coated aluminium doors with 5.5.mm

Sl. No.	LOCATION	FLOORING & SKIRTING 150 MM HIGH	WALL (INTERNAL)	CEILING	DOOR, WINDOWS & VENTILATOR
				with plaster of Paris putty	Thick double glazing & hermetically sealed.
9.	Corridor	Vitrified tiles 8mm thick size 600 x 600mm	Premium acrylic emulsion paint on smooth surface applied with plaster of Paris (2 mm thick)	Oil bound washable distemper on smooth surface applied with plaster of Paris putty	Windows shall be of powder coated aluminium with 5.5mm Thick double glazing & hermetically sealed. All doors shall be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
10.	Portico	Cast-in-situ 40 mm thick Cement concrete (1:2:4) with 18mm granite flooring	Granite cladding	Oil bound washable distemper on smooth surface applied with plaster of Paris putty	All doors shall be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
11.	Toilet	Ceramic tiles	Vitrified tiles 8mm thick size 600 x 600mm	Oil bound washable distemper	Windows/ ventilator shall be of powder coated aluminium with 5.5mm Thick double glazing & hermetically sealed. All doors shall be flush door shutters made of pre-laminated particle board with powder coated aluminium frame.
12.	Janitor room	Ceramic tiles with white cement	DADO glazed tile 2100mm high, oil bound washable distemper above DADO	Oil bound washable distemper	Windows/ ventilator shall be of powder coated aluminium with 5.5mm Thick double glazing & hermetically sealed. All doors shall be flush door shutters made of pre-laminated particle board with powder coated aluminium frame.
~~13.~~	~~GIS Hall~~	~~62mm thick cement concrete flooring with hardener. Two coats of PU coating over~~	~~Non-VOC acrylic emulsion paint over 2mm POP putty up to false ceiling over approved primer coat over plastered~~	~~In case of RCC roof, ceiling shall be finished with Non~~	~~All doors, windows, ventilators shall be of uPVC with minimum 5.5.mm thick double glazing & hermetically sealed.~~

Sl. No.	LOCATION	FLOORING & SKIRTING 150 MM HIGH	WALL (INTERNAL)	CEILING	DOOR, WINDOWS & VENTILATOR
		~~the Floor shall be provided. over the total area (Present + Future). The final coat of PU shall be applied after Installation crons. of equipments. Total thickness of PU coats Shall be minimum 300 microns.~~	~~surface~~	~~- VOC acrylic emulsion paint over approved primer coat.~~	
14.	Panel/ Relay Room/ Communication Room	Vitrified tiles 8mm thick size 600 x 600mm	Non VOC acrylic emulsion paint over 2mm POP putty upto false ceiling over approved primer coat	False ceiling Painted with Non VOC acrylic emulsion paint to give an even shade.	All doors, windows, ventilators shall be of uPVC with minimum 5.5.mm Thick double glazing & hermetically sealed.
15.	AHU Room	62 mm thick cement concrete flooring with hardner	Non VOC acrylic emulsion paint over 2 mm POP Putty up to false ceiling over approved primer coat over plastered surface.	RCC ceiling with Non-VOC acrylic emulsion paint over approved primer coat.	All windows, ventilators shall be of uPVC with minimum 5.5.mm Thick double glazing & hermetically sealed. All doors shall be flush door shutters (35mm thick block board with commercial veneer on both sides with lipping) with powder coated aluminium frame.

……

13.16 **SUBMISSIONS**

The following information/documents/drawings shall be submitted for review and approval:

1. Architectural Structural design calculations, Structural drawings (including construction/ fabrication), both in hard and soft copies, for all reinforced concrete and structural steel structures.
2. Fully dimensioned and detailed floor plans, cross-sections, longitudinal sections and elevations identifying the major building components.

3. Product information of building components and materials, including walls, partitions, flooring, ceilings, roofing, doors, wall panelling and windows and building finishes along with BOQ.
5. A detailed schedule of building finishes including colours schemes along with item description.
6. A door & window schedule showing door & window types and locations, lock sets and latch sets and other door hardware along with item details.

Approval of the above information shall be obtained before ordering materials or starting construction/fabrication, as applicable.

13.17 **FALSE CEILING**

*For all the buildings as Control room & Conference room, Panel room, administration room, battery Room, complete CRB etc. false ceiling shall be provided with aluminium linear ceiling system C84. For rest of the places false ceiling required shall be 15mm thick approximately 600 X 600mm Mineral fiber board panel false ceiling and making cut-outs for electrical fixtures, AC diffusers, open able access etc. complete with silhouette profile system with 15mm wide flange incorporating 6mm central recess white / black main runners at 1200mm centre-centre and not greater than 600mm from the adjacent wall. The cross tees shall be provided to make a module of approximately 600mm X 600mm by fitting 600 mm long cross tees centrally placed between 1200 mm long cross tees. Cross tees also have 15mm wide flange incorporating 6mm central recess white/black. The module formed above shall be anchored to the slab with channels or angles, suspenders as per manufacturer's specifications.

13.18 ELECTRIFICATION

All electrification shall be executed as per details specified elsewhere in the technical specification. All details shall be as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

13.19 **Site Store: Size of the store shall be:** A Site Store of size (Carpet Area 128 SQ. mm) (16 x 8 x 5 (clear Height)) shall be constructed as per Design and drawing developed by the contractor. The Building specification shall be RCC frame with brick work 230 thick. With MS Struss roof covered with pre painted MS profile sheet as per DSR for thickness 0.5 mm. MS frame rolling shutter of size 4 Mtr. Width 4.5 Mtr. Wide and 5 Mtr. Height shall be also provided. 2 Nos. MS frame windows with 10 mm Sq. Bar Grills and 5.5 mm thick glass glazed ventilators (4 Nos.) shall be also provided. 2 Nos. flush doors shutters (35 mm) with commercial ply, duly painted shall be provided.

14.0 FIRE FIGHTING PUMP HOUSE BUILDING

GENERAL

The scope includes design, engineering and construction, including anti-termite treatment, plinth protection, DPC, peripheral drains, fire-fighting, electrification etc. of fire fighting pump house building.

The fire fighting pump house building shall be essentially single storied reinforced cement concrete (RCC) framed Building. The building auxiliary services like internal electrification, fire protection systems shall be designed in accordance with the requirements as specified in relevant section of technical Specification. The design and layout of foundation of various pumps and cable trenches inside building shall be prepared by the contractor as per requirement of proposed fire fighting system.

AREA REQUIREMENTS

Dimensions of the Building shall be decided by the bidder depending upon the requirement. The approximate size of building is 7.3 m X 6.8 m X 4.3 m high. The height of building shall be measured from finished floor level to top of roof slab.

DESIGN CRITERIA

The Building shall be designed:

1. To the requirements of the relevant /Indian standards/ equivalent International standards quoted therein, and as specified in this specification.
2. for the specified climatic and loading conditions.
3. To adequately suit the requirements of the pumps and firefighting system contained in the buildings and in all respects to be compatible with the intended use and occupancy.
4. with a functional and economical space arrangement.
5. To be aesthetically pleasing. Different buildings shall show a uniformity and consistency in architectural design, as far as possible.
6. To allow for easy access to the equipment's as well as maintenance of the equipment's.
7. G.I. ladder with cage shall be provided for access to the roof.
8. With, wherever required, fire retarding materials for walls, ceilings doors etc., which would prevent supporting or spreading of fire and shall be decided by the bidder.
9. Suitable Expansion joints, wherever required, shall be provided as per Codal Provisions.
10. All the members of the buildings frame shall be designed for the worst combination of Loads as per relevant International standards/Indian Standards.
11. Permissible stresses for different load combinations shall be taken as per relevant International standards/Indian Standards.
12. Seismic analysis of the building for Earthquake forces shall be carried out as per relevant International standards/Indian Standards (IS 1893).

DESIGN LOADS

1. Building structure shall be designed for the most critical combinations of dead loads, super-imposed loads, equipment loads, wind loads, seismic loads etc. Any other incidental load, if anticipated, shall be duly accounted for in the design, and shall be clearly mentioned by the bidder.
2. Dead loads shall include the weight of structures complete with finishes, fixtures and partitions, and shall be taken as per relevant International standards/Indian Standards.
3. Super-imposed loads in different areas shall include live loads, cable trays, and small pipe racks/hangers, piping system and erection, operation and maintenance loads wherever these loads are expected.
   1) Non-accessible Roof – 0.75 kN/m2.
   2) Accessible Roof – 1.50 kN/m2
4. Wind loads shall be calculated as per relevant International standards/Indian Standards. The Factors affecting the wind speed shall be taken based on the site conditions.
5. Earthquake loads shall be calculated as per relevant International standards/Indian Standards.
6. Wind forces and Seismic forces shall not be considered to act simultaneously.
7. All the load combinations to create worst combinations of loads shall be as per relevant International standards/Indian Standards.

8. Floors shall be designed to carry loads imposed by Pumps, cables, piping, movement of maintenance trucks (if required) and any other load associated with the building. In general, floors shall be designed for live loads as per relevant International standards/Indian Standards. Cable and piping loads shall also be considered in addition to the live loads for floors where these loads are expected.

FLOORS, WALLS & ROOFS

The floor shall be constructed with 52 mm thick cement concrete finished with iron saw dust hardener topping. 150 mm thick base plain cement concrete layer,100 mm thick compacted local sand filling and 200 mm thick hard core of stone ballast with interstices filled with local sand shall be laid below cement concrete flooring top. The earth filling below floor shall be well rammed.

PLASTERING

External surfaces of building shall have 18 mm thick plaster in two layers, with the under layer 12mm thick 1:5 cement sand (coarse) plaster and the top layer 6 mm thick 1:6 cement sand (coarse) plaster. Inside wall surfaces shall have 12/15 mm thick 1:6 cement sand (coarse) plaster. Rough surfaces shall have 15mm and smooth surface shall have 12 mm thick cement sand plaster. Ceiling shall be plastered with 6 mm thick cement sand plaster (1 Cement : 3 Sand).

EXTERNAL PAINTING

External surfaces of the Building shall be painted with acrylic exterior flat paint as per manufacturer's specification and approval of Employer.

DOORS, WINDOWS AND VENTILATORS

The schedule of doors, roller shutter, windows and ventilators of the Building shall be of steel as per relevant International standards/Indian Standards. Rolling Steel shutters shall be provided as per the layout and requirements of the building. Main entrance door to the Building shall be MS door frame with M.S. sheet double shutter. Windows and ventilators shall be of steel made of hot rolled sections windows and ventilators shall be provided with 5.5 mm thick glazing.

CABLE TRENCH INSIDE FIRE FIGHTING PUMP HOUSE BUILDING

All cable trenches inside the building shall be covered with minimum 6 mm thick steel chequered plate with suitable stiffeners. The structural steel used for cable tray support, earthing cleat, chequered plates for internal cable trenches of fire fighting pump house building shall be measured and paid under miscellaneous steel item of BPS

PLINTH PROTECTION

750 mm wide plinth protection all-around the building shall be provided. Plinth protection shall comprise of 50 mm thick PCC (1:2:4) laid over 75 mm thick well compacted stone aggregates with interstices filled with local sand including smooth finishing top.

PARAPET

230 mm thick and 500 mm high brick parapet shall be provided. The parapet shall be plastered with cement sand plaster (1:6).

BUILDING STORM WATER DRAINAGE

1. The building design shall provide for the collection of storm water from the roof. This water shall be drained to the main drainage system of the Sub-station.
2. Cast Iron Rainwater down comer's pipes conforming to relevant International standards/Indian Standards with water tight lead joints or medium class galvanized mild steel pipes conforms to relevant International standards/Indian Standards shall be provided to drain off the rain water from the roofs. These pipes shall be suitably concealed with masonry work or cement concrete or cladding material.
3. Suitable arrangements for draining out water collected from equipment blow downs, leakages, floor washings, fire fighting etc. shall be provided, if found necessary.

DETAILS OF ROOF

Roof of the Building shall consist of Cast-in-situ RCC slab treated with a water proofing system which shall be an integral cement-based treatment conforming to relevant International standards/Indian Standards. The water proofing treatment shall be of following operations:

(a) Applying and grouting a slurry coat of neat cement using 2.75 kg/m2 of cement admixed with proprietary water proofing compounds conforming to relevant International standards/Indian Standards over the RCC slab including cleaning the surface before treatment.

(b) Laying cement concrete using broken stones 25mm to 100mm size with 50% of cement mortar 1:5 (1 cement: 5 coarse sand) admixed with proprietary water proofing compound conforming to relevant International standards/Indian Standards over 20mm thick layer of cement mortar of min 1:5 (Cement: 5 coarse sand) admixed with proprietary water proofing compound conforming to relevant International standards/Indian Standards to required slope and treating similarly the adjoining walls up to 300mm height including rounding of junctions of walls and slabs.

(c) After two days of proper curing applying a second coat of cement slurry admixed with proprietary water proofing compound conforming to relevant Indian standard codes (I S Codes) / equivalent International Standards.

(d) Finishing the surface with 20mm thick joint less cement mortar of mix 1:4 (1 cement: 4 course sand) admixed with proprietary water proofing compound conforming to relevant International standards/Indian Standards and finally finishing the surface with trowel with neat cement slurry and making of 300 x 300 mm square.

(e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by the Executive Engineer In charge.

(f) Average thickness of water proofing shall be 120 mm and minimum thickness at khurra shall be 65 mm.

DETAILED FINISH SCHEDULE

The detailed finish schedule for Fire Fighting Pump House Building is given below:

Table- 2 : DETAILED FINISH SCHEDULE

S.N	LOCATION	FLOORING & SKIRTING 150 MM HIGH	WALL (Internal)	CEILING	ROLLER SHUTTER,DOOR, WINDOWS & VENTILATOR

1.	Fire Fighting Pump House	62mm thick cement concrete flooring with metallic hardener topping .skirting shall be of cement sand plaster.	Oil bound washable distemper on masonry portion.	As per Manufacturer details.	Windows/ ventilator shall be hot rolled steel section with 5.5mm thick glazing. Entry door shall be of M.S. Sheet double shutter and rolling shutter shall be of steel.

ELECTRIFICATION

All electrification shall be executed as per details specified elsewhere in the technical specification. All details shall be as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

Fire Fighting Water Tank:

1. Reinforced cement concrete water tank with two compartments each of size 9.31 m X 9.31 m and capacity of 317 Cubic Meter shall be constructed. A sump of size 2.5 m X 2.5 m x 0.5 m deep shall be provided at one corner in each compartment. Finished floor level of water tank shall be about 200 mm above finished ground level of switch yard. Base slab of water tank shall rest on 75 mm thick plain cement concrete (1:3:6) laid over 800 mm thick well compacted stone packing (Stone Size from 25 mm to 150 mm) with interstices filled with local sand.
2. The roof of Water tank shall be of Asbestos Corrugated sheet. The sheet shall be supported on suitable steel purlins etc. Suitable gutter shall be provided to drain off rain water.
1. A steel door of size 900 mm X 1850 mm with single shutter made of hot rolled steel section and MS steel door frame shall be provided at about (+) 4.5 m level for access inside water tank.
2. Suitable MS rungs of 20 mm diameter rod @ 300 mm centre to centre staggered on both faces (External and internal) of wall at suitable location shall be provided to act as ladder.
3. Integral water proofing compound of reputed brand shall be added to the concrete and plaster of water tank. Quantity of compound shall be as per manufacturer's recommendation.
4. All inserts, nozzles, pipe sleeves etc. shall be provided during concreting at suitable locations as per firefighting system. The size is to be decided by the contractor to meet the requirement.
5. Inside surfaces of water tank shall be plastered with cement sand plaster (1 Cement: 6 sand).
6. The outer surface of water tank shall be painted with the paint matching with Firefighting pump house building.
7. P.V.C. water stopper shall be provided at all construction joints of water tank.

The design of water tank shall be carried out as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

15.0 CAR PARKING SHED

Aesthetically pleasant RCC car parking shed as per design and drawings as developed by the contractor and suitable to park 05 cars shall be constructed at suitable location to be decided during detailed engineering stage

16.0 WATER SUPPLY

(i) Water shall be made available by Employer at any feasible point within substation boundary at single point to the contractor if water is available. Contractor shall state the total water requirement both in terms of quantity and head to Employer. However, if water is not available, the contractor shall make its own arrangement.

(ii) The contractor shall carry out all the plumbing/erection works required for supply of water in control room cum administrative building beyond the single point as at (i) above.

(iii) The contractor shall carry out all the plumbing/erection works required for supply of water to Fire Fighting pump house, Security room beyond the single point as at (i) above.

(iv) The details of tanks, pipes, fittings, fixtures etc. for water supply are given elsewhere in the specification under respective sections.

(v) A scheme shall be prepared by the contractor indicating the layout and details of water supply which shall be got approved by Employer before actual start of work including all other incidental items not shown or specified but as may be required for complete performance of the works. All drawings shall be prepared by the contractor for approval of Employer.

20.0 SEWERAGE SYSTEM

(i) Sewerage system shall be provided for all buildings wherever applicable.

(ii) The Contractor shall construct septic tank and soak pit suitable for 50 users each for control room building and transit camp, if constructed. If septic and soak pit system is not acceptable by local Authority, contractor will have to install suitable sewerage system as per local statutory requirement.

(iii) The system shall be designed as per relevant Indian standard codes (I S Codes)/ equivalent International Standards. All drawings shall be prepared by the contractor for approval of Employer.

All shop connections shall be welded with appropriate arc welding process and welding shall be in accordance with relevant standard, AWSD 1.1. as appropriate. The Webs should be welded on to the flanges at both the faces at top and bottom for columns, beams and crane girders. Weld material should have strength more than the parent metal.

21.0 Boundary wall, Main Gate, Security Room and septic tank and soak pit

22.1 Boundary Wall:

Boundary wall shall be brick masonry wall with RCC frame. The typical construction drawing of the boundary wall applicable is enclosed with tender document. All walls shall have adequate weep holes/ gratings as per drawing/ as per site conditions for the drainage of water. The layout shall be as per approved layout drawing during detail engineering.

RCC framed with brick masonary/concrete block in fill between columns shall be provided along periphery of substation. The brief description of boundary wall is given below:

(a) Height of boundary wall (Masonary portion) above Natural ground level (NGL) = 2.5 m
(b) 0.5 m High of Y shaped angle supports (50x50x6 mm) above each column with about 0.5 m deep grouted in column shall be provided as grill on the boundary wall
(c) C/c distance of RCC Column (230 X 230 mm size) = 2.5 m
(d) 8 rows of galvanised barbed wire with concertina coil a top of boundary wall shall be provided. 4 rows of barbed wire on each arm of Y-shaped angle are to be provided.
(e) Grade of Concrete for RCC works = M25
(f) Mix of masonary works = 1 Cement: 6 Sand
(g) 12 mm thick Cement sand plaster (1 cement: 6 Sand) over exposed portion of boundary wall along with 50mm thick. CC(1:2:4) coping on the top of wall.
(h) Two coats of oil bound distemper with one coat of cement primer of approved make shall be applied over exposed portion of boundary wall.
(i) A RCC plinth beam (230 X 300 mm deep) shall be provided at ground level. A lintel beam of 230 X 230 mm shall be provided over gratings.
(j) Suitable steel grating made of 20 mm square bars shall be provided at suitable locations preferably @ 100 m to allow the flow of surface water.
(k) Suitable foundation of about 1.5 depth shall be provided for each RCC column. 75 mm thick PCC (1:4:8) layer shall be provided below all RCC works.
(l) All steel works shall be provided with two coats of synthetic enamel paint over a coat of steel primer of approved make.
(m) Twin columns with 25 mm expansion gap at every 45-meter length shall be provided.
(n) Suitable design of boundary wall shall be developed by the contractor.

The boundary wall shall be measured and paid on running meter length basis.

22.2 Main Gate

A steel gate of 2.1 m high and 6 m wide along with 1.5 m wide site gate shall be provided at entry location of substation. The gate shall be supported on steel columns. The steel support columns shall be encased with suitable RCC foundations. Suitable wheel mounting arrangement shall be provided at the bottom of gate for smooth opening of gate. All steel works shall be provided with two coats of synthetic enamel paint over a coat of steel primer of approved make.

The item shall be measured and paid on Lump sum basis. Typical drawing of the gate is also enclosed herewith for reference, however, suitable design and drawing for pillars and foundations shall be prepared by the contractor.

22.3 Security Room:

Typical drawing of the Security Room is enclosed herewith for reference, however, suitable design and drawing for pillars and foundations shall be prepared by the contractor.

An attached toilet of 1.5 m x 1.5 m size shall be provided. Suitable septic tank and soak pit for 10 users with cleaning interval of 3 years shall also be provided. A RCC platform (600 mm wide) at window sill

level along with wardrobe shall be provided. All sanitary works and a PVC water tank of 1000 litre capacity shall also be provided. All finish details shall match with other buildings mentioned elsewhere in the technical specification.

All external walls shall be provided with insulation of 80 mm puff panels (wood look paint) as per specifications of puff panels with an air gap of 40mm fixed with suitable tie members, opening for windows/ventilators/exhaust fans shall be maintained and sealed in the sides.

The item shall be measured and paid on square meter area basis.

23.0 MODE OF MEASUREMENT

23.1 Geotechnical investigation

This shall include carrying out field tests, laboratory tests, compilation of results and preparation of soil report with recommendations for type of foundations shallow or pile type, suitability of soil for construction of substation etc. The geotechnical investigation work shall be measured on lump sum basis.

23.2 Contour survey and site leveling.

The Contour survey work shall not be measured and paid separately and shall be deemed to be included in the item of site levelling work.

Measurement of Earth work in all kind of soil including soft/disintegrated rock in the item of cutting and filling and item of earth work in the filling with borrowed earth shall be made in Cubic meters. No void deduction for 95% compaction. Only the measurement of cutting quantity shall be taken for payments. The filling shall be carried out with the same soil as per specifications. Extra surplus earth after filling shall be disposed off at suitable location by the Contractor. No extra payment for filling quantity and disposal of earth shall be made separately. The borrowed earth if required shall be procured by the Contractor and used for the filling wherever required, it shall be paid separately as per BOQ.

23.3 Earthwork

This shall include excavation in all kinds of soil including rock, all leads and lifts including back filling with suitable earth, compacting, dewatering (if required) and disposal of surplus earth or rock to a suitable location within a lead up to 2 km. The surplus earth if disposed within substation boundary shall be spread in uniform layers each compacted with two passes of suitable compacting equipment. The quantity of excavation for foundations of towers, equipment support structures, all transformers/Reactors, DG Set, firewall, cable trenches, fire fighting water tank, buildings and underground water tanks, covered car parking, External lighting poles, control cubicles, marshalling box as well as quantity of excavation for roads, rail cum road, drains, culverts, rainwater harvesting, septic tank, soak pit, external water supply system, site surfacing, chain link fencing (including gate) shall not be measured separately and shall be deemed to be included in the composite rates quoted by the bidder for the respective works. All other excavation required for the completion of the work

including plinth protection, flooring, sewerage system, manholes, pipes, earth mat etc. shall also not be paid for separately.

23.4 **PCC**

Providing and laying Plain Cement Concrete of all types and at all locations including all leads and lifts. All PCC required for

i) PCC 1:2:4 (1 cement : 2 sand : 4 coarse aggregate 20 mm nominal size) - Flooring of buildings, plinth protection, fencing, transformer/reactor foundation, rail track, drain, culverts, septic tank, chain link fencing, fencing gate ,external lighting poles etc.

ii) PCC 1:4:8 (1 cement : 4 coarse sand : 8 stone aggregate, 40mm nominal size) - All foundations of towers, equipment support structures, buildings, fire fighting water tanks, covered car parking, cable trench, roads, under flooring, rail-cum-road, transformer foundation, reactor foundation, drain, cable trench crossings, culverts, fence, gate etc.

iii) PCC 1:5:10 (1 Cement: 5 sand: 10 Stone aggregate, 40mm nominal size) for site surfacing in switchyard, roof water proofing etc.

and for the completion of the work including hold fasts of doors/windows/rolling shutters, fixing of plumbing pipes, bedding concrete for sewer lines, embedment of electrical conduits etc. shall not be measured and deemed included in the composite rates quoted by the bidder for respective works. Water proofing compound wherever specified shall be added without any extra cost.

23.5 **RCC**

Reinforced cement concrete shall include all leads, lifts, formwork, grouting of pockets and underpinning, (but shall exclude reinforcement & miscellaneous structural steel like inserts etc.), of M25 design mix (Minimum). This shall also include pre-cast RCC work and addition of water proofing compound wherever required for which no additional payment shall be made. RCC quantity shall not be measured separately in cubic meters as this shall be deemed to be covered in respective items of BPS.

23.6 **Steel Reinforcement**

Reinforcement steel shall not be measured separately as this shall be deemed to be covered in respective items of BPS.

23.7 **Stone filling over grating in Transformer/Reactor foundation**

Measurement of stone (40mm nominal size) filling over gratings of transformer/reactor foundations shall **not** be made as per theoretical volume of the space to be filled in the transformer foundation as per approved drawings as this shall be deemed to be covered in item no. 3 (i) of Civil works in BPS.

23.8 **Miscellaneous structural steel**

Measurement for Supply, fabrication, transportation and erection of all miscellaneous structural steel work for rails along with rail fixing details and gratings with supports for transformers/reactors, Cable trenches with covers (Chequered plate covers, cable supports, earthing cleats and edge protection

angles etc.), all other steel fittings and fixtures, inserts and embedment in concrete of transformer/reactor foundation and cable trenches shall be made as per approved drawings. The unit rate for this item shall be inclusive of cutting, grinding, drilling, bolting, welding, pre- heating of the welded joints, applying a priming coat of steel primer and anti-corrosive bitumastic paint/ synthetic enamel paint in general but with Zinc Phosphate Primer (Two packs) for grating and support for grating in Transformer foundation. (Wherever specified), setting of all types of embedment in concrete, etc. Steel required for foundation bolts, nuts and bolt, doors, windows, ventilators, louvers, rolling shutters, chain link fencing, gratings in drains, soil pipes, plumbing pipes, floor traps, embedment's required for rainwater harvesting, septic tank, soak pit, roof truss and purlins required for fire water tank, etc. shall not be considered for payment and measurements. Quantity shall be measured in metric tonnes.

23.9 **Roads**

A). The measurement for the concrete road shall be made on the basis of area in Running meter (RM) of top concrete completed surface of the road and shall be deemed to include all items such as excavation, Concreting, reinforcement, compaction, rolling, watering, WBM, shoulder, etc. complete as per approved drawing.

B) The measurement of bituminous road shall be made on the basis of area in Running meter (RM), of the top bituminous completed surface of the road and shall include all items such as excavation, compaction, rolling, watering, sub base course, WBM, shoulder, premix carpet etc. complete as per approved drawing.

23.10 Anti-weed Treatment, 75mm thick PCC and Stone Spreading

The measurement shall be done for the actual area in square metres of stone spreading provided in the switchyard .It includes providing and spreading of 100mm thickness of uncrushed/crushed/broken stone of 40mm nominal size as per relevant IS codes/equivalent International standards for the specified area. Application of anti-weed treatment including material shall be measured in Square meter based on actual area and it will be same area as of stone spreading in switchyard. The measurement of 75mm thick PCC shall also be done in Sq. meter based on actual area of PCC.

23.11 Chain Link Fencing and gate

The measurement shall be made in running metres of the fence provided as per approved drawing. The rate shall be including the post, fencing, MS Flat, painting, brick work, concrete and plaster of toe wall etc. complete. The Fencing gate shall also be measured as part of chain link fencing.

23.12 **Cable Trenches and Cable trench Crossings**

All items like Excavation, earthwork, PCC, RCC, reinforcement steel except RCC hume pipes and miscellaneous steel required for construction of Cable Trenches of various sizes and cable trench crossings shall be measured in route meter. . However, RCC hume pipes used in culverts and miscellaneous steel required for cable trench shall be measured under respective item of Bid price schedule (BPS) as described in clause of hume pipes and Miscellaneous steel. Please note that No additional payment for brick work, plaster and PVC pipes used for cable trench crossings and sealing of trench mouth shall be admissible.

23.13 **Drains & Culverts**

All items like excavation, PCC, brick work, plaster and stone pitching except RCC hume pipes required for completion of drains and culverts shall be deemed to be included in the quoted rate of drain. The quantity for drain section shall be measured in running meters irrespective of size. However, RCC hume pipes used in culverts shall be measured under respective item of Bid price schedule (BPS) as described in clause of hume pipes.

23.14 **External Finishing of RCC Framed Buildings/structures:**

The item shall be measured per square meter area basis. Contractor has to assess the quantity as per requirement of Control room cum administrative building, Fire Fighting Pump House, fire fighting water tank, switchyard panel room, other buildings, covered car parking and quote for the same separately. This shall include following items.

1) External plastering/cement wash : 18mm Cement plaster in two coats under layer 12 mm thick cement plaster 1:5 (1 cement: 5 coarse Sand) finished with a top layer of 6 mm thick cement plaster 1:6 (1 cement: 6 fine Sand) for all buildings and fire fighting water tank .

2) Providing and applying two or more coats of Acrylic smooth exterior paint over an under coat of suitable primer on new cement plaster surfaces of the control room building, auxiliary building, fire fighting pump house building, fire fighting water tank, panel room , other buildings and covered car parking. It shall be inclusive of required tools, scaffolding, materials and other painting accessories etc. as per recommendations of manufacturer.

23.15 Hume Pipe

Hume pipe shall be measured diameter-wise and laid as per approved drawings and shall be measured in running meters. The item shall be inclusive of excavation, concreting, reinforcement, laying, back filling, jointing etc.

23.16 Building

The measurement of all items of each type of buildings shall be made on carpet area in Square Meter basis. The structural steel used for cable tray support, earthing cleat, chequered plates for internal cable trenches of building and panel room wherever applicable shall be measured and paid under miscellaneous steel item of BPS and described above paras. The structural steel and foundation bolts for fixing equipments with foundations/raft within buildings shall not be measured separately which shall be deemed to be included in the quoted rates per square meter of buildings. External Finishing shall not be measured separately as it shall be deemed to be included in the item No. 6 of Civil works in BPS i.e. Design, Engineering and Construction of Buildings. The rest of the entire work required to complete the building in all respect as per drawings prepared by contractor and approved by Employer shall be deemed to be included in this item rate per square meter area basis.

23.17 Rain Water Harvesting

This is a lump sum item. The contractor shall be required to complete the work in all respect as per drawings prepared by contractor and approved by Employer. All the items including excavation,

miscellaneous steel, brick work, fillings of boulders, gravel, sand, pipes etc. shall be deemed to be included in this lump sum rate.

23.21 External water supply from Bore-well/ other source of water supply arrangement to Fire water tank, Control Room building, Security Room etc.

The external water supply from Bore-well shall be measured diameter-wise in running meters. It shall include all the items such as excavation, piping, pipe fittings, painting, brickwork, sand filling, concrete, valves, chambers cutting chases in walls, openings in RCC and repairs, etc. required to complete the job.

23.22 External Sewage System of Control Room Building and other Buildings.

All the items such as excavation, piping, pipe fittings, manholes, gali trap, gali chamber casing in concrete and repairs etc. required to complete the job shall be deemed to be included in the item No. 6 of Civil works in BPS i.e. Design, Engineering and Construction of Buildings. Any modification in the existing sewage system, if required, shall be done by the Contractor without any extra cost implication to Employer.

24.0 MISCELLANEOUS GENERAL REQUIREMENTS

24.1 Dense concrete with controlled water cement ratio as per IS-code shall be used for all underground concrete structures such as pump-house, tanks, water retaining structures, cable and pipe trenches etc. for achieving water-tightness.

24.2 All joints including construction and expansion joints for the water retaining structures shall be made water tight by using PVC ribbed water stops with central bulb. However, kicker type (externally placed) PVC water stops shall be used for the base slab and in other areas where it is required to facilitate concreting. The minimum thickness of PVC water stops shall be 5 mm and minimum width shall be 230 mm.

24.3 All steel sections and fabricated structures which are required to be transported on sea shall be provided with anti-corrosive paint to take care of sea worthiness.

24.4 All mild steel parts used in the water retaining structures shall be hot-double dip galvanised. The minimum coating of the zinc shall be 750 gm/sq. m. for galvanised structures and shall comply with relevant IS. Galvanizing shall be checked and tested in accordance with relevant IS. The galvanizing shall be followed by the application of an etching primer and dipping in black bitumen in accordance with BS: 3416.

24.5 A screed concrete layer not less than 100 mm thick and of grade not weaker than M10 conforming to relevant IS shall be provided below all water retaining structures. A sliding layer of bitumen paper or craft paper shall be provided over the screed layer to destroy the bond between the screed and the base slab concrete of the water retaining structures.

24.6 Bricks having minimum 75 kg/cm2 compressive strength can only be used for masonry work. Contractor shall ascertain himself at site regarding the availability of bricks of minimum 75 kg/cm2 compressive strength before submitting his offer. The contractor may use concrete blocks of equivalent compressive strength in place of brick work.

24.7 Doors and windows on external walls of the buildings (other than areas provided, with insulated metal claddings) shall be provided with RCC sun-shade over the openings with 300 mm projection on either side of the openings. Projection of sunshade from the wall shall be minimum 450 mm over window openings and 750 mm over door openings.

24.8 All stairs shall have maximum riser height of 150 mm and a minimum tread width of 300 mm. Minimum width of stairs shall be 1500 mm. Service ladder shall be provided for access to all roofs. RCC fire escape staircase if required as per local bye laws, shall be provided in control buildings.

24.9 Angles 50x50x6 mm (minimum) with lugs shall be provided for edge protection all round cut outs/openings in floor slab, edges of drains supporting grating covers, edges of RCC cable/pipe trenches supporting covers, edges of manholes supporting covers, supporting edges of manhole precast cover and any other place where breakage of corners of concrete is expected.

24.10 Anti termite chemical treatment for buildings shall be given to all column pits, wall trenches, foundations, filling below the floors etc. as per relevant International/IS .

24.11 Hand-railing minimum 900mm high shall be provided around all floor/roof openings, projections/balconies, walk ways, platforms, steel stairs etc. All handrails and ladder pipes shall be 32 mm nominal bore MS pipes (medium class) and shall be galvanised (medium-class as per relevant BS). All rungs for ladder shall also be galvanised as per relevant BS.

For RCC stairs, hand railing with 20 mm square MS bars, balustrades with suitable MS flats & aluminium handrails shall be provided.

24.12 For all civil works covered under this specification, design Mix of Minimum M25 grade as per relevant International /IS shall be used. Reinforcement steel shall be of minimum Fe D 500 .

The material specification, workmanship and acceptance criteria shall be as per relevant clauses of applicable International/IS standard.

24.13 Items/components of buildings not explicitly covered in the specification and BPS but required for completion of the project shall be deemed to be included in the scope.

24.14 Requirement of sulphate resistant cement (SRC) for sub structural works shall be decided in accordance with the International/IS Standards based on the findings of the detailed soil investigation to be carried out by the Bidder.

24.15 Foundation system adopted by Bidder shall ensure that relative settlement and other criteria shall be as per provision in relevant IS and other International Standards.

24.16 All water retaining structures designed as uncracked section shall also be tested for water tightness at full water level in accordance with relevant international/ IS standards.

24.17 Construction joints shall be as per International/IS standard.

24.18 All underground concrete structures like basements, pumps houses, water retaining structures etc. shall have plasticizer cum water proofing cement additive conforming to relevant IS. The concrete surface of these structures in contact with earth shall also be provided with two coats of bituminous painting for water/damp proofing.

In case of water leakage in the above structures, The Method shall be applied as per relevant international standard/IS standard for repairing the leakage.

24.19 All building/construction materials shall conform to the best quality specified in relevant International /IS standard.

25.0 INTERFACING

The proper coordination & execution of all interfacing civil works activities like fixing of conduits in roofs/walls/floors, fixing of foundation bolts, fixing of lighting fixtures, fixing of supports/embedment's, provision of cut outs etc. shall be the sole responsibility of the Contractor. He shall plan all such activities in advance and execute in such a manner that interfacing activities do not become bottlenecks and dismantling, breakage etc. is reduced to minimum.

26.0 STATUTORY RULES

26.1 Contractor shall comply with all the applicable statutory rules pertaining to factories act (as applicable for the State). Fire Safety Rules of Tariff Advisory- Committee and Water and sewerage Act for pollution control etc.

26.2 Provisions for fire proof doors, no. of staircases, fire escape stairs ,fire separation wall, plastering on structural members (in fire prone areas) etc. shall be made according to the recommendations of Local Advisory Committee.

26.3 Statutory clearance and norms of Local Pollution Control Board shall be followed as per Water Act for effluent quality from plant.

27.0 FIELD QUALITY PLAN

All tests as required in accordance to IS codes or equivalent International standards have to be carried out. The contractor shall prepare field quality plan for civil works as per relevant IS codes/equivalent International Standards during detailed engineering stage and submit to Employer for approval within ONE month after award of work.

28.0 INDIAN STANDARD CODES

For design and engineering relevant IS codes or equivalent International standards shall be referred by the contractor. Relevant portion of IS codes or equivalent international standards referred by the

contractor for the design shall be made available to Employer if necessary, during detailed engineering stage.

TECHNICAL SPECIFICATION
VOL-II, SEC-XVIII

CONTROL RELAY AND PROTECTION PANEL

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SECTION - XVIII
CONTROL AND RELAY PANELS

1. **TYPE OF PANELS**

1.1 **Simplex Panel**

Simplex panel shall consist of a vertical front panel with equipment mounted thereon and having wiring access from rear for control panels &–front–for relay/protection panels. In case of panel having width more than 800mm, double leaf-doors shall be provided. Doors shall have handles with either built-in locking facility or will be provided with pad-lock.

1.2 **Duplex Panel**

Duplex panel shall be walk-in tunnel type comprising two vertical front and rear panel sections connected back-on-back by formed sheet steel roof tie members and a central corridor in between. The corridor shall facilitate access to internal wiring and external cable connections. In case of number of duplex panels located in a row side by side, the central corridor shall be aligned to form a continuous passage. Both ends of the corridor shall be provided with double leaf doors with lift off hinges. Doors shall have handles either with built-in locking facility or shall be provided with pad-locks. Separate cable entries shall be provided for the front and rear panels. However, inter-connections between front and back panels shall be by means of inter panel wiring at the top of the panel.

2. **CONSTRUCTIONAL FEATURES**

2.1. Control and Relay Board shall be of panels of simplex or duplex type design as indicated in bill of quantity. It is the responsibility of the Contractor to ensure that the equipment specified and such unspecified complementary equipment required for completeness of the protective/control schemes be properly accommodated in the panels without congestion and if necessary, **either add more number of panels or** provide panels with larger dimensions. No price increase at a later date on this account shall be allowed. However, the width of panels that are being offered to be placed in existing switchyard control rooms, should be in conformity with the space availability in the control room.

2.2. Panels shall be completely metal enclosed and shall be dust, moisture and vermin proof. The enclosure shall provide a degree of protection not less than IP-31 in accordance with IEC 60529 (Part-1).

2.3. Panels shall be free standing, floor mounting type and shall comprise structural frames completely enclosed with specially selected smooth finished, cold rolled sheet steel of thickness not less than 3 mm for weight bearing members of the panels such as base frame, front sheet and door frames, and 2.0mm for sides, door, top and bottom portions. There shall be sufficient reinforcement to provide level transportation and installation.

2.4. All doors, removable covers of panels shall be gasketed all around with synthetic gaskets Neoprene/EPDM. However, XLPE gaskets can also be used for fixing protective glass doors. Ventilating louvers, if provided shall have screens and filters. The screens shall be made of either brass or GI wire mesh

2.5. Design, materials selection and workmanship shall be such as to result in neat appearance, inside and outside with no welds, rivets or bolt head apparent from outside, with all exterior surfaces tune and smooth.

2.6. Panels shall have base frame with smooth bearing surface, which shall be fixed on the embedded foundation channels/insert plates. Anti-vibration strips made of shock absorbing materials that shall be supplied by the contractor, which shall be placed between panel & base frame.

2.7. Cable entries to the panels shall be from the bottom. Cable gland plate fitted on the bottom

of the panel shall be connected to earthing of the panel/station through a flexible braided copper conductor rigidly.

2.8. Relay/protection panels of modern modular construction would also be acceptable.

3. MOUNTING

3.1. All equipment on and in panels shall be mounted and completely wired to the terminal blocks ready for external connections. The equipment on front of panel shall be mounted flush.

3.2. Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent devices and are readily accessible without use of special tools. Terminal marking on the equipment shall be clearly visible.

3.3. The Contractor shall carry out cut out, mounting and wiring of the free issue items supplied by others which are to be mounted in his panel in accordance with the corresponding equipment manufacturer's drawings. Cut outs if any, provided for future mounting of equipment shall be properly blanked off with blanking plate.

3.4. The centre lines of switches, push buttons and indicating lamps shall not be less than 750mm from the bottom of the panel. The centre lines of relays, meters and recorders shall not be less than 450mm from the bottom of the panel.

3.5. The centre lines of switches, push buttons and indicating lamps shall be matched to give a neat and uniform appearance. Likewise the top lines of all meters, relays and recorders etc. shall be matched.

3.6. No equipment shall be mounted on the doors.

3.7. At existing station, panels shall be matched with other panels in the control room in respect of dimensions, colour, appearance and arrangement of equipment (centre lines of switches, push buttons and other equipment) on the front of the panel.

4. PANEL INTERNAL WIRING

4.1. Panels shall be supplied complete with interconnecting wiring provided between all electrical devices mounted and wired in the panels and between the devices and terminal blocks for the devices to be connected to equipment outside the panels. When panels are arranged to be located adjacent to each other all inter panel wiring and connections between the panels shall be carried out internally

4.2. All wiring shall be carried out with 650V grade, single core, stranded copper conductor wires with PVC insulation. The minimum size of the multi-stranded copper conductor used for internal wiring shall be as follows:

- All circuits except current transformer circuits and voltage transfer circuits meant for energy metering - one 1.5mm sq. per lead.
- All current transformer circuits - one 2.5 sq.mm per lead.
- Voltage transformer circuit (for energy meters): Two 2.5 mm sq. per lead.

4.3. All internal wiring shall be securely supported, neatly arranged, readily accessible and connected to equipment terminals and terminal blocks. Wiring gutters & troughs shall be used for this purpose.

4.4. Auxiliary bus wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common services shall be provided near the top of the panels running throughout the entire length of the panels.

4.5. Wire termination shall be made with solder less crimping type and tinned copper lugs, which firmly grip the conductor. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with

panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks. All wires directly connected to trip circuit breaker or device shall be distinguished by the addition of red coloured unlettered ferrule.

4.6. Longitudinal troughs extending throughout the full length of the panel shall be preferred for inter panel wiring. Inter-connections to adjacent panel shall be brought out to a separate set of terminal blocks located near the slots of holes meant for taking the inter-connecting wires.

4.7. Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipments.

5. TERMINAL BLOCKS

5.1. All internal wiring to be connected to external equipment shall terminate on terminal blocks. Terminal blocks shall be 650 V grade and have 10 Amps. continuous rating, moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. Markings on the terminal blocks shall correspond to wire number and terminal numbers on the wiring diagrams. All terminal blocks shall have shrouding with transparent unbreakable material.

5.2. Disconnecting type terminal blocks for current transformer and voltage transformer secondary leads shall be provided. Also current transformer secondary leads shall be provided with short circuiting and earthing facilities.

5.3. At least 20% spare terminals shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.

5.4. Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors of external cable on each side

- All CT & PT circuits: minimum of two of 2.5mm Sq. copper.
- AC/DC Power Supply Circuits: One of 6mm Sq. Aluminium.
- All other circuits: minimum of one of 2.5mm Sq. Copper.

5.5. There shall be a minimum clearance of 250mm between the first row of terminal blocks and the associated cable gland plate or panel side wall. Also the clearance between two rows of terminal blocks edges shall be minimum of 150mm.

5.6. Arrangement of the terminal block assemblies and the wiring channel within the enclosure shall be such that a row of terminal blocks is run in parallel and close proximity along each side of the wiring-duct to provide for convenient attachment of internal panel wiring. The side of the terminal block opposite the wiring duct shall be reserved for the external cable connections. All adjacent terminal blocks shall also share this field wiring corridor. All wiring shall be provided with adequate support inside the panels to hold them firmly and to enable free and flexible termination without causing strain on terminals.

5.7. The number and sizes of the Owner's multi core incoming external cables will be furnished to the Contractor after placement of the order. All necessary cable terminating accessories such as gland plates, supporting clamps & brackets, wiring troughs and gutters etc. (except glands & lugs) for external cables shall be included in the scope of supply.

6. PAINTING

The painting shall be carried out as detailed in Section 2–GTR.

7. MIMIC DIAGRAM

7.1. Coloured mimic diagram and symbols showing the exact representation of the system shall be provided in the front of control panels.

7.2. Mimic diagram shall be made preferably of anodised aluminium or plastic of approved fast colour material, which shall be screwed on to the panel and can be easily cleaned. The mimic bus shall be 2mm thick. The width of the mimic bus shall be 10mm for bus bars and 7mm for other connections. Painted overlaid mimic is also acceptable.

7.3. Mimic bus colour will be decided **during detailed Engineering.**

7.4. When semaphore indicators are used for equipment position, they shall be so mounted in the mimic that the equipment in close position shall complete the continuity of mimic.

7.5. Indicating lamp, one for each phase, for each bus shall be provided on the mimic to indicate bus charged condition.

8. NAME PLATES AND MARKINGS

8.1. All equipment mounted on front and rear side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved. Also on the top of each panel on front as well as rear side, large and bold nameplates shall be provided for circuit/feeder designation.

8.2. All front mounted equipment shall also be provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring.

8.3. Each instrument and meter shall be prominently marked with the quantity measured e.g. KV, A, MW, etc. All relays and other devices shall be clearly marked with manufacturer's name, manufacturer's type, serial number and electrical rating data.

8.4. Name Plates shall be made of non-rusting metal or 3 ply lamicoid. Name plates shall be black with white engraving lettering.

8.5. Each switch shall bear clear inscription identifying its function e.g. 'BREAKER' '52A', "SYNCHRONISING" etc. Similar inscription shall also be provided on each device whose function is not other-wise identified. If any switch device does not bear this inscription separate name plate giving its function shall be provided for it. Switch shall also have clear inscription for each position indication e.g. "Trip- Neutral-Close", "ON-OFF", "R-Y-B-OFF" etc.

8.6. All the panels shall be provided with name plate mounted inside the panel bearing LOA No & Date, Name of the Substation & feeder and reference drawing number.

9. MISCELLANEOUS ACCESSORIES

9.1. **Plug Point**: 230V, Single phase 50Hz, AC socket with switch suitable to accept 5 Amps and 15 Amps pin round standard Indian plug, shall be provided in the interior of each cubicle with ON-OFF switch.

9.2. **Interior Lighting**: Each panel shall be provided with a fluorescent lighting fixture rated for 230 Volts, single phase, 50 Hz supply for the interior illumination of the panel controlled by the respective panel door switch. Adequate lighting shall also be provided for the corridor in Duplex panels.

9.3. **Switches and Fuses**: Each panel shall be provided with necessary arrangements for receiving, distributing and isolating of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with Fuses. Selection of the main and sub-circuit Fuses rating shall be such as to ensure selective clearance of sub-circuit faults. Voltage transformer circuits for relaying and metering shall be protected by fuses. All fuses shall be HRC cartridge type conforming to IS: 13703 mounted on plug-in type fuse bases. The short time fuse rating of Fuses shall be not less than 9 KA. Fuse carrier base shall have imprints of the fuse 'rating' and 'voltage'.

9.4. **Space Heater**: Each panel shall be provided with a thermostatically connected space heater rated for 230V, single phase, 50 Hz AC supply for the internal heating of the panel to

prevent condensation of moisture. The fittings shall be complete with switch unit.

10. EARTHING

10.1. All panels shall be equipped with an earth bus securely fixed. Location of earth bus shall ensure no radiation interference from earth systems under various switching conditions of isolators and breakers. The material and the sizes of the bus bar shall be at least 25 X 6 sq.mm copper with threaded holes at a gap of 50 mm with provision of bolts and nuts for connection with cable armours and mounted equipment etc. for effective earthing. When several panels are mounted adjoining each other, the earth bus shall be made continuous and necessary connectors and clamps for this purpose shall be included in the scope of supply of Contractor. Provision shall be made for extending the earth bus bars to future adjoining panels on either side.

10.2. Provision shall be made on each bus bar of the end panels for connecting Substation earthing grid. Necessary terminal clamps and connectors for this purpose shall be included in the scope of supply of Contractor.

10.3. All metallic cases of relays, instruments and other panel mounted equipment including gland plate, shall be connected to the earth bus by copper wires of size not less than 2.5 sq. mm. The colour code of earthing wires shall be green.

10.4. Looping of earth connections which would result in loss of earth connection to other devices when the loop is broken, shall not be permitted. However, looping of earth connections between equipment to provide alternative paths to earth bus shall be provided.

10.5. VT and CT secondary neutral or common lead shall be earthed at one place only at the terminal blocks where they enter the panel. Such earthing shall be made through links so that earthing may be removed from one group without disturbing continuity of earthing system for other groups.

10.6. An electrostatic discharge **arrangement** shall be provided in each panel **so as to discharge human body before he handles the equipments inside the panels**.

11. INDICATING INSTRUMENTS & TRANSDUCERS FOR CONTROL PANEL:

All instruments, meters and transducers shall be enclosed in dust proof, moisture resistant, black finished cases and shall be suitable for tropical use. All megawatt , megavar, Bus voltage and frequency indicating instruments shall be provided with individual transducers and these shall be calibrated along with transducers to read directly the primary quantities. They shall be accurately adjusted and calibrated at works and shall have means of calibration check and adjustment at site. The supplier shall submit calibration certificates at the time of delivery. However no separate transducers are envisaged for digital bus voltmeters and digital frequency meters and the indicating meters provided in the synchronising equipment.

11.1. Indicating Instruments

11.1.1. Unless otherwise specified, all electrical indicating instruments shall be of digital type suitable for flush mounting.

11.1.2. Instruments shall have 4-digit display; display height being not less than 25 mm

11.1.3. Instrument shall confirm to relevant IEC and shall have an accuracy class of 1.5 or better. Watt and Var meters shall have an indication of (+) and (-) to indicate EXPORT and IMPORT respectively.

11.1.4. Digital voltage and frequency meters shall be of class: 0.5 and shall have digital display of 5 and 4 digits respectively, with display size, not less than 25mm (height).

11.2. Transducers

11.2.1. Transducers (for use with Indicating Instruments and Telemetry/Data Communication

application) shall in general conform to IEC:688-1

11.2.2. The transducers shall be suitable for measurement of active power, reactive power, voltage, current and frequency in three phase four wire unbalanced system.

11.2.3. The input to the transducers will be from sub-station current & potential transformers. The output shall be in milli ampere D.C. proportional to the input & it shall be possible to feed the output current directly to the telemetry terminal or indicating instruments.

11.2.4. The transducer characteristic shall be linear throughout the measuring range.

11.2.5. The transducer output shall be load independent.

11.2.6. The input & output of the transducer shall be galvanically isolated.

11.2.7. Each transducer shall be housed in a separate compact case and have suitable terminals for inputs & outputs.

11.2.8. The transducers shall be suitably protected against transient high peaks of voltage & current.

11.2.9. The transducer shall withstand indefinitely without damage and work satisfactorily at 120% of the rated voltage and 120% of the rated input current as applicable.

11.2.10. All the transducers shall have an output of 4-20 mA.

11.2.11. The response time of the transducers shall be less than 1 second.

11.2.12. The accuracy class of transducers shall be 1.0 or better for voltage/current transducer, 0.5 or better for watt/VAR transducer and 0.2 or better for frequency transducer.

11.2.13. The transducers shall have a low AC ripple on output less than 1%.

11.2.14. The transducer shall have dual output.

12. ANNUNCIATION SYSTEM for Control Panel

12.1. Alarm annunciation system shall be provided in the control board by means of visual and audible alarm in order to draw the attention of the operator to the abnormal operating conditions or the operation of some protective devices. The annunciation equipment shall be suitable for operation on the voltages specified in this specification.

12.2. The visual annunciation shall be provided by annunciation facia, mounted flush on the top of the control panels.

12.3. The annunciation facia shall be provided with translucent plastic window for alarm point with approximate size of 35mm x 50mm. The facia plates shall be engraved in black lettering with respective inscriptions. Alarm inscriptions shall be engraved on each window in not more than three lines and size of the lettering shall not be less than 5 mm.

12.4. Each annunciation window shall be provided with two white lamps in parallel to provide safety against lamp failure. Long life lamps shall be used. The transparency of cover plates and wattage of the lamps provided in the facia windows shall be adequate to ensure clear visibility of the inscriptions in the control room having high illumination intensity (350 Lux), from the location of the operator's desk.

12.5. All Trip facia shall have red colour and all Non-trip facia shall have white colour.

12.6. The audible alarm shall be provided by Buzzer/ Hooter /Bell having different sounds and shall be used as follows.

Hooter	Alarm Annunciation
Bell	Annunciation DC failure
Buzzer	AC supply failure

12.7. Sequence of operation of the annunciator shall be as follows :

Sl. NO.	Alarm Condition	Fault Contact	Visual Annunciation	Audible Annunciation
1.	Normal	Open	OFF	OFF
2.	Abnormal	Close	Flashing	ON
3.	Accept Push Button Pressed	Close	Steady On	OFF
		Open	Steady On	OFF
4.	Reset Push Button Pressed	Close	On	OFF
		Open	Off	OFF
5.	Lamp Test Push Button Pressed	Open	Steady On	OFF

12.8. Audible annunciation for the failure of DC supply to the annunciation system shall be provided and this annunciation shall operate on 230 Volts AC supply. On failure of the DC to the annunciation system for more than 2 or 3 seconds (adjustable setting), a bell shall sound. A separate push button shall be provided for the cancellation of this audible alarm alone but the facia window shall remain steadily lighted till the supply to annunciation system is restored.

12.9. A separate voltage check relay shall be provided to monitor the failure of supply (230V AC) to the scheme mentioned in Clause above. If the failure of supply exists for more than 2 to 3 seconds, this relay shall initiate visual and audible annunciation. Visual and audible annunciation for the failure of AC supply to the annunciation system shall be provided and this annunciation shall operate on Annunciation DC and buzzer shall sound.

12.10. The annunciation system described above shall meet the following additional requirements :

a) The annunciation system shall be capable of catering to at least 20 simultaneous signals at a time.

b) One set of the following push buttons shall be provided on each control panel:

- Reset push button for annunciation system
- Accept push button for annunciation system
- Lamp test push button for testing the facia windows

c) One set of the following items shall be provided common for all the control panel (not applicable for extension of substation) :

- Flasher relay for annunciation system
- Push button for Flasher test
- Three Push buttons for test of all audible alarm systems

d) These testing circuits shall be so connected that while testing is being done, it shall not prevent the registering of any new annunciation that may land during the test.

e) The annunciation shall be repetitive type and shall be capable of registering the fleeting signal. Minimum duration of the fleeting signal registered by the system shall be 15 milli seconds.

f) In case of static annunciator scheme, special precaution shall be taken to ensure that spurious alarm condition does not appear due to influence of external electromagnetic/ electrostatic interference on the annunciator wiring and switching

disturbances from the neighbouring circuits within the panels and the static annunciator shall meet the high voltage susceptibility test , impulse voltage withstand test , high frequency disturbance test– class III and fast transient disturbance test –level III as per IEC 60255.

12.11. The annunciation system to be supplied for existing sub-stations shall be engineered as an extension to the existing scheme.

13. SWITCHES

13.1. Control and instrument switches shall be rotary operated type with escutcheon plates clearly marked to show operating position and circuit designation plates and suitable for flush mounting with only switch front plate and operating handle projecting out.

13.2. The selection of operating handles for the different types of switches shall be as follows :

Breaker, Isolator control switches	:	Pistol grip, black
Synchronising switches	:	Oval, Black, Keyed handle (one common removable handle for a group of switches or locking facility having common key)
synchronising Selector switches	:	Oval or knob, black
Instrument switches	:	Round, knurled, black
Protection Transfer switch	:	Pistol grip, lockable and black.

13.3. The control switch of breaker and isolator shall be of spring return to neutral type. The switch shall have spring return from close and trip positions to "after close" and "after trip" positions respectively.

13.4. Instrument selection switches shall be of maintained contact (stay put) type. Ammeter selection switches shall have make-before-break type contacts so as to prevent open circuiting of CT secondary when changing the position of the switch. Voltmeter transfer switches for AC shall be suitable for reading all line- to-line and line-to-neutral voltages for non- effectively earthed systems and for reading all line to line voltages for effectively earthed systems.

13.5. Synchronising switches shall be of maintained contact (stay put) type having a common removable handle for a group of switches. The handle shall be removable only in the OFF position and it shall be co-ordinated to fit into all the synchronising switches. These switches shall be arranged to connect the synchronising equipment when turned to the 'ON' position. One contact of each switch shall be connected in the closing circuit of the respective breaker so that the breaker cannot be closed until the switch is turned to the 'ON' position.

13.6. Lockable type of switches which can be locked in particular positions shall be provided when specified. The key locks shall be fitted on the operating handles.

13.7. The contacts of all switches shall preferably open and close with snap action to minimise arcing. Contacts of switches shall be spring assisted and contact faces shall be with rivets of pure silver or silver alloy. Springs shall not be used as current carrying parts

13.8. The contact combination and their operation shall be such as to give completeness to the interlock and function of the scheme.

13.9. The contact rating of the switches shall be as follows :

Description	Contact Rating in Amps		
	220/110V DC	50V DC	230V AC
Make and carry Continuously	10	10	10
Make and carry for 0.5 sec.	30	30	30
Break for Resistive load	3	20	7
Break for Inductive load with L/R = 40m sec.	0.2	-	-

14. INDICATING LAMPS

14.1. Indicating lamps shall be of cluster LED type suitable for panel mounting with rear terminal connections. Lamps shall be provided with series connected resistors preferably built in the lamp assembly. Lamps shall have translucent lamp covers to diffuse lights coloured red, green, amber, clear white or blue as specified. The lamp cover shall be preferably of screwed type, unbreakable and moulded from heat resisting material.

14.2. The lamps shall be provided with suitable resistors.

14.3. Lamps and lenses shall be interchangeable and easily replaceable from the front of the panel. Tools, if required for replacing the bulbs and lenses shall also be included in the scope of the supply.

14.4. The indicating lamps with resistors shall withstand 120% of rated voltage on a continuous basis.

15. POSITION INDICATORS (if Applicable)

15.1. Position indicators of "SEMAPHORE" type shall be provided when specified as part of the mimic diagrams on panels for indicating the position of circuit breakers, isolating/earthing switches etc. The indicator shall be suitable for semi-flush mounting with only the front disc projecting out and with terminal connection from the rear. Their strips shall be of the same colour as the associated mimic.

15.2. Position indicator shall be suitable for DC Voltage as specified. When the supervised object is in the closed position, the pointer of the indicator shall take up a position in line with the mimic bus bars, and at right angles to them when the object is in the open position. When the supply failure to the indicator occurs, the pointer shall take up an intermediate position to indicate the supply failure.

15.3. The rating of the indicator shall not exceed 2.5 W.

15.4. The position indicators shall withstand 120% of rated voltage on a continuous basis.

16. SYNCHRONISING EQUIPMENT

16.1. For sub-station equipped with sub-station Automation system, the requirement of synchronisation is specified in Section Sub-station Automation System and the same shall prevail. For other sub-station which is not equipped with Sub-sub-station

automation system following shall be applicable as per requirement.

1.1. The synchronising instruments shall be mounted either on a synchronising trolley or on a synchronising panel. The panel/ trolley shall be equipped with double analog voltmeters and double analog frequency meters, synchroscope and lamps fully wired. The size of voltmeters and frequency meters provided in the synchronising panel shall not be less than 144 X 144 sq.mm. Suitable auxiliary voltage transformers wherever necessary shall also be provided for synchronising condition. In case the synchroscope is not continuously rated, a synchroscope cut-off switch shall be provided and an indicating lamp to indicate that the synchroscope is energised, shall also be provided

1.2. Synchronising check relay with necessary ancillary equipment's shall be provided which shall permit breakers to close after checking the requirements of synchronising of incoming and running supply. The phase angle setting shall not exceed 35 degree and have voltage difference setting not exceeding 10%. This relay shall have a response time of less than 200 milliseconds when the two system conditions are met within present limits and with the timer disconnected. The relay shall have a frequency difference setting not exceeding 0.45% at rated value and at the minimum time setting. The relay shall have an adjustable time setting range of 0.5-20 seconds. A guard relay shall be provided to prevent the closing attempt by means of synchronising check relay when control switch is kept in closed position long before the two systems are in synchronism

1.3. The synchronising panel shall be draw out and swing type which can be swivelled in left and right direction. The synchronising panel shall be placed along with control panels and the number of synchronising panel shall be as indicated in BPS. The incoming and running bus wires of VT secondary shall be connected and run as bus wires in the control panels and will be extended to synchronising panel for synchronisation of circuit breakers. The selector switch provided for each circuit breaker in respective control panels shall be lockable type with a common key so that only one selector switch is kept in synchronising mode at a time.

1.4. Alternatively, the trolley shall be of mobile type with four rubber-padding wheels capable of rotating in 360 degree around the vertical axis. Suitable bumpers with rubber padding shall be provided all around the trolley to prevent any accidental damage to any panel in the control room while the trolley is in movement. The trolley shall have two meter long flexible cord fully wired to the instruments and terminated in a plug in order to facilitate connecting the trolley to any of the panels. The receptacle to accept the plug shall be provided on the panel.

1.5. At existing sub-stations, the synchronising scheme shall be engineered to be compatible with the existing synchronising scheme and synchronising socket/switch on the panel. In substations, where synchronising panels are available, the bidder shall carry out the shifting of the above panels, if required, to facilitate the extension of control panel placement.

17. RELAYS

17.1. All relays shall conform to the requirements of IS: 3231/IEC-60255/IEC 61000 or other applicable standards. Relays shall be suitable for flush or semi-flush mounting on the front with connections from the rear.

17.2. All protective relays shall be of numerical type and communication protocol shall be as per IEC 61850. Further, the test levels of EMI as indicated in IEC 61850 shall be applicable to these relays.

17.3. All protective relays shall be in draw out or plug-in type/modular cases with proper testing facilities. Necessary test plugs/test handles shall be supplied loose and shall be included in contractor's scope of supply.

17.4. All AC operated relays shall be suitable for operation at 50 Hz. AC Voltage operated relays shall be suitable for 110 Volts VT secondary and current operated relays for 1

amp CT secondary. All DC operated relays and timers shall be designed for the DC voltage specified, and shall operate satisfactorily between 80% and 110% of rated voltage. Voltage operated relays shall have adequate thermal capacity for continuous operation.

17.5. The protective relays shall be suitable for efficient and reliable operation of the protection scheme described in the specification. Necessary auxiliary relays and timers required for interlocking schemes for multiplying of contacts suiting contact duties of protective relays and monitoring of control supplies and circuits, lockout relay monitoring circuits etc. also required for the complete protection schemes described in the specification shall be provided. All protective relays shall be provided with at least two pairs of potential free isolated output contacts. Auxiliary relays and timers shall have pairs of contacts as required to complete the scheme; contacts shall be silver faced with spring action. Relay case shall have adequate number of terminals for making potential free external connections to the relay coils and contacts, including spare contacts.

17.6. Timers shall be of solid state type. Time delay in terms of milliseconds obtained by the external capacitor resistor combination is not preferred and shall be avoided.

17.7. No control relay, which shall trip the power circuit breaker when the relay is de-energised, shall be employed in the circuits.

17.8. Provision shall be made for easy isolation of trip circuits of each relay for the purpose of testing and maintenance.

17.9. Auxiliary seal-in-units provided on the protective relays shall preferably be of shunt reinforcement type. If series relays are used the following shall be strictly ensured:

(a) The operating time of the series seal-in-unit shall be sufficiently shorter than that of the trip coil or trip relay in series with which it operates to ensure definite operation of the flag indicator of the relay.

(b) Seal-in-unit shall obtain adequate current for operation when one or more relays operate simultaneously.

(c) Impedance of the seal-in-unit shall be small enough to permit satisfactory operation of the trip coil on trip relays when the D.C. Supply Voltage is minimum.

(d) Trip-circuit seal-in is required for all trip outputs, irrespective of the magnitude of the interrupted current. The trip-circuit seal-in logic shall not only seal-in the trip output(s),but also the relevant initiation signals to other scheme functions, (e.g. initiate signals to the circuit-breaker failure function, reclosing function etc.), and the alarm output signals.

(e) Two methods of seal-in are required, one based on the measurement of AC current, catering for those circumstances for which the interrupted current is above a set threshold, and one based on a fixed time duration, catering for those circumstances for which the interrupted current is small (below the set threshold).

(f) For the current seal-in method, the seal-in shall be maintained until the circuit-breaker opens, at which time the seal-in shall reset and the seal-in method shall not now revert to the fixed time duration method. For this seal-in method, the seal-in shall be maintained for the set time duration. For the line protection schemes, this time duration shall be independently settable for single- and three-pole tripping.

(g) Seal-in by way of current or by way of the fixed duration timer shall occur irrespective of whether the trip command originates from within the main protection device itself (from any of the internal protection functions), or from an external device with its trip output routed through the main protection device for tripping. Trip-circuit seal-in shall not take place under sub-harmonic conditions (e.g. reactor ring down).

17.10. The setting ranges of the relays offered, if different from the ones specified shall also be

acceptable if they meet the functional requirements.

17.11. Any alternative/additional protections or relays considered necessary for providing complete effective and reliable protection shall also be offered separately. The acceptance of this alternative/ additional equipment shall lie with the OWNER.

17.12. All relays and their drawings shall have phase indications as R-Red, Y-yellow, B-blue

17.13. For numerical relays, the scope shall include the following:

a) Necessary software and hardware to up/down load the data to/from the relay from/to the personal computer installed in the substation. However, the supply of PC is not covered under this clause.

b) The relay shall have suitable communication facility for future connectivity to SCADA. The relay shall be capable of supporting IEC-61850 protocol.

c) In case of line protection and transformer/reactor protection, the features like fault recorder and event logging function as available including available as optional feature in these relays shall be supplied and activated at no extra cost to the owner. Also necessary software/ hardware for automatic uploading to station HMI/DR work station (as applicable) shall be supplied. It is to be clearly understood that these shall be in addition to Fault recorder function as specified at clause no. 28.

18. TRANSMISSION LINE PROTECTION

18.1. All relays shall be suitable for series compensated line.

18.2. The line protection relays are required to protect the line and clear the faults on line within shortest possible time with reliability, selectivity and full sensitivity to all type of faults on lines. The general concept is to have two main protections having equal performance requirement specially in respect of time as called Main-I and Main-II for 220KV transmission lines and Main and back up protection for 132 KV transmission lines.

18.3. The Transmission system for which the line protection equipment are required is **indicated in Section 1 – Section – Project / General Technical Specification (GTS)**

18.4. The maximum fault current could be as high as 63kA but the minimum fault current could be as low as 20% of rated current of CT secondary. The starting & measuring relays characteristics should be satisfactory under these extremely varying conditions.

18.5. The protective relays shall be suitable for use with capacitor voltage transformers having non-electronic damping and transient response as per IEC.

18.6. Fault Recorder, Distance to fault Locator and Over voltage relay (stage -1/2) functions if offered as an integral part of line protection relays, shall be acceptable provided these meet the technical requirements as specified in the respective clauses.

18.7. Auto reclose relay function if offered as an integral part of line distance protection relay, shall be acceptable **for 132 KV lines only** provided the auto reclose relay feature meets the technical requirements as specified in the respective clause.

18.8. The following protections shall be provided for each of the Transmission lines:

For 220KV

Main-I: Numerical distance protection scheme

Main-II: Numerical distance protection scheme of a make different from that of Main –I

For 132KV

Main: Numerical distance protection scheme

Back up: Directional Over Current and Earth fault Protection

The detailed description of line protections is given here under.

18.9. **Main-I and Main-II Distance Protection scheme**:

(a) shall have continuous self monitoring and diagnostic feature

(b) shall be non-switched type with separate measurements for all phase to phase and phase to ground faults

(c) shall have stepped time-distance characteristics and three independent zones (zone 1, zone-2 and zone-3)

(d) shall have mho or quadrilateral or other suitably shaped characteristics for zone-1 , zone-2 and zone- 3

(e) shall have following maximum operating time (including trip relay time, if any) under given set of conditions and with CVT being used on line (with all filters included)

(i) for 220 KV lines:

For Source to Impedance ratio:	**4**	**15**
Relay setting (Ohms)	(10 or 20) and 2	2
Fault Locations (as % of relay setting)	50	50
Fault resistance (Ohms)	0	0
Maximum operating time (Milliseconds)	40 for all faults	45 for 3 ph. Faults & 60 for all other faults

(ii) for 132 KV lines:

A relaxation of 5 ms in above timings is allowed for 132 KV lines.

(f) The relay shall have an adjustable characteristics angle setting range of 30 -85 degree or shall have independent resistance(R) and reactance (X) setting.

(g) shall have two independent continuously variable time setting range of 0-3 seconds for zone-2 and 0-5 seconds for zone-3

(h) shall have resetting time of less than 55 milli-seconds (including the resetting time of trip relays)

(i) shall have facilities for offset features with adjustable 10-20% of Zone-3 setting

(j) shall have variable residual compensation

(k) shall have memory circuits with defined characteristics in all three phases to ensure correct operation during close-up 3 phase faults and other adverse conditions and shall operate instantaneously when circuit breaker is closed to zero-volt 3 phase fault

(l) shall have weak end in-feed feature

(m) shall be suitable for single & three phase tripping

(n) shall have a continuous current rating of two times of rated current. The voltage circuit shall be capable of operation at 1.2 times rated voltage. The relay shall also be capable of carrying a high short time current of 70 times rated current without damage for a period of 1 sec.

(o) shall be provided with necessary self reset type trip duty contacts for completion of the scheme (Minimum number of these trip duty contacts shall be four per phase) either through built in or through separate high speed trip relays. Making capacity of these trip contacts shall be 30 amp for 0.2 seconds with an inductive load of L/R > 10 mill seconds. If separate high speed trip relays are used , the operating time of the same shall not be more than 10 milliseconds

(p) shall be suitable for use in permissive under reach/ over reach/ blocking communication mode

(q) shall have suitable number of potential free contacts for Carrier aided Tripping, Auto reclosing, CB failure, Disturbance recorder & Data acquisition system

(r) include power swing blocking protection which shall

- have suitable setting range to encircle the distance protection described above
- block tripping during power swing conditions
- release blocking in the event of actual fault

(s) include fuse failure protection which shall monitor all the three fuses of C.V.T. and associated cable against open circuit

- inhibit trip circuits on operation and initiate annunciation
- have an operating time less than 7 milliseconds
- remain inoperative for system earth faults

(t) include a directional back up Inverse Definite Minimum Time (IDMT) earth fault relay with normal inverse characteristics as per IEC 60255-3 as a built in feature or as a separate unit for 220KV transmission lines

(u) Must have a current reversal guard feature.

18.10. **Back-up Directional Over Current and Earth fault protection scheme**

(a) shall have three over current and one earth fault element(s) which shall be either independent or composite unit(s)

(b) shall include necessary VT fuse failure relays for alarm purposes

(c) **over current elements** shall

- have IDMT characteristic with a definite minimum time of 3.0 seconds at 10 times setting
- have a variable setting range of 50-200% of rated current
- have a characteristic angle of 30/45 degree lead
- include hand reset flag indicators or LEDs

(d) **earth fault element** shall

- have IDMT characteristic with a definite minimum time of 3.0 seconds at 10 times setting
- have a variable setting range of 20-80% of rated current
- have a characteristic angle of 45/60 degree lag
- include hand reset flag indicators or LEDs
- include necessary separate interposing voltage transformers or have internal feature in the relay for open delta voltage to the relay

18.11. **LINE OVER VOLTAGE PROTECTION RELAY** shall

(a) monitor all three phases

(b) have two independent stages

(c) stage- I & II as built-in with line distance relays Main I & II respectively are acceptable

(d) have an adjustable setting range of 100-170% of rated voltage with an adjustable time delay range of 1 to 60 seconds for the first stage

(e) have an adjustable setting range of 100-170% of rated voltage with a time delay of 100-200 mill seconds for the second stage

(f) be tuned to power frequency

(g) provided with separate operation indicators (flag target) for each stage relays

(h) have a drop-off to pick-up ratio greater than 95%

(i) provide separate out-put contacts for each 'Phase' and stage for breaker trip relays, event logger and other scheme requirements

18.12. All trip relays used in transmission line protection scheme shall be of self/electrical reset type depending on application requirement.

19. CIRCUIT BREAKER PROTECTION:

This shall include following functions:

19.1. **Numerical AUTO RECLOSING** function shall

(a) have single phase reclosing facilities

(b) have a continuously variable single phase dead time range of 0.1-2 seconds

(c) have a continuously variable reclaim time range of 5-300 seconds

(d) Incorporate a **two** position selector switch, from which single phase auto-reclosure and non-auto reclosure mode can be selected. Alternatively, the mode of auto reclosing can be selected through programming.

(e) be of single shot type

(f) have priority circuit to closing of both circuit breakers in case one and half breaker arrangements to allow sequential closing of breakers

(g) However, Auto-reclose as in built function of bay controller unit (BCU) (if supplied) provided for sub-station automation system is also acceptable.

19.2. **LOCAL BREAKER BACK-UP PROTECTION SCHEME** shall

(a) be triple pole type

(b) have an operating time of less than 15 milli seconds

(c) have a resetting time of less than 15 milli seconds

(d) have three over current elements

(e) be arranged to get individual initiation from the corresponding phase of main protections of line for each over current element. However, common three phase initiation is acceptable for other protections and transformer /reactor equipment protections

(f) have a setting range of 20-80% of rated current

(g) have a continuous thermal withstand two times rated current irrespective of the setting

(h) have a timer with continuously adjustable setting range of 0.1-1 seconds

(i) have necessary auxiliary relays to make a comprehensive scheme

(j) be similar relays for complete scope of work as per specification

20. REACTOR PROTECTION

20.1. **Differential Protection Relay shall**

(a) be triple pole type

(b) have operation time less than 25 milli-seconds at 5 times setting

(c) be tuned to system frequency

(d) have current setting range of 10 to 40% of 1 Amp. or a suitable voltage setting range

(e) be high impedance / biased differential type

(f) be stable for all external faults

20.2. **Restricted Earth Fault Protection Relay** shall

(a) be single pole type

(b) be of current/voltage operated high impedance type

(c) have a current setting of 10-40% of 1 Amp./have a suitable voltage setting range

(d) be tuned to system frequency

(e) have a suitable non-linear resistor to limit the peak voltage to 1000 Volts

20.3. **Back up impedance protection Relay** shall

(a) be triple pole type, with faulty phase identification/ indication

(b) be single step polarised 'mho' distance/ impedance relay suitable for measuring phase to ground and phase to phase faults

(c) have adequate ohmic setting range to cover at least 60% of the impedance of the reactor and shall be continuously variable

(d) have an adjustable characteristic angle of 30-80 degree

(e) have a definite time delay relay with a continuously adjustable setting range of 0.2-2.0 seconds

(f) include VT failure relay which shall block the tripping during VT fuse failure condition

Further, Reactor auxiliary protections contacts (Buchholz, PRV, Oil Temperature, Winding Temperature etc.) can be wired suitably in above protections or provide separate Flag relays/Auxiliary relays as per scheme requirements.

21. TRANSFORMER PROTECTION

All transformer protection functions may be grouped into Group-I and Group-II protections in the following manner:

Group-I Protection: Following protection functions may be provided in Group-I Transformer protection relay:

a) Differential Protection as per clause no. 21.1

b) Over fluxing Protection for HV side as per clause no. 21.2

c) Direction Over current and earth fault protection for HV side as per clause no. 21.4

d) Over Load Protection as per clause no. 21.5

Group-II Protection: Following protection functions may be provided in Group-II Transformer protection relay:

e) REF Protection as per clause no. 21.3

f) Over fluxing Protection for IV/LV side as per clause no. 21.2

g) Direction Over current and earth fault protection for IV/LV side as per clause no. 21.4

h) Neutral Current Relay for Single Phase Transformer Bank

The various protections as built-in function of Group I/II protections shall be accepted only if the functional requirements of corresponding protections as specified in clause no. 21.1 to 21.6 are met otherwise separate protection relay(s) shall be offered.

21.1 Transformer differential protection scheme shall

(a) be triple pole type, with faulty phase identification/ indication

(b) have an operating time not greater than 30 milli seconds at 5 times the rated current

(c) have three instantaneous high set over-current units

(d) have an adjustable bias setting range of 20-50%

(e) be suitable for rated current of 1 Amp.

(f) have second harmonic or other inrush proof features and also should be stable under normal over fluxing conditions. Magnetising inrush proof feature shall not be achieved through any intentional time delay e.g. use of timers to block relay operation or using disc operated relays

(g) have an operating current setting of 15% or less

(h) include necessary separate interposing current transformers for angle and ratio correction or have internal feature in the relay to take care of the angle & ratio correction

(i) have a fault recording feature to record graphic form of instantaneous values of following analogue channels during faults and disturbances for the pre fault and post fault period:

current in all three windings in nine analogue channels in case of 400kV class and above transformers or 6 analogue channels for lower voltage transformers and Voltage in one channel

The disturbance recorder shall have the facility to record the following external digital channel signals apart from the digital signals pertaining to differential relay:

1. REF protection operated
2. HV Breaker status (Main and tie)
3. IV Breaker status
4. Bucholz /OLTC Bucholz alarm / trip etc.
5. WTI/OTI/PRD alarm/trip of transformer etc.

Necessary hardware and software, for automatic up-loading the data captured by disturbance recorder to the personal computer (DR Work Station) available in the substation, shall be included in the scope.

21.2. **Over Fluxing Protection Relays** shall

(a) operate on the principle of Voltage to frequency ratio and shall be phase to phase connected

(b) have inverse time characteristics, matching with transformer over fluxing withstand capability curve

(c) provide an independent 'alarm' with the time delay continuously adjustable between 0.1 to 6.0 seconds at values of 'v/f' between 100% to 130% of rated values

(d) tripping time shall be governed by 'v/f' Vs. time characteristics of the relay

(e) have a set of characteristics for Various time multiplier settings. The maximum operating time of the relay shall not exceed 3 seconds and 1.5 seconds at 'v/f' values of 1.4 and 1.5 times, the rated values, respectively.

(f) have an accuracy of operating time, better than ±10%

(g) have a resetting ratio of 95 % or better

21.3. **Restricted Earth Fault Protection** shall

(a) be single pole type

(b) be of current/voltage operated type

(c) have a current setting range of 10-40% of 1 Amp./ have a suitable voltage setting range

(d) be tuned to the system frequency

21.4. **Back-up Over Current and Earth fault protection scheme with high set feature**

(a) Shall have three over current and one earth fault element(s) which shall be either independent or composite unit(s).

(b) The scheme shall include necessary VT fuse failure relays for alarm purposes

(c) Over current relay shall

- have directional IDMT characteristic with a definite minimum time of 3.0 seconds at 10 times setting and have a variable setting range of 50-200% of rated current
- have low transient, over reach high set instantaneous unit of continuously variable setting range 500-2000 % of rated current
- have a characteristic angle of 30/45 degree lead
- include hand reset flag indicators or LEDs.

(d) Earth fault relay shall

- have directional IDMT characteristic with a definite minimum time of 3.0 seconds at 10 times setting and have a variable setting range of 20-80% of rated current
- have low transient, over reach high set instantaneous unit of continuously variable setting range 200-800 % of rated current
- have a characteristic angle of 45/60 degree lag
- include hand reset flag indicators or LEDs
- include necessary separate interposing voltage transformers or have internal feature in the relay for open delta voltage to the relay

21.5. **Transformer Overload Protection Relay** shall

(a) be of single pole type

(b) be of definite time over-current type

(c) have one set of over-current relay element, with continuously adjustable setting range of 50-200% of rated current

(d) have one adjustable time delay relay for alarm having setting range of 1 to 10.0 seconds, continuously.

(e) have a drop-off/pick-up ratio greater than 95%.

21.6. **Transformer Neutral Current Protection relay** (for 1-Phase transformer bank neutral) shall

(a) have directional IDMT characteristic with a definite minimum time of 3.0 seconds at 10 times setting and have a variable setting range of 20-80% of rated current

21.7. **Further, Transformer auxiliary protections contacts (Buchholz, PRV, Oil Temperature, Winding Temperature, OLTC Buchholz etc.) can be wired suitably in above protections or provide separate Flag relays/Auxiliary relays as per scheme requirements.**

22. TEE DIFFERENTIAL PROTECTION RELAYS

22.1. **TEE-1 Differential protection relay** shall

(a) be triple pole type

(b) have an operating time less than 30 milliseconds at 5 times the rated current

(c) have three instantaneous high set over current units

(d) have an adjustable bias setting range of 20-50%

(e) have an operating current setting of 15% of 1 Amp or less

22.2. **TEE-2 Differential Protection relay** shall

(a) be triple pole type

(b) have operating time less than 25 milliseconds at 5 times setting

(c) be tuned to system frequency

(d) have current setting range of 20 to 80% of 1 Amp

(e) be voltage operated, high impedance type

(f) be stable for all external faults

(g) be provided with suitable non linear resistors across the relay to limit the peak voltage to 1000 volts

23. TRIP CIRCUIT SUPERVISION RELAY

(a) The relay shall be capable of monitoring the healthiness of each 'phase' trip-coil and associated circuit of circuit breaker during 'ON' and 'OFF' conditions.

(b) The relay shall have adequate contacts for providing connection to alarm and event logger.

(c) The relay shall have time delay on drop-off of not less than 200 milli seconds and be provided with operation indications for each phase

24. TRIPPING RELAY

High Speed Tripping Relay shall

(a) be instantaneous (operating time not to exceed 10 milli-seconds).

(b) reset within 20 milli seconds

(c) be D.C. operated

(d) have adequate contacts to meet the requirement of scheme, other functions like auto-reclose relay, LBB relay as well as cater to associated equipment like event logger, Disturbance recorder, fault Locator, etc.

(e) be provided with operation indicators for each element/coil.

25. DC SUPPLY SUPERIVISION RELAY

(a) The relay shall be capable of monitoring the failure of D.C. supply to which, it is connected.

(b) It shall have adequate potential free contacts to meet the scheme requirement.

(c) The relay shall have a 'time delay on drop-off' of not less than 100 milli seconds and be provided with operation indicator/flag.

26. BUS BAR PROTECTION

26.1. Single bus bar protection scheme shall be provided for each main bus and transfer bus (as applicable) for 220KV and 132 KV voltage levels

26.2. Each Bus Bar protection scheme shall

(a) have maximum operating time up to trip impulse to trip relay for all types of faults of 25 milli seconds at 5 times setting value.

(b) operate selectively for each bus bar

(c) give hundred percent security up to 63 KA fault level for 220KV and 31.5 KA for 132 KV

(d) incorporate continuous supervision for CT secondary against any possible open circuit and if it occurs, shall render the relevant zone of protection inoperative and initiate an alarm

(e) not give false operation during normal load flow in bus bars

(f) incorporate clear zone indication

(g) be of phase segregated and triple pole type

(h) provide independent zones of protection (including transfer bus if any). If the bus section is provided then each side of bus section shall have separate set of bus bar protection schemes

(i) include individual high speed electrically reset tripping relays for each feeder. However, in case of distributed Bus bar protection, individual trip relay shall not be required if bay unit is having trip duty contacts for breaker tripping.

(j) be transient free in operation

(k) include continuous D.C. supplies supervision

(l) not cause tripping for the differential current below the load current of heaviest loaded feeder. Contractor shall submit application check for the same.

(m) shall include necessary C.T. switching relays wherever C.T. switching is involved and have 'CT' selection incomplete alarm

(n) include protection 'IN/OUT' switch for each zone

(o) shall include trip relays, CT switching relays (if applicable), auxiliary CTs (if applicable) as well as additional power supply modules, input modules etc. as may be required to provide a Bus-bar protection scheme for the complete bus arrangement i.e. for all the bays or breakers including future bays as per the Single line diagram for new substations. However for extension of bus bar protection scheme in existing substations, scope shall be limited to the bay or breakers covered under this specification. Suitable panels (if required) to mount

these are also included in the scope of the work.

(p) In case of distributed Bus bar Protection, the bay units for future bays may be installed in a separate panel and the same shall be located in switchyard panel room where bus bar protection panel shall be installed.

26.3. Built-in Local Breaker Backup protection feature as a part of bus bar protection scheme shall also be acceptable.

26.4. At existing substations, Bus-bar protection scheme with independent zones for each bus, will be available. All necessary co-ordination for 'AC' and 'DC' interconnections between existing schemes (Panels) and the bays proposed under the scope of this contract shall be fully covered by the bidder. Any auxiliary relay, trip relay, flag relay and multi tap auxiliary CTs (in case of biased differential protection) required to facilitate the operation of the bays covered under this contract shall be fully covered in the scope of the bidder.

26.5. The test terminal blocks (TTB) to be provided shall be fully enclosed with removable covers and made of moulded, non-inflammable plastic material with boxes and barriers moulded integrally. All terminals shall be clearly marked with identification numbers or letters to facilitate connection to external wiring. Terminal block shall have shorting, disconnecting and testing facilities for CT circuits.

27. **WEATHER PROOF RELAY PANELS** (If Applicable)

(a) This panel shall include necessary number of electrically reset relays each with at least eight contacts for isolator auxiliary contacts multiplication and for changing the CT and DC circuits to relevant zones of bus bar protection.

(b) The panel shall be sheet steel enclosed and shall be dust, weather and vermin proof. Sheet steel used shall be at least 2.0 mm thick and properly braced to prevent wobbling.

(c) The enclosures of the panel shall provide a degree of protection of not less than IP-55 (as per IEC-60529).

(d) The panel shall be of free standing floor mounting type or pedestal mounting type as per requirement.

(e) The panel shall be provided with double hinged doors with padlocking arrangement.

(f) All doors, removable covers and panels shall be gasketed all around with synthetic gaskets Neoprene/EPDM. However, XLPE gaskets can also be used for fixing protective glass doors. Ventilating louvers, if provided shall have screens and filters. The screens shall be made of either brass or GI wire mesh

(g) Cable entries shall be from bottom. Suitable removable cable gland plate shall be provided on the cabinet for this purpose.

(h) All sheet steel work shall be degreased, pickled, phosphated and then applied with two coats of zinc chromates primer and two coats of finishing synthetic enamel paint, both inside and outside. The colour of the finishing paint shall be light grey.

(i) Suitable heaters shall be mounted in the panel to prevent condensation. Heaters shall be controlled by thermostats so that the cubicle temperature does not exceed $30^{O}C$. On-off switch and fuse shall be provided. Heater shall be suitable for 230V AC supply Voltage.

(j) The test terminal blocks (TTB) to be provided shall be fully enclosed with removable covers and made of moulded, non-inflammable plastic material with

boxes and barriers moulded integrally. All terminals shall be clearly marked with identification numbers or letters to facilitate connection to external wiring. Terminal block shall have shorting, disconnecting and testing facilities for CT circuits.

28. FAULT RECORDER

28.1. The fault recorder shall be provided for transmission line and the fault recorder as in-built feature of line distance relay is also acceptable provided the requirements of following clauses are met.

28.2. Fault recorder shall be microprocessor based and shall be used to record the graphic form of instantaneous values of voltage and current in all three phases, open delta voltage & neutral current, open or closed position of relay contacts and breakers during the system disturbances.

28.3. The Fault recorder shall consist of individual acquisition units, one for each feeder and an Evaluation unit which is common for the entire Substation. Whenever, more than one acquisition units are connected to an Evaluation unit, necessary hardware and software shall also be supplied for on line transfer of data from all acquisition units to Evaluation unit.

28.4. The acquisition unit is connected with evaluation unit being supplied as described in Section-sub-station automation through bus conforming to IEC 61850. In case of extension sub-station which is equipped with Sub-station Automation System based on IEC 61850, one set of evaluation software shall be supplied and loaded in existing fault recorder evaluation unit. Automatic uploading of disturbance files from acquisition unit to evaluation unit shall be done through existing station bus only conforming to IEC 61850. Necessary configuration/updation including hardware if any shall be in the scope of the contractor.

28.5. In case of extension of existing substation(s) which are without sub-station automation system, one set of Evaluation unit shall be supplied for each substation where ever disturbance recorders are required to be supplied along with necessary evaluation software as specified above. The Evaluation unit shall consist of a desktop personal computer (including at least 17" TFT colour monitor, mouse and keyboard) and printer. The desktop PC shall have Pentium - IV processor or better and having a clock speed 3.0GHz or better. The hard disk capacity of PC shall not be less than 300 GB and RAM capacity shall not be less than 3 GB

28.6. The evaluation unit hardware, for substations having SAS, shall be as described in clause no. 4.0 of Section sub-station automation system.

28.7. Fault recorder shall have atleast 8 analogue and 16 digital channels for each feeder.

28.8. Acquisition units shall acquire the Disturbance data for the pre fault and post fault period and transfer them to Evaluation unit automatically to store in the hard disk. The acquisition units shall be located in the protection panels of the respective feeders.

28.9. The acquisition unit shall be suitable for inputs from current transformers with 1A rated secondary and capacitive voltage transformers with 63.5V (phase to neutral voltage) rated secondary. Any device required for processing of input signals in order to make the signals compatible to the Fault recorder equipment shall form an integral part of it. However, such processing of input signals shall in no way distort its waveform.

28.10. The equipment shall be carefully screened, shielded, earthed and protected as may be required for its safe functioning. Also, the Fault recorder shall have stable software, reliable hardware, simplicity of maintenance and immunity from the effects of the hostile environment of EHV switchyard which are prone to various interference signals typically from large switching transients.

28.11. Necessary software for transferring the data automatically from local evaluation unit to a remote station and receiving the same at the remote station through owner's PLCC/VSAT/LEASED LINE shall be provided.

28.12. Evaluation software shall be provided for the analysis and evaluation of the recorded data made available in the PC under WINDOWS environment. The Software features shall include repositioning of analog and digital signals, selection and amplification of time and amplitude scales of each analogue and digital channel, calculation of MAX/MIN frequency, phase difference values, recording of MAX/MIN values etc. of analogue channel, group of signal to be drawn on the same axis etc. listing and numbering of all analogue and digital channels and current, voltage, frequency and phase difference values at the time of fault/tripping. Also, the software should be capable of carrying out Fourier /Harmonic analysis of the current and voltage wave forms. The Disturbance records shall also be available in COMTRADE format (IEEE standard- Common Format for Transient data Exchange for Power System)

28.13. The Evaluation unit shall be connected to the printer to obtain the graphic form of disturbances whenever desired by the operator.

28.14. Fault recorder acquisition units shall be suitable to operate from 220V DC or 110V DC as available at sub-station. Evaluation unit along with the printer shall normally be connected to 230V, single phase AC supply. In case of failure of AC supply, Evaluation unit and printer shall be switched automatically to the station DC through Inverter of adequate capacity which shall form a part of Fault recorder system. The inverter of adequate capacity shall be provided to cater the requirement specified in Section sub-station automation clause no. 8.0 and DR evaluation unit.

28.15. The acquisition unit shall have the following features

(a) Facility shall exist to alarm operator in case of any internal faults in the acquisition units such as power supply fail, processor / memory fail etc. and same shall be wired to annunciation system.

(b) The frequency response shall be 5 Hz on lower side and 250 Hz or better on upper side.

(c) Scan rate shall be 1000 Hz/channel or better.

(d) Pre-fault time shall not be less than 100 milliseconds and the post fault time shall not be less than 2 seconds (adjustable). If another system fault occurs during one post-fault run time, the recorder shall also be able to record the same. However, the total memory of acquisition unit shall not be less than 5.0 seconds

(e) The open delta voltage and neutral current shall be derived either through software or externally by providing necessary auxiliary transformers.

(f) The acquisition unit shall be typically used to record the following digital channels :

1 Main CB R phase open

2 Main CB Y phase open

3 Main CB B phase open

4 Main-1 carrier received

5 Main-1 protection operated

6 Main/Tie /TBC Auto reclosed operated

7 Over Voltage -Stage-1 /2 operated

8 Reactor / Stub/TEE-1/2/UF protection operated

9 Direct Trip received

10 Main-2 carrier received

11 Main- 2/ Back Up protection operated

12 Bus bar protection operated

13 LBB operated of main /tie/TBC circuit breaker

14 Tie/TBC CB R phase open

15 Tie/TBC CB Y phase open

16 Tie/TBC CB B phase open

(g) In case the Fault recorder is in-built part of line distance protection, above digital channels may be interfaced either externally or internally.

(h) Any digital signal can be programmed to act as trigger for the acquisition unit. Analog channels should have programmable threshold levels for triggers and selection for over or under levels should be possible.

28.16. The **colour laser** printer shall be provided which shall be compatible with the desktop PC and shall use Plain paper. The print out shall contain the Feeder identity, Date and time (in hour, minute and second up to 100th of a second), identity of trigger source and Graphic form of analogue and digital signals of all the channels. Two packets of **A4 size** paper (500 sheets in each packet) suitable for printer shall be supplied.

28.17. Each Fault recorder shall have its own time generator and the clock of the time generator shall be such that the drift is limited to $\pm$0.5 seconds/day, if allowed to run without synchronisation. Further, Fault recorder shall have facility to synchronise its time generator from Time Synchronisation Equipment having output of following types

- Voltage signal : (0-5V continuously settable, with 50m Sec. minimum pulse duration)
- Potential free contact (Minimum pulse duration of 50 m Sec.)
- IRIG-B
- RS232C

The recorder shall give annunciation in case of absence of synchronising within a specified time.

28.18. Substations where Time Synchronisation Equipment is not available, time generator of any one of the Fault recorders can be taken as master and time generators of other Fault recorders and Event loggers in that station shall be synchronised to follow the master.

29. **DISTANCE TO FAULT LOCATOR** shall

a) be electronic or microprocessor based type

b) be 'On-line' type

c) be suitable for breaker operating time of 2 cycles

d) have built-in display unit

e) the display shall be directly in percent of line length or kilometres without requiring any further calculations

f) have an accuracy of 3% or better for the typical conditions defined for operating timings measurement of distance relays

g) The above accuracy should not be impaired under the following conditions:

- presence of remote end in feed

- predominant D.C. component in fault current
- high fault arc resistance
- severe CVT transients

h) shall have mutual zero sequence compensation unit if fault locator is to be used on double circuit transmission line

i) built in feature of line distance relay is acceptable provided the requirements of above clauses are met

30. TIME SYNCHRONISATION EQUPMENT

30.1. The Time synchronisation equipment shall receive the co-ordinated Universal Time (UTC) **transmitted** through Geo Positioning Satellite System (GPS) and synchronise equipments to the IndianStandard Time in a substation.

30.2. Time synchronisation equipment shall include antenna, all special cables and processing equipment etc.

30.3. It shall be compatible for synchronisation of Event Loggers, Disturbance recorders and SCADA at a substation through individual port or through Ethernet realised through optic fibre bus.

30.4. Equipment shall operate up to the ambient temperature of 50 degree centigrade and 80% humidity.

30.5. The synchronisation equipment shall have 2 micro-second accuracy. Equipment shall give real time corresponding to IST (taking into consideration all factors like voltage, & temperature variations, propagation & processing delays etc.)

30.6. Equipment shall meet the requirement of IEC 60255 for storage & operation.

30.7. The system shall be able to track the satellites to ensure no interruption of synchronisation signal.

30.8. The output signal from each port shall be programmable at site for either one hour, half hour, minute or second pulse, as per requirement.

30.9. The equipment offered shall have six (6) output ports. Various combinations of output ports shall be selected by the customer, during detailed engineering, from the following :

- Potential free contact (Minimum pulse duration of 50 milli Seconds.)
- IRIG-B
- RS232C
- SNTP Port

30.10. The equipment shall have a periodic time correction facility of one second periodicity.

30.11. Time synchronisation equipment shall be suitable to operate from 220V DC or 110V DC as available at Substation.

30.12. Equipment shall have real time digital display in hour, minute, second (24 hour mode) & have a separate time display unit to be mounted on the top of control panels having display size of approx. 100 mm height.

31. RELAY TEST KIT

31.1. One relay test kit shall comprise of the following equipment as detailed here under

3 sets	Relay tools kits
2 nos.	Test plugs **for TTB**
2 nos.	Test plugs for using with modular type relays (if applicable)

32. TYPE TESTS

32.1. The reports for following type tests shall be submitted during detailed engineering for the Protective relays, Fault Recorder, Fault locator and Disturbance recorder:

a) Insulation tests as per IEC 60255-5

b) DC Voltage dips and interruptions/Variation as per IEC 6100-4-29.

c) High frequency disturbance test as per IEC 61000-4 16, Class IV (Not applicable for electromechanical relays)

d) Electrostatic discharges as per IEC 61000-4-2, level; 4 (not applicable for Electromechanical relays)

e) Fast transient test as per IEC 61000, Level I**V** (Not applicable for electromechanical relays)

f) Relay characteristics, performance and accuracy test as per IEC 60255

- Steady state Characteristics and operating time
- Dynamic Characteristics and operating time for distance protection relays and current differential protection relays
- Conformance test as per IEC 61850-10.

For Fault recorder, Disturbance recorder; only performance tests are intended under this item.

g) Tests for thermal and mechanical requirements as per IEC 60255-6

h) Tests for rated burden as per IEC 60255-6

i) Contact performance test as per IEC 60255-0-20 (not applicable for Distance to fault locator and Disturbance recorder)

In case there is a change either in version or in model (Except firmware) of the relay, the contractor has to submit the type test reports for the offered revision/model.

32.2. Steady state & Dynamic characteristics test reports on the distance protection relays, as type test, shall be based on test programme specified in Appendix A on simulator/network analyser/PTL. Alternatively, the files generated using Electromagnetic transient Programme (EMTP) can also be used for carrying out the above tests. Single source dynamic tests on transformer differential relay shall be/ should have been conducted based on general guidelines specified in CIGRE committee 34 report on Evaluation of characteristics and performance of Power system protection relays and protective systems.

33. CONFIGURATION OF RELAY AND PROTECTION PANELS

The following is the general criteria for the selection of the equipments to be provided in each type of panel. However, contractor can optimise the requirement of panels by suitably clubbing the feeder protection and CB relay panels. It may be noted that Main-I and Main-II protections for line can not be provided in single panel. Similarly, Group-I & Group-II protections for transformer can not be provided in single panel.

<u>CONTROL PANEL</u>

Various types of control panels shall consist of the following

a	Ammeter	3 set	for each Line, BC, TBC Bus section, Bus Reactor and Transformer

b	Ammeter with Selector switch	1 set	for each line reactor
c	Wattmeter with transducer	1 set	for each line, transformer
d	Varmeter with transducer	1 set	for each line, transformer, Bus reactor
e	Varmeter with transducer	1 set	for each Line Reactor
f	CB Control switch	1 no.	for each Circuit breaker
g	Isolator Control switch	1 no.	for each isolator
h	Semaphore	1 no.	for each earth switch
i	Red indicating lamp	1 no.	for each Circuit breaker
j	Red indicating lamp	1 no.	for each isolator
k	Green indicating lamp	1 no.	for each Circuit breaker
l	Green indicating lamp	1 no.	for each isolator
m	White indicating lamp (DC healthy lamp)	2 nos.	for each feeder
n	Annunciation windows with associated annunciation relays	18 nos.	for each feeder
o	Push button for alarm Accept/reset/lamp test	3 nos.	for each control panel
p	Synchronising Socket	1 no.	for each Circuit Breaker if required
q	Synchronising selector Switch	1no.	for each Circuit Breaker if required
r	Protection Transfer Switch	1 no.	for each breaker in case of DMT /DM*/SMT scheme(Except TBC And BC Breaker)-*with Bypass ISO
s	Mimic to represent SLD	Lot	in all control panels

t	Voltmeter with selector Switch		1no.for each line, transformer , bus reactor
u	Cut out, mounting and wiring for RWTI and selector switch	Lot	for transformers/reactors

Notes:

1 For transformer feeders, all equipments of control panel shall be provided separately for HV and MV sides.

2. In case of incomplete diameter (D and I type layouts), control panel shall be equipped fully as if the diameter is complete, unless otherwise specified. Annunciation relays shall also be provided for the same and if required, necessary panel shall be supplied to accommodate the same.

3. The above list of equipments mentioned for control panel is generally applicable unless it is defined elsewhere and in case of bay extension in existing substations, necessary equipments for matching the existing control panel shall be supplied.

4. Common synchronising switch is also acceptable in Synchronising trolley for new Substations. In this case. individual synchronising selector switch is not required for each Circuit Breaker in control panel

5. Each line /HV side of transformer/MV/LV side of transformer /Bus reactor /TBC /BC/ Bus Section shall be considered as one feeder for above purpose.

LINE PROTECTION PANEL (220 & 132kV)

The Line Protection panel for transmission lines shall consist of following protection features/schemes

Sl. No.	Description	220kV	132kV
1.	Main-1 Numerical Distance protection scheme	1 Set	1 Set
2.	Main-2 Numerical Distance protection scheme	1 Set	NIL
3.	Over Voltage Protection Scheme	NIL	NIL
4.	Fault Recorder	1 Set	NIL
5.	Distance to fault Locator	1 Set	1 Set
6.	3 Phase Trip Relays	2 Nos.	2 Nos.
7.	Flag relays, carrier receive relays, aux. Relays, timers etc. as per scheme requirements	As required	As required
8.	Under Voltage protection relay	2 Nos.	2 Nos.

Sl. No.	Description for isolator/earth switch	220kV	132kV
9. .	Cut-out and wiring with TTB for supplied energy meter	1 Set	1 Set
10.	Directional Back up Over current and E/F protection scheme	1 Set	1 Set

In a substation where 220 KV lines are under the scope of the contract, bidder is required to give identical Main-1 and Main-2 distance protection schemes for all voltage levels.

a) 33 KV LINE CONTROL & PROTECTION PANEL (For Substation with Automation)

Sl No.	DESCRIPTION	QTY
1	Bay Control Unit/Bay Control & Protection Unit	1NO.
2	Numerical Non Directional Over Current and Earth Fault Relay 1No.with High Set Feature and in built LBB protection(LBB function as part of BCU is acceptable)	1NO.
3	Electronic Trivector Meter with 0.2 Class Accuracy With RS 485, RS 232 & Front Optical port)	1NO.
4	Master Trip Relay with adequate no of contacts 1 No. and Electrical Resettable type	1NO.
5	CB Troubles and Alarm (Part of BCU)	1 SET
6	Metering (part of BCU)	1 SET

b) 132/33kV TRANSFORMER CONTROL & PROTECTION RELAY PANEL

I. The protection panel for 132/33kV Transformer shall consist of the following equipments.

		132kV Side	33kV
1	Transformer Differential protection scheme	1 no	NIL
2	Restricted Earth fault protection scheme	1 no	1 no
3	Directional back up over current and E/F Relay With non-directional high set feature	1set	Nil
4	Non-Directional back up over current and E/F Relay with non-directional high set feature (Part of 33kV BCU is acceptable)	NIL	1 Set
5	Over fluxing protection scheme	Nil	1No.
6	Over load protection scheme	1No.	Nil
7	Three phase trip relays	2No.	2No.
8	Trip supervision relay	2No.	2No.
9	Scheme requirements including transformer Alarms and trip function	Lot	Lot
10	Disturbance Recorder	1No.	-------
11	Revenue Energymeter (As per T.S. Section-1)	1No.	1No.

$ BCU for 220kV&132kV Bays has been included in the BOQ details of SAS.

c) 33kV BREAKER RELAY PANEL

(Acceptable as Part of Line /transformer Relay panel)

The breaker relay panel for 33kV shall comprise of the following:

	Without A/R
1. DC supply supervision relay	2 no.
2.Trip circuit supervision relays	2 nos.
3. Emergency CB TNC Switches	1 No.
4. Flag relays, aux. relays, timers, trip relays etc. As per scheme requirements. (Acceptable as part of BCU)	Lot

d) <u>TRANSFORMER PROTECTION PANEL (220/132kV)</u>

The protection panel for Auto transformer/Transformer shall consists of the following features/schemes:

S. No.	Description	HV side	MV/LV side
1.	Transformer Differential Protection scheme	1 Nos.	Nil
2.	Restricted Earth fault protection scheme	1 no.	1 no@
	@ Not applicable for auto-transformer		
3.	Directional back up O/C and E/F relay with non directional high set feature	1 set	1 set
4.	Over Fluxing Protection scheme	1 no.	--
5.	Overload protection scheme	1 nos.	NIL
6.	Three phase trip relays	2 nos.	2 nos.
7.	CVT selection relays as per scheme requirement	Lot	Lot
8.	Cut-out and wiring with TTB for supplied energy meter	1 set	1 set
9.	Transformer Neutral Current relay for 1-Phase transformer bank	1 Set	
10.	Flag Relays/Aux. Relays for wiring Transformer auxiliary protection contacts such as Buchholz, Oil Temperature, Winding Temperature, PRV, OLTC Buchholz etc. as per scheme requirements	As required	

The above protection schemes may be clubbed in Group-I/II as per clause no. 21 of technical specification.

e) <u>REACTOR PROTECTION PANEL (220kV & 132kV)</u>

The protection panel for Reactor shall consist of the following protection features/schemes:

Sl. No.	Description	Qty.
1.	Reactor Differential Protection scheme	1 no.
2.	Restricted Earth fault Protection scheme	1 no.
3.	Reactor back up impedance protection scheme	1 set
4.	Three phase trip relays	2 nos.

5.	CVT selection relay as per scheme requirement	Lot
6.	Flag Relays/Aux. Relays for wiring Reactor auxiliary protection contacts such as Buchholz, Oil Temperature, Winding Temperature, PRV etc. as per scheme requirements	As required

f) BREAKER RELAY PANEL (220kV & 132kV)

The breaker relay panel shall comprise of the following:

Sl. No.	Description	With A/R	Without A/R
1.	Breaker failure Protection Scheme	1 No.	1 No.
2.	DC supply Supervision relay	2 Nos.	2 Nos.
3.	Trip Circuit supervision relays#	6 Nos.	6 Nos.
4.	Auto-reclose scheme (if standalone)	1 Nos.	NIL
5.	Flag relays, aux relays, timers, trip relays as per scheme requirements	As required	As required

Trip supervision relays shall be 2 or 6 numbers as per no. of trip coils for each 132KV Circuit breaker

Note: Equipment/relays to be provided under CB Relay Panel may be accommodated in the Protection Panels to be provided for Transmission Line/Transformer/Reactor as applicable.

34. ERECTION AND MAINTENANCE TOOL EQUIPMENTS

All special testing equipment required for the installation and maintenance of the apparatus, instruments devices shall be furnished in relevant schedule

35. TROPICALISATION

Control room will be normally air-cooled/air- conditioned. All equipments shall however be suitable for installation in a tropical monsoon area having hot, humid climate and dry and dusty seasons with ambient conditions specified in the specification. All control wiring, equipment and accessories shall be protected against fungus growth, condensation, vermin and other harmful effects due to tropical environment.

Test programme for distance relays

General Comments:

1. These test cases are evolved from the report of working group 04 of study committee 34 (Protection) on evaluation of characteristics and performance of power system protection relays and protective systems. For any further guidelines required for carrying out the tests, reference may be made to the above document.
2. The test shall be carried out using network configuration and system parameters as shown in the figure-1
3. All denotations regarding fault location, breakers etc. are referred in figure –1
4. The fault inception angles are referred to R- N voltage for all types of faults
5. The fault inception angle is zero degree unless otherwise specified
6. Where not stated specifically, the fault resistance (Rf) shall be zero or minimum as possible in simulator
7. Single pole circuit breakers are to be used
8. The power flow in double source test is 500 MW

System parameters

System voltage =400KV

CTR= 1000/1

PTR = 400000/110 (with CVT, the parameters of CVT model are shown in figure –2)

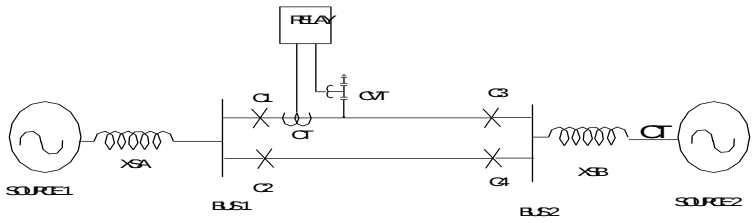

FIGURE 1

Line parameters/km

Positive Sequence Resistance, (r1)	= 0. 02897 Ω
Positive Sequence Reactance (x1)	= 0.3072 Ω
Zero Sequence Resistance (r0)	= 0.2597 Ω
Zero Sequence Reactance (x1)	= 1.0223 Ω

Zero Sequence Mutual Resistance (rm) = 0.2281 Ω
Zero Sequence Mutual Reactance (xm) = 0.6221 Ω
Zero Sequence succeptance (bo) = 2.347 µ mho
Positive Sequence succeptance (b1) =3.630 µ mho

Type of line	Short		Long
Secondary line impedance	2 Ω		20 Ω*
Length of line in Kms	23.57		235.7
SIR	4	15	4
Source impedance (pry) (at a time constant of 50 ms)	29.09 Ω (5500 MVA)	109.09 Ω (1467 MVA)	290.9 Ω (550 MVA)

* Alternatively, the tests can be done with 10 Ω secondary impedance and source impedance may accordingly be modified

CVT Model

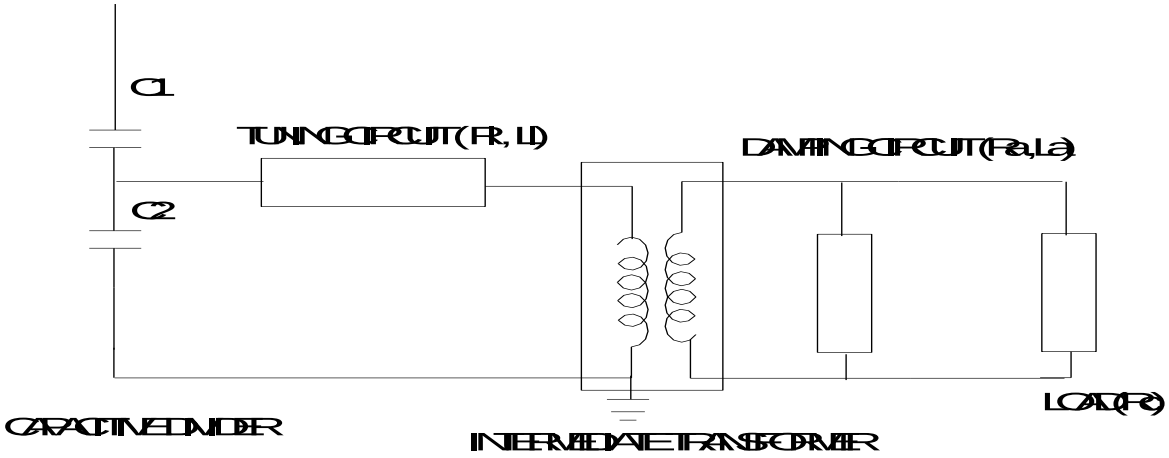

Figure2

XC1	1.455 µ mho
XC2	27.646 µ mho
Rl	320 Ω
XLl	34243 Ω
Ra	4.200 Ω
Xla	197.92 Ω

Rc	14.00 Ω
Transformation ratio of Intermediate transformer	181.8

Details of fault cases to be done

Sl no	Description	Single source with short line (2)		Single source long line (20)	Double source with short double line (2)	Double source with long single line (20)
		CLOSE C1, OPEN C2,C3,C4		CLOSE C1, OPEN C2,C3,C4	CLOSE C1, C2,C3,C4	CLOSE C1,C3 OPEN C2,C4
		SIR=4	SIR=15	SIR =4	SIR = 4	SIR=4
1	Dynamic accuracy for zone 1	Tests to be done at 2 locations (84 % and 76 % of line length) X 4 faults (RN , YB, YBN, RYB) X 2 fault inception angle (0°, 90°)= 16 cases	Tests to be done at 2 locations (84 % and 76 % of line length) X 4 faults (RN , YB, YBN, RYB) X 2 fault inception angle (0°,90°)= 16 cases	Tests to be done at 2 locations (84 % and 76 % of line length) X 4 faults (RN , YB, YBN, RYB) X 2 fault inception angle (0°,90°)= 16 cases		Tests to be done at 2 locations (84% and 76% of line length) X 4 faults (RN , YB, YBN, RYB) X 2 fault inception angle (0°, 90°)= 16 cases
2	Operating time for zone 1 at SIR =4	Tests to be done at 3 locations (0% , 40% and 64% of line length) X 4 faults (RN, YB, YBN, RYB) X 4 fault inception angle (0°, 30°,60° and 90°) = 48 cases	Tests to be done at 3 locations (0 % , 40 % and 64 % of line length) X 4 faults (RN , YB, YBN, RYB) X 4 fault inception angle (0°,30°,60°and 90°)= 48 cases	Tests to be done at 3 locations (0 % , 40 % and 64 % of line length) X 4 faults (RN , YB, YBN, RYB) X 4 fault inception angle (0°, 30°,60° and 90°)= 48 cases	Tests to be done at 1 location (40 % of line length) X 4 faults (RN, YB, YBN, RYB) X 4 fault inception angle (0°,30°,60° and 90 °)= 16 cases	Tests to be done at 1 location (40 % of line length) X 4 faults (RN, YB, YBN, RYB) X 4 fault inception angle (0°,30°,60° and 90°)= 16cases
3	Operating time for	Tests to be done at 1	Tests to be done at 1	Tests to be done at 1		

Sl no	Description	Single source with short line (2)		Single source long line (20)	Double source with short double line (2)	Double source with long single line (20)
	zone II and Zone III	location (100 % of line length) X 1 faults (RN, YB, YBN, RYB) X 2 zones (II and III) = 2 cases	location (100 % of line length) X 1 faults (RN , YB, YBN, RYB) X 2 zones (II and III) = 2 cases	location (100 % of line length) X 1 faults (RN , YB, YBN, RYB) X 2 Zones (II and III) = 2 cases		
4	Switch on to fault feature			Tests to be done at 2 location (0 % and 32 %) X 1 faults (RYB) Any fault inception angle = 2 cases		
5	Operation during current reversal				Tests to be done at 2 location (0 % and 80 % of line length) X 1 faults (RN) X 1 fault inception angle (0 degrees) = 2 cases	
		CLOSE C1, OPEN C2,C3,C4		CLOSE C1, OPEN C2,C3,C4	CLOSE C1, C2,C3,C4	CLOSE C1,C3 OPEN C2,C4
		SIR=4	SIR=15	SIR =4	SIR = 4	SIR=4
6	Operation at simultaneous faults				Tests to be done at 2 location (8 % and 64 % of line length) X 2 faults (RN in circuit 1 to BN in circuit 2 and RN in circuit 1 to RYN in circuit 2 in 10 ms) X 1	

Sl no	Description	Single source with short line (2)		Single source long line (20)	Double source with short double line (2)	Double source with long single line (20)
					fault inception angle (0 °) = 4 cases (*1)	
7	Directional sensitivity					Tests to be done at 1 location (0% reverse) X 6 faults (RN ,YB, YBN , RYB,RN with Rf=13.75 ohm(sec) and RYN with Rf= 13.75 Ohm (sec) X 2 fault inception angle (0° ,90°) = 12cases
8	Limit for fault resistance					Tests to be done at 2 location (0% and 68 % of line length) X 1 fault (RN with Rf=13.75 ohm(sec) X 2 fault inception angle (0°,90°) = 4 cases
9	Operation at evolving faults					Tests to be done at 2 location (32 % and 0% of line length) X 2 faults (RN to RYN) x in 2 timings (10 ms and 30 ms) X 2 load direction (from A to B and from B to A) = 16 cases
10	Fault locator function , in case the same is offered as	Measure fault location for all cases under 1 and 2	Measure fault location for all cases under 1 and 2	Measure fault location for all cases under 1 and 2	Measure fault location for all cases under 2 and 6	Measure fault location for all cases under 2, 7 and 9

Sl no	Description	Single source with short line (2)		Single source long line (20)	Double source with short double line (2)	Double source with long single line (20)
	built in feature					

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VISUAL MONITORING SYSTEM

SECTION – XIX
VISUAL MONITORING SYSTEM

Visual monitoring system for Surveillance / watch and ward of Substation premises:

Visual monitoring system (VMS) for effective watch and ward of sub station premises covering the areas of entire switchyard, Control Room cum Administrative building, Fire fighting pump house, stores and main gate, shall be provided. The contractor shall design, supply, erect, test and commission the complete system including cameras, Digital video recorder system, mounting arrangement for cameras, cables, LAN Switches, UPS and any other items/accessories required to complete the system. To provide all the necessary licenses to run the system successfully shall be in the scope of contractor.

System with Color IP Cameras for VMS surveillance would be located at various locations including indoor areas and outdoor switchyard and as per the requirement/direction of Executive Engineer Engineer(S/S Site). The VMS data partly/completely shall be recorded (minimum for 15 days) and stored on network video recorder.

The number of cameras and their locations shall be decided in such a way that any location covered in the area can be scanned. The cameras shall be located in such a way to monitor at least:

1. The operation of each and every isolator pole of the complete yard in case of AIS Sub-station.
2. All other Major AIS Equipment (such as CB, CT, CVT, SA etc. as applicable)
3. All the Transformer and Reactors All the Entrance doors of Control Room Building and Fire-fighting Pump House
4. All the gates of switchyard.
5. Main entrance Gate

The cameras can be mounted on structures, buildings or any other suitable mounting arrangement to be provided by the contractor.

1.1 **Technical requirements of major equipment of Visual Monitoring System**.

1.1.1 The Video Monitoring system shall be an integrated system with IP network centric functional and management architecture aimed at providing high-speed manual/automatic operation for best performance.

1.1.2 The system should facilitate viewing of live and recorded images and controlling of all cameras by the authorized users.

1.1.3 The system shall use video signals from various types of indoor/outdoor CCD color cameras installed at different locations, process them for viewing on

workstations/monitors in the control Room and simultaneously record all the cameras after compression using H 264/MPEG 4 or better standard. Mouse/Joystick-Keyboard controllers shall be used for Pan, Tilt, Zoom, and other functions of desired cameras.

1.1.4 The System shall provide sufficient storage of all the camera recordings for a period of 15 days or more @ 25 FPS, at 4 CIF or better quality using necessary compression techniques for all cameras. It shall be ensured that data once recorded shall not be altered by any means. The recording resolution and frame rate for each camera shall be user programmable.

1.1.5 The surveillance VMS System shall operate on 230 V, 50 Hz single-phase power supply. System shall have back up UPS power supply meeting the power supply need of all the cameras in the stations including those which are installed at gate for a period of 2 hours. The bidder shall submit the sizing calculation for the UPS considering the total load requirement of Video Monitoring System.

1.2 **System requirements:**

a) System must provide built-in facility of watermarking or Digital certificate to ensure tamperproof recording.

b) All cameras may be connected through a suitable LAN which shall be able to perform in 400kV class sub-station environment without fail.

c) All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp. Camera ID, Location/Area of recording & date/time shall be programmable by the system administrator with User ID & Password.

d) Facility of camera recording in real-time mode (25 FPS)/15/12.5/10 or lower FPS as well as in any desired combination must be available in the system.

e) Facility of Camera recording in HD (1280X720p), D1, 4CIF, CIF, VGA, as well as in any combination i.e. any camera can be recorded in any quality.

f) System to have facility of 100% additional camera installation beyond the originally planned capacity.

g) In order to optimize the memory, while recording, video shall be compressed using H 264/MPEG-4 or better standard and streamed over the IP network.

h) System shall be triplex i.e. it should provide facility of Viewing, Recording & Replay simultaneously.

i) The offered system shall have facility to export the desired portion of clipping (from a specific date/time to another specific date/time) on CD or DVD. Viewing of this recording shall be possible on standard PC using standard software like windows media player etc.

j) System shall have provision of WAN connectivity for remote monitoring.

k) The equipment should generally conform to Electromagnetic compatibility requirements for outdoor equipment in EHV switchyards. The major EMC required for Cameras and other equipment shall be as under:

1. Electrical Fast Transient (Level 4) – As per IEC 61000-4-4

2. Damped Oscillatory (1 MHz and 100 KHz) (level 3) – As per IEC 61000-4-18

3. AC Voltage Dips & Interruption/Variation (class 3) – As per IEC 61000-4-11

4. Electrostatic Discharge (Level 4) – As per IEC 61000-4-2

5. Power Frequency Magnetic Field (level 4) – As per IEC 61000-4-8

6. Ripple on DC input Power Supply Port immunity test (level 4) - As per IEC 61000-4-17

Type test reports to establish compliance with the above requirement shall be submitted during detailed engineering.

1.2.1 **VIDEO SURVEILLANCE APPLICATION SOFTWARE**

a) Digital video surveillance control software should be capable to display and manage the entire surveillance system. It should be capable of supporting variety of devices such as cameras, video encoder, Servers, NAS boxes/Raid backup device etc.

b) The software should have inbuilt facility to store configuration of encoders and cameras.

c) The software should Support flexible 1/2/4/8/16/32 Windows Split screen display mode and scroll mode on the PC monitor.

d) The software should be able to control all cameras i.e. PTZ control, Iris control, auto / manual focus, and color balance of camera, Selection of presets, Video tour selection etc.

e) The software should have user access authority configurable on per device or per device group basis. The system shall provide user activity log with user ID, time stamp, action performed, etc.

f) The users should be on a hierarchical basis as assigned by the administrator. The higher priority person can take control of cameras, which are already being controlled by a lower priority user.

g) It should have recording modes viz. continuous, manual, or programmed modes on date, time and camera-wise. All modes should be disabled and enabled using scheduled configuration. It should also be possible to search and replay the recorded images on date, time and camera-wise. It should provide onscreen controls for remote operation of PTZ cameras. It should have the facility for scheduled recording. Different recording speeds (fps) and resolution for each recording mode for each camera should be possible.

h) The software for clients should also be working on a browser based system for remote users. This will allow any authorized user to display the video of any desired camera on the monitor with full PTZ and associated controls.

i) Retrieval: The VMS application should allow retrieval of data instantaneously or any date / time interval chosen through search functionality of the application software. In case data is older than 15 days and available, the retrieval should be possible. The system should also allow for backup of specific data on any drives like DVD's or any other device in a format which can be replayed through a standard PC based software. Log of any such activity should be maintained by the system.

j) VMS shall provide the full functionality reporting tool which can provide reports for user login/logoff, camera accessibility report, server health check reports etc.

1.2.2 **Network video recorder**

The Network Video recorder shall include at least Server (min 3.0 GHZ, 4GB RAM, 3000GB HDD(min)), RAID 5 ,with suitable configuration along with Colored TFT 22" High resolution monitor, and Internal DVD writer. Windows XP/Vista/7 Prof. or VMS compatible operating system latest version with hardware like graphic cards, licensed Anti-virus etc.

Further the digital video recorder shall conform to the following requirements:

1.	Server Spec	Intel Quad Core (or better) 3.0 Ghz (min.) , 8 MB Cache , 4 GB memory , with suitable NVIDIA graphics card,3 TB HDD , Raid 5
2.	Recording and Display Frame Rate	Real-time 25 frames per second per channel , manual select
3.	Recording Resolution	(PAL): 1280X720 , 704(H) x 586(V) It should be possible to select lower resolutions

4.	Compression Method	H.264/MPEG-4 or better and latest
5.	Video Motion Detection Capable	Standard and built-in (selectable in menu)
6.	Monitoring Options	Split screen 1, 2, 4 , 8, 16, 32 or more cameras
7.	Playback Options	Search, still image capture
8.	Alarm/Event Recording Capable	To be provided with built-in external alarm input/ output ports minimum(8 in, 2 out)
9.	Network Operation Capable	To be provided by using WAN or LAN router
10.	Remote Internet Viewing Capable	Using WAN or LAN router
11.	HDD Storage Consumption	1GB ~ per hour / channel variable based on frame speed and resolution settings, as well as compression
12.	Operation	Triplex operation (simultaneous recording, playback, network operation)
13.	Number of Video	32
14.	Audio Recording	32
15.	Input Voltage	230V AC or equivalent with UPS as a Back up for 30 minutes

1.2.3 VMS Camera

a) The color IP camera for substation shall have PAN, TILT and ZOOM facilities so that it can be focused to the required location from the remote station through a controller. Whereas wireless IP cameras with PTZ controls are required for installation at gates of the PDD Substation premises as per the requirement/direction of Executive Engineer

b) The IP Camera at the main gate can be fixed or PTZ based and shall be used for monitoring entry and exit

c) It should have sufficient range for viewing all the poles of isolators and other equipments with high degree of clarity.

d) The VMS camera shall be suitable for wall mounting, ceiling mounting and switchyard structure mounting.

e) It shall be possible to define at 128 selectable preset locations so that the camera gets automatically focused on selection of the location for viewing a predefined location.

f) The camera should be able to detect motion in day & night environments having light intensity of Color: 0.5 Lux; B&W:0.05 Lux

g) Housing of cameras meant for indoor use shall be of IP 42 or better rating whereas outdoor camera housing shall be of IP 66 or better rating. Housing

shall be robust and not have the effect of electromagnetic induction in 400/220 KV switchyard.

h) All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp. Camera ID, Location/Area of recording & date/time shall be programmable by the system administrator with User ID & Password

i) Facility of camera recording in real-time mode (25 FPS)/15/12.5/10 or lower FPS as well as in any desired combination must be available in the system.

A. Outdoor IP Fixed Megapixel Camera Specifications (For Main Gate)

1.	Image Sensor	2-megapixel Progressive ,1 / 3" CMOS/CCD sensor, Minimum illumination 0.1 Lux
2.	Min Luminous	0.5LUX(Color) 0.05Lux(Black)
3.	Camera Enclosure Type	IP66 Grade
4.	Iris/Focus	Auto/Manual
5.	Video Compression	Dual Stream H.264 and MPEG 4 user selectable
6.	Support Dual-stream	primary/secondary stream, H.264/MPEG 4 optional
7.	Video Definition	Primary stream:1600x1200,1280x960,1280x720,
		Secondary stream:800x600,400x288,192x144
8.	Video Parameters	Brightness, hue, contrast, saturation and image quality
9.	Video Frame Rate	PAL: 1-25frames/second NTSC:1-30frames/second
10.	Video Compression BR	32Kbit/S - 6Mbit/S
11.	Video Output	One channel composite Streaming
12.	Supported Protocols	TCP, UDP, IP, HTTP, FTP, SMTP, DHCP, DNS,ARP, ICMP, POP3, NTP, IPsec, UpnP, RTP, RTCP
13.	Operating Temperature	-5 ~ +50℃
14.	Operating Humidity	10 ~ 90%

B. Outdoor IP66 PTZ HD Camera Specifications (For Switch Yards)

1.	Image sensor	1/3 type solid state Progressive scan CCD, WDR (High Definition)
2.	Security	Multiplier user access with password protection
3.	Effective Pixels	(PAL): Main Stream : 1280 x 720 Sub Stream: 640 x 360, 320 x 280 selectable
4.	Compression	Dual stream H.264 and MPEG 4 user selectable
5.	Signal system	50 Hz
6.	S/N (Signal to Noise) Ratio	Better than 50 dB
7.	Electronic Shutter	1/60 ~ 1/10,000 Sec automatic or better
8.	Scanning System	Progressive / Interlace
9.	Low Light Sensitivity (Lux)	Color: 0.5 Lux; B&W:0.02 Lux
10.	Lens	Minimum 10 x (minimum optical in High Definition (**The system shall be able to Zoom the images on the monitor without any distortion to the maximum level of the optical zoom**)
11.	Lens Size	Minimum 4.1~73.8 mm
12.	Lens Aperture	F 1.6 (wide) ~ F 2.8 (tele), f = 4.1~ 41.0 mm, 10X Zoom, Video Auto Focus Angle of view Horizontal : 52 deg. Wide, 2.8 deg (tele)
13.	PTZ Data Transfer Baud/ Bit Rates Supported	Selectable 2400 bps / 4800 bps / 9600 bps
14.	Panning range	Complete 360 degrees (horizontal)
15.	Pan Speed	Adjustable, 0.1 degrees / second ~ 250 degrees / second
16.	Tilting Range	Minimum 180 degree tilt rotation
17.	Tilt Speed	Adjustable, 0.1 degrees / second ~ 150 degrees / second
18.	In Built Storage	Camera should have inbuilt storage TF or SD format for recording and storing Pictures
19.	IP Class	IP66 Standard
20.	Working temperature	- 0℃ ~ +50℃
21.	Working Humidity	10 ~ 90%

1.2.4 **PTZ-Keyboards**

The features of PTZ shall include:

- Fully functional dynamic keyboard/joystick controllers
- Controls all pan, tilt, zoom, iris, preset functions
- Control up to 255 units from a single keyboard
- Many preset options and advanced tour programming

- Compatible with all connected cameras

1.	Key Application	wired keyboard control operation of PTZ functions for weatherproof dome cameras
2.	Pan / Tilt / Zoom Protocol Languages Supported	Selectable
3.	PTZ Data Transfer Baud Rates Supported	selectable 1200 bps / 2400 bps / 4800 bps / 9600 bps
4.	Additional Features	dynamic joystick for smooth camera movements, preset location option for quick access to frequently monitored areas

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SUBSTATION AUTOMATION

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ANNEXURE-I	LIST OF ANALOGUE AND DIGITAL INPUT
ANNEXURE-II	LIST OF IO POINTS TO BE TRANSMITTED TO RSCC

SECTION XX
SUBSTATION AUTOMATION SYSTEM

1.0 GENERAL

1.1. The substation automation system shall be offered from a manufacturer who must have designed, manufactured, tested, installed and commissioned substation automation system which must be in satisfactory operation on 220kV system or higher for at least 2 (Two) years as on the date of bid opening.

1.2. The Substation Automation System (SAS) shall be installed to control and monitor all the sub-station equipment from remote control centre (RCC) as well as from local control centre.

The SAS shall contain the following main functional parts:

- Bay control Intelligence Electronic Devices (IEDs) for control and monitoring.
- Station Human Machine Interface (HMI)
- Redundant managed switched Ethernet Local Area Network communication infrastructure with hot standby.
- Gateway for remote control via industrial grade hardware (to RCC) through IEC60870-5-101 protocol.
- Gateway for remote supervisory control (to RSCC), the gateway should be able to communicate with RSCC on IEC 60870-5-101 protocol. The specific protocol to be implemented is enclosed as Appendix-I.. It shall be the bidder's responsibility to integrate his offered system with existing RSCC system for exchange of desired data. The requirement of IO point shall be worked out by the bidder as per criterion enclosed as Appendix-II for data exchange with RLDCs.
- Remote HMI.

1.3. Peripheral equipment like printers, display units, key boards, Mouse etc. It shall enable local station control via a PC by means of human machine interface (HMI) and control software package, which shall contain an extensive range of supervisory control and data acquisition (SCADA) functions. It shall include communication gateway, intelligent electronic devices (IED) for bay control and inter IED communication infrastructure. An architecture drawing for SAS is enclosed.

1.4. The communication gateway shall facilitate the information flow with remote control centres. The bay level intelligent electronic devices (IED) for protection and control shall provide the direct connection to the switchgear without the need of interposing components and perform control, protection, and monitoring functions.

2. System design

2.1 General system design

The Substation Automation System (SAS) shall be suitable for operation and monitoring of the complete substation including future extensions as given in Section 1 – GTS/ Section - 1 Project

The systems shall be of the state-of-the art suitable for operation under electrical environment present in Extra high voltage substations, follow the latest engineering practice, ensure long-term compatibility requirements and continuity of equipment supply and the safety of the operating staff.

The offered SAS shall support remote control and monitoring from Remote Control centres via gateways.

The system shall be designed such that personnel without any background knowledge in Microprocessor-based technology are able to operate the system. The operator interface shall be intuitive such that operating personnel shall be able to operate the system easily after having received some basic training.

The system shall incorporate the control, monitoring and protection functions specified, self-monitoring, signalling and testing facilities, measuring as well as memory functions, event recording and evaluation of disturbance records.

Maintenance, modification or extension of components may not cause a shutdown of the whole substation automation system. Self-monitoring of components, modules and communication shall be incorporated to increase the availability and the reliability of the equipment and minimize maintenance.

Bidder shall offer the Bay level unit (a bay comprises of one circuit breaker and associated disconnector, earth switches and instrument transformer), bay mimic along with relay and protection panels and PLCC/Communication panels (described in other sections of technical specifications) housed in Control Room /air-conditioned *Switchyard Panel Room* suitably located in switchyard and Station HMI in Control Room building for overall optimisation in respect of cabling and control room building..

2.2 System architecture

The SAS shall be based on a decentralized architecture and on a concept of bay-oriented, distributed intelligence.

Functions shall be decentralized, object-oriented and located as close as possible to the process.

The main process information of the station shall be stored in distributed databases. The typical SAS architecture shall be structured in two levels, i.e. in a station and a bay level.

At bay level, the IEDs shall provide all bay level functions regarding control, monitoring and protection, inputs for status indication and outputs for commands. The IEDs should be directly connected to the switchgear without any need for additional interposition or transducers.

Each bay control IED shall be independent from each other and its functioning shall not be affected by any fault occurring in any of the other bay control units of the station.

The data exchange between the electronic devices on bay and station level shall take place via the communication infrastructure. This shall be realized using fibre-optic cables, thereby guaranteeing disturbance free communication. The fibre optic cables shall be run in G . I conduit pipes. Data exchange is to be realised using IEC 61850 protocol with a redundant managed switched Ethernet communication infrastructure

The communication shall be made in fault tolerant ring in redundant mode, excluding the links between individual bay IEDs to switch wherein the redundant connections are not envisaged, such that failure of one set of fiber shall not affect the normal operation of the SAS. However failure of fiber shall be alarmed in SAS. Each fiber optic cable shall have four (4) spare fibers

At station level, the entire station shall be controlled and supervised from the station HMI. It shall also be possible to control and monitor the bay from the bay level equipment at all times.

Clear control priorities shall prevent operation of a single switch at the same time from more than one of the various control levels, i.e. RCC, station HMI, bay level or apparatus level. The priority shall always be on the lowest enabled control level.

The station level contains the station-oriented functions, which cannot be realised at bay level, e.g. alarm list or event list related to the entire substation, gateway for the communication with remote control centres.

The GPS time synchronising signal (as specified in the section relay & protection) for the synchronization of the entire system shall be provided.

The SAS shall contain the functional parts as described in para 1.2 above.

2.3 FUNCTIONAL REQUIREMENTS

The high-voltage apparatus within the station shall be operated from different places:

- Remote control centres
- Station HMI.
- Local Bay controller IED (in the bays)

Operation shall be possible by only one operator at a time.

The operation shall depend on the conditions of other functions, such as interlocking, synchrocheck, etc. (see description in"Bay level control functions").

2.3.1 Select-before-execute

For security reasons the command is always to be given in two stages: selection of the object and command for operation under all mode of operation except emergency operation. Final execution shall take place only when selection and command are actuated.

2.3.1.1 Command supervision

Bay/station interlocking and blocking

Software Interlocking is to be provided to ensure that inadvertent incorrect operation of switchgear causing damage and accidents in case of false operation does not take place.

In addition to software interlocking hardwired interlocking are to be provided for:

(a) Bus Earth switch Interlocking

(b) Transfer Bus interlocking (if applicable)

It shall be a simple layout, easy to test and simple to handle when upgrading the station with future bays. For software interlocking the bidder shall describe the scenario while an IED of another bay is switched off or fails.

A software interlock override function shall be provided which can be enabled to bypass the interlocking function.

2.3.2 Run Time Command cancellation

Command execution timer (configurable) must be available for each control level connection. If the control action is not completed within a specified time, the command should get cancelled.

2.3.3 Self-supervision

Continuous self-supervision function with self-diagnostic feature shall be included.

2.3.4 User configuration

The monitoring, controlling and configuration of all input and output logical signals and binary inputs and relay outputs for all built-in functions and signals shall be possible both locally and remotely.

It shall also be possible to interconnect and derive input and output signals, logic functions, using built-In functions, complex voltage and currents, additional logics (AND-gates, OR gates and timers). (Multi-activation of these additional functions should be possible).

The Functional requirement shall be divided into following levels:

a. Bay (a bay comprises of one circuit breaker and associated disconnector, earth switches and instrument transformer) Level Functions

b. System Level Functions

3.1. Bay level functions

In a decentralized architecture the functionality shall be as close to the process as possible. In this respect, the following functions can be allocated at bay level:

- Bay control functions including data collection functionality in bay control/protection unit.
- Bay protection functions

Separate IEDs shall be provided for bay control function and bay protection function.

3.1.1. Bay control functions

3.1.1.1. Overview

Functions

- Control mode selection
- Select-before-execute principle
- Command supervision:
  - Interlocking and blocking
  - Double command
- Synchrocheck, voltage selection
- Run Time Command cancellation
- Transformer tap changer control (Raise and lower of tap) (for power transformer bays)
- Operation counters for circuit breakers and pumps
- Hydraulic pump/ Air compressor runtime supervision
- Operating pressure supervision through digital contacts only
- Breaker position indication per phase
- Alarm annunciation
- Measurement display
- Local HMI (local guided, emergency mode)
- Interface to the station HMI.
- Data storage for at least 200 events
- Extension possibilities with additional I/O's inside the unit or via fibre-optic communication and process bus

3.1.1.2. Control mode selection

Bay level Operation:

As soon as the operator receives the operation access at bay level the operation is normally performed via bay control IED. During normal

operation bay control unit allows the safe operation of all switching devices via the bay control IED.

EMERGENCY Operation

It shall be possible to close or open the selected Circuit Breaker with ON or OFF push buttons even during the outage of bay IED**.**

REMOTE mode

Control authority in this mode is given to a higher level (Remote Control Centre) and the installation can be controlled only remotely. Control operation from lower levels shall not be possible in this operating mode.

3.1.1.3. Synchronism and energizing check

The synchronism and energizing check functions shall be bay-oriented and distributed to the bay control and/or protection devices. These features are:

- Settable voltage, phase angle, and frequency difference.
- Energizing for dead line - live bus, live line - dead bus or dead line – dead bus with no synchro-check function.
- Synchronising between live line and live bus with synchro-check function

Voltage selection

The voltages relevant for the Synchro check functions are dependent on the station topology, i.e. on the positions of the circuit breakers and/or the isolators. The correct voltage for synchronizing and energizing is derived from the auxiliary switches of the circuit breakers, the isolator, and earthing switch and shall be selected automatically by the bay control and protection IEDs.

3.1.1.4. Transformer tap changer control

Raise and lower operation of OLTC taps of transformer shall be facilitated through Bay controller IED.

3.1.2. Bay protection functions

3.1.2.1. General

The protection functions are independent of bay control function. The protection shall be provided by separate protection IEDs (numerical relays) and other protection devices as per section Relay & Protection.

IEDs, shall be connected to the communication infrastructure for data sharing and meet the real-time communication requirements for automatic functions. The data presentation and the configuration of the various IEDs shall be compatible with the overall system communication and data exchange requirements.

Event and disturbance recording function

Each IED should contain an event recorder capable of storing at least 200 time-tagged events. The disturbance recorder function shall be as per detailed in Section – Control, Relay & Protection Panels.

3.1.2.2. Bay Monitoring Function:

Analogue inputs for voltage and current measurements shall be connected directly to the voltage transformers (VT) and the current transformers (CT) without intermediate transducers. The values of active power (W), reactive power (VAR), frequency (Hz), and the rms values for voltage (U) and current (I) shall be calculated in the Bay control/protection unit.

3.2. System level functions

3.2.1. Status supervision

The position of each switchgear, e.g. circuit breaker, isolator, earthing switch, transformer tap changer etc., shall be supervised continuously. Every detected change of position shall be immediately displayed in the single-line diagram on the station HMI screen, recorded in the event list, and a hard copy printout shall be produced. Alarms shall be initiated in the case of spontaneous position changes.

The switchgear positions shall be indicated by two auxiliary switches, normally closed (NC) and normally open (NO), which shall give ambivalent signals. An alarm shall be initiated if these position indications are inconsistent or if the time required for operating mechanism to change position exceeds a predefined limit.

The SAS shall also monitor the status of sub-station auxiliaries. The status and control of auxiliaries shall be done through separate one or more IED and all alarm and analogue values shall be monitored and recoded through this IED.

3.2.2. Measurements

The analogue values acquired/calculated in bay control/protection unit shall be displayed locally on the station HMI and in the control centre. The abnormal values must be discarded. The analogue values shall be updated every 2 seconds.

Threshold limit values shall be selectable for alarm indications.

3.2.3. Event and alarm handling

Events and alarms are generated either by the switchgear, by the control IEDs, or by the station level unit. They shall be recorded in an event list in the station HMI. Alarms shall be recorded in a separate alarm list and appear on the screen. All, or a freely selectable group of events and alarms shall also be printed out on an event printer. The alarms and events shall be

time-tagged with a time resolution of 1 ms. The tentative list for various feeders and systems are enclosed as Annexure-I

3.2.4. Station HMI

3.2.4.1. Substation HMI Operation:

On the HMI the object has to be selected first. In case of a blocking or interlocking conditions are not met, the selection shall not be possible and an appropriate alarm annunciation shall occur. If a selection is valid the position indication will show the possible direction, and the appropriate control execution button shall be pressed in order to close or open the corresponding object.

Control operation from other places (e.g. REMOTE) shall not be possible in this operating mode.

3.2.4.2. Presentation and dialogues

General

The operator station HMI shall be a redundant with hot standby and shall provide basic functions for supervision and control of the substation. The operator shall give commands to the switchgear on the screen via mouse clicks.

The HMI shall give the operator access to alarms and events displayed on the screen. Aside from these lists on the screen, there shall be a printout of alarms or events in an event log.

An acoustic alarm shall indicate abnormalities, and all unacknowledged alarms shall be accessible from any screen selected by the operator.

The following standard pictures shall be available from the HMI:

- Single-line diagram showing the switchgear status and measured values
- Control dialogues with interlocking or blocking information details. This control dialogue shall tell the operator whether the device operation is permitted or blocked**.**
- Measurement dialogues
- Alarm list, station / bay-oriented
- Event list, station / bay-oriented
- System status

3.2.4.3. HMI design principles

Consistent design principles shall be adopted with the HMI concerning labels, colours, dialogues and fonts. Non-valid selections shall be dimmed out.

The object status shall be indicated using different status colours for:

- Selected object under command
- Selected on the screen

- Not updated, obsolete values, not in use or not sampled
- Alarm or faulty state
- Warning or blocked
- Update blocked or manually updated
- Control blocked
- Normal state

3.2.4.4. Process status displays and command procedures

The process status of the substation in terms of actual values of currents, voltages, frequency, active and reactive powers as well as the positions of circuit breakers, isolators and transformer tap-changers shall be displayed in the station single-line diagram.

In order to ensure a high degree of security against undesired operation, a "select-before-execute" command procedure shall be provided. After the "selection" of a switch, the operator shall be able to recognize the selected device on the screen, and all other switchgear shall be blocked. As communication between control centre and device to be controlled is established, the operator shall be prompted to confirm the control action and only then final execute command shall be accepted**.** After the "execution" of the command the operated switching symbol shall flash until the switch has reached its new position.

The operator shall be in a position to execute a command only, if the switch is not blocked and if no interlocking condition is going to be violated. The interlocking statements shall be checked by the interlocking scheme implemented at bay and station level.

After command execution the operator shall receive a confirmation that the new switching position has been reached or an indication that the switching procedure was unsuccessful with the indication of the reason for non-functioning.

3.2.4.5. System supervision & display

The SAS system shall be comprehensively self-monitored such that faults are immediately indicated to the operator, possibly before they develop into serious situations. Such faults are recorded as a faulty status in a system supervision display. This display shall cover the status of the entire substation including all switchgear, IEDs, communication infrastructure and remote communication links, and printers at the station level, etc.

3.2.4.6. Event list

The event list shall contain events that are important for the control and monitoring of the substation.

The event and associated time (with1 ms resolution) of its occurrence has to be displayed for each event.

The operator shall be able to call up the chronological event list on the monitor at any time for the whole substation or sections of it.

A printout of each display shall be possible on the hard copy printer.

The events shall be registered in a chronological event list in which the type of event and its time of occurrence are specified. It shall be possible to store all events in the computer for at least one month. The information shall be obtainable also from a printed event log.

The chronological event list shall contain:

- Position changes of circuit breakers, isolators and earthing devices
- Indication of protective relay operations
- Fault signals from the switchgear
- Indication when analogue measured values exceed upper and lower limits. Suitable provision shall be made in the system to define two level of alarm on either side of the value or which shall be user defined for each measurands.
- Loss of communication.

Filters for selection of a certain type or group of events shall be available. The filters shall be designed to enable viewing of events grouped per:

- Date and time
- Bay
- Device
- Function e.g. trips, protection operations etc.
- Alarm class

3.2.4.7. Alarm list

Faults and errors occurring in the substation shall be listed in an alarm list and shall be immediately transmitted to the control centre. The alarm list shall substitute a conventional alarm tableau, and shall constitute an evaluation of all station alarms. It shall contain unacknowledged alarms and persisting faults. The date and time of occurrence shall be indicated.

The alarm list shall consist of a summary display of the present alarm situation. Each alarm shall be reported on one line that contains:

- The date and time of the alarm
- The name of the alarming object
- A descriptive text
- The acknowledgement state.

Whenever an alarm condition occurs, the alarm condition must be shown on the alarm list and must be displayed in a flashing state along with an audible alarm. After acknowledgement of the alarm, it should appear in a steady (i.e. not flashing) state and the audible alarm shall stop. The alarm should disappear only if the alarm condition has physically cleared and the operator has reset the alarm with a reset command. The state of the alarms shall be shown in the alarm list (Unacknowledged and persistent, Unacknowledged and cleared, Acknowledged and persistent).

Filters for selection of a certain type or group of alarms shall be available as for events.

3.2.4.8. Object picture

When selecting an object such as a circuit breaker or isolator in the single-line diagram, the associated bay picture shall be presented first. In the selected object picture, all attributes like

- Type of blocking
- Authority
- Local / remote control
- RSCC / SAS control
- Errors
- etc.,

shall be displayed.

3.2.4.9. Control dialogues

The operator shall give commands to the system by means of mouse click located on the single-line diagram. Data entry is performed with the keyboard. Dedicated control dialogues for controlling at least the following devices shall be available:

- Breaker and disconnector
- Transformer tap-changer

3.2.5. User-authority levels

It shall be possible to restrict activation of the process pictures of each object (bays, apparatus...) within a certain user authorisation group. Each user shall then be given access rights to each group of objects, e.g.:

- Display only
- Normal operation (e.g. open/close of switchgear)
- Restricted operation (e.g. by-passed interlocking)
- System administrator

For maintenance and engineering purposes of the station HMI, the following authorisation levels shall be available:

- No engineering allowed
- Engineering/configuration allowed
- Entire system management allowed

The access rights shall be defined by passwords assigned during the log-in procedure. Only the system administrator shall be able to add/remove users and change access rights.

3.2.6. Reports

The reports shall provide time-related follow-ups of measured and calculated values. The data displayed shall comprise:

- Trend reports:
  - Day (mean, peak)
  - Month (mean, peak)
  - Semi-annual (mean, peak)
  - Year (mean, peak)
- Historical reports of selected analogue Values:
  - Day (at 15 minutes interval)
  - Week
  - Month
  - Year

It shall be possible to select displayed values from the database in the process display on-line. Scrolling between e.g. days shall be possible. Unsure values shall be indicated. It shall be possible to select the time period for which the specific data are kept in the memory.

Following printouts shall be available from the printer and shall be printed on demand:

i. Daily voltage and frequency curves depicting time on X-axis and the appropriate parameters on the Y-axis. The time duration of the curve is 24 hours.

ii. Weekly trend curves for real and derived analogue values.

iii. Printouts of the maximum and minimum values and frequency of occurrence and duration of maximum and minimum values for each analogue parameter for each circuit in 24 hr period.

iv. Provision shall be made for logging information about breaker status like number of operation with date and time indications along with the current value it interrupts (in both condition i.e. manual opening and fault tripping)

v. Equipment operation details shift wise and during 24 hours.

vi. Printout on adjustable time period as well as on demand for MW, MVAR, Current, Voltage on each feeder and transformer as well as Tap Positions, temperature and status of pumps and fans for transformers.

vii. Printout on adjustable time period as well as on demand system frequency and average frequency.

viii. Reports in specified formats which shall be handed over to successful bidder. The bidder has to develop these reports. The

reports are limited to the formats for which data is available in the SAS database.

3.2.7. Trend display (historical data)

It shall be possible to illustrate all types of process data as trends - input and output data, binary and analogue data. The trends shall be displayed in graphical form as column or curve diagrams with a maximum of 10 trends per screen. Adjustable time span and scaling ranges must be provided.

It shall be possible to change the type of value logging (direct, mean, sum, or difference) on-line in the window. It shall also be possible to change the update intervals on-line in the picture as well as the selection of threshold values for alarming purposes.

3.2.8. Automatic disturbance file transfer

All recorded data from the IEDs with integrated disturbance recorder as well as dedicated disturbance recording systems shall be automatically uploaded (event triggered or once per day) to a dedicated computer and be stored on the hard disc.

3.2.9. Disturbance analysis

The PC-based work station shall have necessary software to evaluate all the required information for proper fault analysis.

3.2.10. IED parameter setting

It shall be possible to access all protection and control IEDs for reading the parameters (settings) from the station HMI or from a dedicated monitoring computer. The setting of parameters or the activation of parameter sets shall only be allowed after entering a password.

3.2.11. Automatic sequences

The available automatic sequences in the system should be listed and described, (e.g. sequences related to the bus transfer). It must be possible to initiate pre-defined automatic sequences by the operator and also define new automatic sequences.

3.3. Gateway

3.3.1 Communication Interface

The Substation Automation System shall have the capability to support simultaneous communications with multiple independent remote master stations,

The Substation Automation System shall have communication ports as follows:
(a) Two ports for Remote Control Centre
(b) Two ports for Regional System Coordination Centre (RSCC)

The communication interface to the SAS shall allow scanning and control of

defined points within the substation automation system independently for each control centre. The substation automation system shall simultaneously respond to independent scans and commands from employer's control centres (RCC & RSCC). The substation automation system shall support the use of a different communication data exchange rate (bits per second), scanning cycle, and/or communication protocol to each remote control centre. Also, each control centre's data scan and control commands may be different for different data points within the substation automation system's database.

3.3.2 Remote Control Centre Communication Interface

Employer will supply communication channels between the Substation Automation System and the remote control centre. The communication channels provided by Employer will consist either of power line carrier, microwave, optical fibre, VSAT or leased line, the details of which shall be provided during detailed Engineering.

3.3.3 Interface equipment:

The Contractor shall provide interface equipment for communicating between Substation Automation system and Remote control centre and between Substation Automation system and Regional System Coordination Centre (RSCC). However, the communication channels available for this purpose are specified in Section 1 - GTS.

In case of PLCC communication any modem supplied shall not require manual equalization and shall include self-test features such as manual mark/space keying, analogue loop-back, and digital loop-back. The modems shall provide for convenient adjustment of output level and receive sensitivity. The modem should be stand alone complete in all respects including power supply to interface the SAS with communication channel. The configuration of tones and speed shall be programmable and maintained in non-volatile memory in the modem. All necessary hardware and software shall also be in the scope of bidder.

3.3.4 Communication Protocol

The communication protocol for gateway to control centre must be open protocol and shall support IEC 60870-5-101 and IEC 61850 for all levels of communication for sub-station automation such as Bay to station HMI, gateway to remote station etc.

4.0 System hardware:

4.1 Redundant Station HMI, Remote HMI and Disturbance Recorder Work station:

The contractor shall provide redundant station HMI in hot standby mode. The servers used in these work stations shall be of industrial grade**.**

It shall be capable to perform all functions for entire substation including future requirements as indicated in the SLD. It shall use industrial grade components. Processor and RAM shall be selected in such a manner that during normal operation not more than 30% capacity of processing and memory are used. Supplier shall demonstrate these features.

The capacity of hard disk shall be selected such that the following requirement should occupy less than 50% of disk space:

1. Storage of all analogue data (at 15 Minutes interval)and digital data including alarm , event and trend data for thirty(30) days,
2. Storage of all necessary software,
3. 20GB space for OWNER'S use.

Supplier shall demonstrate that the capacity of hard disk is sufficient to meet the above requirement.

4.1.1 HMI (Human Machine Interface)

The VDU shall show overview diagrams (Single Line Diagrams) and complete details of the switchgear with a colour display. All event and alarm annunciation shall be selectable in the form of lists. Operation shall be by a user friendly function keyboard and a cursor positioning device. The user interface shall be based on WINDOWS concepts with graphics & facility for panning, scrolling, zooming, decluttering etc.

4.1.2 Visual Display Units/TFT's (Thin Film Technology)

The display units shall have high resolution and reflection protected picture screen. High stability of the picture geometry shall be ensured. The screen shall be at least 21" diagonally in size and capable of colour graphic displays.

The display shall accommodate resolution of 1280 X 1024 pixels.

4.1.3 Printer

It shall be robust & suitable for operation with a minimum of 132 characters per line. The printing operation shall be quiet with a noise level of less than 45 dB suitable for location in the control room. Printer shall accept and print all ASCII characters via master control computer unit interface.

The printer shall have in built testing facility. Failure of the printer shall be indicated in the Station HMI. The printer shall have an off line mode selector switch to enable safe maintenance. The maintenance should be simple with provisions for ease of change of print head, ribbon changing, paper insertion etc.

All reports and graphics prints shall be printed on laser printer. One dot matrix printer shall be exclusively used for hourly log printing.

All printers shall be continuously online.

4.1.4 Mass Storage Unit

The mass storage unit shall be built-in to the Station HMI. All operational measured values, and indications shall be stored in a mass-storage unit **in form** of **DVD RW** The unit should support at least Read (48X), Write(24X), and Re-Write (10X) operations, with Multi-Session capability. It should support ISO9660, Rockridge and Joliet Filesystems. It should support formatting and use under the operating system provided for Station HMI. The monthly back up of data shall be taken on disc. The facility of back up of data shall be inherent in the software**.**

4.1.5 Switched Ethernet Communication Infrastructure:

The bidder shall provide the redundant switched optical Ethernet communication infrastructure for SAS. One switch shall be provided to connect all IEDs for two bays of 220kV yard to communication infrastructure. Each switch shall have at least two spare ports for connecting bay level IEDs and one spare port for connecting station bus.

4.2 Bay level unit

The bay unit shall use industrial grade components. The bay level unit, based on microprocessor technology, shall use numerical techniques for the calculation and evaluation of externally input analogue signals. They shall incorporate select-before-operate control principles as safety measures for operation via the HMI. They shall perform all bay related functions, such as control commands, bay interlocking, data acquisition, data storage, event recording and shall provide inputs for status indication and outputs for commands. They shall be directly connected to the switchgear. The bay unit shall acquire and process all data for the bay (Equipment status, fault indications, measured values, alarms etc.) and transmit these to the other devices in sub-station automation system. In addition, this shall receive the operation commands from station HMI and control centre. The bay unit shall have the capability to store all the data for at least 24 hours.

One number Bay level unit shall be provided for supervision and control of each ~~220/~~132 kV bay (a bay comprises of one circuit breaker and associated disconnector, earth switches and instrument transformer). The Bay level unit shall be equipped with analogue and binary inputs/outputs for handling the control, status monitoring and analogue measurement functions. All bay level interlocks are to be incorporated in the Bay level unit so as to permit control from the Bay level unit/ local bay mimic panel, with all bay interlocks in place, during maintenance and commissioning or in case of contingencies when the Station HMI is out of service.

The bay control unit to be provided for the bays shall be preferably installed in the CB relay panel/feeder protection panel for respective bay.

The bay control unit for future bay (if required as per Section 1 – Project Specification Requirement) shall be installed in a separate panel.

The Bay level unit shall meet the requirements for withstanding electromagnetic interference according to relevant parts of IEC 61850. Failure of any single component within the equipment shall neither cause unwanted operation nor lead to a complete system breakdown.

4.2.1 Input/Output (I/O) modules

The I/O modules shall form a part of the bay level unit and shall provide coupling to the substation equipment. The I/O modules shall acquire all switchgear information (i.e. data coming directly from the switchgear or from switchgear interlocking devices) and transmit commands for operation of the switchgear. The measured values of voltage and current shall be from the secondaries of instrument transformers. The digital inputs shall be acquired by exception with 1 ms resolution. Contact bouncing in digital inputs shall not be assumed as change of state

4.3 Switchyard Panel Room:

The switchyard panel room shall be constructed to house Bay level units, bay mimic, relay and protection panels, PLCC panels etc. The layout of equipment/panel shall be subject to Owner's approval. The switchyard panel room shall be provided with necessray illuminations, fire alarm system with at least two detectors with necessary power supply if required and it shall be wired to SAS. The detailed constructional requirement of switchyard panel room is detailed in Section- civil of technical specification and air conditioning requirement of switchyard panel room shall be as detailed in Section - Air conditioning system of technical specification. The air conditioner provided in switchyard panel room shall be monitored from substation automation system.

4.4 Extendibility in future

Offered substation automation system shall be suitable for extension in future for additional bays. During such requirement, all the drawings and configurations, alarm/event list etc. displayed shall be designed in such a manner that its extension shall be easily performed by the employer. During such event, normal operation of the existing substation shall be unaffected and system shall not require a shutdown. The contractor shall provide all necessary software tools along with source codes to perform addition of bays in future and complete integration with SAS by the user. These software tools shall be able to configure IED, add additional analogue variable, alarm list, event list, modify interlocking logics etc. for additional bays/equipment which shall be added in future.

5.0 Software structure

The software package shall be structured according to the SAS architecture and strictly divided in various levels. Necessary firewall shall be provided at suitable points in software to protect the system. An extension of the station shall be possible with lowest possible efforts. Maintenance, modification or

an extension of components of any feeder may not force a shut-down of the parts of the system which are not affected by the system adaptation.

5.1.1 Station level software

5.1.1.1 Human-machine interface (HMI)

The base HMI software package for the operator station shall include the main SAS functions and it shall be independent of project specific hardware version and operating system. It shall further include tools for picture editing, engineering and system configuration. The system shall be easy to use, to maintain, and to adapt according to specific user requirements. Systems shall contain a library with standard functions and applications.

5.1.2 Bay level software

5.1.1.1 System software

The system software shall be structured in various levels. This software shall be placed in a non-volatile memory. The lowest level shall assure system performance and contain basic functions, which shall not be accessible by the application and maintenance engineer for modifications. The system shall support the generation of typical control macros and a process database for user specific data storage. In case of restoration of links after failure, the software along with hardware shall be capable of automatically synchronising with the remaining system without any manual interface. This shall be demonstrated by contractor during integrated system test.

5.1.1.2 Application software

In order to ensure robust quality and reliable software functions, the main part of the application software shall consist of standard software modules built as functional block elements. The functional blocks shall be documented and thoroughly tested. They form part of a library.
The application software within the control/protection devices shall be programmed in a functional block language.

5.1.1.3 Network Management System (NMS):

The contractor shall provide a network management system software for following management functions:

a. Configuration Management
b. Fault Management
c. Performance Monitoring

This system shall be used for management of communication devices and other IEDs in the system. This NMS can be loaded in DR work-station and shall be easy to use, user friendly and menu based. The NMS shall monitor all the devices in the SAS and report if there is any fault in the monitored devices. The NMS shall

(a) Maintain performance, resource usage, and error statistics for all managed links and devices and present this information via displays, periodic reports and on demand reports.
(b) Maintain a graphical display of SAS connectivity and device status.
(c) Issue alarms when error conditions occurs
(d) Provide facility to add and delete addresses and links

5.1.1.4 The contractor shall provide each software in two copies in CD to load into the system in case of any problem related with Hardware/Communication etc.

6.0 TESTS

The substation automation system offered by the bidder shall be subjected to following tests to establish compliance with IEC 61850 for EHV sub-station equipment installed in sheltered area in the outdoor switchyard and specified ambient conditions:

6.1 Type Tests:

6.1.1 Control IEDs and Communication Equipment:

a. Power Input:
i. Auxiliary Voltage
ii. Current Circuits
iii. Voltage Circuits
iv. Indications

b. Accuracy Tests:
i. Operational Measured Values
ii. Currents
iii. Voltages
iv. Time resolution

c. Insulation Tests:
i. Dielectric Tests
ii. Impulse Voltage withstand Test

d. Influencing Quantities
i. Limits of operation
ii. Permissible ripples
iii. Interruption of input voltage

e. Electromagnetic Compatibility Test:
i. 1 MHZ. burst disturbance test
ii. Electrostatic Discharge Test
iii. Radiated Electromagnetic Field Disturbance Test
iv. Electrical Fast transient Disturbance Test
v. Conducted Disturbances Tests induced by Radio Frequency Field
vi. Magnetic Field Test
vii. Emission (Radio interference level) Test.
viii. Conducted Interference Test

f. Function Tests:
i. Indication
ii. Commands

iii. Measured value Acquisition
iv. Display Indications

g. Environmental tests:

i. Cold Temperature
ii. Dry Heat
iii. Wet heat
iv. Humidity (Damp heat Cycle)
v. Vibration
vi. Bump
vii. Shock

6.2 Factory Acceptance Tests:

The supplier shall submit a test specification for factory acceptance test (FAT) and commissioning tests of the station automation system for approval. For the individual bay level IED's applicable type test certificates shall be submitted**.**

The manufacturing and configuration phase of the SAS shall be concluded by the factory acceptance test (FAT). The purpose is to ensure that the Contractor has interpreted the specified requirements correctly and that the FAT includes checking to the degree required by the user. The general philosophy shall be to deliver a system to site only after it has been thoroughly tested and its specified performance has been verified, as far as site conditions can be simulated in a test lab. During FAT the entire Sub-station Automation System including complete control and protection system to be supplied under present scope shall be tested for complete functionality and configuration in factory itself. The extensive testing shall be carried out during FAT. The purpose of Factory Acceptance Testing is to ensure trouble free installation at site. No major configuration setting of system is envisaged at site.

If the complete system consists of parts from various suppliers or some parts are already installed on site, the FAT shall be limited to sub-system tests. In such a case, the complete system test shall be performed on site together with the site acceptance test (SAT).

6.2.1 Hardware Integration Tests:

The hardware integration test shall be performed on the specified systems to be used for Factory tests when the hardware has been installed in the factory. The operation of each item shall be verified as an integral part of system. Applicable hardware diagnostics shall be used to verify that each hardware component is completely operational and assembled into a configuration capable of supporting software integration and factory testing of the system. The equipment expansion capability shall also be verified during the hardware integration tests. The vendor specifically demonstrates how to add a device in future in SAS during FAT. The device shall be from a

different manufacturer than the SAS supplier.

6.2.2 Integrated System Tests:

Integrated system tests shall verify the stability of the hardware and the software. During the tests all functions shall run concurrently and all equipment shall operate a continuous 100 Hours period. The integrated system test shall ensure the SAS is free of improper interactions between software and hardware while the system is operating as a whole.

6.3 Site Acceptance Tests:

The site acceptance tests (SAT) shall completely verify all the features of SAS hardware and software. The bidder shall submit the detailed SAT procedure and SAT procedure shall be read in conjunction with the specification.

7.0 SYSTEM OPERATION

7.1 Substation Operation

7.1.1 NORMAL OPERATION

Operation of the system by the operator from the remote RCC or at the substation shall take place via industry standard HMI (Human Machine interface) subsystem consisting of graphic colour VDU , a standard keyboard and a cursor positioning device (mouse).

The coloured screen shall be divided into 3 fields:

i) Message field with display of present time and date
ii) Display field for single line diagrams
iii) Navigation bar with alarm/condition indication

For display of alarm annunciation, lists of events etc. a separate HMI View node shall be provided.

All operations shall be performed with mouse and/or a minimum number of function keys and cursor keys. The function keys shall have different meanings depending on the operation. The operator shall see the relevant meanings as function tests displayed in the command field (i.e. operator prompting). For control actions, the switchgear (i.e. circuit breaker etc.) requested shall be selectable on the display by means of the cursor keys. The switching element selected shall then appear on the background that shall be flashing in a different colour. The operator prompting shall distinguish between:-

- Prompting of indications e.g. fault indications in the switchgear, and

- prompting of operational sequences e.g. execution of switching operations

The summary information displayed in the message field shall give a rapid

display of alarm/message of the system in which a fault has occurred and alarm annunciation lists in which the fault is described more fully.

Each operational sequence shall be divided into single operation steps which are initiated by means of the function keys/WINDOW command by mouse. Operator prompting shall be designed in such a manner that only the permissible keys are available in the command field related to the specific operation step. Only those switching elements shall be accessed for which control actions are possible. If the operation step is rejected by the system, the operator prompting shall be supported by additional comments in the message field. The operation status shall be reset to the corresponding preceding step in the operation sequence by pressing one of the function keys. All operations shall be verified. Incorrect operations shall be indicated by comments in the message field and must not be executed.

The offer shall include a comprehensive description of the system. The above operation shall also be possible via WINDOWS based system by mouse.

8.0 POWER SUPPLY

Power for the substation automation system shall be derived from substation 220V DC system.
2No.s of Inverter of minimum 2KVA capacity shall be provided for servers, gateways station HMI disturbance recorder evaluation unit and its peripheral devices e.g. printer etc. In the event of Power failure, necessary safeguard software shall be built for proper shutdown. Inverter shall be connected to 220V DC independent source and should be used to drive 1No. each server/HMI/Gateway so that in case any failure of DC power supply system is not affected.

9.0 DOCUMENTATION

The following documents shall be submitted for employer's approval during detailed engineering:

(a) System Architecture Drawing
(b) Hardware Specification
(c) Functional Design Document
(d) Clear procedure describing how to add an IED/bay/diameter in future covering all major supplier

The following documentation to be provided for the system in the course of the project shall be consistent, CAD supported, and of similar look/feel. All CAD drawings to be provide in "dxf" format.

- List of Drawings
- Substation automation system architecture
- Block Diagram
- Guaranteed technical parameters, Functional Design Specification and

Guaranteed availability and reliability

- Calculation for power supply dimensioning
- I/O Signal lists
- Schematic diagrams
- List of Apparatus
- List of Labels
- Logic Diagram (hardware & software)
- **Switchyard Panel Room** (If applicable)layout drawing
- Control Room Lay-out
- Test Specification for Factory Acceptance Test (FAT)
- Product Manuals
- Assembly Drawing
- Operator's Manual
- Complete documentation of implemented protocols between various elements
- Listing of software and loadable in CD ROM
- Other documents as may be required during detailed engineering

Two sets of hard copy and Four sets of CD ROM containing all the as built documents/drawings shall be provided.

10.0 TRAINING, SUPPORT SERVICES, MAINTENANCE AND SPARES

10.1 Training

Contractor personnel who are experienced instructors and who speak understandable English shall conduct training. The contractor shall arrange on its own cost all hardware training platform required for successful training and understanding in Nepal. The Contractor shall provide all necessary training material. Each trainee shall receive individual copies of all technical manuals and all other documents used for training. These materials shall be sent to Employer at least two months before the scheduled commencement of the particular training course. Class materials, including the documents sent before the training courses as well as class handouts, shall become the property of Employer. Employer reserves the right to copy such materials, but for in-house training and use only. Hands-on training shall utilize equipment identical to that being supplied to Employer.

The Contractor shall quote training prices as indicated in BPS.

The schedule, location, and detailed contents of each course will be finalized during Employer and Contractor discussions.

10.2 Computer System Hardware Course

A computer system hardware course shall be offered, but at the system level only. The training course shall be designed to give Employer hardware personnel sufficient knowledge of the overall design and operation of the system so that they can correct obvious problems, configure the hardware, perform preventive maintenance, run diagnostic programs, and

communicate with contract maintenance personnel. The following subjects shall be covered:

(a) System Hardware Overview: Configuration of the system hardware.
(b) Equipment Maintenance: Basic theory of operation, maintenance techniques and diagnostic procedures for each element of the computer system, e.g., processors, auxiliary memories, LANs, routers and printers. Configuration of all the hardware equipments.
(c) System Expansion: Techniques and procedures to expand and add equipment such as loggers, monitors, and communication channels.
(d) System Maintenance: Theory of operation and maintenance of the redundant hardware configuration, failover hardware, configuration control panels, and failover switches. Maintenance of protective devices and power supplies.
(e) Subsystem Maintenance: Theory of design and operation, maintenance techniques and practices, diagnostic procedures, and (where applicable) expansion techniques and procedures. Classes shall include hands-on training for the specific subsystems that are part of Employer's equipment or part of similarly designed and configured subsystems. All interfaces to the computing equipment shall be taught in detail.
(f) Operational Training: Practical training on preventive and corrective maintenance of all equipment, including use of special tools and instruments. This training shall be provided on Employer equipment, or on similarly configured systems.

10.3 Computer System Software Course

The Contractor shall provide a computer system software course that covers the following subjects:

(g) System Programming: Including all applicable programming languages and all stand-alone service and utility packages provided with the system. An introduction to software architecture, Effect of tuning parameters (OS software, Network software, database software etc.) on the performance of the system.
(h) Operating System: Including the user aspects of the operating system, such as program loading and integrating procedures; scheduling, management, service, and utility functions; and system expansion techniques and procedures
(i) System Initialization and Failover: Including design, theory of operation, and practice
(j) Diagnostics: Including the execution of diagnostic procedures and the interpretation of diagnostic outputs,
(k) Software Documentation: Orientation in the organization and use of system software documentation.

(l) Hands-on Training: One week, with allocated computer time for trainee performance of unstructured exercises and with the course instructor available for assistance as necessary.

10.4 Application Software Course

The Contractor shall provide a comprehensive application software courses covering all applications including the database and display building course. The training shall include:

(m) Overview: Block diagrams of the application software and data flows. Programming standards and program interface conventions.

(n) Application Functions: Functional capabilities, design, and major algorithms. Associated maintenance and expansion techniques.

(o) Software Development: Techniques and conventions to be used for the preparation and integration of new software functions.

(p) Software Generation: Generation of application software from source code and associated software configuration control procedures.

(q) Software Documentation: Orientation in the organization and use of functional and detailed design documentation and of programmer and user manuals.

(r) Hands-on Training: One week, with allocated computer time for trainee performance of unstructured exercises and with the course instructor available for assistance as necessary.

10.5 Requirement of training:

The contractor shall provide training for OWNER'S personnel comprehensively covering following courses.

S. No.	Name of Course
1	Computer System Hardware
2	Computer System Software
3	Application Software

11.0 Maintenance

11.1 Maintenance Responsibility during the Guaranteed Availability Period.

During Guaranteed Availability Period, the Contractor shall take continual actions to ensure the guaranteed availability and shall make available all the necessary resources such as specialist personnel, spare parts, tools, test devices etc. for replacement or repair of all defective parts and shall have prime responsibility for keeping the system operational. **During guarantee period as specified in tender document, contractor shall arrange bi-monthly visit of their representative to site to review the performance of system and in case any defect/shortcoming etc. is observed during the period, the same shall be set right by the contractor within 15 days.**

12.0 RELIABILITY AND AVAILABILITY

The SAS shall be designed so that the failure of any single component, processor, or device shall not render the system unavailable. The SAS shall be designed to satisfy the very high demands for reliability and availability concerning:

- Mechanical and electrical design
- Security against electromagnetic interference (EMI)
- High quality components and boards
- Modular, well-tested hardware
- Thoroughly developed and tested modular software
- Easy-to-understand programming language for application programming
- Detailed graphical documentation and application software
- Built-in supervision and diagnostic functions
- Security
  - Experience of security requirements
  - Process know-how
  - Select before execute at operation
  - Process status representation as double indications
- Distributed solution
- Independent units connected to the local area network
- Back-up functions
- Panel design appropriate to the harsh electrical environment and ambient conditions
- Panel grounding immune against transient ground potential rise

Outage terms

1) Outage

The state in which substation automation system or a unit of SAS is unavailable for Normal Operation as defined in the clause 7.1 due to an event directly related to the SAS or unit of SAS. In the event, the owner has taken any equipment/ system other than Sub-station Automation System for schedule/forced maintenance, the consequent outage to SAS shall not be considered as outage for the purpose of availability.

2) Actual outage duration (AOD)

The time elapsed in hours between the start and the end of an outage. The time shall be counted to the nearest $1/4^{th}$ of an hour. Time less than $1/4^{th}$ of an hour shall be counted as having duration of $1/4^{th}$ of an hour.

3) Period Hours (PH)

The number of hours in the reporting period. In a full year the period hour are 8760h (8784h for a leap year).

4) Actual Outage hours (AOH)

The sum of actual outage duration within the reporting period

$$AOH = \sum AOD$$

5) Availability:

Each SAS shall have a total availability of 99.98 % i.e. the ratio of total time duration minus the actual outage duration to total time duration.

12.1 Guarantees Required

The availability for the complete SAS shall be guaranteed by the Contractor. Bidder shall include in their offer the detailed calculation for the availability. The contractor shall demonstrate their availability guaranteed by conducting the availability test on the total sub-station automation system as a whole after commissioning of total Sub-station Automation system. The test shall verify the reliability and integrity of all sub-systems. Under these conditions the test shall establish an overall availability of 99.98%. After the lapse of 1000 Hours of cumulative test time, test records shall be examined to determine the conformance with availability criterion. In case of any outage during the availability test, the contractor shall rectify the problem and after rectification, the 1000 Hours period start after such rectification. If test object has not been met the test shall continue until the specified availability is achieved.

The contractor has to establish the availability in a maximum period of three months from the date of commencement of the availability test.

After the satisfactory conclusion of test both contractor and employer shall mutually agree to the test results and if these results satisfy the availability criterion, the test is considered to be completed successfully. After that the system shall be taken over by the employer and then the guarantee period shall start.

13.0 Spares

13.1 Consumables:

All consumables such as paper, cartridges shall be supplied by the contractor till the SAS is taken over by the owner.

13.2 Availability Spares:

In addition to mandatory spares as listed in section project for SAS, the bidder is required to list the spares, which may be required for ensuring the guaranteed availability during the guaranteed availability period. The final list of spares shall form part of scope of supply and accordingly the price thereof shall be quoted by the bidder and shall be considered in the evaluation of the bids. During the guaranteed availability period, the spare parts supplied by the Contractor shall be made available to the Contractor for usage subject to replenishment at the earliest. Thus, at the end of availability period the inventory of spares with the Employer shall be fully replenished by the Contractor. However, any additional spares required to meet the availability of the system (which are not a part of the above spares supplied by the Contractor) would have to be supplied immediately by the Contractor free of cost to the Employer.

14.0 LIST OF EQUIPMENTS

Quantity of equipments shall be decided by bidder in order to achieve guaranteed reliability and availability as declared by bidder.

i) Station HMI
ii) Redundant Station HMI (in Hot-stand by mode)

iii) Bay level units along with bay mimic as detailed in Section 1 – Project Specification Requirement.
iv) Bay Level Unit for Auxiliary system (as per requirement)
v) Disturbance Recorder Work Station(Maintenance HMI)
vi) Colour Laser Printer – 1 No. (For Reports & Disturbance records)
vii) Dot matrix printers - (one each for Alarms and log sheets)
viii) All interface equipment for gateway to RCC and RSCC
ix) Communication infrastructure between Bay level units, Station HMI, Printers, gateways, redundant LAN etc. as required
x) Remote workstation including HMI and along with one printer
xi) Modems as per requirement.
xii) Any other equipment as necessary.

Annexure-I

List of Analogue and Digital Inputs

Basic Monitoring requirements are:

- Switchgear status indication
- Measurements (U, I, P, Q, f)
- Event
- Alarm
- Winding temperature of transformers & reactors
- ambient temperature
- Status and display of 400V LT system, 220/110V & 48V DC system
- Status of display of Fire protection system and Air conditioning system.
- Acquisition of all counters in PLCC panels through potential free contacts from PLCC or independently by counting the receive/send commands.
- Acquisition of alarm and fault record from protection relays
- Disturbance records
- Monitoring the state of batteries by displaying DC voltage, charging current and load current etc.
- Tap-position of Transformer

List of Inputs

The list of input for typical bays is as below:-

Analogue inputs

i) For line
Current R phase
Y phase
B phase
Voltage R-Y phase
Y-B phase
B-R phase

ii) For transformer/reactor
Current R phase
Y phase
B phase
WTI (for transformer and reactor)
Tap position (for transformer only)

iii) For TBC and bus coupler

Current R phase
Y phase
B phase

iv) Common

a) Voltage for Bus-I, Bus-II and Transfer bus wherever applicable

Voltage R-Y phase
Y-B phase
B-R phase

b) Frequency for Bus-I and Bus-II

c) Ambient temperature (switchyard)

d) Switchyard Panel Room Temperature.

e) LT system

i) Voltage R-Y, Y-B, B-R of Main Switch Board section-I
ii) Voltage R-Y, Y-B, B-R of Main Switch Board section-II
iii) Voltage R-Y, Y-B, B-R of Diesel Generator
iv) Current from LT transformer-I
v) Current from LT transformer-II
vi) Current from Diesel Generator
vii) Voltage of 220V DCDB-I
viii) Voltage of 220V DCDB-II
ix) Current from 220V Battery set-I
x) Current from 220V Battery set-II
xi) Current from 220V Battery charger-I
xii) Current from 220V Battery charger-I
xiii) Voltage of 48V DCDB-I
xiv) Voltage of 48V DCDB-II
xv) Current from 48V Battery set-I
xvi) Current from 48V Battery set-II
xvii) Current from 48V Battery charger-I
xviii) Current from 48V Battery charger-I

Digital Inputs

The list of input for various bays/SYSTEM is as follows:

1. Line bays

i) Status of each pole of CB.
ii) Status of Isolator, Earth switch
iii) CB trouble
iv) CB operation/closing lockout
v) Pole discrepancy optd
vi) Trip coil faulty
vii) LBB optd
viii) Bus bar protn trip relay optd
ix) Main bkr auto recloser operated
x) Tie/transfer auto recloser operated
xi) A/r lockout
xii) Tie/transfer bkr a/r lockout
xiii) Direct trip-I/II sent

xiv) Direct trip-I/II received
xv) Main I/II blocking
xvi) Main I/II-Inter trip send
xvii) Main I/II-Inter trip received
xviii) O/V STAGE – I operated
xix) O/V STAGE – II operated
xx) FAULT LOCATOR FAULTY
xxi) MAIN-I/II CVT FUSE FAIL
xxii) MAIN-I PROTN TRIP
xxiii) MAIN-II PROTN TRIP
xxiv) MAIN-I PSB ALARM
xxv) MAIN-I SOTF TRIP
xxvi) MAIN-I R-PH TRIP
xxvii) MAIN-I Y-PH TRIP
xxviii) MAIN-I B-PH TRIP
xxix) MAIN-I START
xxx) MAIN-I/II Carrier aided trip
xxxi) MAIN-I/II fault in reverse direction
xxxii) MAIN-I/II ZONE-2 TRIP
xxxiii) MAIN-I/II ZONE-3 TRIP
xxxiv) MAIN-I/II weak end infeed optd
xxxv) MAIN-II PSB alarm
xxxvi) MAIN-II SOTF TRIP
xxxvii) MAIN-II R-PH TRIP
xxxviii) MAIN-II Y-PH TRIP
xxxix) MAIN-II B-PH TRIP
xl) MAIN-II start
xli) MAIN-II aided trip
xlii) MAIN-I/II fault in reverse direction
xliii) Back-up o/c optd
xliv) Back-up e/f optd
xlv) 220V DC-I/II source fail
xlvi) SPEECH CHANNEL FAIL
xlvii) PLCC Protection Channel-I FAIL
xlviii) PLCC Protection Channel-II FAIL

2. **Transformer bays**

i) Status of each pole of CB, Isolator, Earth switch
ii) CB trouble
iii) CB operation/closing lockout
iv) Pole discrepancy optd
v) Trip coil faulty
vi) LBB optd
vii) Bus bar protn trip relay optd
viii) REF OPTD
ix) DIF OPTD
x) OVERFLUX ALARM (MV)
xi) OVERFLUX TRIP (MV)
xii) OVERFLUX ALARM (HV)
xiii) OVERFLUX TRIP (HV)

xiv) HV BUS CVT ½ FUSE FAIL
xv) MV BUS CVT ½ FUSE FAIL
xvi) OTI ALARM/TRIP
xvii) PRD OPTD
xviii) OVERLOAD ALARM
xix) BUCHOLZ TRIP
xx) BUCHOLZ ALARM
xxi) OLTC BUCHOLZ ALARM
xxii) OLTC BUCHOLZ TRIP
xxiii) OIL LOW ALARM
xxiv) back-up o/c (HV) optd
xxv) back-up e/f (HV)optd
xxvi) 220v DC-I/II source fail
xxvii) TAP MISMATCH
xxviii) GR-A PROTN OPTD
xxix) GR-B PROTN OPTD
xxx) back-up o/c (MV) optd
xxxi) back-up e/f (MV)optd

3. **Transformer bays**

i) Status of each pole of CB, Isolator, Earth switch
ii) CB trouble
iii) CB operation/closing lockout
iv) Pole discrepancy optd
v) Trip coil faulty
vi) LBB optd
vii) Bus bar protn trip relay optd
viii) REF OPTD
ix) DIF OPTD
x) HV BUS CVT ½ FUSE FAIL
xi) OTI ALARM/TRIP
xii) PRD OPTD
xiii) BUCHOLZ TRIP
xiv) BUCHOLZ ALARM
xv) OIL LOW ALARM
xvi) Back-up impedance relay
xvii) 220v DC-I/II source fail
xviii) GR-A PROTN OPTD
xix) GR-B PROTN OPTD

4. Line/Bus Reactor bays (as applicable):

i) Status of each pole of CB, Isolator, Earth switch
ii) CB trouble
iii) CB operation/closing lockout
iv) Pole discrepancy optd
v) Trip coil faulty
vi) LBB optd
vii) Bus bar protn trip relay optd
viii) REF OPTD

ix) DIF OPTD
x) Line/ BUS CVT ½ FUSE FAIL
xi) OTI ALARM/TRIP
xii) PRD OPTD
xiii) BUCHOLZ TRIP
xiv) BUCHOLZ ALARM
xv) OIL LOW ALARM
xvi) Back-up impedance relay
xvii) 220V DC-I/II source fail
xviii) GR-A PROTN OPTD
xix) GR-B PROTN OPTD

5 **Bus bar Protection**

i) Bus bar main-I trip
ii) Bus bar main-II trip
iii) Bus bar zone-I CT open
iv) Bus bar zone-II CT open
v) Bus transfer CT sup. Optd
vi) Bus transfer bus bar protn optd
vii) Bus protection relay fail

6. **Auxiliary system**

i) Incomer-I On/Off
ii) Incomer-II On/Off
iii) 400V Bus-I/II U/V
iv) 400V bus coupler breaker on/off
v) DG set bkr on/off
vi) Alarm/trip signals as listed in Section: DG set
vii) LT transformer-I Bunchholz Alarm & trip
viii) LT transformer-II Buchloz Alarm & trip
ix) LT transformer-I WTI Alarm & trip
x) LT transformer-II WTI Alarm & trip
xi) LT transformer-I OTI Alarm & trip
xii) LT transformer-II OTI Alarm & trip
xiii) PLCC exchange fail
xiv) Time sync. Signal absent
xv) Alarm/trip signals as listed in Section: Battery and Battery charger
xvi) 220V DC-I earth fault
xvii) 220V DC-II earth fault
xviii) Alarm/trip signals as listed in Section: Fire protection system

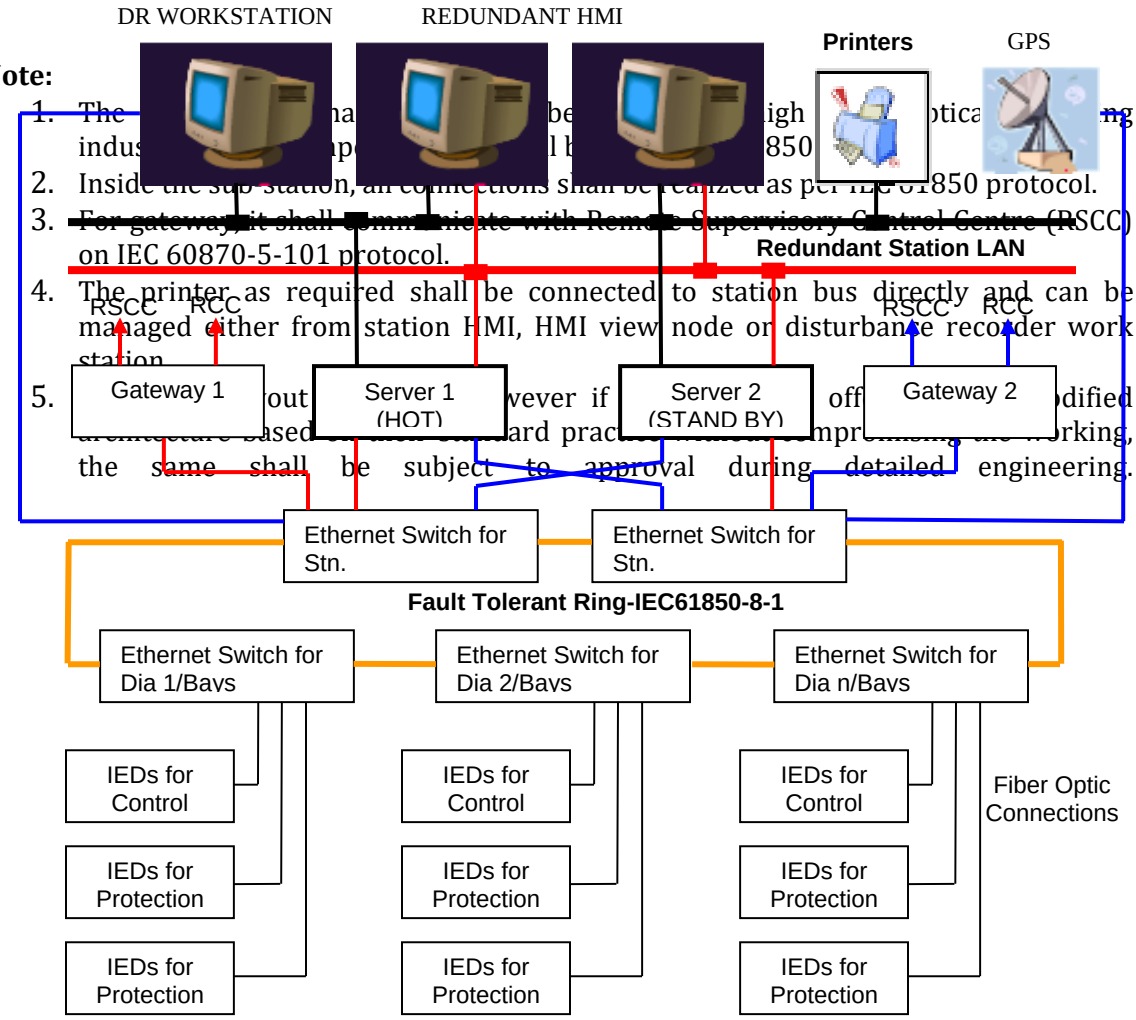
7. Switchyard Panel Room:

i) AC Compressor 1 ON/OFF
ii) AC Compressor 2 ON/OFF
iii) Fire Detection 1 ON/OFF
iv) Fire Detection 2 On/OFF
v) Switchyard Panel Room Temperature High Alarm

Annexure-I

The exact number and description of digital inputs shall be as per detailed engineering requirement Apart from the above mentioned digital inputs, minimum of 200 inputs shall be kept for future use.

TYPICAL ARCHITECTURAL DRAWING
OF
SUBSTATION AUTOMATION SYSTEM



Note:

1. The [illegible] high [illegible] optica[illegible] ng indus[illegible] l b[illegible] 850
2. Inside the sub-station, all connections shall be realized as per IEC 61850 protocol.
3. For gateway, it shall communicate with Remote Supervisory Control Centre (RSCC) on IEC 60870-5-101 protocol.
4. The printer as required shall be connected to station bus directly and can be managed either from station HMI, HMI view node or disturbance recorder work station.
5. [illegible] out [illegible] wever if [illegible] off [illegible] odified architecture based [illegible] ard practice without compromising the working, the same shall be subject to approval during detailed engineering.

Appendix-II

List of IO Points to be transmitted to RSCC

a) MW and MVAR for all lines , transformers, reactors and Capacitors
b) Voltage of all buses
c) Frequency of 220kV Bus
d) All Breakers
e) All isolators
f) Tap Position for all transformers
g) Master protection signal for all feeders, transformers Units and Bus Bar
h) Loss of Voltage signal for Bus bar
i) All the points identified in point (e), (h) and (i) above as GPS Time stamped.
j) Temperature value per substation.
k) Any other point decided during detailed engineering

TECHNICAL SPECIFICATION

VOL-II, SEC-XXI

220KV CLASS SPECIFICATIONS FOR TRANSFORMERS

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SECTION - XXI
220KV CLASS SPECIFICATIONS FOR TRANSFORMERS
(Transformer up to 220 kV class)

1.0 General

1.1 This specification covers design, engineering, manufacture, testing at manufacturer's works, delivery at site including all materials, accessories, spares, unloading, handling, proper storage at site, erection, testing and commissioning of the equipment specified.

1.2 Transportation

1.2.1 The Contractor shall be responsible to select and verify the route, mode of transportation and make all necessary arrangement with the appropriate authorities for the transportation of the equipment. The dimension of the equipment shall be such that when packed for transportation, it will comply with the requirements of loading and clearance restrictions for the selected route. It shall be the responsibility of the contractor to coordinate the arrangement for transportation of the transformer for all the stages from the manufacturer's work to site.

1.2.2 The contractor shall carry out the route survey along with the transporter and finalise the detail methodology for transportation of transformer and based on route survey; any modification/ extension/ improvement to existing road, bridges, culverts etc. if required, shall be in the scope of the bidder.

1.2.3 The Contractor shall dispatch the transformer filled with oil or in an atmosphere of nitrogen or dry air. In the former case the contractor shall take care of the weight limitation on transport and handling facility at site. In the latter case, necessary arrangement shall be ensured by the contractor to take care of pressure drop of nitrogen or dry air during transit and storage till completion of oil filling during erection. A gas pressure testing valve with necessary pressure gauge and adaptor valve shall be provided.

1.2.4 Transformer shall also be fitted with at least one Electronic impact recorder (on returnable basis) during transportation to measure the magnitude and duration of the impact in all three directions. The acceptance criteria and limits of impact in all three directions which can be withstood by the equipment during transportation and handling shall be submitted by the contractor during detailed engineering. The recording shall commence in the factory before dispatch and must continue till the unit is installed on its foundation. The data of electronic impact recorder(s) shall be down loaded at site and a soft copy of it shall be handed over to Engineer-in-charge. Further, within three weeks the contractor shall communicate the interpretation of the data. In the unlikely event of impact recorder output not available at site, the equipment shall be thoroughly internally inspected by the manufacturer's representative before erection at site to ensure healthiness of the equipment. Contractor shall mount Vehicle tracking system (GPRS/ GPS/ GSM based) to track the exact position of the vehicle on which the equipment is being loaded for transportation in order to ensure traceability and safety during transportation.

2.0 Performance

2.1 The transformers shall be used for bi-directional flow of rated power.

2.2 Transformers shall be capable of operating under natural cooled condition up to the full/Specified load. Transformers shall be fitted with coolers, capable of dissipating total losses at continuous maximum rating.

2.3 The transformers shall be capable of being operated, without danger, on any tapping at the rated MVA with voltage variation of ± 10% corresponding to the voltage of the tapping.

2.4 The maximum flux density in any part of the core and yoke at the rated MVA, voltage and frequency shall be such that under 10 per cent continuous over voltage condition it does not exceed 1.9 Tesla at any tap position.

2.5 DGA of oil shall be periodically monitored by the Employer and the interpretation of DGA results will be as per IEC - 60599.

2.6 Radio Interference and Noise Level

2.6.1 The transformers shall be designed with particular attention to the suppression of maximum harmonic voltage, especially the third and fifth so as to minimize interference with communication circuit.

2.6.2 The noise level of transformer, when energized at normal voltage and frequency with cooler equipments in operation shall not exceed, when measured under standard conditions, the values specified at relevant clause.

2.7 The transformers shall be capable of being loaded in accordance with IEC-60076-7. There shall be no limitation imposed by bushings, tap changers etc. or any other associated equipment.

2.8 The transformer and all its accessories including CTs etc. shall be designed to withstand without injury, the thermal and mechanical effects of any external short circuit to earth and of short circuits at the terminals of any winding for a period of 3 secs. The short circuit level of the HV & LV System to which the subject transformers will be connected is 40 kA for 1 sec (sym, rms, 3 phase fault) on 220kV, 31.5 kA (sym, rms,3 phase fault on 132 kV) & 25kA (sym rms 3 phase fault on 33kV).

2.9 Transformer shall be capable of withstanding thermal and mechanical stresses caused by symmetrical or asymmetrical faults on any winding.

2.10 Transformers shall withstand, without injurious heating, combined voltage and frequency fluctuations which produce the following over fluxing conditions:

110% for continuous operation
125% for 1 - minute
140% for 5 – seconds

2.11 Dynamic Short Circuit Test requirement

i) For 220 kV Class Transformer:

Bidder / Manufacturer should have successfully carried out Dynamic Short Circuit Test on any rating of 220 kV or above voltage class transformer as on the originally scheduled date of bid opening and shall enclose the relevant Test Report / Certificate along with bid. In case bidder has not successfully tested 220 kV or above voltage class transformer for Dynamic Short Circuit Test, their bid shall be considered technically

non-responsive. Further design review of offered 220 kV class transformers shall be carried out based on design of short circuit tested 220 kV or above voltage class transformer.

ii) For 132 kV Class Transformer:

Bidder / Manufacturer should have successfully carried out Dynamic Short Circuit Test on any rating of 132 kV or above voltage class transformer as on the originally scheduled date of bid opening and shall enclose the relevant Test Report / Certificate along with bid. In case bidder has not successfully tested 132 kV or above voltage class transformer for Dynamic Short Circuit Test, their bid shall be considered technically non-responsive. Further design review of offered 132 kV class transformers shall be carried out based on design of short circuit tested 132 kV or above voltage class transformer.

2.12 **Design review**

The transformers shall be designed, manufactured and tested in accordance with the best international engineering practices under strict quality control to meet the requirement stipulated in the technical specification. Adequate safety margin with respect to thermal, mechanical, dielectric and electrical stress etc. shall be maintained during design, selection of raw material, manufacturing process etc so that the transformer provide long life with least maintenance.

Design reviews shall be conducted by Owner or an appointed Consultant at different stages of the procurement process for transformer, however the entire responsibility of design shall be with the manufacturer.

Owner may visit to the manufacturers works to inspect design, manufacturing and test facilities.

The design review will commence after placement of award with successful bidder and shall be finalised before commencement of manufacturing activity. These design reviews shall be carried out in detail to the specific design with reference of the transformer under scope of this specification.

The design review shall be conducted generally following the "Guidelines for conducting design reviews for transformers 100 MVA and 123kV and above" prepared by Cigre SC 12 Working Group 12.22.

The manufacturer shall provide all necessary information and calculations during design review to demonstrate that the transformer meets the requirements for short circuit strength and durability. The latest recommendations of IEC and Cigre SC 12 shall be applied for short circuit withstand evaluation.

The manufacturer will be required to demonstrate the use of adequate safety margin for thermal, mechanical, dielectric and vibration etc. design to take into the account the uncertainties of his design and manufacturing processes.

The scope of such a design review shall at least include the following:

1.	Core and magnetic design
2.	Winding and tapping design
3.	Short-circuit withstand capability

4.	Thermal design including review of localised potentially hot area.
5.	Cooling design
6.	Overload capability
7.	Eddy current losses
8.	Seismic design, as applicable
9.	Insulation co-ordination
10.	Tank and accessories
10.1	Bushings and barrier design
10.2	Tap changers
10.3	Protective devices
10.4	Radiators
10.5	Oil and oil preservation system
11.	Corrosion protection
12.	Electrical and physical Interfaces with substation
13.	Earthing
14.	Processing and assembly
15.	Testing capabilities
16.	Inspection and test plan
17.	Transport and storage
18.	Sensitivity of design to specified parameters
19.	Acoustic Noise
20.	Spares, inter-changeability and standardization
21.	Maintainability

3.0 Construction Details

The features and construction details of each power transformer shall be in accordance with the requirement stated hereunder.

3.1 Tank and Tank Accessories

3.1.1 Tank

3.1.1.1 Tank shall preferably be of welded construction and fabricated from tested quality low carbon steel of adequate thickness.

3.1.1.2 All seams and those joints not required to be opened at site shall be factory welded, and wherever possible they shall be double welded. After completion of tank and before painting, dye penetration test shall be carried out on welded parts of jacking bosses, lifting lugs and all load bearing members. The requirement of post weld heat treatment of tank/stress relieving shall be based on recommendation of BS-5500 table 4.4.3.1. ./IS 10801

3.1.1.3 Tank stiffeners shall be provided for general rigidity and these shall be designed to prevent retention of water.

3.1.1.4 The transformer shall have conventional type tank. In case the joint is welded it shall be provided with flanges suitable for repeated welding. The joint shall be provided with a suitable gasket to prevent weld splatter inside the tank. Proper tank shielding shall be done to prevent excessive temperature rise of the joint.

3.1.1.5 Each tank shall be provided with:

(a) Lifting lugs suitable for lifting the equipment complete with oil.

(b) A minimum of four jacking pads in accessible position to enable the transformer complete with oil to be raised or lowered using hydraulic jacks. Each jacking pad shall be designed to support with an adequate factor of safety for at least half of the total mass of the transformer filled with oil allowing in addition for maximum possible misalignment of the jacking force to the centre of the working surface.

(c) Suitable haulage holes shall be provided.

3.1.1.6 The tank shall be designed in such a way that it can be mounted on the rollers.

3.1.1.7 The base of each tank shall be so designed that it shall be possible to move the complete transformer unit by skidding in any direction without injury when using plates or rails.

3.1.1.8 Paint system and procedures

The painting details for transformer main tank, pipes, conservator tank, radiator, control cabinet/ marshalling box / oil storage tank etc. shall be as given below. The paint should not fade during drying process. The paint should be able to withstand temperature up to 120 deg. C .The detailed painting procedure shall also be submitted along with the bid which shall be finalized before award of the contract.

	Surface preparation	Primer coat	Intermediate undercoat	Finish coat	Total dry film thick-ness (DFT)	Colour shade
Main tank, pipes, conservator tank, oil storage tank etc. (external surfaces)	Shot Blast cleaning Sa 2 ½*	Epoxy base Zinc primer (30-40□m)	Epoxy high build Micaceous iron oxide (HB MIO) (75□m)	Aliphatic polyurethane (PU) (Minimum 50□m)	Minimum 155□m	RAL 7035
Main tank, pipes (above 80 NB), conservator tank, oil storage tank etc. (Internal surfaces)	Shot Blast cleaning Sa 2 ½*	Hot oil resistant, non-corrosive varnish or paint or epoxy	--	--	Minimum 30□m	Glossy white for paint
Radiator (external surfaces)**	Chemical / Shot Blast cleaning Sa 2 ½*	Epoxy base Zinc primer (30-40□m)	Epoxy base Zinc primer (30-40□m)	PU paint (Minimum 50□m)	Minimum 100□m	Matching shade of tank/ different shade aesthetically matching to tank

Radiator and pipes up to 80 NB (Internal surfaces)	Chemical cleaning, if required	Hot oil proof, low viscosity varnish	--	--	--	--
Control cabinet / marshalling box/RTCC	Seven tank process as per IEC	Zinc chromate primer (two coats)	--	EPOXY paint with PU top coat	Minimum 80 m	RAL 7035 shade for exterior and interior

Note: * Indicates Sa 2 ½ as per Swedish Standard SIS 055900 of ISO 8501 Part-1.
** **Radiator hot dip galvanized may also acceptable**.

3.1.2 **Tank Cover**

3.1.2.1 The tank cover shall be designed to prevent retention of rain water and shall not distort when lifted. The internal surface of the top cover shall be shaped to ensure efficient collection and direction of free gas to the buchholz relay.

3.1.2.2 At least one adequately sized inspection openings shall be provided in the transformers for easy access to bushings and earth connections. The inspection covers shall not weigh more than 25 kg. Handles shall be provided on the inspection cover to facilitate lifting.

3.1.2.3 The tank covers shall be fitted with pockets at the position of maximum oil temperature at maximum continuous rating for bulbs of oil and winding temperature indicators. It shall be possible to remove these bulbs without lowering the oil in the tank. The thermometer shall be fitted with a captive screw to prevent the ingress of water.

3.1.2.4 Bushing turrets, covers of inspection openings, thermometer pockets etc. shall be designed to prevent ingress of water into or leakage of oil from the tank.

3.1.2.5 All bolted connections shall be fitted with weather proof, hot oil resistant, resilient gasket in between for complete oil tightness. If gasket is compressible, metallic stops/other suitable means shall be provided to prevent over-compression. All gasketed joints shall be designed, manufactured and assembled to ensure long-term leak and maintenance free operation. Groove provided to accommodate round nitrile rubber cord for rectangular openings shall be milled.

3.1.2.6 Tank hotspot

The maximum temperature on any metal part shall not exceed 130 deg. Celsius.

3.1.2.7 Currents flowing in tank cover and bushing turrets

To allow for the effect of possible induced and capacitive surge current, good electrical connection shall be maintained between the tank and turrets.

3.1.2.8 The transformer shall be provided with pipe flange of suitable diameter with bolted blanking plate, gasket and shall be fitted at the highest point of the transformer tank for maintaining vacuum in the tank.

3.1.3 **Axles and Wheels**

3.1.3.1 The transformer shall be mounted on rollers, as per manufacturer's standard practice.

3.1.3.2 The roller mounted transformers are to be provided with flanged bi-directional wheels and axles. This set of wheels and axles shall be suitable for fixing to the under carriage of transformer to facilitate its movement on rail track. Suitable locking arrangement along with foundation bolts shall be provided for the wheels to prevent accidental movement of transformer.

3.1.3.3 The rail track gauge shall be 1676 mm.

3.1.4 **Foundation and Anti Earthquake Clamping Device**

To prevent transformer movement during earthquake, suitable clamping devices shall be provided for fixing the transformer to the foundation.

3.1.5 **Conservator & Oil Preservation System**

Main conservator shall have air cell type constant oil pressure system to prevent oxidation and contamination of oil due to contact with moisture, and shall be fitted with magnetic oil level gauge with low oil level potential free contacts.

3.1.5.2 OLTC shall have conventional type conservator with prismatic oil level gauge.

3.1.5.3 **Conservator tank and pipe work**

3.1.5.3.1 Conservator tank shall have adequate capacity with highest and lowest visible-levels to meet the requirements of expansion of total cold oil volume in the transformer and cooling equipment from minimum ambient temperature to 100degC. The capacity of the conservator tank shall be such that the transformer shall be able to carry the specified overload without overflowing of oil. The Calculation shall be submitted during design review.

3.1.5.3.2 The conservator shall be fitted with integral lifting lugs in such a position so that it can be removed for cleaning purposes. Suitable provision shall be kept to replace air cell and cleaning of the conservator wherever applicable.

3.1.5.3.3 Conservator shall be positioned so as not to obstruct any electrical connection to transformer. Pipe work shall neither obstruct the removal of tap changers for maintenance or the opening of inspection or manhole covers.

3.1.5.3.4 Pipe work connections shall be of adequate size for their duty and as short and direct as possible. Only radiused elbows shall be used.

3.1.5.3.5 The feed pipe to the transformer tank shall enter the transformer cover plate at its highest point and shall be straight for a distance not less than five times its internal diameter on the transformer side of the Buchholz relay, and straight for not less than three times that diameter on the conservator side of the relay.

3.1.5.3.6 This pipe shall rise towards the oil conservator, through the Buchholz relay, at an angle of not less than 5 degree.

3.1.5.4 **Oil Preservation Equipment**

The requirements of air cell type oil sealing system are given below.

3.1.5.4.1 Contact of the oil with atmosphere is prohibited by using a flexible air cell of nitrile rubber reinforced with nylon cloth.

3.1.5.4.2 The temperature of oil is likely to rise upto 100 deg C during operation. As such air cell used shall be suitable for operating continuously at 100 deg C.

3.1.5.4.3 Air cell of conservator shall be able to withstand the vacuum during installation /maintenance periods. Otherwise provision shall be kept to isolate the conservator from the main tank when the latter is under vacuum by providing a vacuum sealing valve or other suitable means in the pipe connecting main tank with the conservator. The transformer manual shall give full and clear instructions on the operation, maintenance, testing and replacement of the air cell. It shall also indicate shelf life, life expectancy in operation, the recommended replacement intervals and the supplier.

3.1.5.4.4 The connection of air cell to the top of the conservator is by air proof seal preventing entrance of air into the conservator.

3.1.5.5 **Dehydrating Filter Breather**

Conservator shall be fitted with a dehydrating filter breather. It shall be so designed that:

a) Passage of air is through silicagel.
b) Silicagel is isolated from atmosphere by an oil seal.
c) Moisture absorption indicated by a change in colour of the tinted crystals can be easily observed from a distance.
d) Breather is mounted not more than 1200 mm above rail top level.
e) To minimise the ingress of moisture two breathers (of identical size) shall be connected in series for main tank conservator and two breathers (of identical size) shall be connected in series for OLTC tank conservator.

3.1.5.6 Pressure Relief Device

Adequate number of pressure relief devices shall be provided at suitable locations. These shall be of sufficient size for rapid release of any pressure that may be generated in the tank and which may result in damage to equipment. The device shall operate at a static pressure less than the hydraulic test pressure of the transformer tank. It shall be mounted directly on the tank. One set of electrically insulated contacts shall be provided for alarm/tripping.. Discharge of pressure relief device shall be properly taken through pipes and directed away from the transformer/other equipment and this shall be prevented from spraying on the tank. Following routine tests shall be conducted on PRD

a. Air pressure test
b. Liquid pressure test
c. Leakage test
d. Contact test
e. Dielectric test.

3.1.5.7 **Buchholz Relay**

A double float/reed type Buchholz relay shall be provided. Any gas evolved in the transformer shall collect in this relay. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation and taking gas sample.

A copper/stainless steel tube shall be connected from the gas collector to a valve located about 1200 mm above ground level to facilitate sampling with the transformer in service. The device shall be provided with two electrically independent ungrounded contacts, one for alarm on gas accumulation and the other for tripping on sudden rise of pressure. Buchholz relay shall be type tested as per international standards. Buchholz relay and its terminal box shall conform to IP 55 degree of protection.

3.1.5.8 **Temperature Indicators**

3.1.5.8.1 **Oil Temperature Indicator (OTI)**

All transformers shall be provided with a 150 mm (approx.) dial type thermometer for top oil temperature indication. The thermometer shall have adjustable, electrically independent ungrounded alarm and trip contacts, maximum reading pointer and resetting device shall be provided in the OTI. A temperature sensing element suitably located in a pocket on top oil shall be furnished. This shall be connected to the OTI by means of capillary tubing. Temperature indicator dials shall have linear gradations to clearly read atleast every 2 deg C. Accuracy of OTI shall be ± 3.0 deg C or better. The setting of alarm and tripping contacts shall be adjustable at site.

In addition to the above, the following equipment shall be provided for remote indication of oil temperature:

a) Signal transmitter

Signal transmitter shall have additional facility to transmit signal for recording oil temperature at Employer's data acquisition system, for which duplex platinum RTD with nominal resistance of 100 ohms at zero degree centigrade shall be supplied. The RTD shall be three wire ungrounded system. The calibration shall be as per SAMA (USA) standard or equivalent. The RTD may be placed in the pocket containing temperature sensing element and image coil for OTI system which will be used for both remote OTI and DAS. Necessary equipment for sending the signal to remote OTI and DAS shall be provided. In lieu, separate RTD for each of the functions shall be provided.

b) Remote oil temperature indicator

It shall be suitable for flush mounting on Employer's/RTCC panel. This shall not be repeater dial of local OTI and will operate by signal transmitter.

Any special cable required for shielding purpose, for connection between cooler control cabinet and remote OTI control circuit, shall be in the scope of Contractor. Only one ROTI with a four point selector switch shall be provided.

3.1.5.8.2 **Winding Temperature Indicator (WTI)**

A device for measuring the hot spot temperature of each winding shall be provided (HV and LV). It shall comprise the following :

i) Temperature sensing element.

ii) Image coil.

iii) Auxiliary CTs, if required to match the image coil, shall be furnished and mounted in the cooler control cabinet.

iv) 150 mm (approx) dia local indicating instrument with maximum reading pointer and two adjustable electrically independent, ungrounded contacts; besides that required for control of cooling equipment if any, one for high winding temperature alarm and one for trip. Temperature indicator dials shall have linear gradations to clearly read at least every 2 deg C.

v) Calibration device.

vi) Accuracy of WTI shall be ± 3.0 deg C or better.
The setting of alarm and tripping contacts shall be adjustable at site and typical values are as given below which will be reviewed during detailed engineering based on manufacturer's recommendation.

Alarm – 110degC
Trip - 120degC

vii) In addition to the above, the following equipment shall be provided for remote indication of winding temperature for each of the winding:

a) Signal transmitter for each winding

Signal transmitter shall have additional facility to transmit signal for recording winding temperature at Employer's data acquisition system, for which duplex platinum RTD with nominal resistance of 100 ohms at zero degree centigrade shall be supplied. The RTD shall be three wire ungrounded system. The calibration shall be as per SAMA (USA) standard or equivalent. The RTD may be placed in the pocket containing temperature sensing element and image coil for WTI system which will be used for both remote WTI and DAS. Necessary equipment for sending the signal to remote WTI and DAS shall be provided. In lieu, separate RTD for each of the functions shall be provided.

b) Remote winding temperature indicator

It shall be suitable for flush mounting on Employer's panel. This shall not be repeater dial of local WTI and will operate by signal transmitter.

Any special cable required for shielding purpose, for connection between cooler control cabinet and remote WTI control circuit, shall be in the scope of Contractor. Only one RWTI with a selector switch shall be provided for all the windings (HV and LV).

3.1.9 **Earthing Terminals**

3.1.9.1 Two (2) earthing pads (each complete with two (2) nos. holes, M 10 bolts, plain and spring washers) suitable for connection to 75 x 6 mm galvanised steel grounding flat shall be provided each at position close to earth of the two (2) diagonally opposite bottom corners of the tank.

3.1.9.2 Two earthing terminals suitable for connection to 75 x 6 mm galvanised steel flat shall also be provided on cooler, marshalling box and any other equipment mounted separately.

3.2 **Core**

3.2.1 The core shall be constructed from prime quality, non-ageing, cold rolled, super grain oriented, silicon steel laminations.

3.2.2 The design of the magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earthed clamping structure and production of flux component at right angles to the plane of laminations which may cause local heating. The temperature of any part of the core or its support structure in contact with oil shall not exceed 120 deg C under normal operating condition and 130 deg C under most extreme operating condition. Adequate temperature margin shall be provided to maintain longer life expectancy for this material.

3.2.3 The insulation of core to bolts and core to clamp plates shall be able to withstand a voltage of 2 KV (rms) for 1 minute.

3.2.4 Core and winding shall be capable of withstanding the shock during transport, installation and service. Adequate provision shall be made to prevent movement of core and winding relative to tank during these conditions.

3.2.5 All steel sections used for supporting the core shall be thoroughly sand blasted after cutting, drilling and welding.

3.2.6 Each core lamination shall be insulated with a material that will not deteriorate due to pressure and hot oil.

3.2.7 The supporting frame work of the core shall be so designed as to avoid presence of pockets which would prevent complete emptying of tank through drain valve or cause trapping of air during oil filling.

3.2.8 Adequate lifting lugs will be provided to enable the core and windings to be lifted.

3.2.9 The core shall be earthed to the core clamping structure at one point only, through a removable external link suitably located and protected to facilitate testing after installation of the transformer.

In case core laminations are divided into sections by insulating barriers or cooling ducts parallel to the plane of the lamination, tinned copper bridging strips shall be inserted to maintain electrical continuity between sections.

A drawing furnishing the details of the internal earthing design shall be included in the manual.

3.3 **Windings**

3.3.1 The Contractor shall ensure that windings of all transformers are made in dust proof and conditioned atmosphere.

3.3.2 The conductors shall be of electrolytic grade copper free from scales and burrs.

3.3.3 The insulation of transformer windings and connections shall be free from insulating compounds which are liable to soften, ooze out, shrink or collapse and be non-catalytic and chemically inactive in transformer oil during service.

3.3.4 Coil assembly and insulating spacers shall be so arranged as to ensure free circulation of oil and to reduce the hot spot of the winding.

3.3.5 The coils would be made up, shaped and braced to provide for expansion and contraction due to temperature changes.

3.3.6 The conductor shall be transposed at sufficient intervals in order to minimize eddy currents and to equalise the distribution of currents and temperature along the winding.

3.4 **Unused inhibited Insulating Oil**

3.4.1 The insulating oil shall be virgin high grade inhibited, conforming to IEC-60296 & all parameters specified below, while tested at supplier's premises. The contractor shall furnish test certificates from the supplier against the acceptance norms as mentioned below, prior to dispatch of oil from refinery to site. Under no circumstances, poor quality oil shall be filled into the transformer and only thereafter be brought up to the specified parameter by circulation within the transformer.

Sl. No.	Property	Test Method	Limits
A1.	Function		
1a.	Viscosity at 100degC	ISO 3104 or ASTM D445 or ASTM D7042	(Max.) 3 mm2/s
1b.	Viscosity at 40degC	ISO 3104 or ASTM D445 or ASTM D7042	(Max.)12 mm2/s
1c.	Viscosity at -30degC	ISO 3104 or ASTM D445 or ASTM D7042	(Max.)1800 mm2/s
2.	Appearance	A representative sample of the oil shall be examined in a 100 mm thick layer, at ambient temperature	The oil shall be clear and bright, transparent and free from suspended matter or sediment
3.	Pour point	ISO 3016 or ASTM D97	(Max.)- 40degC
4.	Water content a) for bulk supply b) for delivery in drums	IEC 60814 or ASTM D1533	(Max.) 30 mg/kg 40 mg/kg
5.	Electric strength (breakdown voltage)	IEC 60156 or ASTM D1298	(Min.) 50 kV(new unfiltered oil) / 70 kV (after treatment)
6.	Density at 20 deg C	ISO 3675 or ISO 12185 or ASTM D 4052	0.820 - 0.895 g/ml
7.	Dielectric dissipation factor (tan delta) at 90 deg C	IEC 60247 or IEC 61620 Or ASTM D924	(Max) 0.0025
8.	Resistivity at 90 deg C	IEC 60247	150 X 10^12 Ohm –cm, (Min.) for records only.
9.	Negative impulse testing KVp @ 25 deg C	ASTM D-3300	145 (Min.)
10.	Carbon type composition (% of Aromatic, Paraffins and Naphthenic compounds.)	IEC 60590 or ASTM D 2140	Max.Aromatic : 4 to12 % Paraffins : <50% & balance shall be Naphthenic compounds.
B1.	Refining / Stability		
1.	Acidity	IEC 62021-1 or ASTM D974	(Max) 0.01 mg KOH/g
2.	Interfacial tension at 27degC	ISO 6295 or ASTM D971	(Min) 0.04 N/m
3.	Total sulfur content	BS 2000 part 373 or ISO 14596	0.15 % (Max.)
4.	Corrosive sulphur	IEC 62535	Non-Corrosive on copper and paper

		ASTM D1275B	Non-Corrosive
5.	Presence of oxidation inhibitor	IEC 60666 or ASTM D2668 or D4768	0.08% (Min.) to 0.4% (Max.) Oil should contain no other additives .Supplier should declare presence of additives, if any.
6.	2-Furfural content	IEC 61198 or ASTM D5837	25 Microgram/litre (Max.)
C1.	Performance		
1	Oxidation stability -Total acidity -Sludge - Dielectric dissipation factor (tan delta) at 90degC	IEC 61125 (method c) Test duration 500 hour IEC 60247	 Max 0.3 mg KOH/g Max 0.05 % Max 0.05
2.	Gassing	IEC 60628A or ASTM D2300	No general requirement
3.	Oxidation stability (Rotating Bomb test)	IEC : 61125(Method B) / ASTM D2112 (e)	220 Minutes (Min.)
D1.	Health, safety and environment (HSE)		
1.	Flash point	ISO 2719	(Min.)135degC
2.	PCA content	BS 2000 Part 346	Max 3%
3.	PCB content	IEC 61619 or ASTM D4059	Not detectable (Less than 2 mg/kg)

3.4.2 i) Prior to filling in main tank at site and shall be tested for

1. Break Down voltage (BDV) : 70kV (min.)
2. Moisture content : 5 ppm (max.)
3. Tan-delta at 90 °C : 0.0025 (max)
4. Interfacial tension : More than 0.004 N/m

ii) Prior to energisation at site oil shall be tested for following properties &acceptance norms as per below generally in line with IEC 60422:

1. Break Down voltage (BDV) : 70 kV (min.)
2. Moisture content : 10 ppm (max.)
3. Tan-delta at 90 °C : 0.01 (max.)
4. Resistivity at 90 °C : 6 X 10 ^12 ohm-cm (min.)
5. Interfacial tension : 0.035 N/m (min.)
6. *Oxidation Stability (Test method as per IEC 61125 method C,Test duration: 500hour for inhibited oil)
   a) Acidity : 0.3 (mg KOH /g) (max.)
   b) Sludge : 0.05 % (max.)
   c) Tan delta at 90 °C : 0.05 (max.)
7. * Total PCB content : Not detectable (2 mg/kg total)

* For Sr. No. 6 & 7 separate oil sample shall be taken and test results shall be submitted within 45 days after commissioning for approval of Consultant.

3.4.3 At manufacturer's works the quality of oil used for first filling, testing and impregnation of active parts shall meet at least parameters as mentioned in serial no. 1 to 5 of clause 3.4.2 ii) above. The oil test results shall form part of equipment test report.

Oil sample shall be drawn before and after heat run test and shall be tested for dissolved gas analysis. Oil sampling to be done 2 hours prior to commencement of temperature rise test. For ONAN/ONAF cooled transformers, sample shall not be taken earlier than 2 hours after shutdown. The acceptance norms with reference to various gas generation rates shall be as per IEC 61181.

3.5 Terminal Arrangements

3.5.1 Bushings

3.5.1.1 The electrical and mechanical characteristics of bushings shall be in accordance with IEC 60137/ DIN 42530.

3.5.1.2 Bushing for various voltage rating shall be as follows

52 kV and above	Hermetically sealed Oil filled condenser type/ RIP bushing with porcelain or composite insulator.
36 kV and below	Solid porcelain or oil communicating type. Dimensions of 36 kV bushing shall conform to IEC

3.5.1.3 Oil Filled condenser type bushing shall be provided with at least the following fittings:

(a) Oil level gauge.

(b) Tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable.

3.5.1.4 Where current transformers are specified, the bushings shall be removable without disturbing the current transformers.

3.5.1.5 Bushings of identical rating shall be interchangeable.

3.5.1.6 Porcelain used in bushing manufacture shall be homogenous, free from lamination, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.

3.5.1.7 Clamps and fittings shall be of hot dip galvanised steel.

3.5.1.8 Bushing turrets shall be provided with vent pipes, to route any gas collection through the Buchholz relay.

3.5.1.9 No arcing horns shall be provided on the bushings.

3.5.1.10 Suitable insulating cap (preferably of porcelain) shall be provided on the terminal of Bushing of tertiary winding to avoid accidental external short circuit.

3.5.1.11 Installation procedures for the various voltage class bushings shall be clearly brought out in the Instruction manual.

3.5.2 **Terminal Marking**

The terminal marking and their physical position shall be as per IEC: 60076.

3.5.3 **Neutral Earthing Arrangement**

3.5.3.1 **For 3-Phase Unit**

The neutral terminals of transformer shall be brought to the ground level by a brass/tinned copper grounding bar, supported from the tank by using porcelain insulators. The end of the brass/tinned copper bar shall be brought to the bottom of the tank, at a convenient point, for making bolted connection to two (2) 75 x 6 mm galvanised steel flats connected to Employer's grounding mat.

3.5.3.2 **For 1-Phase Unit**

The neutral of the transformer shall be brought out through bushing. The contractor shall connect the neutrals of 1-phase transformers by overhead connection using an overhead common brass/tinned copper/Aluminum pipe /ACSR conductor grounding bus, supported from the tank and fire walls by using porcelain insulators. All material like Bus post insulator, Aluminium tube, conductor, clamps & connectors, earthing materials, support structure, hardware etc required for neutral formation and connection with neutral CT and earthing of neutral shall be provided by contractor. The neutral formation shall be such that neutral winding of single-phase spare transformer can be disconnected or connected to either of the three phase banks.

3.5.4 **Delta Formation (applicable for 1-Phase Transformer)**

The tertiary/LV winding terminals of the transformer shall be brought out through bushing. The contractor shall connect Tertiary/LV of 1-phase transformers in DELTA configuration by overhead connection to operate in 3-Phase Bank. The Delta shall be formed by approximate size of 3" IPS Al tube, which shall be insulated with heat shrinkage insulating sleeve or cable of suitable voltage class and adequate thickness and shall be supported by structure mounted bus post insulators at suitable intervals.

The minimum phase to phase horizontal spacing for delta formation shall be 1.5 meter. All associated materials like bus post insulators, Aluminium tube, clamps & connectors, support structures; hardware etc. required for tertiary delta formation shallbe provided by the contractor.

3.5.5 **Spare Unit connection arrangement (as applicable for 1-Phase Transformer)**

The contractor shall make connection arrangement as well as control scheme of OLTC and Cooler in such a way that spare unit of transformer can be connected in place of faulty unit without physically shifting it from its location. For this purpose, HV, IV, Tertiary and Neutral Connections of spare unit are to be extended upto the other unit by forming auxiliary buses with tertiary connection insulated with heat shrinkage insulating sleeve of suitable voltage class and adequate thickness and shall be supported by structure mounted bus post insulators at suitable intervals to enable spare unit connection through flexible/rigid conductor and suitable connector in place of existing unit to be replaced. For connection of spare unit in place of other units, HV, LV, Tertiary delta and neutral connection change over will be achieved by the help of manual connection changeover. Provision of manual changeover should be such that changeover can be achieved in very less time. However, the detail configuration and actual sizes of various items shall be finalized during detailed engineering and shall be subject to Employer's approval. All associated materials like Bus post insulators, Aluminum tube, conductors, clamps & connectors, insulator strings, hardware, cables, support structures, required for the above-mentioned arrangement shall be provided by the contractor.

3.6 **Cooling Equipment and its Control**

3.6.1 **Cooling Equipment**

3.6.1.1 The cooler shall be designed using sufficient number of tank mounted radiators. Design of cooling system shall satisfy the performance requirements.

3.6.1.2 Tank mounted radiators shall have its cooling fans , shut off valves at the top and bottom of suitable size, lifting lugs, top and bottom oil filling valves, air release plug at the top, a drain and sampling valve and thermometer pocket fitted with captive screw cap on the inlet and outlet.

3.6.1.3 Required number of standby fans of approximately 20% capacity shall also be provided with radiators.

3.6.1.4 Cooling fans shall be directly mounted on radiator. Each fan shall be suitably protected by galvanised wire guard. The exhaust air flow from cooling fan shall not be directed towards the main tank in any case.

3.6.1.5 Cooling fans motors shall be suitable for operation from 400 volts, three phase 50 Hz power supply and shall conform to IEC. Each cooling fan motors shall be provided with starter thermal overload and short circuit protection. The motor winding insulation shall be conventional class 'B' type. Motors shall have hose proof enclosure equivalent to IP: 55.

3.6.1.6 The cooler and its accessories shall preferably be hot dip galvanised or corrosion resistant paint (as per clause 3.1.1.8) should be applied to it.

3.6.1.7 Air release device and oil plug shall be provided on oil pipe connections. Drain valves shall be provided in order that each section can be drained independently.

3.6.2 Cooling Equipment Control (ONAN/ONAF COOLING)

3.6.2.1 Automatic operation control of fans shall be provided (with temperature change) from contacts of winding temperature indicator. The Contractor shall recommend the setting of WTI for automatic changeover of cooler control from ONAN to ONAF. The setting shall be such that hunting i.e. frequent start-up operations for small temperature differential do not occur.

3.6.2.2 Suitable manual control facility for cooler fans shall be provided.

3.6.2.3 Selector switches and push buttons shall also be provided in the cooler control cabinet to disconnect the automatic control and start/stop the fans manually.

3.6.2.4 Indicating Devices

Following lamp indications shall be provided in cooler control cabinet:

a) Control Supply failure.

b) Cooling fan failure.

c) Common thermal overload trip

One potential free initiating contact for all the above conditions shall be wired independently to the terminal blocks of cooler control cabinet for further wiring to Common Marshalling Box (CMB).

3.6.2.5 Two auxiliary power supplies, 400 volt, three phase four (4) wire shall be provided at common marshalling box. All loads shall be fed by one of the two sources through an electrically interlocked automatic transfer scheme housed in the CMB. Power supply to individual phase unit shall be extended from the CMB. Power supply to spare unit shall be extended from nearest CMB only. Suitably rated power contactors, separate MCBs/MCCBs shall be provided in the Common Marshalling Box for each circuit.

3.6.2.6 Control and power supplies are to be given for Cooler circuits after suitable selection at Common Marshalling Box. Necessary isolating switches and protective devices shall be provided at suitable points as per Purchaser's approved scheme. The Contractor shall derive AC power for Cooler Control Circuitry from the AC feeder as mentioned above. In case auxiliary power supply requirement for Cooler Control Mechanism is different than station auxiliary AC supply, then all necessary converters shall be provided by the Contractor.

3.6.2.7 For each circuit, suitably rated MCBs/MCCBs as required for further distribution of auxiliary power supply to DM boxes, Online Gases and moisture monitoring system, Online drying system and Fibre optic sensor Box etc. (as applicable), shall be provided by contractor, in individual marshalling boxes /cooler control boxes.

3.6.3 Auxiliary power supply distribution scheme shall be submitted for approval. Supply and laying of Power, Control and special cables from common marshalling box to individual MB/Cooler Control Cubicle (including spare unit) & further distribution from IMB/CCC to all accessories is in the scope of the contractor. Further any special cable (if required) from CMB to Owner's Control Panels/RTCC panels are also in the scope of the contractor.

3.6.4 The cooler control cabinet / Individual Marshalling box shall have all necessary devices meant for cooler control and local temperature indicators. All the contacts of various protective devices mounted on the transformer and all the secondary terminals of the bushing CTs shall also be wired upto the terminal board in the cooler control cabinet/Individual Marshalling box. All the CT secondary terminals in the cooler control cabinet shall have provision for shorting to avoid CT open circuit while it is not in use. All the necessary terminations for remote connection to Purchaser's panel shall be wired upto the Common Marshalling box.

3.6.5 Connection arrangement for spare unit shall be in such a way that spare unit of transformer can be connected in place of faulty unit without physically shifting and all the control, protection, indication signals of spare unit shall also be brought in common marshalling box of all the banks. Necessary arrangement in schematic of Common marshalling box is required to facilitate change-over of all the signals of faulty units to spare unit of Transformer, to ensure flow of control, protection and indication signals between Purchaser's Control panels / Digital RTCC Panel / SCADA and individual units under operation (i.e. any designated unit for bank or spare unit, if it replace any designated unit). To facilitate change-over of spare unit signals with faulty unit in CMB, male-female plug-in connector or better arrangement shall be provided to reduce the outage time

3.6.6 **Valves**

3.6.6.1 All valves shall be of gun metal or of cast steel/cast iron. They shall be of full way type with internal screw and shall open when turned counter clock wise when facing the hand wheel.

3.6.6.2 Suitable means shall be provided for locking the valves in the open and close positions. Provision is not required for locking individual radiator valves.

3.6.6.3 Each valve shall be provided with the indicator to show clearly the position of the valve.

3.6.6.4 All valves flanges shall have machined faces.

3.6.6.5 All valves in oil line shall be suitable for continuous operation with transformer oil at 115 deg C.

3.6.6.6 The oil sampling point for main tank shall have two identical valves to be put in series .Oil sampling valve shall have provision to fix rubber hose of 10 mm size to facilitate oil sampling.

3.6.6.7 A valve or other suitable means shall be provided to fix (in future) on line dissolved gas monitoring system to facilitate continuous dissolved gas analysis. The location & size of the same shall be finalised during detail engineering stage

3.6.6.8 After testing, inside surface of all cast iron valves coming in contact with oil shall be applied with one coat of oil resisting paint/varnish with two coats of red oxide zinc chromate primer followed by two coats of fully glossy finishing paint conforming to international standards. Outside surface except gasket setting surface of butterfly valves shall be painted with two coats of red oxide zinc chromate conforming to International Standards followed by two coats of fully glossy finishing paint.

3.6.6.9 All hardware used shall be cadmium plated/electro galvanised steel.

3.6.6.10 For estimation purpose of spares one set of valves would mean one valve of each type used in Transformer.

3.7 Tap Changing Equipment

Each transformer shall be provided with On Load Tap changing equipment.

3.7.1 On Load Tap Changing Gear (OLTC)

OLTC shall be motor operated for local as well as remote operation. An external handle shall be provided for local manual operation. This handle shall be suitable for operation by a man standing at ground level

3.7.1.1 Each three phase transformer shall be provided with voltage control equipment of the tap changing type for varying its effective transformation ratio whilst the transformers are on load and without producing phase displacement.

3.7.1.2 The requirements of on load tap changing equipment are given here below:

a) The current diverting contacts shall be housed in a separate oil chamber not communicating with the oil in main tank of the transformer.

b) The contacts shall be accessible for inspection without lowering oil level in the main tank and the contact tips shall be replaceable.

c) The Bidder shall indicate the safeguards in order to avoid harmful arcing at the current diverting contacts in the event of operation of the OLTC gear under overload conditions of the transformer. Necessary tools and tackles shall be furnished for maintenance of OLTC gear.

d) The diverter switch or arcing switch oil chamber shall have oil filling and drain plug, oil sampling valve, relief vent and level glass. It shall also be fitted with a oil surge relay the outlet of which shall be connected to a separate conservator tank.

e) The diverter switch or arcing switch shall be designed so as to ensure that its operation once commenced shall be completed independently of the control relays or switches, failure of ancillary supplies etc. To meet any contingency which may result in incomplete operation of the diverter switch, adequate means shall be provided to safeguard the transformer and its ancillary equipment.

f) Tap changer shall be so mounted that bell cover of transformer can be lifted without removing connections between windings and tap changer.

g) Local OLTC control cabinet shall be mounted on the tank in accessible position. It should be adequately ventilated and provided with anti-condensation metal clad heaters. All contactors relay coils and other parts shall be protected against corrosion, deterioration due to condensation, fungi etc.

h) Operating mechanism for on load tap changer shall be designed to go through one step of tap change per command. Subsequent tap changes shall be initiated only by a new or repeat command.

i) On load tap changer shall be equipped with a time delayed INCOMPLETE STEP alarm consisting of a normally open contact which closes, if the tap changer fails to make a complete tap change. The alarm shall not operate for momentary loss of auxiliary power.

j) The selsyn units or approved equivalents shall be installed in the local OLTC control cabinet to provide tap position indication for the transformer .The Bidder shall also provide a set of instruments for tap position indication in the control room. Complete mounting details shall be included in the approved diagram.

k) Transformer on load tap shall be equipped with a fixed resistor network capable of providing discrete voltage steps for input to the supervisory system.

l) Limit switches shall be provided to prevent overrunning of the mechanism and shall be directly connected in the circuit of the operating motor. In addition, a mechanical stop shall be provided to prevent over-running of the mechanism under any condition.

m) Limit switches may be connected in the control circuit of the operating motor provided that a mechanical de-clutching mechanism is incorporated.

n) Thermal device or other means shall be provided to protect the motor and control circuit. All relays, switches, fuses etc. shall be mounted in the local OLTC control cabinet and shall be clearly marked for the purpose of identification.

o) A permanently legible lubrication chart if required, shall be fitted within the local OLTC control cabinet.

p) Any 'DROP DOWN' tanks associated with the tap changing apparatus shall be fitted with guide rod to control the movements during lifting or lowering.

q) A counter of at least five digits shall be fitted to the tap changing equipment to indicate the number of operations completed and shall have no provision for resetting.

r) All relays and operating devices shall operate correctly at any voltage between the limits specified.

s) It shall not be possible to operate the electric drive when the manual operating gear is in use.

t) It shall not be possible for any two controls to be in operation at the same time.

u) The equipment shall be suitable for supervisory control and indication with make before break multi-way switch, having one potential free contact for each tap position. This switch shall be provided in addition to any other switch/switches which may be required for remote tap position indication.

v) Operation from the local or remote control switch shall cause one tap movement only until the control switch is returned to the off position between successive operations.

w) All electrical control switches and the local operating gear shall be clearly labelled in a suitable manner to indicate the direction of tap changing.

x) Transfer of source in the event of failure of one AC supply shall not affect the tap changer.

3.7.1.3 OLTC Control of Three Phase Transformers

Each three phase transformer shall be suitable for local and remote control. The control feature shall provide the following:

3.7.1.3.1 Local Electrical Control

(a) 'Local-remote' selector switch mounted in the local OLTC control cabinet shall switch control of all load tap changers as followings:

i) When the selector switch is in 'local' position, it shall be possible to operate the 'raise-lower' control switches specified in clause 3.9.3.1(b) below. Remote control of the raise-lower functions shall be prevented.

ii) When the selector switch is in 'remote' position the local OLTC control cabinet mounted 'raise-lower' switch specified in clause 3.9.3.1(b) below shall be in-operative. Remote control of the raise/lower function shall be possible from the remote control panel. The 'local-remote' selector switch shall have at least two spare contacts per position which are closed in that position but open in the other position.

(b) A 'raise-lower' control switch/push button shall be provided in the local OLTC control cabinet. This switch shall be operative only when 'local remote' selector switch is in 'local' position.

(c) An OFF-ON tap changer control switch shall be provided in the local OLTC control cabinet of the transformer. The tap changer shall be in-operative in the OFF position. Also the OFF-ON switch shall have atleast one spare contact per position which is closed in that position but open in the other position.

3.7.1.3.2 Manual Control

The cranking device for manual operation of the OLTC gear shall be removable and suitable for operation by a man standing at ground level. The mechanism shall be complete with the following:

a) Mechanical tap position indicator which shall be clearly visible from near the transformer.

b) A mechanical operation counter.

c) Mechanical stops to prevent over-cranking of the mechanism beyond the extreme tap positions.

d) The manual control considered as back up to the motor operated load tap changer control shall be interlocked with the motor to block motor start-up during manual operation. The manual operating mechanism shall be labelled to show the direction of operation for raising the HV terminal voltage and vice-versa.

3.7.1.3.3 Remote Electrical Group Control

The OLTC control scheme offered shall have provision of remote electrical group control during the parallel operation of transformer. This is in addition to independent control of OLTC:

i) A four position selector switch having Master, Follower, Independent and Off position shall be provided in the remote OLTC control panel for each transformer. This shall be wired to enable operator to select operation of OLTC in either Master, Follower or Independent mode.

ii) Out of step relays with timer contacts shall also be provided to give alarm and indication in case tap position in all the transformers under group control are not in same position.

iii) Master Position

If the selector switch is in Master position, it shall be possible to control the OLTC units in the follower mode by operating the controls of the master unit. Independent operation of the units under Follower mode shall have to be prevented. However the units under independent mode will be controlled independently.

iv) Follower Position

If the selector switch is in Follower mode, control of OLTC shall be possible only from panel of the Master unit.

v) Independent Position

In this position of Selector Switch, Control of OLTC of individual unit shall only be possible.

3.7.1.5 The control circuits shall comply with following conditions:

3.7.1.5.1 An interlock to cut off electrical control automatically upon recourse being taken to the manual control in emergency.

3.7.1.5.2 Reinforcement of the initiating impulse for a tap change, ensuring a positive completion once initiated to the next (higher or lower) tap.

3.7.1.5.2.3 "Step-by-Step" operation ensuring only one tap change from each tap changing impulse and a lock-out of the mechanism if the control switch (or push button) remains in the "operate" position.

3.7.1.5.2.4 An interlock to cut-out electrical control when it tends to operate the gear beyond either of the extreme tap positions.

3.7.1.5.2.5 An electrical interlock to cut-off a counter impulse for reverse step change being initiated during a progressing tap change and until the mechanism comes to rest and resets circuits for a fresh position.

3.7.1.5.2.6 Tap change in progress indication shall be provided by means of an indicating lamp at the Employer's control panel. Necessary contacts for this and for remote tap position indicator at Employer's control panel shall be provided by the Bidder.

3.7.1.5.2.7 Protective apparatus, considered essential by the Bidder according to specialities of the gear.

3.7.2 Local OLTC Control Cabinet, Cooler Control Cabinet and Remote Tap Changer Control Panel

3.7.2.1 Each three phase transformer unit shall be provided with local OLTC control cabinet, cooler control cabinet and RTCC panel.

3.7.2.2 Cabinets and Panels shall be tank mounted, provided with suitable lifting arrangement and have sloping roof.

3.7.2.3 A space heater, and cubicle lighting with ON-OFF switch shall be provided in each panel.

3.7.3 Necessary shorting of terminals shall be done at the cooler control cabinet, local OLTC cabinet and remote OLTC panel. All the CT secondary terminals in the cooler control cabinet shall have provision for short circuiting to avoid CT open circuit while it is not in use.

3.7.4 Cooler Control Cabinet

3.7.4.1 The cooler control cabinet shall have all necessary devices meant for cooler control and local temp indicators. All the contacts of various protective devices mounted on the transformer and all the secondary terminals of the bushing CTs shall also be wired upto the terminal board in the cooler control cabinet. All the necessary terminals for remote connection to Employer's panel shall be wired upto the cooler control cabinet.

3.7.4.2 The cooler control cabinet shall have two (2) sections. One section shall have the control equipment exclusively meant for cooler control. The other section shall house the temperature indicators, aux. CTs and the terminal boards meant for termination of various alarm and trip contacts as well as various bushing CT secondary. Alternatively

the two sections may be provided as two separate panels depending on the standard practice of the Bidder.

3.7.4.3 The temperature indicators shall be so mounted that the dials are about 1200 mm from ground level. Glazed door of suitable size shall be provided for convenience of reading.

3.7.5 Local OLTC Control Cabinet

The Local OLTC control cabinet shall house all necessary devices meant for OLTC control and indication. It shall be complete with the following:

i) A circuit breaker/contactor with thermal overload devices for controlling the AC Auxiliary supply to the OLTC motor.

ii) Cubicle light with door switch.

iii) Space heaters to prevent condensation of moisture.

iv) Locking arrangement for hinged door of cabinet.

v) Cable terminal glands for power and control cables to the OLTC gear.

3.7.6 Remote Tap Changer Control Panel.

3.7.6.1 The Contractor shall supply a Remote Tap Changer Control (RTCC) panel suitable for remote operation of On load tap changing gear.

3.7.6.2 The RTCC panel shall house actuating switch for electrical raise/lower control, tap position indicator, signal lamps for "Tap change in progress" and "Tap changer out of step", and all other auxiliary devices for remote electrical control of the OLTC. For tap position indicator, the dual output type OLTC transducer shall be provided in the RTCC panel. One of the outputs of this transducer shall be used for local indication of tap position in RTCC panel and other output (0-10 mA or 4-20 mA) shall be used for RTUs/automation system.

3.7.6.3 The RTCC panel shall be located in Employer's control room /Air conditioned switchyard panel room.

3.8 **Auxiliary Power Supply of OLTC, Cooler Control and Power Circuit**

3.8.1 Two auxiliary power supplies, 400 volt, three phase four (4) wire shall be provided by the Employer at cooler control cabinet for OLTC and cooler control and power circuit.

3.8.2 All loads shall be fed by one of the two feeders through an electrically interlocked automatic transfer switch housed in the cooler control cabinet for on load tap changer control and cooler circuits.

Design features of the transfer switch shall include the following:

a) Provision for the selection of one of the feeder as normal source and other as standby.

b) Upon failure of the normal source, the loads shall be automatically transferred after an adjustable time delay to standby sources.

c) Indication to be provided at cooler control cabinet for failure of normal source and for transfer to standby source and also for failure to transfer.

d) Automatic re-transfer to normal source without any intentional time delay following re-energization of the normal source.

e) Both the transfer and the re-transfers shall be dead transfers and AC feeders shall not be paralleled at any time.

3.8.3 Power Supply for OLTC Circuits

a) AC feeder shall be brought to the local OLTC control cabinet by the Contractor after suitable selection at cooler control cabinet for which description is given in 3.10.2 above, for control power circuit of OLTC.

b) The Contractor shall derive AC power for OLTC control circuitry from the AC feeder as mentioned above by using appropriately rated dry type transformers. If the control circuit is operated by DC supply, then suitable main and standby converters shall be provided by the Contractor to be operated from AC power source.

3.8.4 Power Supply for Cooler Circuits

3.8.4.1 Control and power supplies are to be given for Cooler circuits after the selection as mentioned above.

3.8.4.2 The Contractor shall derive AC power for Cooler Control Circuitry by using appropriately rated dry type transformer in case of using supply voltage different from the Employer's auxiliary supply. If the control circuit is operated by DC supply then suitable main and standby convertors shall be provided by the Contractor, to be operated from AC power source.

3.8.5 Necessary isolating switches and MCBs/MCCBs shall be provided at suitable points as per Employer's approved scheme**.**

4 **Fittings**

4.1 The following fittings shall be provided with each three phase transformer covered in this specification.

4.1.1 Conservator for main tank with oil filling hole and cap, air cell, isolating valves, drain valve, magnetic oil level gauge with low level alarm contacts and dehydrating silicagel breather.

4.1.2 Pressure relief devices with alarm/trip contacts.

4.1.3 Buchholz relay double float/reed type with isolating valves on both sides, bleeding pipe with pet cock at the end to collect gases and alarm and trip contacts.

4.1.4 Air release plug.

4.1.5 Inspection openings and covers.

4.1.6 Bushing with metal parts and gaskets to suit the termination arrangement.

4.1.7 Winding temperature indicators for local and remote mounting. One remote winding temperature indicator with a four point selector switch shall be provided for the three windings for three phase unit to have selection of any of the three windings.

4.1.8 Cover lifting eyes, transformer lifting lugs, jacking pads, towing holes and core and winding lifting lugs.

4.1.9 Protected type mercury or alcohol in glass thermometer.

4.1.10 Bottom and top filter valves with threaded male adaptors, bottom sampling valve and drain valve.

4.1.11 Rating and diagram plates on transformers and auxiliary apparatus.

4.1.12 Flanged bi-directional wheels/Trolley for movement

4.1.13 Cooler cabinet.

4.1.14 Off load / On load tap changing gear.

4.1.15 Cooling equipment

4.1.16 Bushing current transformers.

4.1.17 Drain valves/plugs shall be provided in order that each section of pipe work can be drained independently.

4.1.18 Terminal marking plates.

4.1.19 Valves schedule plates.

4.1.20 Oil temperature indicator for local and remote mounting

.

4.1.21 Oil flow indicator

4.1.22 Marshalling box/Common Marshalling box

4.1.23 Suitable galvanized iron or stainless steel tray for cabling on main tank for better aesthetics.

4.1.24 Terminal clamp & connector

4.1.25 The fittings listed above are only indicative and other fittings which generally are required for satisfactory operation of the transformer are deemed to be included.

4.1.26 One set of hand tools of reputed make packed in a carry bag/box broadly comprising of double ended spanners (open jaws, cranked ring, tubular with Tommy bar each of sizes 9mm to 24mm, one set each), adjustable wrenches (8 &12 inch one set), gasket punches (of different sizes as used in the reactor one set), pliers (flat nose, round nose & side cutting one of each type), hammer with handle (one), files with handle (two), knife with handle (one), adjustable hacksaw (one), and cold chisel (one) shall be supplied per Substation.

5 Inspection and Testing

The Contractor shall carry out a comprehensive inspection and testing programme during manufacture of the equipment. An indication of inspection envisaged by the Employer is given under Clause 5.1. This is however not intended to form a comprehensive programme as it is Contractor's responsibility to draw up and carry out such a programme in the form of detailed quality plan duly approved by Employer for necessary implementation.

5.1 **Inspection**

5.1.1 **Tank and Conservator**

5.1.1.1 Certification of chemical analysis and material tests of plates.

5.1.1.2 Check for flatness.

5.1.1.3 Electrical interconnection of top and bottom by braided tinned copper flexibles.

5.1.1.4 Welder's qualification and weld procedure.

5.1.1.5 Testing of electrodes for quality of base materials and coatings.

5.1.1.6 Inspection of major weld preparation.

5.1.1.7 Crack detection of major strength weld seams by dye penetration test.

5.1.1.8 Measurement of film thickness of :

i) Oil insoluble varnish.

ii) Zinc chromate paint.

iii) Finished coat.

5.1.1.9 Check correct dimensions between wheels, demonstrate turning of wheels through 90 deg C and further dimensional check.

5.1.1.10 Check for physical properties of materials for lifting lugs, jacking pads, etc. All load bearing welds including lifting lug welds shall be subjected to NDT.

5.1.1.11 Leakage test of the conservator.

5.1.1.12 Certification of all test results.

5.1.2 **Core**

5.1.2.1 Sample testing of core materials for checking specific loss, bend properties, magnetization characteristics and thickness.

5.1.2.2 Check on the quality of varnish if used on the stampings :

i) Measurement of thickness and hardness of varnish on stampings.

ii) Solvent resistance test to check that varnish does not react in hot oil.

iii) Check over all quality of varnish by sampling to ensure uniform shining colour, no bare spots, no over burnt varnish layer and no bubbles on varnished surface.

5.1.2.3 Check on the amount of burrs.

5.1.2.4 Bow check on stampings.

5.1.2.5 Check for the overlapping of stampings. Corners of the sheet are to be part.

5.1.2.6 Visual and dimensional check during assembly stage.

5.1.2.7 Check for interlaminar insulation between core sectors before and after pressing.

5.1.2.8 Visual and dimensional checks for straightness and roundness of core, thickness of limbs and suitability of clamps.

5.1.2.9 High voltage test (2 kV for one minute) between core and clamps.

5.1.2.10 Certification of all test results.

5.1.3 **Insulation Material**

5.1.3.1. Sample check for physical properties of materials.

5.1.3.2 Check for dielectric strength.

5.1.3.3 Visual and dimensional checks.

5.1.3.4 Check for the reaction of hot oil on insulating materials.

5.1.3.5 Dimension stability test at high temperature for insulating material.

5.1.3.6 Tracking resistance test on insulating material

5.1.3.7 Certification of all test results.

5.1.4 **Winding**

5.1.4.1 Sample check on winding conductor for mechanical properties and electrical conductivity.

5.1.4.2 Visual and dimensional checks on conductor for scratches, dent marks etc.

5.1.4.3 Sample check on insulating paper for pH value, bursting strength and electric strength.

5.1.4.4 Check for the reaction of hot oil on insulating paper.

5.1.4.5 Check for the bonding of the insulating paper with conductor.

5.1.4.6 Check and ensure that physical condition of all materials taken for windings is satisfactory and free of dust.

5.1.4.7 Check for absence of short circuit between parallel strands.

5.1.4.8 Check for brazed joints wherever applicable.

5.1.4.9 Measurement of voltage ratio to be carried out when core/yoke is completely restacked and all connections are ready.

5.1.4.10 Conductor enamel test for checking of cracks, leakage and pin holes.

5.1.4.11 Conductor flexibility test

5.1.4.12 Heat shrink test for anameled wire.

5.1.4.13 Certification of all test results.

5.1.5 **Checks Before Drying Process**

5.1.5.1 Check condition of insulation on the conductor and between the windings.

5.1.5.2 Check insulation distance between high voltage connections, cables and earth and other live parts.

5.1.5.3 Check insulating distances between low voltage connections and earth and other parts.

5.1.5.4 Insulation of core shall be tested at 2 kV/minute between core to bolts and core to clamp plates.

5.1.5.5 Check for proper cleanliness and absence of dust etc.

5.1.5.6 Certification of all test results.

5.1.6 **Checks During Drying Process**

5.1.6.1 Measurement and recording of temperature, vacuum and drying time during vacuum treatment.

5.1.6.2 Check for completeness of drying by periodic monitoring of IR and Tan delta.

5.1.6.3 Certification of all test results.

5.1.7 **Assembled Transformer**

5.1.7.1 Check completed transformer against approved outline drawings, provision for all fittings, finish level etc.

5.1.7.2 Test to check effective shielding of the tank.

5.1.7.3 Jacking test with oil on all the assembled transformers.

5.1.7.4 Dye penetration test shall be carried out after the jacking test.

5.1.8 **Bought Out Items**

5.1.8.1 The makes of all major bought out items shall be subject to Employer's approval.

5.1.8.2 The Contractor shall also prepare a comprehensive inspection and testing programme for all bought out/sub-contracted items and shall submit the same to the Employer for approval. Such programme shall include the following components:

a) Buchholz Relay.

b) Axles and wheels.

c) Winding temperature indicators for local and remote mounting.

d) Oil temperature indicators.

e) Bushings.

f) Bushing current transformers.

g) Cooler cabinet.

h) ON Load / Off Load Tap change gear.

i) Oil pumps.

j) Terminal connectors.

k) Pressure relief device relay

l) Cables used for interconnecting Turret CT, equipment relays (exposed), with marshalling box.

The above list is not exhaustive and the Contractor shall also include other bought out items in his programme.

5.1.9 **Pre-Shipment Checks at Manufacturer's Works**

5.1.9.1 Check for interchangeability of components of similar transformers for mounting dimensions.

5.1.9.2 Check for proper packing and preservation of accessories like radiators, bushings, dehydrating breather, rollers, buchholz relay, fans, control cubicle, connecting pipes, conservator etc.

5.1.9.3 Check for proper provision for bracing to arrest the movement of core and winding assembly inside the tank.

5.1.9.4 Gas tightness test to confirm tightness and record of dew point of gas inside the tank.

5.1.9.5 Derivation of leakage rate and ensure the adequate reserve gas capacity.

5.1.9.6 Measure and record the dew point of dry air /Nitrogen at the time of filling and after 24 hours in the transformer tank. Dew point of dry air / nitrogen at the time of transformer dispatch should be better than (-) 30 deg C. Also the dew point of dry air / nitrogen cylinders attached for make up during transportation should of the order of (-) 50 deg C.

5.1.9.7 Functioning of impact recorder(s) at their works before installing on the tank.

5.2 Factory Tests

The manufacturer shall be fully equipped to perform all the required tests as specified. Bidder shall confirm the capabilities of the proposed manufacturing plant in this regard when submitting the bid. Any limitations shall be clearly stated in. The contractor shall bear all additional costs related to tests which are not possible to carry out at his own works. Procedure for some of tests is given at annexure-I.

The contractor shall submit an Inspection and test plan (ITP) for approval. A typical test plan is indicated below.

No.	Item	Test Category
1.	Measurement of winding resistance	Routine
2.	Voltage ratio measurement	Routine
3.	Polarity & Vector group test	Routine
4.	No-load loss and current measurement	Routine
5.	Impedance voltage and load loss measurement	Routine
6.	Measurement of insulation resistance & Polarization Index	Routine
7.	Measurement of insulation power factor and capacitance between winding and earth	Routine
8.	Measurement of insulation power factor and capacitance of bushings	Routine
9.	Lightning impulse test	Routine
10a	Short duration induced AC withstand Test (ACSD) with PD measurement	Routine
11.	Separate source voltage withstand test	Routine
12.	On-load tap changer test (Ten complete cycle before LV test)	Routine
13.	Gas-in-oil analysis	Routine
14.	Core assembly dielectric and earthing continuity test	Routine
15.	Oil leakage test on transformer tank	Routine
16.	Appearance, construction and dimension check	Routine
17.	Magnetic balance test	Routine
18.	Measurement of no load current & Short circuit impedance with 400 V, 50 Hz AC.	Routine
19.	High voltage with stand test on auxiliary equipment and wiring after assembly	Routine
20.	Tank vacuum test	Routine
21.	Tank pressure test	Routine
22.	Frequency response analysis (Soft copy of test report in sfra format to be submitted to site along with O & M manual)	Routine
23.	Temperature rise test	*Type
24.	Measurement of harmonic level in no load current	*Type
25.	Measurement of acoustic noise level	*Type
26.	Measurement of Zero seq. reactance	*Type
27.	Measurement of power taken by fans and oil pumps	*Type

All tests shall be done in line with IEC: 60076 and as per "Annexure-A". Complete test report shall be submitted to purchaser after proper scrutiny and signing on each page by the test engineer of the manufacturer. * Type test shall be carried out at first unit manufactured against the LOA at each manufacturing plant.

5.2.1 Measurement of capacitance and tan delta to determine capacitance between winding and earth. Tan delta value shall not be more than 0.5% at ambient temperature.

5.2.2 Measurement of capacitance and tan delta of OIP bushings. Tan delta value shall not be more than 0.4% at ambient temperature.

5.2.3 Type Tests on fittings:

All the following fittings shall conform to type tests and the type test reports shall be furnished by the contractor along with the drawings of equipment/ fittings as per the clause no. 9.0 of the Section2 – GTR. The list of fittings and the type test requirement is:

1. Bushing (Type Test as per IEC: 60137, including snap back/seismic test)

2. Buchholz relay (Type Test as per IEC and IP-55 Test on terminal box)

3. OLTC (Temperature Rise of contact, Short circuit current test, Mechanical test and Dielectric Test as per IEC: 60214 and IP-55 test on driving mechanism box).

4. Cooling fan and motor assembly – Free air delivery, Temperature rise, sound level, running at reduced voltage, IP-55 degree of protection for terminal box.

5. Air Cell (Flexible air separator) – Oil side coating, Air side under Coating, Air side outer coating and coated fabric as per IS: 3400/BS: 903/ IS 7016.

6. Cooler Control cabinet (IP-55 test)

7. Pressure Relief device Test

The pressure Relief Device of each size shall be subjected to increase in oil pressure. It shall operate before reaching the test pressure specified in transformer tank pressure test above.. The operating pressure shall be recorded. The device shall seal off after excess pressure has been released.

The terminal box / boxes of PRD should conform to degree of protection as per IP-55.

8. Magnetic Oil Level gauge & Terminal Box for IP-55 degree of protection.

9. OTI & WTI – Switch setting & operation, switch differential, switch rating.

5.2.4 **Pre-Shipment Checks at Manufacturer's Works**

5.2.5 Check for interchangeability of components of similar transformers for mounting dimensions.

5.2.6 Check for proper packing and preservation of accessories like radiators, bushings, dehydrating breather, rollers, buchholz relay, fans, control cubicle, connecting pipes, conservator etc.

5.2.7 Check for proper provision for bracing to arrest the movement of core and winding assembly inside the tank.

5.2.8 Gas tightness test to confirm tightness and record of dew point of gas inside the tank.

5.2.9 Derivation of leakage rate and ensure the adequate reserve gas capacity.

5.2.10 Measure and record the dew point of dry air /Nitrogen at the time of filling and after 24 hours in the transformer tank. Dew point of dry air / nitrogen at the time of transformer despatch should be better than (-) 30 deg C. Also the dew point of dry air / nitrogen cylinders attached for make up during transportation should of the order of (-) 50 deg C.

5.3 **Inspection and Testing at Site**

The Contractor/Manufacturer shall carry out a detailed inspection and testing programme for field activities covering areas right from the receipt of material stage upto commissioning stage. An indicative programme of inspection as envisaged by the Employer is given below. Pre commissioning Procedures and Formats for equipments shall be contractor's responsibility to draw up and carry out such a programme.

5.3.1 **Receipt and Storage Checks**

5.3.1.1 Check and record condition of each package, visible parts of the transformer etc. for any damage.

5.3.1.2 Check and record the gas pressure in the transformer tank as well as in the gas cylinder. Measure and record the dew point of dry air /nitrogen in the transformer tank.

5.3.1.3 Visual check for wedging of core and coils before filling up with oil and also check conditions of core and winding in general.

5.3.2 **Installation Checks**

5.3.2.1 Inspection and performance testing of accessories like tap changers etc.

5.3.2.2 (i) Check the direction of rotation of fans .

(ii) Check the bearing lubrication.

5.3.2.3 Check whole assembly for tightness, general appearance etc.

5.3.2.4 Oil leakage test

5.3.2.5 Capacitance and tan delta measurement of bushing before fixing/connecting to the winding, contractor shall furnish these values for site reference.

5.3.2.6 Leakage test on bushing before erection.

5.3.2.7 Measure and record the dew point of nitrogen/dry air in the main tank before assembly. Manufacturer shall submit dew point acceptable limits along with temperature correction factor and shall form part of instruction manual. In case dew point values are not within permissible limit suitable drying out process shall be applied for dry out of active part in consultation with the Manufacturer.

5.3.2.8 **Oil filling.**

5.3.2.8.1 Oil impregnation or drying under vacuum at site shall be done with the transformer and oil at a temperature not exceeding 70 deg C.

5.3.2.8.2 The duration of the vacuum treatment shall be demonstrated as adequate by means of water measurement with a cold trap or other suitable method. The vacuum shall be measured on the top of the transformer tank and should be less than 1mbar.

5.3.2.8.3 Vacuum shall not be broken until the transformer is oil filled up to the Buchholz relay. Whenever the active insulation or any paper insulated HV connections, especially those from the windings to the bushings are exposed, these shall be re-impregnated under vacuum along with the complete transformer. For this purpose the transformer shall first be drained to expose all insulation material.

5.3.2.8.4 The minimum safe level of oil filling (if different from the Buchholz level) to which the transformer shall be oil filled under vacuum, shall be indicated in the manual.

5.3.2.8.5 Procedures for site drying, oil purification, oil filling etc shall be submitted for approval and complete instructions shall form part of the manual.

5.3.3 **Commissioning Checks**

5.3.3.1 Check the colour of silicagel in silicagel breather.

5.3.3.2 Check the oil level in the breather housing, conservator tanks, cooling system, condenser bushing etc.

5.3.3.3 Check the bushing for conformity of connection to the lines etc,

5.3.3.4 Check for correct operation of all protection devices and alarms :

(i) Buchholz relay.

(ii)Excessive winding temperature.

(iii) Excessive oil temperature.

(iv) Low oil flow.

(v) Low oil level indication.

(vi) Fan and pump failure protection.

5.3.3.5 Check for the adequate protection on the electric circuit supplying the accessories.

5.3.3.6 Check resistance of all windings on all steps of the tap changer. Insulation resistance measurement for the following:

(i) Control wiring.

(ii) Main windings.

5.3.3.7 Check for cleanliness of the transformer and the surroundings.

5.3.3.8 Continuously observe the transformer operation at no load for 24 hours.

Gradually put the transformer on load, check and measure increase in temperature in relation to the load and check the operation with respect to temperature rise and noise level etc.

5.3.3.9 Phase out and vector group test.

5.3.3.10 Ratio test on all taps.

5.3.3.11 Magnetising current test.

5.3.3.12 Capacitance and Tan delta measurement of winding and bushing.

5.3.3.13 DGA of oil just before commissioning and after 24 hours energisation at site.

5.3.3.14 Frequency response analysis (FRA) at site by the equipment to be provided by the bidder.

5.3.3.15 Contractor shall prepare a comprehensive commissioning report including all commissioning test results and forward to Employer for future record.

6.0 Technical Parameters

6.1

6.1.1 Technical Particulars / Parameters of Transformers (220/33 kV 3-Phase Auto Transformer)

Cl. No.	Description	Unit	TECHNICAL PARAMETERS
1.1	Rated Capacity		
	HV	MVA	50
	LV	MVA	50
1.2	Single / Three Phase Design		Three
1.3	Applicable Standard		IEC 60076
1.4	Frequency	Hz	50
1.5	Cooling		ONAN/ONAF
1.6	Rating at different cooling	%	80%/100%
1.7	Type of Transformer		Constant Ohmic impedance type (Refer Note1)
1.8	HV – LV Impedance at 75 Deg C		
i)	Max. Voltage tap	%	10.3
ii)	Principal tap	%	12.5
iii)	Min. Voltage tap	%	15.4
iv)	Tolerance on Impedance	%	As per IEC
1.9	Service		OUTDOOR
1.10	Duty		CONTINUOUS
1.11	Overload Capacity		IEC 60076-7
1.12	Temperature rise over 50deg C Ambient Temp		
i)	Top oil measured by thermometer	^{0}C	50
ii)	Average winding measured by resistance method	^{0}C	55
1.13	Windings		
i)	System Fault level		
	HV	kA	40
	LV	kA	25
	Neutral	kA	-
ii)	Lightning Impulse withstand Voltage		
	HV	kV_p	950

	LV	kV_p	250
	Neutral	kV_p	95
iii)	Switching Impulse withstand Voltage		
	HV	kV_p	850
iv)	One Minute Power Frequency withstand Voltage		
	HV	kV_{rms}	460
	LV	kV_{rms}	95
	Neutral	kV_{rms}	38
v)	Neutral Grounding		Solidly grounded
vi)	Insulation		
	HV		GRADED
	LV		UNIFORM
viii)	Tan delta of winding	%	<0.5%
1.14 i	Vector Group (3 –ph) (unless specified differently elsewhere)		YNyn0
1.15	Tap Changer		OLTC
i)	Tap Range & No. of steps		–5% to +10% of HV variation in the step of 1.25%, 12 Steps
ii)	Location of Tap changer		On the 132 kV side of the series winding
iii)	Design		Constant flux voltage variation type as per cl. 6.2 of IEC 60076 part-I
iv)	Tap control		Full capacity - on load tap changer suitable for group / independent, remote /local electrical and local manual operation and bi-directional power flow
1.16	Bushings		
i)	Rated voltage		
	HV	kV	245
	LV	kV	52
	Neutral	kV	36
ii)	Rated current (Min.)		
	HV	A	800
	LV	A	800
	Neutral	A	1000
iii)	Lightning Impulse withstand Voltage		
	HV	kVp	1050
	LV	kVp	250
	Neutral	kVp	170
iv)	Switching Impulse withstand Voltage		
	HV	kVp	850
v)	One Minute Power Frequency withstand Voltage		
	HV	kVrms	505

	LV	kVrms	105	
	Neutral	kVrms	77	
vi)	Minimum total creepage distances			
	HV	mm	6125	
	LV	mm	1300	
	Neutral	mm	900	
vii)	Tan delta of bushing			
	HV	%	<0.4	
	LV	%	<0.4	
	Neutral	%	-	
viii)	Max Partial discharge level at U_m			
	HV	pC	10	
	LV	pC	10	
1.17	Max Partial discharge level at $1.5Um/\sqrt{3}$	pC	100	
1.18	Max Noise level at rated voltage and at principal tap on full load and all cooling active	dB	75	

Notes:

1. For parallel operation with existing transformer, the impedance, OLTC connection & range and the winding configuration (if necessary) is to be matched.

2. No external or internal Transformers / Reactors are to be used to achieve the specified HV/IV, HV/LV and IV/LV impedances.

3. Tan delta of Winding & Bushing shall be measured at ambient temperature. No temperature correction factor shall be applied.

4. The criteria for Transformer losses shall be "**Copper Loss (Load Loss) > Iron Loss (No Load Loss) > Cooler Loss (Auxiliary Loss)".**

6.2 Technical Particulars / Parameters of Transformers (220/132/33 kV 1-Phase Auto Transformer)

Cl. No.	Description	Unit	TECHNICAL PARAMETERS		
1.19	Rated Capacity				
	HV	MVA	10	33.33	53.33
	IV	MVA	10	33.33	53.33
	LV (Tertiary: Active Loading)	MVA	1	2	5
1.20	Voltage ratio (HV/IV/LV) (Line to line)	kV	(220/√3) / (132/√3) / 33		
1.21	Single / Three Phase Design		SINGLE		
1.22	Applicable Standard		IEC 60076		
1.23	Frequency	Hz	50		
1.24	Cooling		ONAN/ONAF		ONAN/ONAF/(OFAF or ODAF) : 60% / 80%/100% OR

					ONAN/ONA F1/ONAF2
1.25	Rating at different cooling	%	60 / 100		60% / 80%/100%
1.26	Type of Transformer		Constant Ohmic impedance type (Refer Note1)		
1.27	HV – IV Impedance at 75 Deg C				
i)	Max. Voltage tap	%	8.30	10.3	10.3
ii)	Principal tap	%	10.00	12.5	12.5
iii)	Min. Voltage tap	%	12.30	15.4	15.4
iv)	Tolerance on Impedance	%	As per IEC		
1.28	Service		OUTDOOR		
1.29	Duty		CONTINUOUS		
1.30	Overload Capacity		IEC 60076-7		
1.31	Temperature rise over 50deg C Ambient Temp				
i)	Top oil measured by thermometer	^{o}C	50		
ii)	Average winding measured by resistance method	^{o}C	55		
1.32	Windings				
i)	System Fault level				
	HV	kA	40		
	IV	kA	31.5		
	LV	kA	25		
	Neutral	kA	-		
ii)	Lightning Impulse withstand Voltage				
	HV	kV_p	950		
	IV	kV_p	550		
	LV	kV_p	250		
	Neutral	kV_p	95		
iii)	Switching Impulse withstand Voltage				
	HV	kV_p	750		
iv)	One Minute Power Frequency withstand Voltage				
	HV	kV_{rms}	395		
	IV	kV_{rms}	230		
	LV	kV_{rms}	95		
	Neutral	kV_{rms}	38		
v)	Neutral Grounding		Solidly grounded		
vi)	Insulation				
	HV		GRADED		
	IV		GRADED		
	LV		UNIFORM		
vii)	Tertiary Connection (3Ph Bank)		Ungrounded Delta		
viii)	Tan delta of winding	%	<0.5%		
1.33 i	Vector Group (3 –ph) (unless specified differently elsewhere)		YNa0Od11		
1.34	Tap Changer		OLTC		

i)	Tap Range & No. of steps		–5% to +15% of HV variation in the step of 1.25%, 16 steps		
ii)	Location of Tap changer		On the 132 kV side of the series winding		
iii)	Design		Constant flux voltage variation type as per cl. 6.2 of IEC 60076 part-I		
iv)	Tap control		Full capacity - on load tap changer suitable for group / independent, remote /local electrical and local manual operation and bi-directional power flow		
1.35	Bushings				
i)	Rated voltage				
	HV	kV	245		
	IV	kV	145		
	LV	kV	52		
	Neutral	kV	36		
ii)	Rated current (Min.)				
	HV	A	800	800	800
	IV	A	800	800	1250
	LV	A	800	800	800
	Neutral	A	1000	1000	1000
iii)	Lightning Impulse withstand Voltage				
	HV	kVp	1050		
	IV	kVp	650		
	LV	kVp	250		
	Neutral	kVp	170		
iv)	Switching Impulse withstand Voltage				
	HV	kVp	850		
v)	One Minute Power Frequency withstand Voltage				
	HV	kVrms	505		
	IV	kVrms	305		
	LV	kVrms	105		
	Neutral	kVrms	77		
vi)	Minimum total creepage distances				
	HV	mm	6125		
	IV	mm	3625		
	LV	mm	1300		
	Neutral	mm	900		
vii)	Tan delta of bushing				
	HV	%	<0.4		
	IV	%	<0.4		
	LV	%	<0.4		
	Neutral	%	-		
viii)	Max Partial discharge level at U_m				
	HV	pC	10		
	IV	pC	10		

	LV	pC	10
1.36	Max Partial discharge level at 1.5Um/√3	pC	100
1.37	Max Noise level at rated voltage and at principal tap on full load and all cooling active	dB	75

Notes:

5. For parallel operation with existing transformer, the impedance, OLTC connection & range and the winding configuration (if necessary) is to be matched.

6. No external or internal Transformers / Reactors are to be used to achieve the specified HV/IV, HV/LV and IV/LV impedances.

7. Tan delta of Winding & Bushing shall be measured at ambient temperature. No temperature correction factor shall be applied.

8. The criteria for Transformer losses shall be "**Copper Loss (Load Loss) > Iron Loss (No Load Loss) > Cooler Loss (Auxiliary Loss)".**

6.3 Technical Particulars / Parameters of Transformers (132/33 kV, 3-Phase Power Transformer)

Cl. No.	Description	Unit	TECHNICAL PARAMETERS			
1.38	Rated Capacity					
	HV	MVA	50	40	31.5	25
	LV	MVA	50	40	31.5	25
1.39	Voltage ratio (HV/LV) Line to line	kV	132/33			
1.40	Single / Three Phase Design		3 (THREE)			
1.41	Applicable Standard		IEC 60076			
1.42	Frequency	Hz	50			
1.43	Cooling		ONAN/ONAF			
1.44	Rating at different cooling	%	60 / 100			
1.45	Type of Transformer		Constant Ohmic impedance type (Refer note 1)			
1.46	HV-LV Impedance at 75 Deg C					
i)	Max. Voltage tap	%	10.3			
ii)	Principal tap	%	12.5			
iii)	Min. Voltage tap	%	15.4			
iv)	Tolerance on Impedance	%	As per IEC			
1.47	Service		OUTDOOR			
1.48	Duty		CONTINUOUS			
1.49	Overload Capacity		IEC 60076-7			

1.50	Temperature rise over 50deg C Ambient Temp		
i)	Top oil measured by thermometer	^{o}C	50
ii)	Average winding measured by resistance method	^{o}C	55
1.51	Windings		
i)	System Fault level		
	HV	kA	31.5
	LV	kA	25
	Neutral	kA	-
ii)	Lightning Impulse withstand Voltage		
	HV	kV_p	550
	LV	kV_p	170
	Neutral	kV_p	95
iii)	Switching Impulse withstand Voltage		
	HV	kV_p	460
iv)	One Minute Power Frequency withstand Voltage		
	HV	kV_{rms}	230
	LV	kV_{rms}	70
	Neutral	kV_{rms}	38
v)	Neutral Grounding		Solidly grounded
vi)	Insulation		
	HV		GRADED
	LV		UNIFORM
vii)	Tan delta of winding	%	<0.5%
1.52	Vector Group (3 –ph) (unless specified differently elsewhere)		YNynO
1.53	Tap Changer		OLTC
i)	Tap Range & No. of steps		–15% to +5% of HV variation in the step of 1.25%, 16 stpes
ii)	Location of Tap changer		On Neutral side of 132 kV winding
iii)	Design		Constant flux voltage variation type as per cl. 6.2 of IEC 60076 part-I
iv)	Tap control		Full capacity on load tap changer suitable for group/independent, remote /local electrical and local manual operation and bi-directional power flow.
1.54	Bushings		
i)	Rated voltage		
	HV	kV	145

	LV	kV	36
	Neutral	kV	36
ii)	Rated current (Min.)		
	HV	A	800
	LV	A	1250
	Neutral	A	1250
iii)	Lightning Impulse withstand Voltage		
	HV	kVp	650
	LV	kVp	170
	Neutral	kVp	170
iv)	One Minute Power Frequency withstand Voltage		
	HV	kVrms	305
	LV	kVrms	77
	Neutral	kVrms	77
v)	Minimum total creepage distances		
	HV	mm	3625
	LV	mm	900
	Neutral	mm	900
vi)	Tan delta of bushing		
	HV	%	<0.4
vii)	Max Partial discharge level at U_m		
	HV	pC	10
1.55	Max Partial discharge level at $1.5Um/\sqrt{3}$	pC	100
1.56	Max Noise level at rated voltage and at principal tap on full load and all cooling active	dB	75

Notes:

1. For parallel operation with existing transformer, the impedance, OLTC connection & range and the winding configuration (if necessary) is to be matched.

2. No external or internal Transformers / Reactors are to be used to achieve the specified HV/IV, HV/LV and IV/LV impedances.

3. Tan delta of Winding & Bushing shall be measured at ambient temperature. No temperature correction factor shall be applied.

4. The criteria for Transformer losses shall be "**Copper Loss (Load Loss) > Iron Loss (No Load Loss) > Cooler Loss (Auxiliary Loss)".**

7.0 Bushing Current Transformer

7.1 Current transformers shall comply with IEC-60185.

7.2 It shall be possible to remove the turret mounted current transformers from the tank without removing the tank cover. Necessary precautions shall be taken to minimize eddy currents and local heat generated in the turret.

7.3 Current transformer secondary leads shall be brought out to a weather proof terminal box near each bushing. These terminals shall be wired out to cooler control cabinet/ marshalling box using separate cables for each core.

7.4 Bushing Current transformer parameters indicated in this specification are tentative and liable to change within reasonable limits. The Contractor shall obtain Employer's approval before proceeding with the design of bushing current transformers.

7.5 **Technical Parameters for Bushing CT**

7.5.1 **Technical Parameters of Current Transformers (for 160MVA, 100MVA & 50MVA 220/132kV 3-Ph Transformers and 53.33, 33.33 & 10 MVA 220/132kV 1-ph Transformer)**

Description	**Current Transformer Parameters (Transformer)**		
	HV Side	**IV Side**	**Neutral Side**
(a) Ratio			
CORE 1	1000/1	1000/1	1000/1
CORE 2	600/1	1000/1	-
(b) Minimum knee point voltage or burden and accuracy class			
CORE 1	600V, TPS	600V, TPS	600V, TPS
CORE 2	0.5 Class 15VA ISF ≤ 5	0.5 Class 15VA ISF ≤ 5	-
(c) Maximum CT Secondary Resistance			
CORE 1	1.5 Ohm	1.5 Ohm	1.5 Ohm
CORE 2	-	-	-
(d) Application			
CORE 1	Restricted Earth Fault	Restricted Earth Fault	Restricted Earth Fault
CORE 2	Metering	Metering	-
(e) Maximum magnetization current (at knee point voltage)			
CORE 1	100 mA	100 mA	100 mA
CORE 2	-	-	-

NOTE:

i) For TPS class CT's, Dimensioning parameter "K", Secondary VA shall be considered 1.5 and 20 respectively. Class (for the relevant protection and duties) as per IEC 60185.

ii) Rated continuous thermal current rating shall be 200% of rated primary current.

iii) Parameters of WTI CT for each winding shall be provided by the contractor.

iv) For estimation of spares, one set of CTs shall mean one CT of each type used in transformer.

v) The CT used for REF protection must have the identical parameters in order to limit the circulating current under normal condition for stability of protection.

7.5.2 **Technical Parameters of Current Transformers (for 31.5 MVA, 25MVA, 20MVA, 12.5MVA 132/33kV 3-Ph Transformers)**

Description	**Current Transformer Parameters (Transformer)**			
	HV Side	**HV Neutral Side**	**LV Side**	**LV Neutral Side**
(a) Ratio				
CORE 1	200/1	200/1	600/1	600/1
CORE 2	200/1	-	600/1	-
(b) Minimum knee point voltage or burden and accuracy class				
CORE 1	400V, TPS	400V, TPS	600V, TPS	600V, TPS
CORE 2	0.2 Class 15VA ISF ≤ 5	-	0.2 Class 15VA ISF ≤ 5	-
(c) Maximum CT Secondary Resistance				
CORE 1	1.5 Ohm	1.5 Ohm	1.5 Ohm	1.5 Ohm
CORE 2		-	-	-
(d) Application				
CORE 1	Restricted Earth Fault	Restricted Earth Fault	Metering	Restricted Earth Fault
CORE 2	Metering			-
(e) Maximum magnetization current (at knee point voltage)				

Description	Current Transformer Parameters (Transformer)			
	HV Side	HV Neutral Side	LV Side	LV Neutral Side
(a) Ratio				
CORE 1	100mA	100 mA	100 mA	100 mA
CORE 2		-	-	-

NOTE:

i) For TPS class CT's, Dimensioning parameter "K", Secondary VA shall be considered 1.5 and 20 respectively. Class (for the relevant protection and duties) as per IEC 60185.

ii) Rated continuous thermal current rating shall be 200% of rated primary current.

iii) Parameters of WTI CT for each winding shall be provided by the contractor.

iv) For estimation of spares, one set of CTs shall mean one CT of each type used in transformer.

v) The CT used for REF protection must have the identical parameters in order to limit the circulating current under normal condition for stability of protection.

8.0 Oil Storage Tank

8.1 General

This specification is for oil storage tank. Oil Storage tank shall be Supplied if specified in Bid Price schedule.

8.2 Standard

The oil storage tank shall be designed and fabricated as per relevant standards.

8.3 Specifications

Transformer oil storage tanks shall be towable on pneumatic tyres and rested on manual screw jacks of adequate quantity & size. The tank shall be cylindrical in shape and mounted horizontally and made of mild steel plate of adequate thickness. Size of the storage tank shall be as follows:

Diameter : 1.5 meter (For 10 cubic meter capacity)
2.0 meter (For 20 cubic meter capacity)

Minimum Capacity : As mentioned in BPS

The tank shall be designed for storage of oil at a temperature of 100□C.

8.3.1 The Bidder may further note that maximum height of any part of the complete assembly of the storage tank shall not exceed 4.0 metres above road top.

8.3.2 The tank shall have adequate number of jacking pad so that it can be kept on jack while completely filled with oil. The tank shall be provided with suitable saddles so that tank can be rested on ground after removing the pneumatic tyres.

8.3.3 The tank shall also fitted with manhole, outside & inside access ladder, silicagel breather assembly, inlet & outlet valve, oil sampling valve with suitable adopter, oil drainage valve, air vent etc. Pulling hook on both ends of the tank shall be provided so that the tank can be pulled from either end while completely filled with oil. Bidder shall indicate the engine capacity in horse power to pull one tank completely fitted with oil. Oil level indicator shall be provided with calibration in terms of litre so that at any time operator can have an idea of oil in the tank. Suitable arrangement shall also be provided to prevent overflow in the tank. Solenoid valve (Electro-mechanically operated) with centrifugal pump shall be provided at bottom inlet so that pump shall be utilized both ways during oil fill up and draining. Suitable arrangement shall also be provided to prevent overflow and drain from the tank/

8.3.4 The following accessories shall form part of supply along with each Oil storage tank.

i) Four numbers of suitable nominal bore rubber hoses for transformer oil application upto temperature of 100□C, full vacuum and pressure up to 2.5 Kg/ cm2 with couplers and unions each not less than 10 metre long shall be provided.

ii) Two numbers of suitable nominal bore vacuum hoses, suitable for full vacuum without collapsing and kinking, with couplers and unions each not less than 10 metre long shall also be provided.

(iii) One number of digital vacuum gauge with sensor capable of reading up to 0.001 torr, operating on 230V 50Hz AC supply shall be supplied. Couplers and unions for sensor should block oil flow in the sensor. Sensor shall be provided with atleast 8 meter cable so as to suitably place the Vacuum gauge at ground level.

8.3.5 The painting of oil storage tank and its control panel shall be as per clause no 3.1.1.8.

8.3.6 The tank shall contain a self mounted centrifugal oil pump with inlet and outlet valves, with couplers -suitable for flexible rubber hoses and necessary switchgear for its control. There shall be no rigid connection to the pump. The pump shall be electric motor driven, and shall have a discharge of not less than 3.0 (For 10 cubic meter capacity) / 6.0 kl/hr (For 20 cubic meter capacity) with a discharge head of 8.0m. The pump motor and the control cabinet shall be enclosed in a cubical with IP-55 enclosure.

9.0 OIL SAMPLING BOTTLE

9.1 Oil sampling bottles shall be suitable for collecting oil samples from transformers and shunt reactors, for Dissolved Gas Analysis. Bottles shall be robust enough, so that no damage occurs during frequent transportation of samples from site to laboratory.

9.2 Oil sampling bottles shall be made of stainless steel having a capacity of one litre.

9.3 Oil Sampling bottles shall be capable of being sealed gas-tight and shall be fitted with cocks on both ends.

9.4 The design of bottle & seal shall be such that loss of hydrogen shall not exceed 5% per week.

9.5 An impermeable oil-proof, transparent plastic or rubber tube of about 5 mm diameter, and of sufficient length shall also be provided with each bottle along with suitable connectors to fit the tube on to the oil sampling valve of the equipment and the oil collecting bottles respectively.

10.0 Nitrogen Injection Type Fire Prevention & Extinguishing System

Nitrogen Injection Fire Protection System shall be designed to prevent explosion of transformer tank and the fire during internal faults resulting from arc and also to extinguish the external oil fires on transformer/ reactor due to tank explosion and / or external failures like bushing fires, OLTC fires and fire from surrounding equipment's, etc.

The system shall work on the principle of Drawin and Stir. On activation, it shall drain a pre-determined quantity of oil from the tank top through drain valve to reduce the tank pressure, isolate conservator tank oil and inject nitrogen gas at high pressure from the bottom side of the tank through inlet valves to create stirring action and reduce the temperature of oil below flash point to extinguish the fire. The quantity of oil removed from the tank shall be such that adequate amount of oil shall remain to cover active part, i.e. Core coil assembly even after stoppage of oil drain.

Electrical isolation of transformer shall be an essential pre-condition for activating the system.

10.1 **Operational Controls**:-

The system operation shall be fully automatic and activate from the required fire and other trip signals. In addition to automatic operation, remote operation from control room/remote centre and local manual control in the fire extinguishing cubicle shall also be provided. System shall operate on following situations.

10.2 Prevention of transformer explosion and Fire

To prevent transformer explosion and fire in case of an internal fault, signals given by operation of Electrical protection relays and tripping of circuit breaker of transformer and operation of either Buchholtz relay, or pressure relief valve (PRV) shall be used to activate the system. The exact logic for system activation shall be finalized during detailed engineering.

10.3 Fire Protection

In case of fire, sensed by fire detectors, the system shall be activated only after electrical isolation of the transformer, confirmed by breaker trip. If the fire detection is not associated with any other fault, the system activation shall be only manual. Manual operation switch shall be provided in the control room/ remote control centre with a cover to avoid accidental operation of it.

10.4 Operation of System

On receiving activation signal, the following shall take place:-

i) Open the quick opening drain valve to drain the top layer oil
ii) Shut off the conservator isolation valve to prevent flow of oil from the Conservator tank to the main tank.
iii) Open the Nitrogen regulator valve to inject Nitrogen into the transformer tank to create stirring of oil.

There shall be interlock to prevent activation of the system if the transformer is not electrically isolated.

There shall also be provision for isolating the system during maintenance and/ or testing of the transformer.

10.5 Technical Particulars

The contractor shall be responsible for the design of the complete system and shall submit the drawings and design calculations for the number of fire detectors, pipe sizing of drain pipe and Nitrogen Injection pipe, Nitrogen cylinder capacity, number of injection points, etc. and get approval from PDD, J&K.

Facility shall be provided to test the system when the transformer is in service, without actually draining the oil and injecting Nitrogen.

The nitrogen regulator valve shall be designed in such a way that the Nitrogen shall not enter the transformer tank even in case of passing/ leakage of valve.

The system shall work on station DC supply. PDD, J&K shall give two distinct DC feeders in control. The control box of fire protection system shall have facility to receive these feeders for auto changeover of supply. It shall be the contractor's responsibility to further distribute power to the required locations.

Individual system component / equipment should not have working voltage other than station DC voltage. AC- DC/ DC- DC converter shall not be used for reliable operation.

Following minimum indications and alarms shall be provided in the cubicle as well as the control box:-

- Nitrogen cylinder pressure indication.
- Nitrogen cylinder pressure low.
- Fire in transformer / Reactor.
- Oil drain started.
- Conservator oil isolation valve closed.
- Nitrogen injection started.
- DC supply fail
- Oil drain valve closed
- Gas inlet valve closed

10.6 Details of Supply of System Equipment's and other Related Activities:-

The scope of supply shall include the following items and any other items required for safe and trouble free operation of the system.

(i) Fire extinguishing cubicle with base frame and containing at least the following:-

- Nitrogen gas cylinder of sufficient capacity with pressure regulator and manometer with sufficient number of adjustable NO contacts.
- Oil Drain Assembly including oil drain pipe extension of suitable size for connecting pipes to oil pit.
- Mechanical release devices for oil drain and nitrogen release.
- Limit switches for monitoring of the systems.
- Panel lighting.

- Flanges on top of the panel for connecting oil drain and nitrogen injection pipes for transformer.
- Back up pressure switch to operate nitrogen gas valve.
- Pressure indicator for Nitrogen pressure of the cylinder and actual injection through Nitrogen regulator.

(ii) Control box to be installed in the control room of the station for monitoring system operation, automatic control and remote operation, with alarms, indication light, switches, push buttons, audio signal, suitable for tripping and signaling.

(iii) Conservator isolation valve which shall be flow sensitive and shut off when the flow in the pipe is more than the flow expected in the permissible normal operating conditions. It shall be provided with physical position indicator along with remote alarm indication on control box. This valve shall be provided with locking arrangement for normal position and oil filling/ filtration position. Conservator Isolation valve should not obstruct oil surge from transformer tank towards conservator and in normal working of transformer should allow flow of oil in both directions.
(iv) Required number of fire detectors to be located in strategic locations to be finalized during detailed engineering.
(v) All controls, alarms, panels, cables, cable trays (if required), junction boxes etc.

10.7 Installation and pre-commissioning test

After installation the system pre-commissioning tests shall be carried out jointly with the PDD, J&K representative before the system is put in service.

11.0 **SERVO VOLTAGE STABLIZER**

11.1 GENERAL

11.1.1 The Servo voltage stabilizer shall conform to IS 9815 with latest amendments

11.1.2 The unit shall comprise of an AC synchronous motor coupled with three phase transformer, panel, and protective devices for over current, short circuit, overload etc.

11.1.3 The contractor shall be responsible for complete design, manufacture, testing, supply, installation, testing and commissioning at Nagrota Sub Station

2.0 Technical Requirement

Rating	-	Three (3) phase, 250KVA
Input Voltage	-	350V-460 Volts AC, Three Phase
Output voltage	-	415V AC rms ± 2%
Operating frequency	-	50Hz ± 6%
Phase	-	3- phase 4 wire
Overload Capacity	-	10% for 10 minute
Method of Cooling	-	Oil cooled
Output Efficiency	-	> 98%

No load losses	-	< 1 %
Suitability	-	3 phase, 4 Wire, Unbalanced load & voltage
Operating Temperature	-	(0 to 50) degree Centigrade Ambient temperature
Waveform Distortion	-	NIL
Response time	-	Less than 10 Milli Sec
Control Circuit	-	Automatic IC Based Solid state
Acoustic level	-	< 50 dB
Operation Mode	-	Automatic / Manual
Transformer	-	Wound with Electrolyte Grade Copper of 99%purity With Low loss CRGO Lamination to be used.
Earthing	-	Suitable Earthing Thimble to be provided
High Voltage	-	Can withstand 2.5kV for 5 Sec
Insulation	-	Better than 5 Mega ohm, H Class
Indicator	-	Input / Output Voltage Per Phase Input / Output Current Per Phase Frequency High/Low Voltage with Buzzer Phase Sequence Indicator Oil level Indictor
Monitoring Facility	-	Input Voltage/Current Output Voltage/Current Frequency Power Factor Energy KWH KW/KVA
Oil Temperature		
Protection	- - -	LOW/HIGH Voltage Cut off Over Current / Over load Short Circuit
Testing	-	Testing shall be carried out as per relevant IS.
Inspection	-	Inspection shall be done before dispatch of material.

All tests shall be carried out as per IEC: 60076 on transformer.

1) Magnetic Circuit Test

After assembly each core shall be tested for 1 minute at 2000 Volts between all bolts, side plates and structural steel work.

2) Tank Tests

(i) Oil Leakage Test

All tanks and oil filled compartments shall be tested for oil tightness by being completely filled with air or oil of a viscosity not greater than that of insulating oil conforming to IEC-60296 at the ambient temperature and applying a pressure equal to the normal pressure plus 35 KN/Sq.m (5 psi) measured at the base of the tank. The pressure shall be maintained for a period of not less than 12 hours for oil and one hour for air during which time no leak shall occur.

(ii) Vacuum Test

All transformer tank of each size shall be subjected to the specified vacuum. The tank designed for full vacuum shall be tested at an internal pressure of 3.33 KN/Sq.m absolute (25 torr) for one hour. The permanent deflection of flat plate after the vacuum has been released shall not exceed the values specified below:

Horizontal Length of flat plate (in mm)	**Permanent deflection (in mm)**
Upto and including 750	5.0
751 to 1250	6.5
1251 to 1750	8.0
1751 to 2000	9.5
2001 to 2250	11.0
2251 to 2500	12.5
2501 to 3000	16.0
Above 3000	19.0

(iii) Pressure Test

All transformer tank of each size, its radiator, conservator vessel and other fittings together or separately shall be subjected to an air pressure corresponding to twice the normal head of oil or to the normal pressure plus 35 KN/m2 whichever is lower measured at the base of the tank and maintained for one hour. The permanent deflection of flat plates after the excess pressure has been released shall not exceed the figure specified above for vacuum test.

3) Measurement of capacitance and tan delta to determine capacitance between winding and earth. Tan delta value shall not be more than 0.5% corrected at 20deg C. Temperature correction factor table shall be given by the Contractor and shall form the part of test results.

4) Temp. Rise Test (as per IEC 60076)

Gas chromatographic analysis on oil shall also be conducted before and after this test and the values shall be recorded in the test report. The sampling shall be in accordance with IEC 60567. For the evaluation of the gas analysis in temperature rise test the procedure shall be as IEC: 60567 and results will be interpreted as per IEC -61181. The DGA results shall generally conform to IEC/IEEE guidelines.

The temperature rise test shall be conducted at a tap for the worst combination of loading on the three windings of the transformer. The Contractor before carrying out such test shall submit detailed calculations showing alternatives possible, on various taps of the transformer and shall recommend the combination that results in highest temperature rise for the test.

6) Type Tests on fittings:

All the following fittings shall conform to type tests and the type test reports shall be furnished by the contractor along with the drawings of equipment/ fittings. The list of fittings and the type test requirement is:

a. Bushing (Type Test as per IEC: 60137)
b. Buchholz relay (Type Test and IP-55 Test on terminal box)
c. Marshalling box (IP-55 test)
d. Pressure Relief device Test

The pressure Relief Device of each size shall be subjected to increase in oil pressure. It shall operate before reaching the test pressure specified in transformer tank pressure test. The operating pressure shall be recorded. The device shall seal off after excess pressure has been released. The terminal box / boxes of PRD should conform to degree of protection as per IP-55.

e. Magnetic Oil Level gauge & Terminal Box for IP-55 degree of protection.
f. Air Cell (Flexible air separator) –Oil side coating, Air side under Coating, Air side outer coating and coated fabric as per BS: 903.
g. OTI & WTI – Switch setting & operation, switch differential, switch rating.

7) Inspection and Testing at Site

The Contractor/Manufacturer shall supervise testing & commissioning at site. Testing & commissioning shall be carried out by the owner (MOEP-2). Contractor shall submit a detailed procedure for Testing & Commissioning at site including receipt, storage & installation checks as mentioned below.

a) Receipt and Storage Checks

- Check and record condition of each package, visible parts of the transformer etc. for any damage.
- Check and record the gas pressure in the transformer tank as well as in the gas cylinder.
- Visual check for wedging of core and coils before filling up with oil and also check conditions of core and winding in general.
- Check and record reading of impact recorder at receipt and verify the allowable limits as per manufacturer's recommendations.

b) Installation Checks

- Check whole assembly for tightness, general appearance etc.
- Oil leakage test
- Capacitance and tan delta measurement of bushing before fixing/connecting to the winding, contractor shall furnish these values for site reference.
- Leakage check on bushing before erection.
- Measure and record the dew point of nitrogen/dry air in the main tank before assembly. Manufacturer shall submit dew point acceptable limits along with temperature correction factor and shall form part of instruction manual. In case dew point values are not within permissible limit suitable drying out process shall be applied for dry out of active part in consultation with the Manufacturer.

c) Oil filling

Oil impregnation or drying under vacuum at site shall be done with the transformer and oil at a temperature not exceeding 70°C.

The duration of the vacuum treatment shall be demonstrated as adequate by means of water measurement with a cold trap or other suitable method but shall generally not be less than 72 hours. The vacuum shall be measured on the top of the transformer tank and should be less than 1mbar.

Vacuum shall not be broken until the transformer is oil filled up to the Buchholz relay. Whenever the active insulation or any paper insulated HV connections, especially those from the windings to the bushings are exposed, these shall be re-impregnated under vacuum along with the complete transformer. For this purpose the transformer shall first be drained to expose all insulation material.

The minimum safe level of oil filling (if different from the Buchholz level) to which the transformer shall be oil filled under vacuum, shall be indicated in the manual.

Procedures for site drying, oil purification, oil filling etc shall be submitted for approval and complete instructions shall form part of the manual.

d) Commissioning Checks

- Check the colour of silicagel in silicagel breather.
- Check the oil level in the breather housing, conservator tanks, cooling system, condenser bushing etc.
- Check the bushing for conformity of connection to the lines etc,
- Check for correct operation of all protection devices and alarms:
  (i) Buchholz relay.
  (ii) Excessive winding temperature.
  (iii) Excessive oil temperature.
  (iv) Low oil level indication.
- Check for the adequate protection on the electric circuit supplying the accessories.
- Check resistance of all windings on all steps of the tap changer. Insulation resistance measurement for the following:
  (i) Control wiring.
  (ii) Main windings.
- Check for cleanliness of the transformer and the surroundings.
- Continuously observe the transformer operation at no load for 24 hours.

- Gradually put the transformer on load, check and measure increase in temperature in relation to the load and check the operation with respect to temperature rise and noise level etc.
- Phase out and vector group test.
- Ratio test on all taps.
- Magnetising current test.
- Capacitance and Tan delta measurement of winding and bushing.
- DGA of oil just before commissioning and after 24 hours energisation at site.

8) GUARANTEE, EVALUATION OF LOSSES & PENALTIES

The bidder shall indicate the Guaranteed values of No load losses, load losses and auxiliary losses in his bid.

a. Capitalization Formula for Transformer Losses

The rate of Capitalization of transformer losses depends upon the rate of interest, rate of electrical energy per kWh, life of transformer and average annual loss factor. In computing the rate of capitalization of iron losses, copper losses and auxiliary losses, following realization assumptions have been made:

i) Rate of interest (r = 12.5%)
ii) Rate of electrical energy (EC = Rs. 7/kW)
iii) Life of the transformer (n = 35 Years)
iv) Average annual loss factor (LS = 0.432)
v) Annual load factor (LF = 60)

Capitalized Cost of Transformer = Initial cost + Capitalized cost of annual iron losses + Capitalized cost of annual copper losses + Capitalized cost of annual auxiliary losses.

$$\text{Capitalized cost of iron losses per KW} = 8400 \times EC \times \frac{(1+r)^n - 1}{r(1+r)^n}$$

$$\text{Capitalized cost of copper Losses per kW} = 8400 \times EC \times \frac{(1+r)^n - 1}{r(1+r)^n} \times LS$$

$$\text{Capitalized cost of auxiliary Losses per kW} = 0.4 \times 8400 \times EC \times \frac{(1+r)^n - 1}{r(1+r)^n}$$

b. The measured losses of each transformer shall not exceed the value in the tender, by more than the tolerance admissible as per **IS: 2026**. The losses need to be very low.

c. The No load loss in Kilo watts at rated voltage and rated frequency shall be guaranteed. The excess of difference between test values of total losses and No load losses in 'Kilo-watt' over corresponding guaranteed losses shall be recovered. In case of fraction of KW, the penalties shall be applied for full KW.

d. **Liquidated Damage for Excessive Losses:** On testing, if it is found that actual losses are more than the values quoted including maximum tolerance, the undisputed liquidate damages shall be recovered from the bidder at the rates double of that calculated from above.

e. **Guarantee, Evaluation of Auxiliary Power Consumption and Penalties**

i. The power consumed at full load by the fans, oil pumps and any other auxiliary apparatus shall be stated in the offer which shall be guaranteed. Tolerance, if any on this figure shall also be indicated failing which a tolerance of 10% shall be assumed. For the purpose of evaluation of tenders and imposition of penalty the guaranteed figure after taking in account the maximum tolerance if any, shall be assumed.

ii. For the purpose of evaluation of tenders, the power consumption of the auxiliaries shall be considered for 20% of the capacity and shall be capitalized to arrive at the final evaluated price for comparison. For the purpose of evaluation, the rates as given in para above shall be taken.

f. REJECTION

The Employer may reject any transformer if during tests or service any of the following conditions arise:

i) No load loss exceeds the guaranteed value by 15% or more.
ii) Load loss exceeds the guaranteed value by 15% or more.
iii) Total losses exceed the guaranteed value by 10% or more.
iv) Impedance value exceeds the guaranteed value by + 10% or more.
v) Transformer fails on impulse test.
vi) Transformer fails on power frequency voltage withstand test.
vii) Transformer provided to have been manufactured not in accordance with the specification.

g. **Capitalization Cost of Transformer Losses (to be used for evaluation of Price Bid)** = Capitalized cost of iron losses + Capitalized cost of copper losses + Capitalized cost of auxiliary losses.

$$\text{Capitalized cost of iron losses per KW} = 8400 \times EC \times \frac{(1+r)^n - 1}{r(1+r)^n}$$

$$\text{Capitalized cost of copper Losses per kW} = 8400 \times EC \times \frac{(1+r)^n - 1}{r(1+r)^n} \times LS$$

$$\text{Capitalized cost of auxiliary Losses per kW} = 0.4 \times 8400 \times EC \times \frac{(1+r)^n - 1}{r(1+r)^n}$$

Wherein –
Rate of interest (r = 12.5%)
Rate of electrical energy (EC = Rs. 7/kW)
Life of the transformer (n = 35 Years)
Average annual loss factor (LS = 0.432)
Annual load factor (LF = 60)

TECHNICAL SPECIFICATION
VOL-II, SEC-XXII

TELECOMMUNICATION SYSTEM

SECTION - XXII
TELECOMMUNICATION SYSTEMS

1.1 General

This section describes the Fiber Optic Communication equipment characteristics for communication system to be installed under the project. The sub-systems addressed within this section are:

(1) Fiber Optic Transmission System (FOTS)
(2) DDF and Cabling
(3) Craft Terminal based Network Management System (NMS)
(4) FO Approach Cable
(5) FODP

The equipment supplied shall support existing communication network for Power system operational requirements.

The security related requirements of the equipment shall be as per DoT (Department of Telecommunication) guidelines and all similar security requirements as amended by DoT on time to time basis shall be followed/complied by the vendor at no additional cost to Employer till the implementation of the project.

The manufacturer shall allow the Employer and/or its designated agencies to inspect the hardware, software, design, development, manufacturing, facility and supply chain and subject all software to a security /threat check any time during the supplies of equipment

The contractor shall ensure that the supplied equipments have been got tested as per relevant contemporary Indian or International Security Standards e.g. IT and IT related elements against ISO/IEC 15408 standards, for Information Security Management System against ISO 27000 series Standards, Telecom and Telecom related elements against 3GPP security standards, 3GPP2 security standards etc. from any international agency/ labs of the standards e.g. Common Criteria Labs in case of ISO/IEC 15408 standards until 31st March 2013. The certification shall be got done from authorized and certified agency/lab in India.

In case of any deliberate attempt for a security breach at the time of procurement or at a later stage after deployment/installation of the equipment or during maintenance, liability and criminal proceedings can be initiated against the Contractor as per guidelines of DoT and any other Government department.

The primary function of the equipment is to provide a highly reliable voice and data communication system for grid operation in support of the SCADA/EMS, RTUs, Teleprotection & PMUs and for new technological requirements of Power System Operation such as Special Protection Scheme, Grid Security Expert System, Load Management, Advanced Protection System & Substation Automation System. A brief summary of the system requirements is as follows:

(a) High speed E1 channel support

(b) 64kbps & nx64kbps data channel support as required

(c) Low speed (300 -1200 bps) data channel support as required

(d) Voice (2 wires, 4 wires) channel support and integration with Employer's/RLDC's EPABX system. The details of EPABX System shall be provided during detailed engineering.

(e) Data transport supporting Network Management channels

(f) The connectivity envisaged between Substation and Control Centre over TCP-IP using Ethernet interface for various services of data and voice such as for PMUs, RTUs , VOIP etc.

2.1 Fibre Optic Transmission System

2.1.1 General Network Characteristics

The SDH node shall be used for interconnection of terminal Substation to the fibre optic network and shall be based on the Synchronous Digital Hierarchy (SDH) having bit rate of STM-4/16 as specified in BPS.

The FO Communication equipment to be supplied shall be a complete SDH node (add-drop multiplexer) providing all the features e.g. protection and performance monitoring. This will be used for delivering E1 as per ITU-T G.703 and Giga/fast Ethernet services except repeater stations. In case other interface such as Asynchronous Sub-channel data card (RS232/V.24/V.28), Synchronous data card (V.35/X.21), 2 wire voice channel card or 4 wire (E&M) voice channel card as required, shall be supplied either in the same equipment or as independent PDH equipment.

The Contractor shall supply the equipment as per the technical specification.The deliverables shall include all installation materials necessary for successful installation and commissioning of the equipment viz. AC & DC power supply cabling, Krone type/120Ω balanced type Digital Distribution Frame (DDF) in enclosure, optical patch cords for FODP-to-equipment and equipment-to-equipment connection, optical attenuator (5dB/10dB), flexible conduits etc. as per site requirement. Additionally one (1) pair of optical patch cord per SDH node will be supplied as spare. User Manual, System Guide shall be delivered with each equipment. The Contractor shall provide all required minor civil works necessary for full connectivity as required.

Equipment redundancy and Automatic Protection Schemes (APS) are specified in the Table 1. The failure of one element shall not prevent the use of any other that has not failed.

Table 1
Equipment Redundancy Requirements Summary

Fiber Optic transmission Equipment :	
Power Supply & Converters ----------	1:1 APS or distributed power supply
Common Control* Cards ----------	1:1 APS
*** = Common control cards which are essentially required for operation of the equipment.**	

The offered equipment shall support automatic switchover function between the redundant modules and all required modules and hardware to support the automatic switch over shall be provided by the Contractor.

At any digital signal level, reapplication of a lost signal shall result in automatic resynchronization and full restoration to normal operation without manual intervention. All alarms incident to the signal failure, shall be automatically cleared at the equipment, rack and monitoring levels and normal operation indications restored and reported if applicable.

The offered transmission equipment (SDH node) shall support optical link of at least 250 Km for STM-4 and 225Km for STM-16 without any repeater station in between. If required, wavelength translator/ optical amplifier shall be provided by the contractor.

2.1.2 Features of Transmission Equipment

- Aggregate interface shall be STM-4/16, with three (3)/Five (5) MSP protected directions (as required in BPS). If bidder is offering equipment with multifunction cards such as cross-connect or control card with optical interface/SFP or tributary interface, such type of multifunction card shall be considered as Common control card and shall be the part of base equipment. In case optical interface/SFP is embedded with control card, the adequate number of optical interface/SFPs shall be offered to meet the redundancy requirements of the specifications. Further, main and protection channel shall be terminated on separate cards. Aggregate interface of STM-4/16 shall have FC/PC or SC or LC connector.

- All software and hardware shall support IPv4 and IPv6 simultaneously (dual stack).

- SDH equipment shall support dual power feed with redundancies for Power supply unit and Control unit in each rack.

- Minimum 16 nos. x 2 Mbit/s per card, 120Ω tributary interface compliant to ITU-T G.703, G.704 with suitable connector

- Ethernet interface shall have minimum 8 nos. per card of RJ-45 port for ingress and egress of Ethernet data (Ethernet over SDH) at 10/100/1000 Base-T speeds/standards (ITU-T G.7041GFP capsulation). Ethernet shall support LCAS feature. It shall support full throughput upto 1000 Mbps on Ethernet port by virtual concatenation of requisite no. of VC-12.There shall be the provision of "Auto Negotiation" and "Flow control" Enabling/disabling through NMS of the system. Also there shall be provision of configuring the equipment for unrestricted nxVC12 bandwidth (upto 1000Mbps). The Ethernet interface shall support VLAN (IEEE 802.IP/Q), spanning tree (IEEE 802.ID) quality of service. The protection scheme for Ethernet traffic should be VLAN/ERPS based.

- Services channel shall be provided as a function of the SDH equipment and shall be equipped with Service Channel Muldems that shall provide at a minimum: One voice channel (order wire) with analog interface (0.3 to 3.4 kHz) and one data channel. There shall be a facility to extend the line system order-wire to any other system or exchange lines.

- ADM configuration for traffic protection by using SNCP & MSP.

- Synchronization: The synchronization of the FO equipment shall be as per ITU-T standard G.811. The substation GPS can be used for extending synchronization to equipment. Alternately existing network Master Clock can be used for synchronization.

- ISM (In Service Monitoring) circuitry shall be provided as a function of the SDH equipment. Local visual alarm indicators shall be provided on the equipment, as a rack summary alarm panel. Alarms shall be as per ITU-T Standards G.774, G.783 and G.784.

- Downloading of software shall be possible from remote.

- Shall have Embedded Communication Channel (ECC), ports (Ethernet/RS232) for craft terminal and management interface and shall support DCC pass trough.

- DCN implementation through protected VC12. Support DCN grooming in VC12.

- Pre-connectorised Optical patch cords shall be of G.625D fibre. The Patch cord return loss shall be equal to or better than 40 dB and insertion loss equal to or less than 0.5 dB. Fiber jumpers shall be of sufficient lengths as to provide at least 0.5m of service loop.

- Shall be operated with -48 V DC Power Supply. DC power interface shall be suitable to work on a nominal voltage of -48V ± 20%.

- Compact design suitable for installation in 19" rack.

2.1.2.1 Network Monitoring (Craft Terminal based)

- Manageable by Craft Terminal programme. It shall support performance monitoring, remote software upgrade, configuration management from remote as well as local craft terminal. The craft terminal shall have minimum configuration of 2.4 GHz, 2 GB RAM, 256 MB Video Graphics Memory, DVD RW drive, 160 GB Hard Disk Drive, keyboard, mouse/trackball etc., serial/USB (2.0) ports to accommodate printers, IEEE 802.11a/b/g wireless LAN, Bluetooth, Internal/external Data/Fax modem and a battery back-up of at least 3 hours. VDUs shall be 15" TFT active matrix color LCD with a minimum resolution of 1024 X 768.
- Local Craft Terminal will be provided with requisite software for performing all element level management functions viz. configuration management, fault management, performance management etc.

- Provision shall be there in the Local Craft Terminal for integration with full fledged NMS server .

2.1.3 Optical Link Budget Calculations

The fibre optic link budget calculations shall be calculated based upon the following criteria:

(1) Fibre attenuation: The fibre attenuation shall be taken to be the guaranteed maximum fibre attenuation i.e. 0.21 dB/Km @1550nm and 0.35 dB/km @1310nm.

(2) Splice loss: Minimum 0.05 dB per splice. One splice shall be considered for every 3 kms.

(3) Connector losses: Losses due to connectors shall be considered to be minimum 1.0 dB per link.

(4) Equipment Parameters: The equipment parameters to be considered for link budget calculations shall be the guaranteed “End of Life (EOL)” parameters. In case, the End of Life parameters are not specified for the SDH equipment, an End of Life Margin of at least 2 dB shall be considered and a similar margin shall be considered for optical amplifiers.

(5) Optical path Penalty: An optical path penalty of at least 1 dB shall be considered to account for total degradations due to reflections, inter symbol interference, mode partition noise and laser chirp.

(6) Maintenance Margin: A maintenance margin of at least 2.5 dB/100Km shall be kept towards cabling, repair splicing, cable ageing and temperature variations etc.

(7) Other losses: Other losses, if any required specifically for system to be supplied shall also be suitably considered.

(8) Dispersion: The fibre dispersion shall be taken to be the guaranteed maximum dispersion i.e. 18 ps/nm.Km @1550 nm & 3.5 ps/nm.km @ 1310 nm for DWSM fibres.

(9) Bit Error Rate: The link budget calculations shall be done for a BER of 10-10.

The bidders shall determine the total link loss based on the above parameters and shall submit the system design (including link budget calculations) for each fibre optic link during detailed engineering.

For finalising the FOTS system design & BOQ, above methodology shall be adopted taking into account fibre attenuation, dispersion and splice loss determined during the detailed engineering. Accordingly, additions and deletions from the contract shall be carried out based on unit rates indicated in the contract.

2.2 Fibre Optic Approach Cable

For purposes of this specification, a fibre optic approach cable is defined as the Armoured underground fibre optic cable required to connect Overhead Fibre Optic Cable (OPGW) between the final in line splice enclosure on the gantry / tower forming the termination of the fibre cable on the power line and the Fibre Optic Distribution Panel (FODP) installed within the building. The estimated fibre optic approach cabling length requirements are indicated in the appendices. However, the Contractor shall supply & install the optical fibre approach cable as required based on detailed site survey to be carried out by the Contractor during the project execution and the Contract price shall be adjusted accordingly. Approach Cable shall consist G.652D DWSM Fibers.

2.2.1 Basic Construction

The cable shall be suitable for direct burial, laying in trenches & PVC/Hume ducts, laying under false flooring and on indoor or outdoor cable raceways. The jacket shall conform to ASTM D1248 for density.

2.2.2 Optical Electrical and Mechanical Requirements

Approach cable shall contain fibres with identical optical/ physical characteristics as those in the OPGW cables. The cable core shall comprise of tensile strength member(s), fibre support/bedding structure, core wrap/bedding, and an overall impervious jacket.

2.2.3 Installation Of Approach Cable

The existing cable trenches/ cable raceways proposed to be used shall be identified in the survey report. The Contractor shall make its best effort to route the cable through the existing available cable trenches. Where suitable existing cable trenches are not available, suitable alternatives shall be provided after Employer approval.

Suitable provisions shall be made by the Contractor to ensure adequate safety earthing and insulated protection for the approach cable.

All required fittings, supports, accessories, ducts, inner ducts, conduits, risers and any item not specially mentioned but required for laying and installation of approach cables shall be supplied and installed by the Contractor.

2.3 Optical Fibre Termination and Splicing

Optical fibre terminations shall be done in Fibre Optic Distribution Panels (FODP) designed to provide protection for fibre splicing of preconnectorized pigtails and to accommodate connectorized termination and coupling of the fibre cables. The Contractor shall provide rack /wall mounted Fibre Optic Distribution Panels (FODPs) sized as indicated in the appendices and shall terminate the fibre optic cabling up to the FODPs. The location of FODP rack shall be fixed by the Contractor, with the Employer's approval.

2.3.1 Fibre Optic Distribution Panel

At each location requiring the termination of at least one fibre pair within a cable, all fibres within that cable shall be connectorized and terminated in Fibre Optic Distribution Panels in a manner consistent with the following:

(a) All fibre optic terminations shall be housed using FODPs provisioned with splice organizers and splice trays. All fibres within a cable shall be fusion spliced to preconnectorized pigtails and fitted to the "Back-side" of the provided fibre optic couplings.

(b) FODPs shall be suitable for use with each of the cable types provided as part of this contract. FODPs shall accommodate pass-through splicing and fibre terminations.

(c) FODPs for indoor use shall be supplied in suitable cabinets/racks with locking arrangement.

(d) The FODP shall be of corrosion resistant, robust construction and shall allow both top or bottom entry for access to the splice trays. Ground lugs shall be provided on all FODPs and the Contractor shall ensure that all FODPs are properly grounded. The FODP shall meet or exceed ingress protection class IP55 specifications.

(e) Flexible protection shall be provided to the patch cord bunches going out from FODP cabinet to other equipment cabinet.

3.1 Environmental, EMI, Power Supply Cabling and Earthing Requirements

- Equipment shall operate in accordance with the Environmental Operating limits as shown in Table-2:

Table -2
Environmental Operating Limits

Temperature Range:	(Un Controlled Environment)
Specification	0 to 45°C

Operation without damage **Shipping/storage**	-10 to 55°C -40 to 60°C
Relative Humidity, non-condensing	Upto 90%
Elevation: **Operating** **Non-operating**	to 3,000 m to 10,000 m

- Equipment shall be properly shielded against radiated emissions at each location.

- Power Distribution and Protection: Power supplies/converters for communications equipment shall use -48Vdc uninterrupted primary source power. The Employer will furnish only one power source. Contractor shall provide required distribution panels, circuit breakers, appropriate panel disconnects and all cabling, fusing, switching required. Distribution Panel feeders, Panel Disconnects, distribution panels and circuit breakers shall be sized and equipped to support at least 100% expanded load requirements.

- Contractor shall provide equipment and rack safety earthing in full compliance with EMI/EMC requirements as per relevant international standards.

- Equipment cabinet (enclosure) shall be designed 19 inch, free standing but shall be mounted on the floor. The dimensions of the cabinet shall be minimum 2200mmx600mmx600mm. All doors and removable panels shall be fitted with long life synthetic gaskets Neoprene/EPDM conforming with provision of IS 11149. All panels shall be fabricated from minimum 2.0mm thickness steel sheet. However, for racks with load bearing Aluminium extrusion frame, door panels and side panels may be fabricated from minimum 1.6mm thickness steel sheet and the top & bottom panels shall be fabricated from minimum 2.0mm thickness steel sheet. The exterior and interior colour of the paint shall be RAL 7032. Equipment cabinet (enclosure) shall be dust and moisture proof as per IP41 specification or better (supporting certificates/documents shall be submitted during detailed engineering).

- The Contractor shall provide all required minor civil works necessary for full connectivity as required in the Contractor's scope of work.

- Any other miscellaneous items which may be required for successful interfacing for establishment of end-to-end communication is deemed to be included in the scope of the Contractor.

4.1 TESTING

All materials furnished and all work performed under this Contract shall be inspected and tested. The entire cost of testing for factory & site acceptance, routine tests, production tests and other test during manufacture & site activities specified herein shall be treated as included in the quoted unit price of materials, except for the expenses of Inspector/Employer's representative. All tests shall be witnessed by the Employer and/or its authorized representative (hereinafter referred to as the Employer) unless the Employer authorizes testing to proceed without witness.

"Type Tests" shall be defined as those tests which are to be carried out to prove the design, process of manufacture and general conformity of the materials to this Specification. All equipment being supplied shall conform to type tests as per Annexure-I of technical specification. The test reports submitted shall be of the tests conducted within last five (5) years. In case the test reports are older than five (5) years, the Contractor shall repeat these tests at no extra cost to the purchaser. In the event of any discrepancy in the test reports or any type tests not carried out, same shall be carried out by Contractor without any additional cost implication to the Employer. Type Tests shall be certified or performed by reputed laboratories using material and equipment data sheets and test procedures that have been approved by the Employer.

Equipments to be delivered shall be tested at factory before despatch as per approved procedure. Factory Acceptance Test shall demonstrate the technical characteristics of the equipment in relation to this specification and approved drawings and documents. The Contractor shall provide procedures for installation and site acceptance test. The site acceptance testing will comprise of end- to-end testing between the terminal stations and RLDC/SLDC and RTAMC/other CC end.

The detailed requirements for Type Test, Factory Acceptance Test and Site Acceptance Test are attached at 'Annexure – I

5.1 TRAINING

The Contractor will provide a training of suitable duration on supplied SDH equipment for Employer's personnel to provide working knowledge of the equipment, operation and diagnostic tools, supervision and monitoring using local craft terminal. The training may be provided by the Contractor or its sub-vendor at the site itself, preferably during installation, and will include training materials and presentation equipment. No separate charges for training shall be payable to the Contractor.

6.1 SUPPORT SERVICES

Throughout design, implementation, factory testing, and field installation and testing, the Contractor shall supply consulting assistance, as required by the Employer for site preparation, field installation, and other areas where technical support may be required.

The Contractor shall be responsible for minor facility renovation, and maintenance of the supplied system up to and including successful completion of the Site Acceptance Test.

After final acceptance of the communications equipment, the Contractor shall offer continuing technical support and spare parts for the designed life of the equipment or 7 years after the declaration of withdrawal of equipment from production whichever is earlier. However the termination of production shall not occur prior to Operational Acceptance of the system by the Employer. Some locations have existing SDH & MUX equipment. The traffic may be switched over to new fibre optic communication equipment in phase manner. The Contractor shall review the Employer existing equipment make, integration & switch over recommendation and prepare a detailed field implementation plan.

6.1.1 Technical Support

Consultation with Contractor's technical support personnel and trained field service personnel shall be readily available on a short-term/long-term basis to assist the Employer personnel in maintaining, expanding, and enhancing the telecommunication network upon expiration of the warranty period.

6.1.2 Contractor's Future Hardware/Software Changes

The Employer shall be informed of all alterations or improvements to the hardware supplied under this Specification. The Employer shall be placed on the Contractor's mailing list to receive announcements of the discovery, documentation, and solution of hardware/software problems as well as other improvements that could be made on supplied equipment. The service shall begin at the time of contract award, and shall continue for the designed life of the equipment. The Contractor shall also include a subscription to the hardware subcontractors' change notification service from the time of contract award through the warranty period, with a Employer renewable option for extended periods.

6.1.3 Mandatory Spare Parts

The Contractor shall be required to supply minimum spares for each subsystem as per BPS. The subsystem set of spare parts is defined to include all equipment modules, subunits and parts required to effect replacement, repair and restoration to full operational status of a defined unit of a subsystem (i.e. SDH equipment.).

6.1.4 Warranty Period

The one year period commencing immediately after the operational acceptance is called the Warranty Period/Defect liability Period. In addition to the responsibilities covered under Vol-I Condition of Contracts during Defect Liability Period, the Contractor shall also

be responsible for maintenance of the Fibre Optic Transmission System etc. supplied under this Package.

6.1.5 Miscellaneous Supplies

The Contractor shall provide all required consumable and non-consumable supplies necessary to support all installation and test activities through final operational acceptance. However, if there are any problems in the SAT and additional consumables are required, the same shall also be supplied by the Contractor at no additional cost.

7.1 Documentation

The Contractor shall submit following documents during detailed engineering:

(a) Data Requirement sheets
(b) Link Budget calculations
(c) MQP, FQP
(d) Bill of Quantity including mandatory spares
(e) Previous Type test reports
(f) Factory Test report
(g) Manuals for each equipment
(h) Schematic drawing
(i) Numbering, Marking, labelling document
(j) Synchronization plan
(k) Test schedule
(l) Training manual
(m) Configuration diagram
(n) Transportation & handling Procedure
(o) Installation Manuals
(p) Maintenance Manuals

Annexure - I

Testing Requirement of Communication Equipment

1.1 List of type test to be conducted on Telecom equipment

The type tests for Telecom Equipment with all types of cards are described below:

1.1.1 Temperature and Humidity Tests

The tests listed below are defined in IEC Publication 60068.

(a) Low Temperature Test: Operation to Specifications

Low temperature tests shall be conducted as defined in IEC Publication 60068-2-1, test method Ad, with the following specifications:

(1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for sixteen (16) hours. Its performance is checked during the test.

(2) Degree of Severity: Test shall be done at 0°C

(3) Acceptance Criteria: No degradation of performance during and after the test.

(b) Low Temperature Test : Operation without Damage

Low temperature tests shall be conducted as defined in IEC Publication 60068-2-1, test method Ad, with the following specifications:

(1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 72 hours. Its performance is checked during the test and after the test as soon as the thermal equilibrium is reached at the room temperature (*Post-test*).

(2) Degree of Severity: Test shall be done at -10° C

(3) Acceptance Criteria: Degradation of performance is allowable during the test, however there shall be no degradation of performance in the *post-test*.

(c) Dry Heat Test: Operation to Specifications

Dry heat test shall be done as defined in IEC Publication 60068-2-2, test method Bd, with the following specifications:

(1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 96 hours. Its performance is checked during the test.

(2) Degree of Severity: operation to specification range.

(3) Acceptance Criteria: No degradation of performance during and after the test.

(d) Dry Heat Test: Operation without Damage

Dry heat tests shall be done as defined in IEC Publication 60068-2-2, test method Bd, with the following specifications:

(1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 96 hours. Its performance is checked during the test and after the test as soon as the thermal equilibrium is reached at the room temperature (*Post-test*).

(2) Degree of Severity: Test shall be done at 55ºC.

(3) Acceptance Criteria: Degradation of performance is allowable during the test, however there shall be no degradation of performance in the *post-test*.

(e) Damp Heat Test

Damp heat testing reveals aging with respect to the humidity level and applies basically to electronic equipment. This test shall be done as defined in IEC Publication 60068-2-3 with the following specifications:

(1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 10 days. Its performance is checked during the test.

(2) Degree of Severity: Test shall be done at (40 ± 2) °C & (93 ± 3) % RH

(3) Acceptance Criteria: The equipment shall meet the specified requirement and there shall not be any degradation in BER.

(f) Temperature Variation Test

Temperature variation testing shall be as per IEC Publication 60068-2-14 (Gradual Variations, Method Nb). The equipment shall be powered on and various parameters shall be monitored continuously during the test period.

(1) Number of cycles required is five (5)

(2) The degree of severity: temperature TL:0°C, TH: (Operation to specification range)

(3) Cycle duration for each temperature is three (3) hours.

(4) Ramp : 1 °C/minute.

(5) Acceptance Criteria: The equipment shall meet the specified requirement and there shall not be any degradation in BER.

1.1.2 Power Supply and EMI/EMC tests

The test procedure and acceptance criteria shall be as defined in IEC 60870-2-1.

(a) Immunity Tests

The list of Immunity tests are specified below in Table 1:

Table 1: Recommended Immunity Tests

S. No.	Immunity Test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
1	Voltage Fluctuations	Yes	Yes	N/A	N/A	Table 11 of IEC 60870-2-1: 1995 - Level : 1
2	Voltage dips and Interruptions	Yes	Yes	N/A	N/A	
3	1.2/50 - 8/20 µs surges	Yes	Yes	Yes	N/A	Table 12 of IEC 60870-2-1: 1995 - Level : 4
4	Fast transient bursts	Yes	Yes	Yes	Yes	

Table 1: Recommended Immunity Tests

S. No.	Immunity Test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
5	Damped oscillatory waves	Yes	Yes	Yes	Yes	
6	10/700 μs surges	N/A	N/A	N/A	Yes	
7	Electrostatic discharge	Yes				Table 13 of IEC 60870-2-1: 1995 - Level : 4
8	Power frequency magnetic field	Yes				Table 14 of IEC 60870-2-1: 1995 - Level : 4
9	Damped oscillatory magnetic field	Yes				
10	Radiated electromagnetic field	Yes				Table 15 of IEC 60870-2-1: 1995 - Level : 4
11	Power Frequency voltage on control and signal lines	N/A	N/A	Yes	Yes	IEC 61000-4-16 : 2002-07 Level : 4
12	DC voltage on control and signal lines	N/A	N/A	Yes	N/A	IEC 61000-4-16 : 2002-07 Level : 4
-End of Table-						

(b) Emission Tests

The list of Emission tests are specified below in Table 2

Table 2:
Recommended Emission Tests

S. NO.	Emission test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
1	LF disturbance voltages CCITT recommendation P.53	N/A	Yes	N/A	N/A	Table 17 of IEC 60870-2-1: 1995 - Class : B

Table 2:
Recommended Emission Tests

S. NO.	Emission test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
2	RF disturbance voltages CISPR 22	Yes	Yes	N/A	N/A	
3	RF disturbance currents CISPR 22	N/A	N/A	N/A	Yes	
4	RF radiated fields CISPR 22	Yes				
-End Of Table-						

(c) Insulation Withstand Voltages

As per section 6 of IEC 870-2-1. Recommended class : VW1 of Table 18.

1.1.3 Mechanical Tests

(a) Mechanical Vibration Test

The procedure for this test is described in IEC Publication 60068-2-6. The testing procedure shall be carried out in the sequence 8.1 + 8.2.1 + 8.1 as described in document 60068-2-6. For the vibration response investigation (clause 8.1 of 60068-2-6), the test shall be carried out over a sweep cycle under the same conditions as for the endurance test (described later), but the vibration amplitude and the sweep rate may be decreased below these conditions so that the determination of the response characteristics can be obtained.

The endurance tests conditions are selected according to the vibration withstand requirements.

Transportation tests shall be performed with the equipment packed according to the Contractor's specifications.

(b) Shock Test

The procedure of this test is defined in IEC Publication 60068-2-27 (each test) with a semi-sinusoidal shape (clause 3.1.1.2).

The recommended severity shall be A = 294 m/s², D = 18 ms. Three shocks per axis per direction shall be applied to the equipment packed according to the Contractor's specifications.

Or Free Fall Test

This test could be performed as an alternative to the shock or Bump test. The procedure is defined in IEC publication 60068-2-32. The equipment shall be packed according to the Contractor's specifications. The drop height shall be defined in accordance with IEC 68-2-32. The surface of the packing case which comes into contact with the ground is the surface on which the packing case normally rests; if the packing does not have any features (inscription, special shape, etc.) identifying this surface, the test is carried out successively on all the surfaces of the packing.

Or Bump Test

This test could be performed as an alternative to Shock test or Free Fall test. The procedure is defined in IEC 60068-2-29.

1.2 Type tests for Optical Fibres

The type tests listed below in Table 3 shall be conducted on DWSM fibres to be supplied as part of Approach cable. The tests specific to the cable type are listed in subsequent sections.

Table 3
Type Tests For Optical Fibres

S. No.	Test Name	Acceptance Criteria	Test procedure
1	Attenuation	As per Standard	IEC 60793-1-40 Or EIA/TIA 455-78A
2	Attenuation Variation with Wavelength	As per Standard	IEC 60793-1-40 Or EIA/TIA 455-78A
3	Attenuation at Water Peak	As per Standard	IEC 60793-1-40 Or EIA/TIA 455-78A
4	Temp. Cycling (Temp dependence of Attenuation)		IEC 60793-1-52 Or EIA/TIA 455-3A, 2 cycles
5	Attenuation With Bending (Bend Performance)		IEC 60793-1-47 Or EIA/TIA 455-62A
6	Mode Field dia.		IEC 60793-1-45 Or EIA/TIA 455-164A/167A/174
7	Chromatic Dispersion		IEC 60793-1-42 Or EIA/TIA 455-168A/169A/175A

Table 3
Type Tests For Optical Fibres

S. No.	Test Name	Acceptance Criteria	Test procedure
8	Cladding Diameter		IEC 60793-1-20 Or EIA/TIA 455-176
9	Point Discontinuities of attenuation		IEC 60793-1-40 Or EIA/TIA 455-59
10	Core -Clad concentricity error		IEC 60793-1-20 Or EIA/TIA 455-176
11	Fibre Tensile Proof Testing		IEC 60793-1-30 Or EIA/TIA 455-31B
-End Of table-			

1.3 Type tests for Fibre Optic Approach Cable

The type tests to be conducted on the Fibre Optic Approach cable are listed in Table 4: Type Tests for Fibre Optic Approach Cable. Unless specified otherwise in the technical specifications or the referenced standards, the optical attenuation of the specimen, measured during or after the test as applicable, shall not increase by more than 0.05 dB/Km.

Table 4:
Type Tests Fibre Optic Approach Cable

S.NO.	Test Name	Test Procedure
1	Water Ingress Test	(IEC 60794-1-F5 / EIA 455-82B) Test duration : 24 hours
2	Seepage of filling compound	(EIA 455-81A) Preconditioning : 72 hours, Test duration : 24 hours.
3	Crush Test	(IEC 60794-1-E3/ EIA 455-41)
4	Impact Test	(IEC-60794-1-E4/ EIA 455-25A)
5	Stress strain Test	(EIA 455-33A)
6	Cable Cut-off wavelength Test	(EIA 455-170)
7	Temperature Cycling Test	(IEC60794-1-F1/EIA-455-3A) – 2 cycles
-End Of Table-		

1.4 Factory Acceptance Test Requirement

Table 5:
Factory Acceptance Testing for Fibre Optic Transmission System

Item:	Description:
1.	Physical inspection for conformance to DRS, BOQ, drawings and appearance of equipment
2.	Optical output power
3.	Transmitter lightwave spectral analysis
4.	Low receive level threshold
5.	Generation of bit error rate curve
6.	Measurement of analog and digital service channel parameters as well as service channel functionality
7.	Performance of supervision, alarm, Craftsperson interface, diagnostics, loop backs etc.
8.	Electrical interface tests which include: output and input jitter, bit error rate, pulse shape, cable compensation, and line rate tolerance for multiplexers
9.	At a minimum tests on Ethernet interface shall include demonstration of ping test, throughput test, Latency test, Packet Loss test as per RFC 2544
11.	Simulation of failure conditions and failover of each redundant unit.
12.	VLAN (Layer-2 switching) feature testing configuration.
13.	Protection scheme for Ethernet Traffic (ERPS)
14.	Test of spare card slots
15.	Checks of power supply/converter voltage margins
16.	Random inspections to verify the accuracy of documentation
17.	Test of spare parts/modules/cards as per applicable tests

Table 6 FAT on NMS (Craft Terminal)	
1	Physical inspection of NMS hardware (Craft Terminal) for conformance to approved BoQ, DRS & drawing
2	Testing of NMS to demonstrate proper operation of all functions: Configuration Management, Performance Management, Fault Management and Security Management.

Table 7 Factory Acceptance Tests On Approach Cable
Factory Acceptance Test
Attenuation Co-efficient at 1310 nm and 1550 nm
Point discontinuities of attenuation
Visual Material verification and dimensional checks as per approved DRS/Drawings

Table 8 Factory Acceptance Test
Visual check of Quantities and Specific Component Number for each component of FODP and dimensional checks against the approved drawings.

1.5 Site Acceptance Tests

All equipment shall be tested on site under the conditions in which it will normally operate.

The tests shall be exhaustive and shall demonstrate that the overall performance of the contract works satisfies every requirement specified. At a minimum Site Acceptance Testing requirement for Telecom equipment, NMS etc. is outlined in following section. This testing shall be supplemented by the Contractor's standard installation testing program, which shall be in accordance with his quality plan(s) for Telecom equipment installation.

During the course of installation, the Employer shall have full access for inspection and verification of the progress of the work and for checking workmanship and accuracy, as may be required. On completion of the work prior to commissioning, all equipment shall be tested to the satisfaction of the Employer to demonstrate that it is entirely suitable for commercial operation.

1.5.1 Phases for Site Acceptance Testing

The SAT shall be completed in following phases:

1.5.1.1 Installation Testing

The field installation test shall be performed for all equipment at each location. If any equipment has been damaged or for any reason does not comply with this Specification, the Contractor shall provide and install replacement parts at its own cost and expense.

In the installation test report, the Contractor shall include a list of all hardware or components replaced or changed between the completion of factory tests and the start of field tests and show that documentation and spare parts have been updated.

The minimal installation testing requirements for fiber optic transmission subsystem are provided in the table below:

Table 9

Fibre Optic Transmission system Installation Testing

Item:	Description:
1.	Physical Inspection for conformance to drawings, rack elevations and appearance of equipment and cabling
2.	Equipment power supply (DC-DC converter) output voltage measurements
3.	Terminal transceiver performance testing (Tx power, Tx spectrum, receive signal strength, connector losses etc.)
4.	Service channel performance
5.	Craftsperson interface, alarm and control functional performance
6.	Rack and local alarms: No alarms shall be present and all alarms shall be demonstrated to be functional
7.	Network management interface and supervision performance
8.	Correct configuration, level setting & adjustments and termination of Input/ output interfaces
9.	Proper establishment of Safety and signalling earthing system and resistance to ground to be checked.
10.	Simulation of failure conditions and failover of protected components.

1.5.1.2 Link Commissioning Tests

The commissioning tests shall verify that communication can be performed over the fiber optic link under test. Delay measurement, Bit Error measurements & service channel performance monitoring shall be made on the fibre optic links to verify compliance with designed link performance.

For Ethernet interface: At a minimum the following test requirements shall be demonstrated as per RFC 2544:

a) Ping test
b) Throughput test
c) Latency test
d) Packet Loss

The links shall be tested for 12 Hour. In case any link does not meet the performance requirements during 12 hour, then the cause of failure shall be investigated and the test shall be repeated after rectifying the defects.

This phase of testing shall be conducted by the Contractor and witnessed by the Employer. Field adjustments shall be made to meet established standard, however if the field adjustments fail to correct the defects the equipments may be returned to the Contractor for replacement at his own expense. In case any adjustments are required to be made during the interval of the test then the test shall be repeated.

1.5.1.3 Integrated Testing

Prior to commencement of integrated testing the overall system shall be configured as required to provide all the data and voice channel required to interconnect to control centres and other nodes in existing system. The integrated testing shall include end-to-end testing of communication.. The intent of integrated testing is to demonstrate that the equipment is operational end to end under actual conditions, that all variances identified during factory and field installation and communications testing have been corrected, and that the communication equipment is compatible with other equipment. The Integrated System Test shall include all fibre optic transmission equipment, the network management subsystem (Craft Terminal) and other components.

At a minimum the following tests shall be included in the integrated testing:

(1) Equipment configuration shall be checked to establish that it supports the channel routing.

(2) End to end testing of all individual voice circuits (VOIP) and to demonstrate proper operation of channels over wideband systems. Operation shall be checked in terms of quality of voice, call initiation and call termination processes.

(3) End-to-end testing of all individual Data Circuits (Ethernet) and E1 channel routing. Individual port of each tributary card to be checked. Operation shall be checked in terms of monitoring of BER/packet loss.

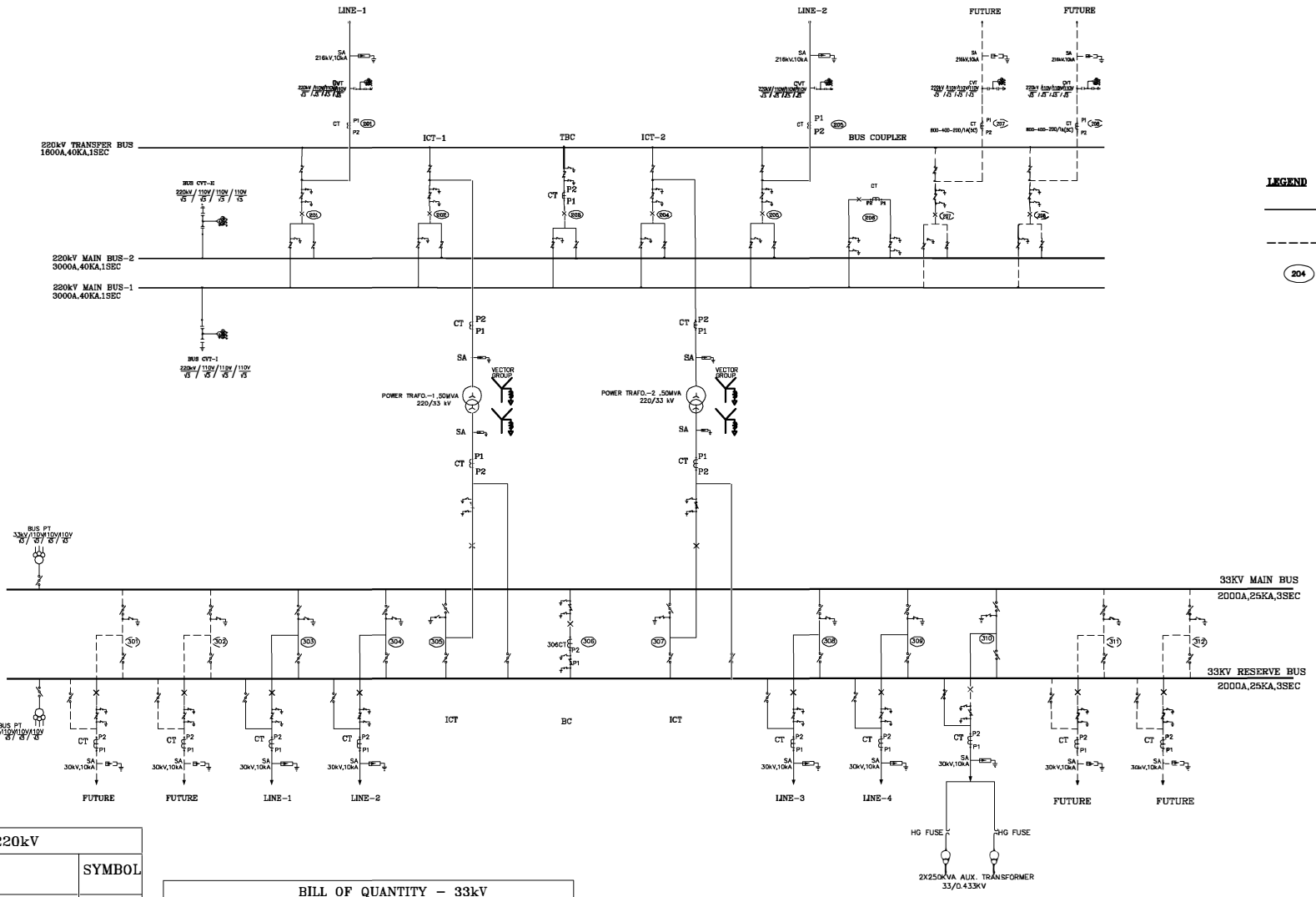
(5) Testing of NMS (Craft Terminal) to demonstrate proper operation of all functions. All the standard features of the NMS (Craft Terminal) shall be demonstrated for proper functioning.

(6) Demonstration of Protection switching and synchronization of equipment.

TECHNICAL SPECIFICATION

VOL-II, SEC-XXIII

DRAWINGS



BILL OF QUANTITIES–220kV

SL. NO.	DESCRIPTION	SYMBOL
1	50 MVA,220/33kV POWER TRANSFORMER (3–PH).	
2	2500A,40KA,1SEC, SF–6 CIRCUIT BREAKER (3–PH).	
3	1600A,40KA DOUBLE BREAK ISOLATOR WITH ONE EARTH SWITCH (3–PH).	
4	1600A,40KA DOUBLE BREAK ISOLATOR WITH TWO EARTH SWITCHES (3–PH).	
5	2500A,40KA DOUBLE BREAK ISOLATOR WITH TWO EARTH SWITCHES (3–PH).	
6	1600A,40KA DOUBLE BREAK ISOLATOR WITHOUT EARTH SWITCH (3–PH) –TANDEM TYPE	
7	800A,40KA,5CORE 120% CURRENT TRANSFORMER (1–PH)	
8	1600A,40KA,5CORE 150% CURRENT TRANSFORMER (1–PH)	
9	245kV CAPACITOR VOLTAGE TRANSFORMER (1–PH) 4400 PF, $\frac{220kV}{\sqrt{3}}/\frac{110V}{\sqrt{3}}/\frac{110V}{\sqrt{3}}/\frac{110V}{\sqrt{3}}$	
10	216kV, 10kA SURGE ARRESTOR (1–PH)	

BILL OF QUANTITY – 33kV

SL. NO.	DESCRIPTION	SYMBOL
1	LT TRANSFORMER 250kVA, 33/0.433kV (3–PH).	
2	1250A, 25kA, 3–PH CIRCUIT BREAKER	
3	2500A, 25kA, 3–PH CIRCUIT BREAKER	
4	36kV,1200A,25KA,1–PH 120% CURRENT TRANSFORMER (1–PH)	
5	36kV,2000A,25KA,1–PH 150% CURRENT TRANSFORMER (1–PH)	
6	33kV POTENTIAL TRANSFORMER, $\frac{33kV}{\sqrt{3}}/\frac{110V}{\sqrt{3}}/\frac{110V}{\sqrt{3}}/\frac{110V}{\sqrt{3}}$	
7	HORIZONTAL DOUBLE BREAK ISOLATOR WITH ONE E/S 1250A, 25kA, 1SEC (3–PH)	
8	HORIZONTAL DOUBLE BREAK ISOLATOR WITHOUT E/S 1250A, 25kA 1SEC (3–PH)	
9	HORIZONTAL DOUBLE BREAK ISOLATOR WITH TWO E/S 1250A, 25kA, 1SEC (3–PH)	
10	HORIZONTAL DOUBLE BREAK ISOLATOR WITH TWO E/S 2500A, 25kA, 1SEC (3–PH)	
11	SURGE ARRESTER 30KV, 1DKA (1–PH).	
12	HORNGAP FUSE 36KV, 400A (1–PH).	

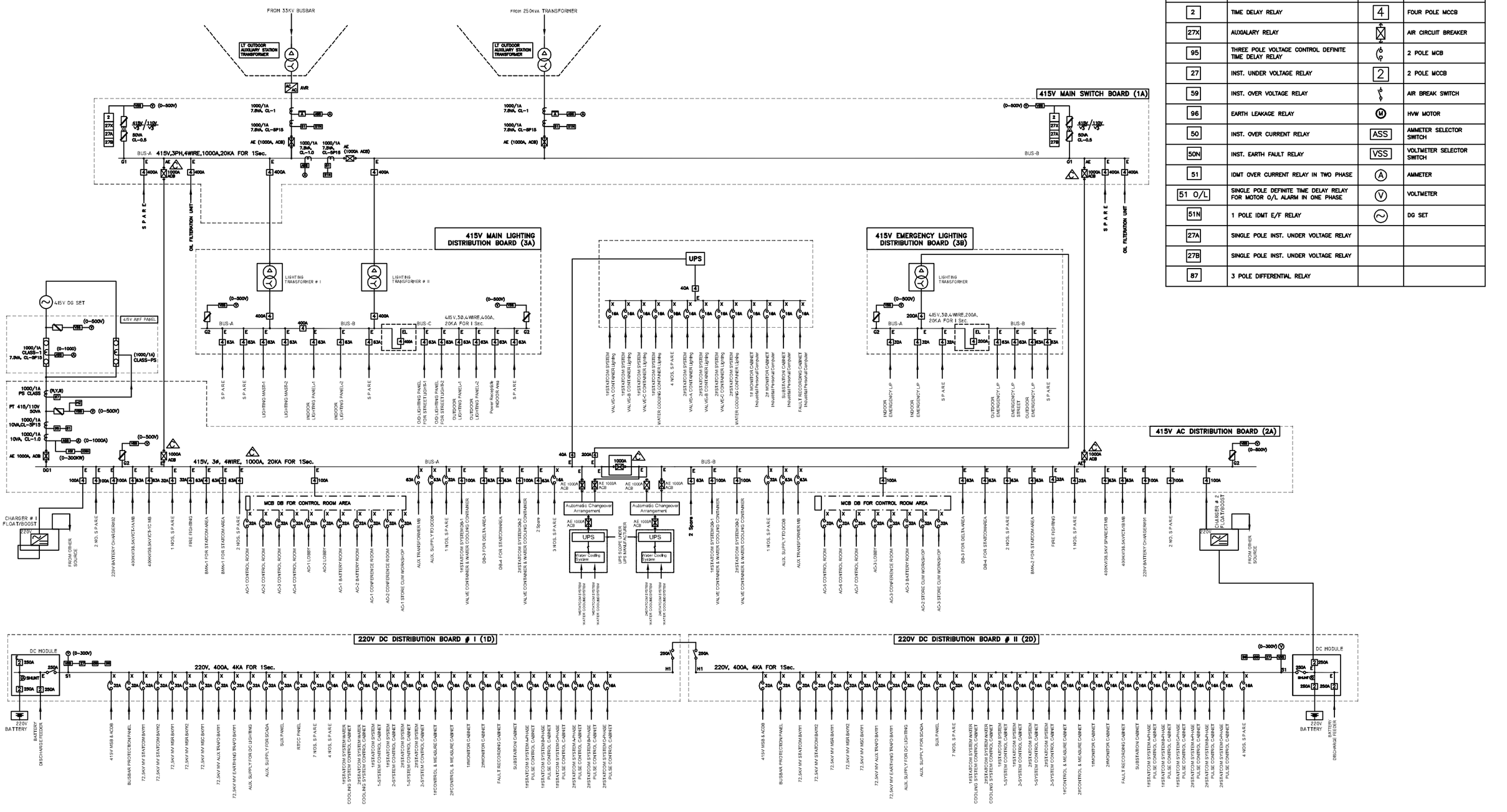
FOR TENDER PURPOSE ONLY

REC Transmission Project Company Limited

PROJECT :
2X50MVA,220/33KV NAGROTA GRID STATION(DISTRICT JAMMU)

TITLE : **SINGLE LINE DIAGRAM**

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
2	TIME DELAY RELAY	4	FOUR POLE MCCB
27X	AUXIALARY RELAY		AIR CIRCUIT BREAKER
95	THREE POLE VOLTAGE CONTROL DEFINITE TIME DELAY RELAY		2 POLE MCB
27	INST. UNDER VOLTAGE RELAY	2	2 POLE MCCB
59	INST. OVER VOLTAGE RELAY		AIR BREAK SWITCH
96	EARTH LEAKAGE RELAY	M	HVW MOTOR
50	INST. OVER CURRENT RELAY	ASS	AMMETER SELECTOR SWITCH
50N	INST. EARTH FAULT RELAY	VSS	VOLTMETER SELECTOR SWITCH
51	IDMT OVER CURRENT RELAY IN TWO PHASE	A	AMMETER
51 O/L	SINGLE POLE DEFINITE TIME DELAY RELAY FOR MOTOR O/L ALARM IN ONE PHASE	V	VOLTMETER
51N	1 POLE IDMT E/F RELAY		DG SET
27A	SINGLE POLE INST. UNDER VOLTAGE RELAY		
27B	SINGLE POLE INST. UNDER VOLTAGE RELAY		
87	3 POLE DIFFERENTIAL RELAY		



NOTES:

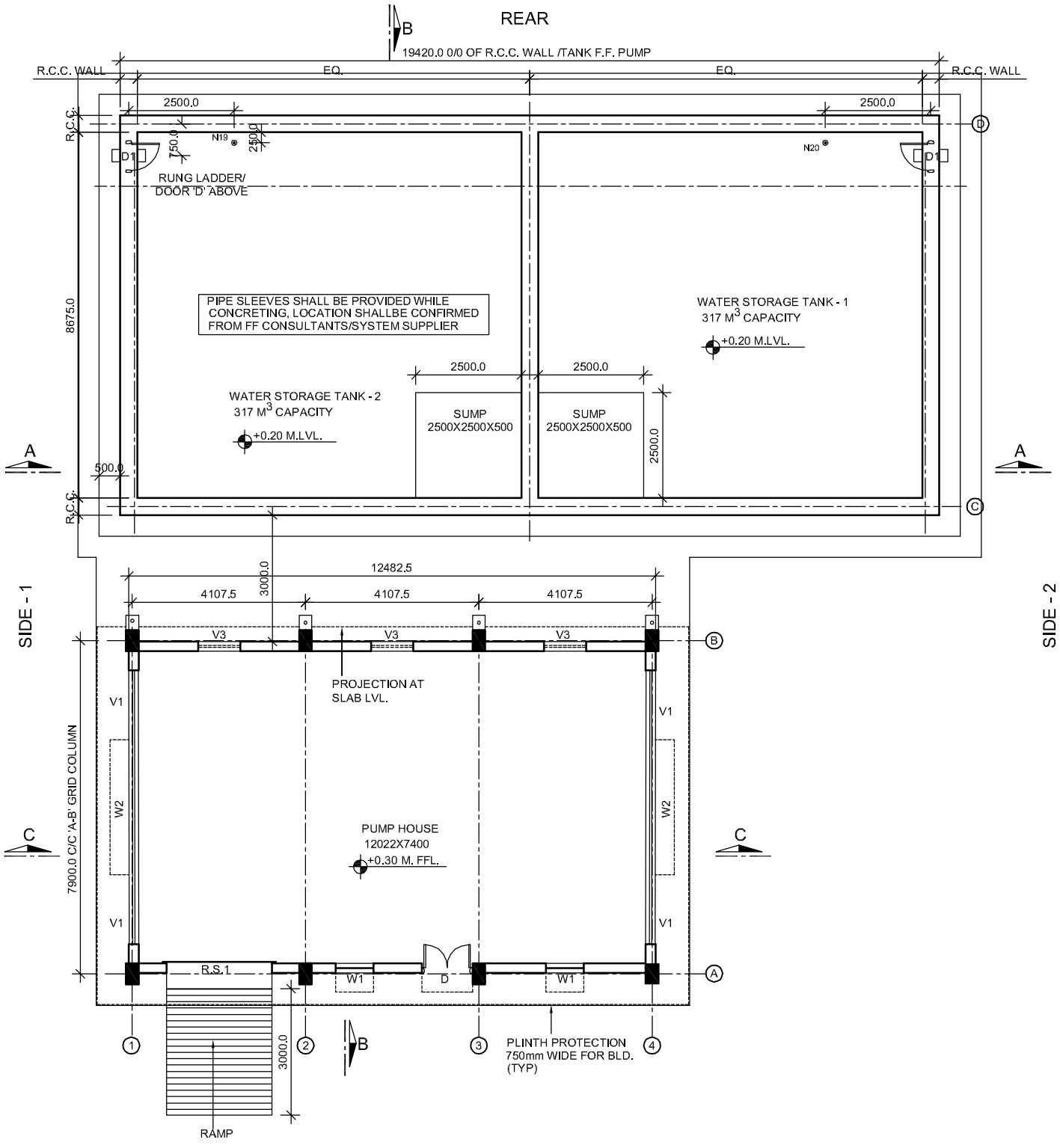
1. THIS DRG. SHALL BE READ IN CONJUNCTION WITH PGCIL TECHNICAL SPECIFICATION LT SWITCHGEAR REV.–05
2. NO TWO AC SOURCE SHALL BE PARALLED AT ANY STAGE.
3. DG SET SHALL BE AUTO START TYPE.
4. LIGHTING TRANSFORMERS WILL BE IN RESPECTIVE BOARDS, DEGREE OF PROTECTION FOR THIS MODULE SHALL BE ATLEAST IP: 31.
5. EACH TRAFO. MB SHALL BE FED BY ATLEAST ONE SOURCE FROM 415V ACDB. SECOND SOURCE SHALL BE LOOPED FROM NEAREST TRAFO. MB WHICH SHALL BE FED FROM ANOTHER SOURCE FROM 415V ACDB.
6. AS PER CLAUSE NO: 1.26.3.1 OF LT SWITCHGEAR THAT DC BUSBAR SHORT CIRCUIT CURRENT RATING SHOULD BE 4 KA FOR 1 SEC.

For Tender Purpose only

REC TRANSMISSION PROJECTS PVT. LTD.

PROJECT : **2x50 MVA, 220/33 KV Nagrota Substation**

TITLE : **LT SWITCHGEAR SLD**



FRONT

GROUND FLOOR PLAN FOR FFPH

For Tender Purpose Only

REC TRANSMISSION PROJECTS PVT. LTD

PROJECT : 2x50 MVA, 220/33 KV Nagrota Substation

TITLE : **GROUND FLOOR PLAN FOR FIRE WATER PUMP HOUSE & WATER TANK**

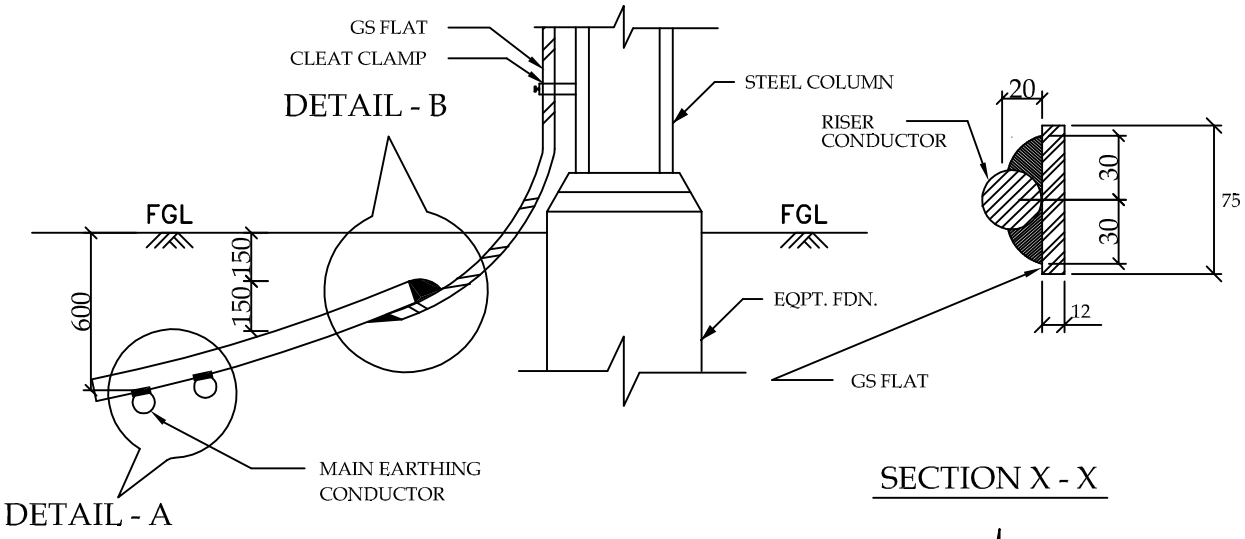
GENERAL INSTRUCTION FOR EARTHING:

1. Location of earthing conductors / risers shown in the earthing drawing may change to suit the site condition.
2. Two different risers of one structure/equipment shall be connected to different conductors of main earthmat.
3. Earthing conductor around the building shall be burried at a minimum distance of 1500 mm from the outer boundary of the building.
4. Minimum distance of 6000 mm shall be maintained between two treated (pipe) electrode.
5. For surge arrester, earthing lead from surge counter to to main earthmat shall be shortest in length as pratically as possible. Earthing lead from surge arrester shall not be passed through any pipe.
6. No welding is allowed in the over ground earthing leads/risers if the length is less than 6m .

For Tender Purpose only

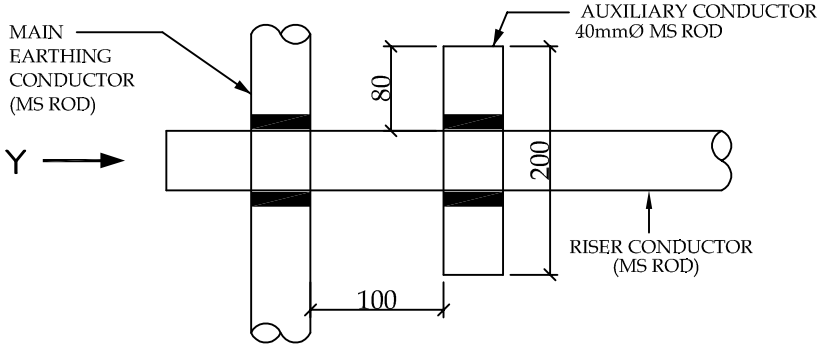
PROJECT :- **2x50 MVA, 220/33 KV Nagrota substation**

TITLE:- STANDARD EARTHING DETAILS

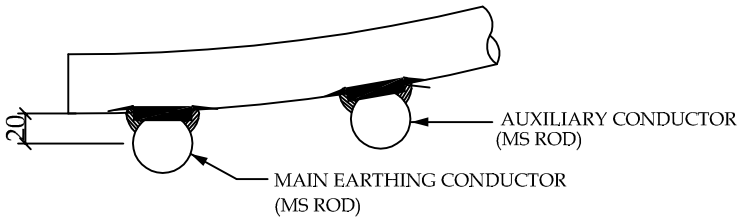


SECTION X - X

TYPICAL DETAILS OF RISER

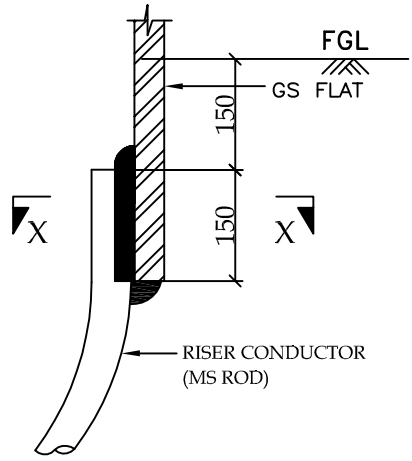


PLAN



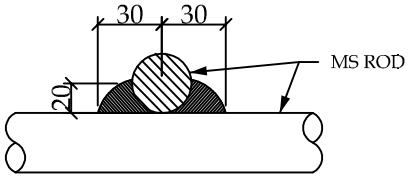
ELEVATION

DETAIL - A



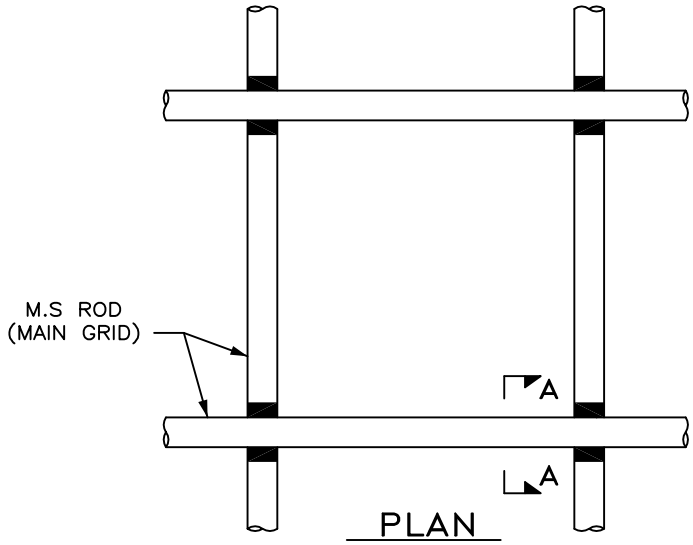
ELEVATION

DETAIL - B

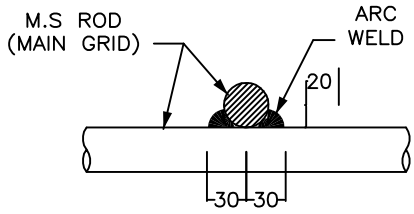


VIEW - Y

For tender purpose only			
PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**			
TITLE:- STANDARD EARTHING DETAILS			
CKD BY	PRPD BY	Date	

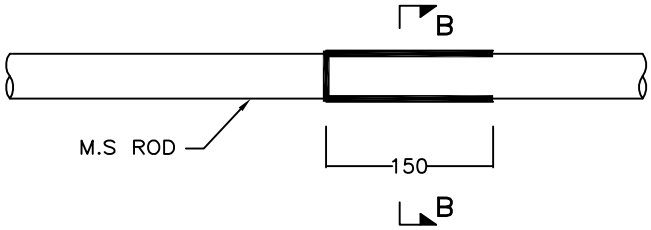


PLAN



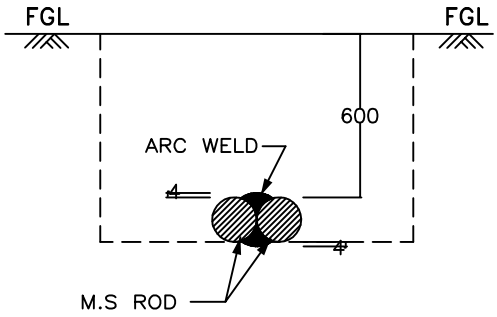
SECTION A – A

DETAIL OF CROSS JOINT

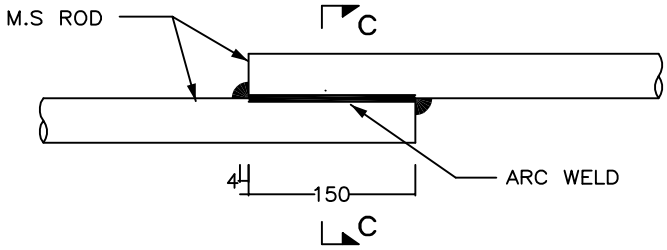


ELEVATION

(CONDUCTORS KEPT ON SIDES)

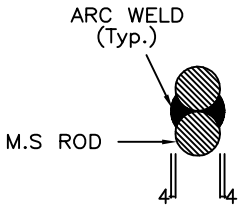


SECTION B – B



ELEVATION

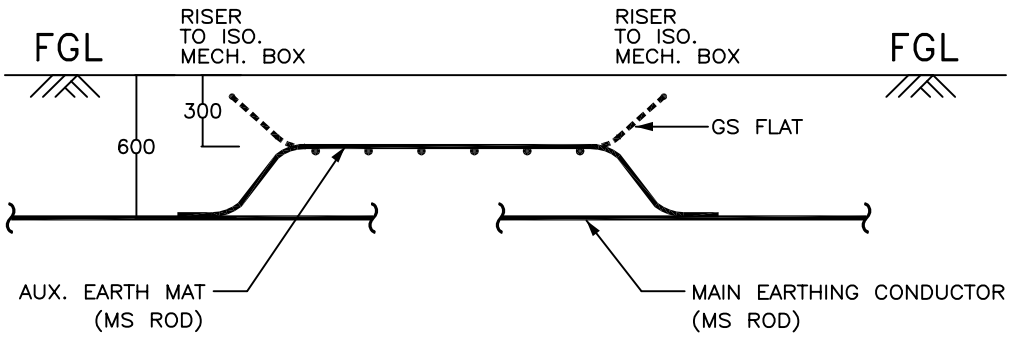
(CONDUCTORS ONE ABOVE THE OTHER)



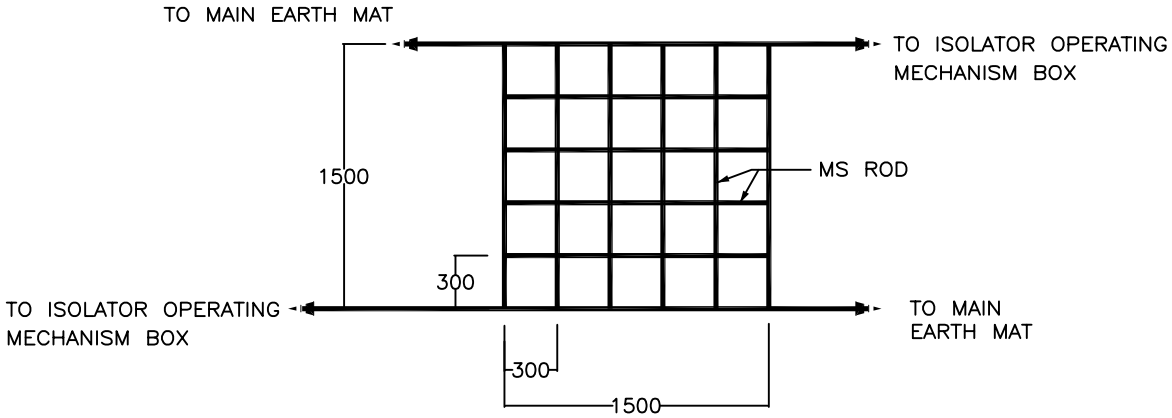
SECTION C – C

DETAIL OF LAP JOINT

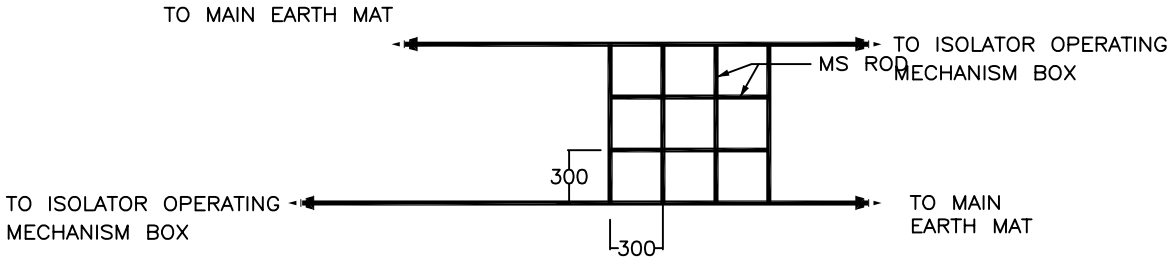
For Tender Purpose only			
PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**			
TITLE:- STANDARD EARTHING DETAILS			
CKD BY	PRPD BY	Date	



ELEVATION



PLAN (For 220kV & above class isolators)



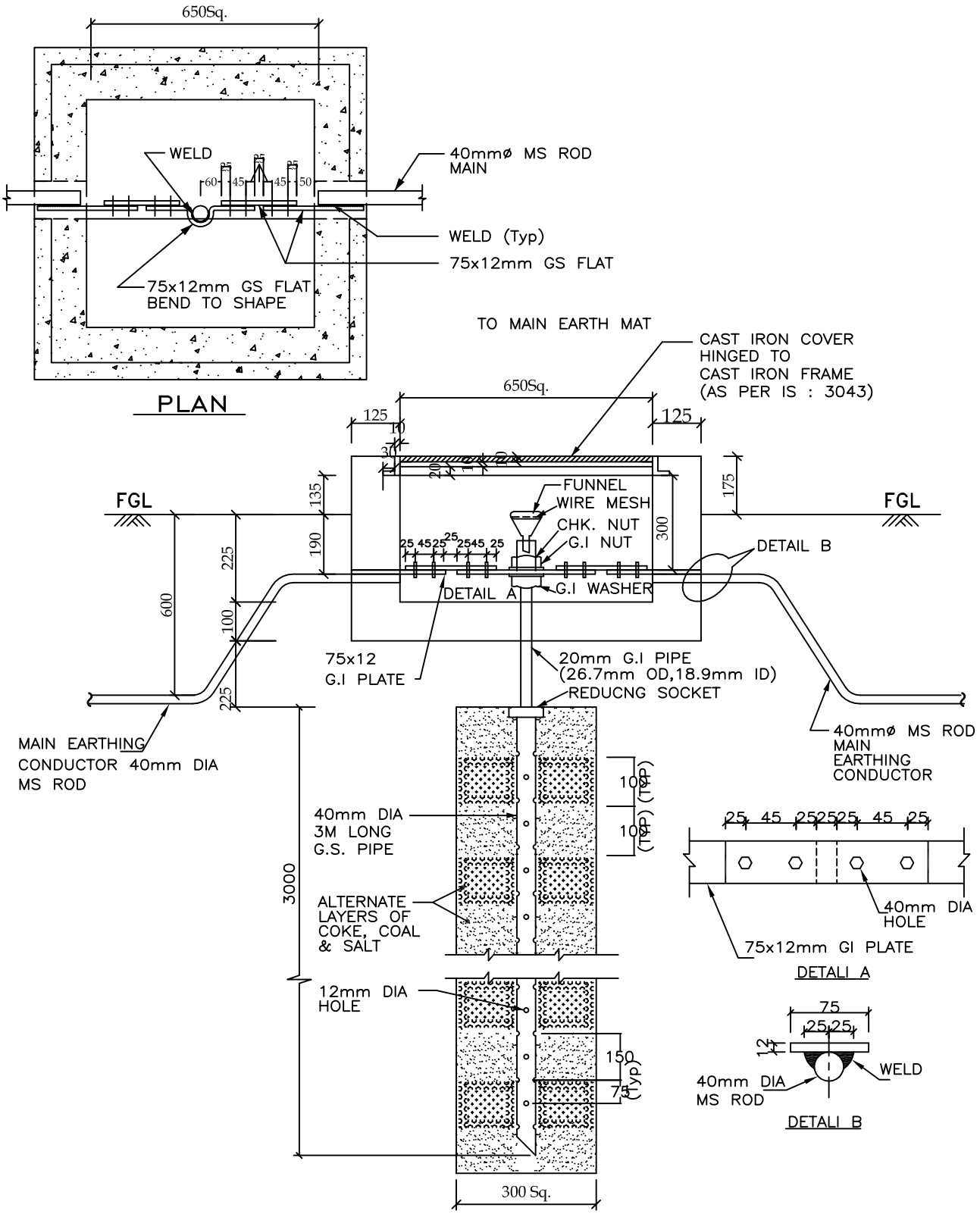
PLAN (For 132kV & below class isolators)

For tender purpose only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	



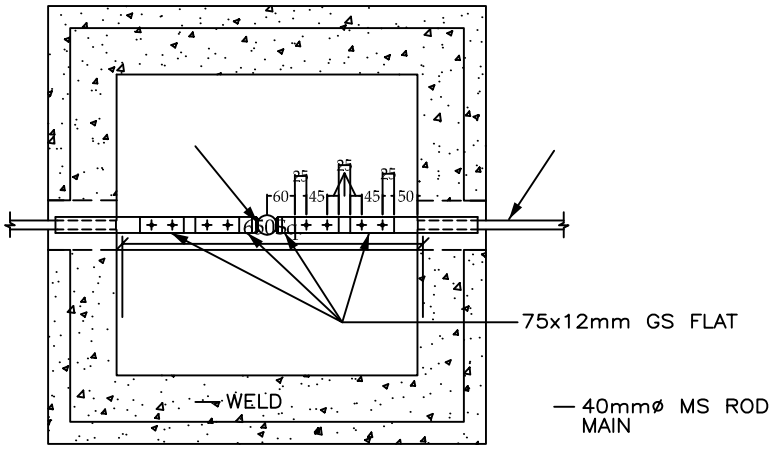
For Tender Purpose Only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

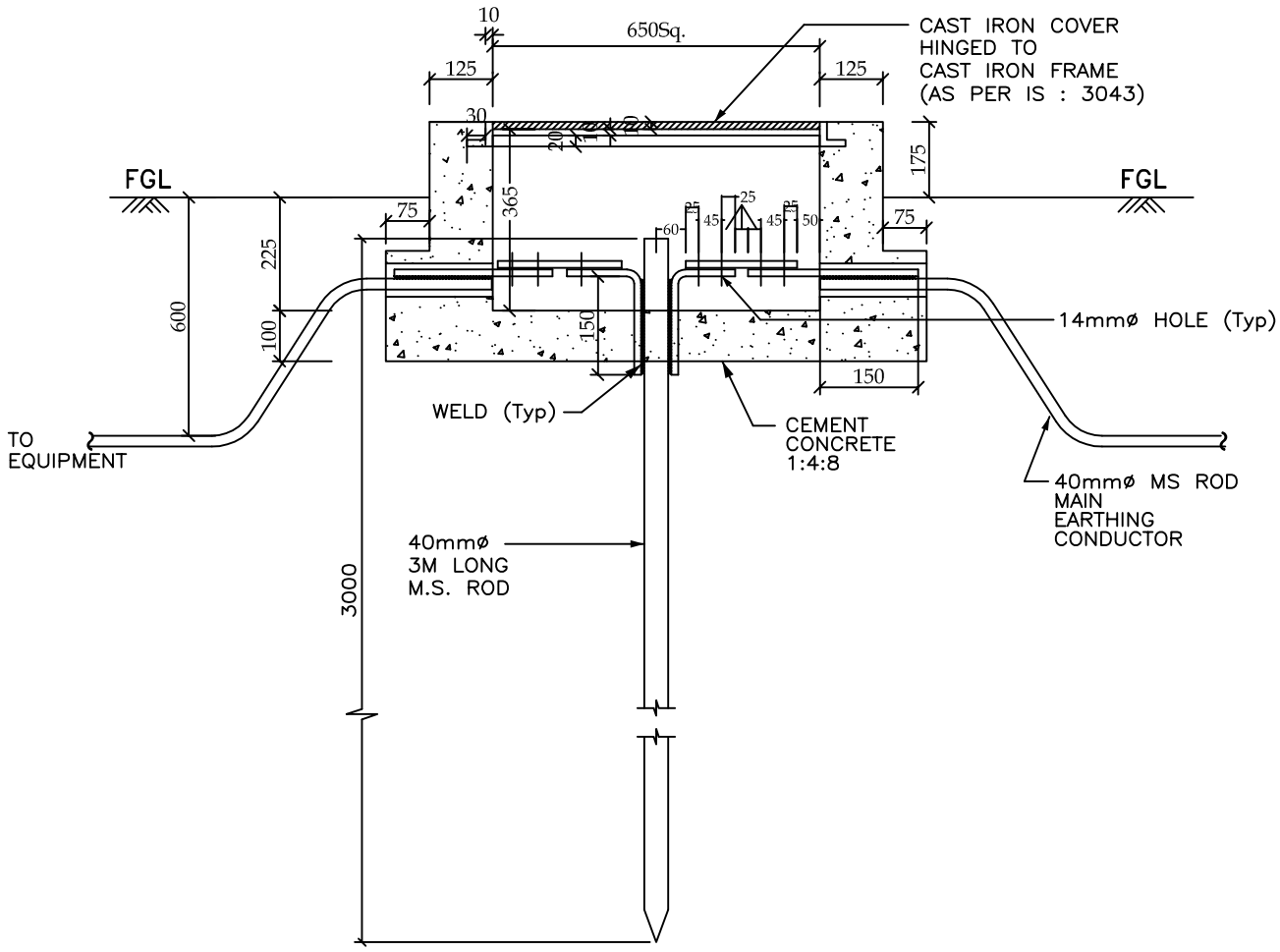
TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

ROD ELECTRODE WITH TEST LINK FOR LM, TOWER WITH PEAK, CVT, LA



PLAN



ELEVATION

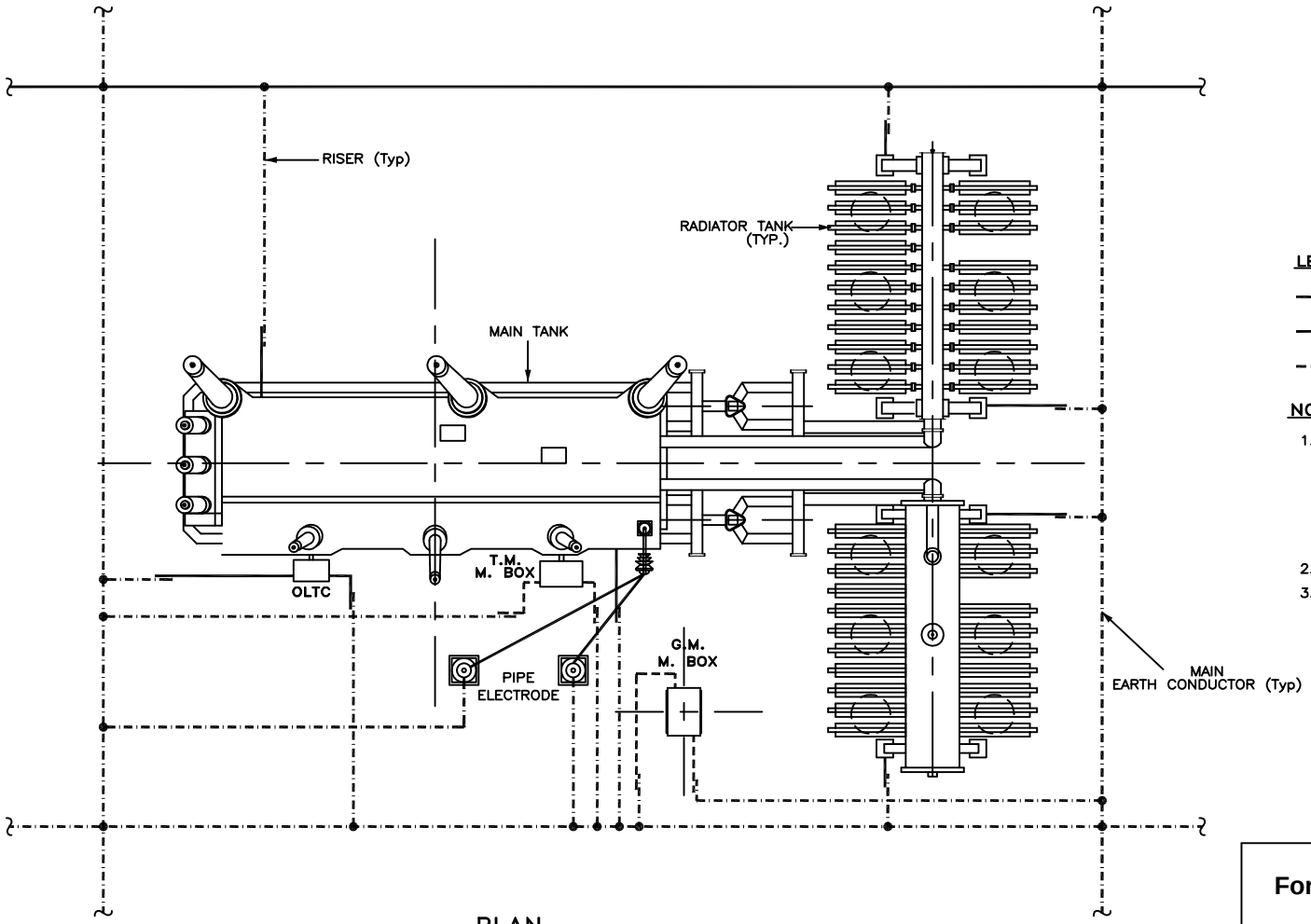
For Tender Purpose only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF TRANSFORMER/ REACTOR



PLAN

LEGEND

- 40mmø MS ROD
- 75 x 12 mm GS FLAT
- 50 x 6 mm GS FLAT

NOTES :-

1. No. OF RISERS :-

MAIN TANK	–	2 Nos.
RADIATOR TANK	–	4 Nos.
OLTC	–	2 Nos. (ICT only)
M. BOX	–	2 Nos./M. BOX
NEUTRAL EARTH ELECTRODE	–	2 Nos.

2. No. OF PIPE ELECTRODE REQUIRED = 2 Nos.
3. PYLON SUPPORTS SHALL BE EARTHED TO THE MAIN EARTHING CONDUCTOR BY GS FLAT.

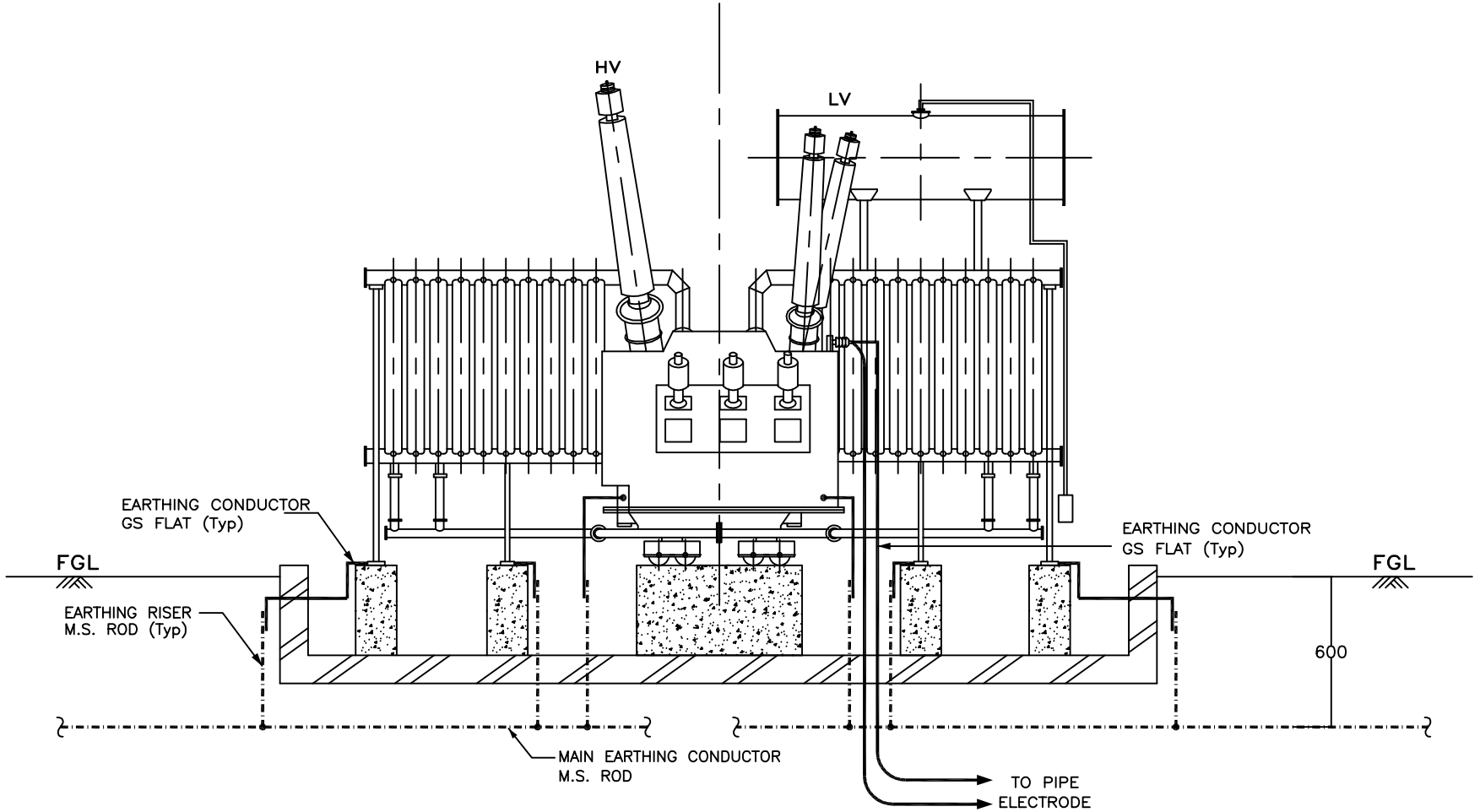
For tender Purpose only

PROJECT :- **2 x 50 MVA, 220/33 KV Nagrota Substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF TRANSFORMER/ REACTOR



LEGEND

- 40mmø MS ROD
- 75 x 12 mm GS FLAT
- 50 x 6 mm GS FLAT

END VIEW

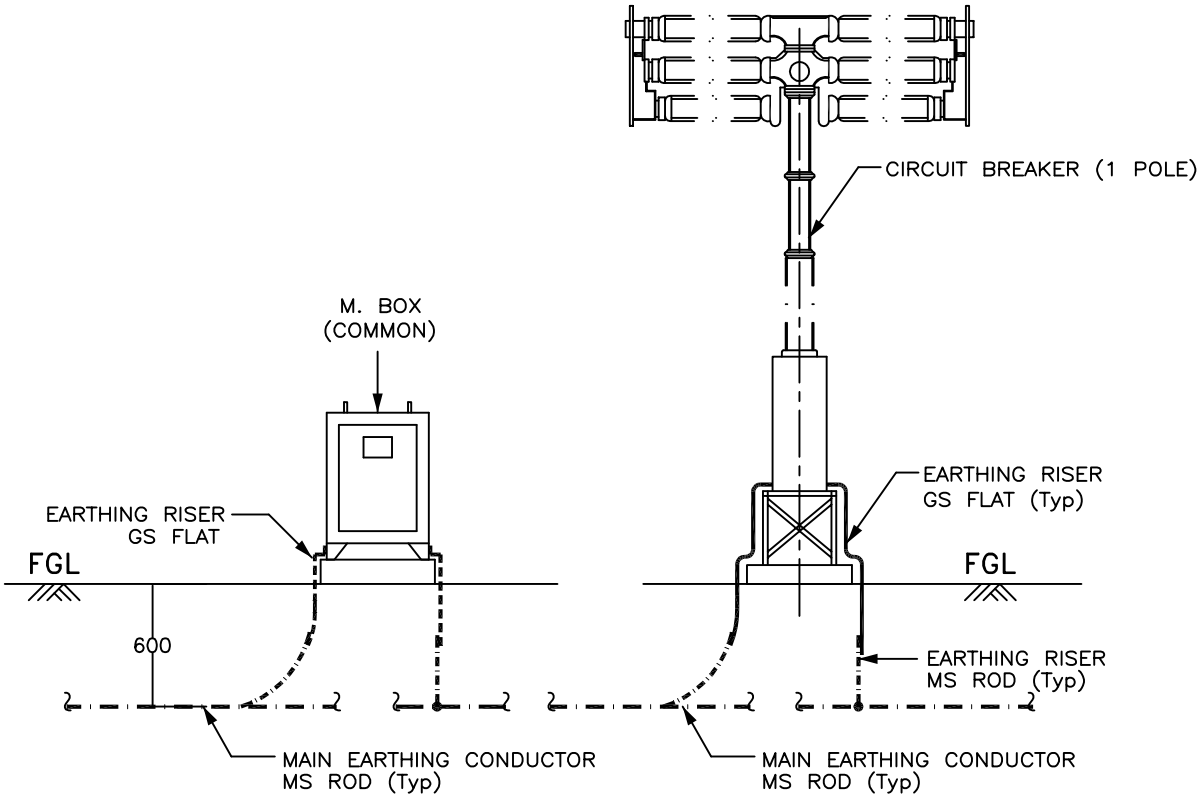
For Tender Purpose only

PROJECT :- 2x50 MVA, 220/33 KV Nagrota Substation

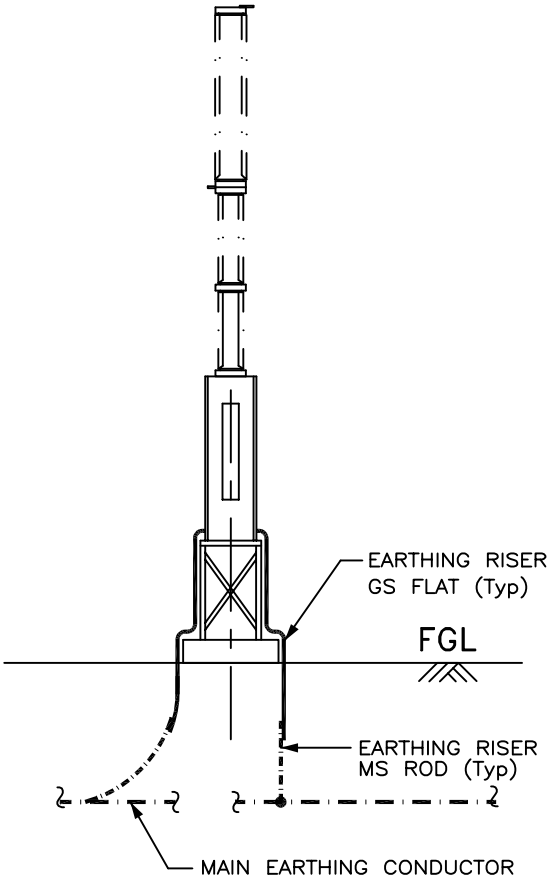
TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF CIRCUIT BREAKER



ELEVATION



NOTES :–

1. No. OF RISERS FOR CIRCUIT BREAKER = 2 Nos. / PHASE
1. No. OF RISERS FOR LADDER (IF Applicable) = 2 Nos.
2. No. OF RISERS FOR MAR. BOX = 2 Nos.
3. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

LEGEND

- 40mmø MS ROD
- 75 x 12 mm GS FLAT
- 50 x 6 mm GS FLAT

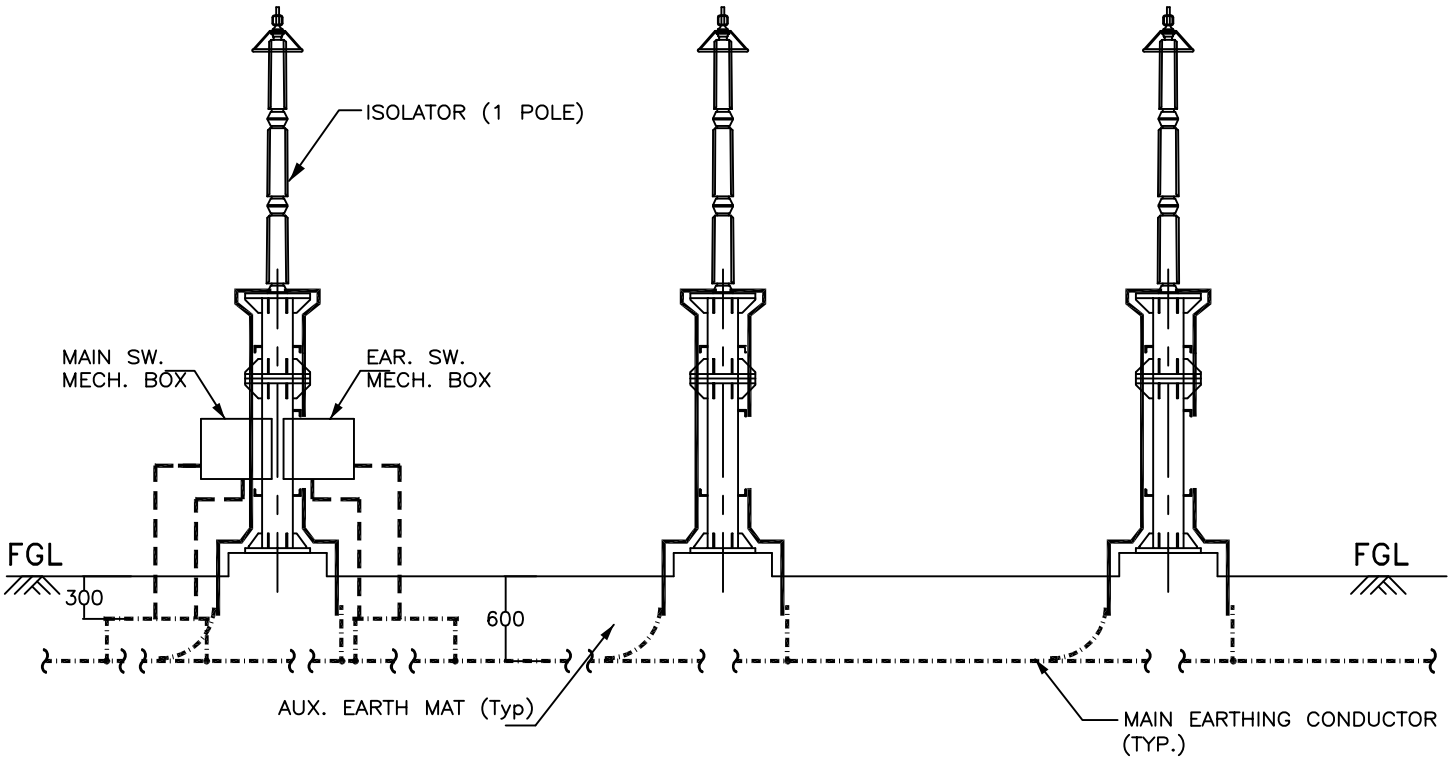
For tender Purpose only

PROJECT :- 2x50 MVA, 220/33 KV nagrota substation

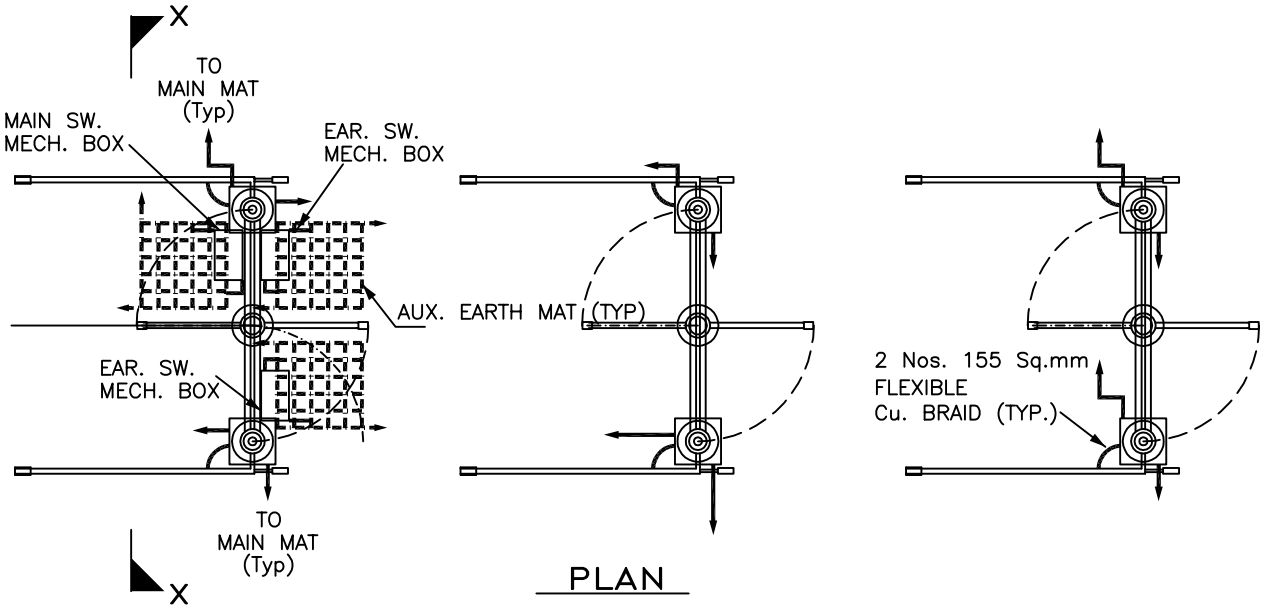
TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF ISOLATOR



ELEVATION



PLAN

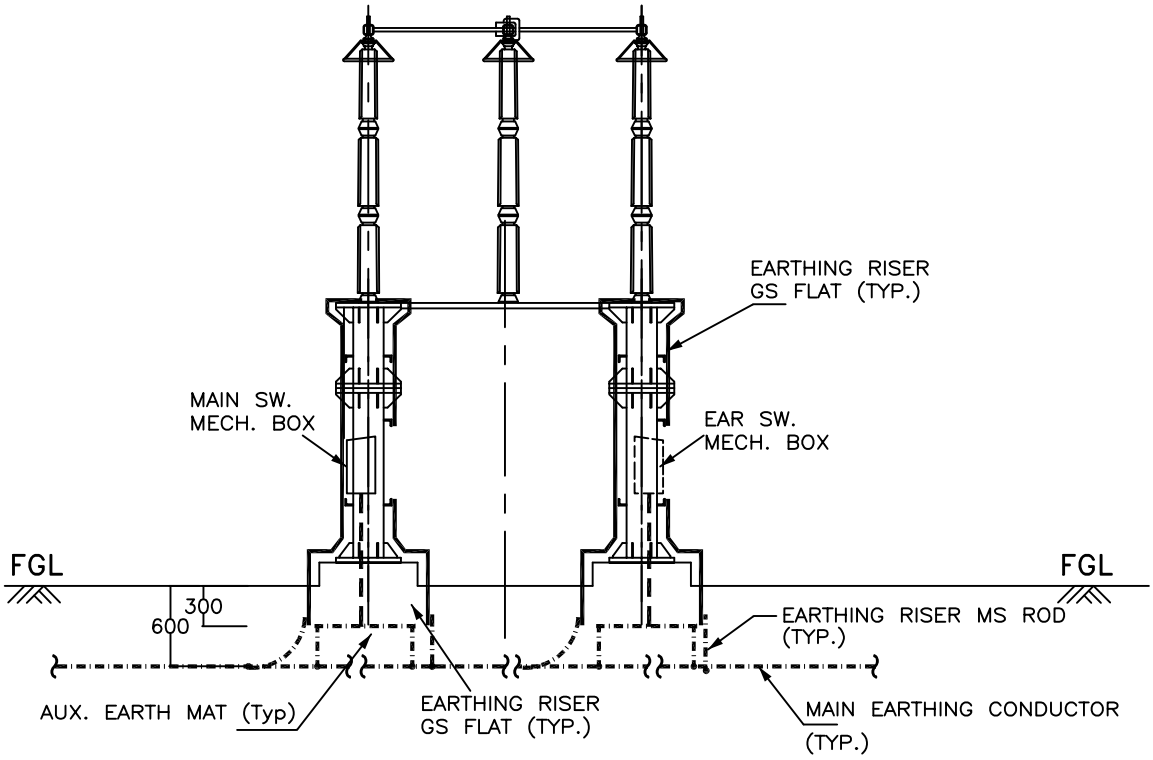
For tender Purpose only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF ISOLATOR (1 PH)



VIEW – X X

LEGEND

—— · —— · ——	40mmø MS ROD
————————	75 x 12 mm GS FLAT
- - - - - - - - - - - - - - - -	50 x 6 mm GS FLAT

NOTES :–

1. No. OF RISERS FOR ISOLATOR = 4 Nos. / PHASE.
2. No. OF RISERS FOR MAIN MECH. BOX = 2 Nos.
3. No. OF RISERS FOR EARTH SW. MECH. BOX = 2 Nos. / BOX.
4. No. OF AUXILIARY EARTH MAT = 1 Nos. FOR EACH MB
5. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.
6. NO. OF AUX. EARTHMAT IS INDICATIVE ONLY. IT SHALL BE EXECUTED AS PER ACTUAL NUMBER/POSITION OF EARTH SWITCHES.

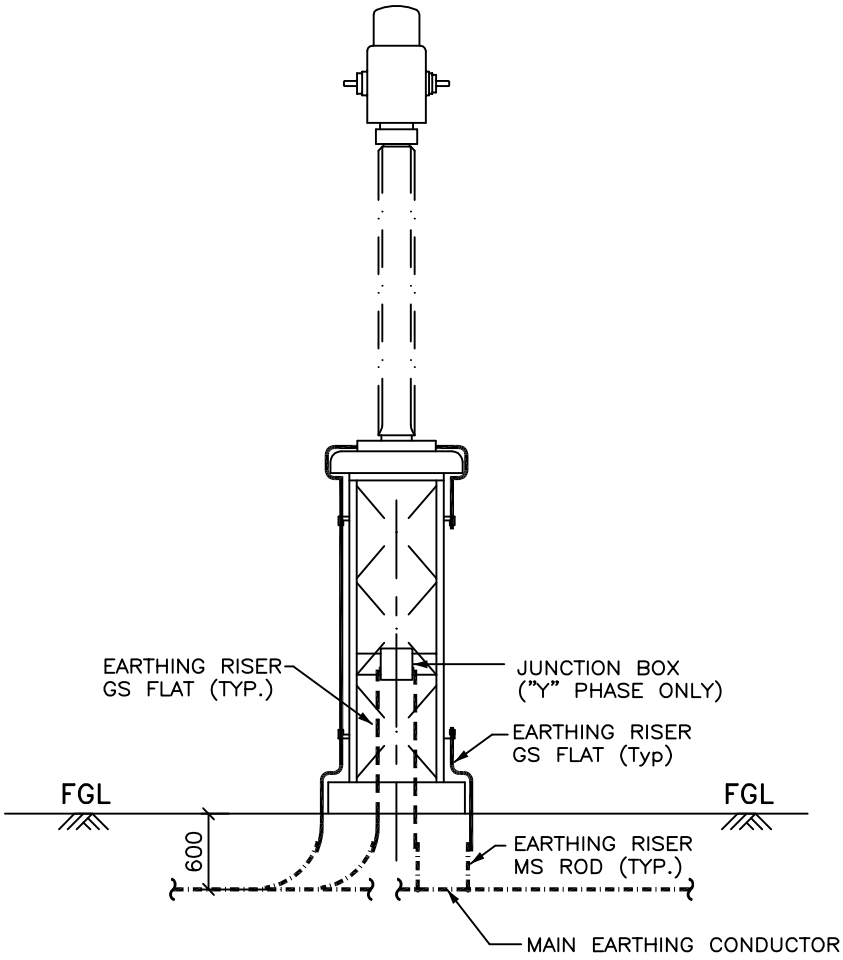
For Tender Purpose only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF CURRENT TRANSFORMER (1 PH)



ELEVATION

LEGEND

40mmø MS ROD

75 x 12 mm GS FLAT

50 x 6 mm GS FLAT

NOTES :–

1. No. OF RISERS = 2 Nos. / PHASE.
2. No. OF RISERS FOR JUN. BOX = 2 Nos.
3. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

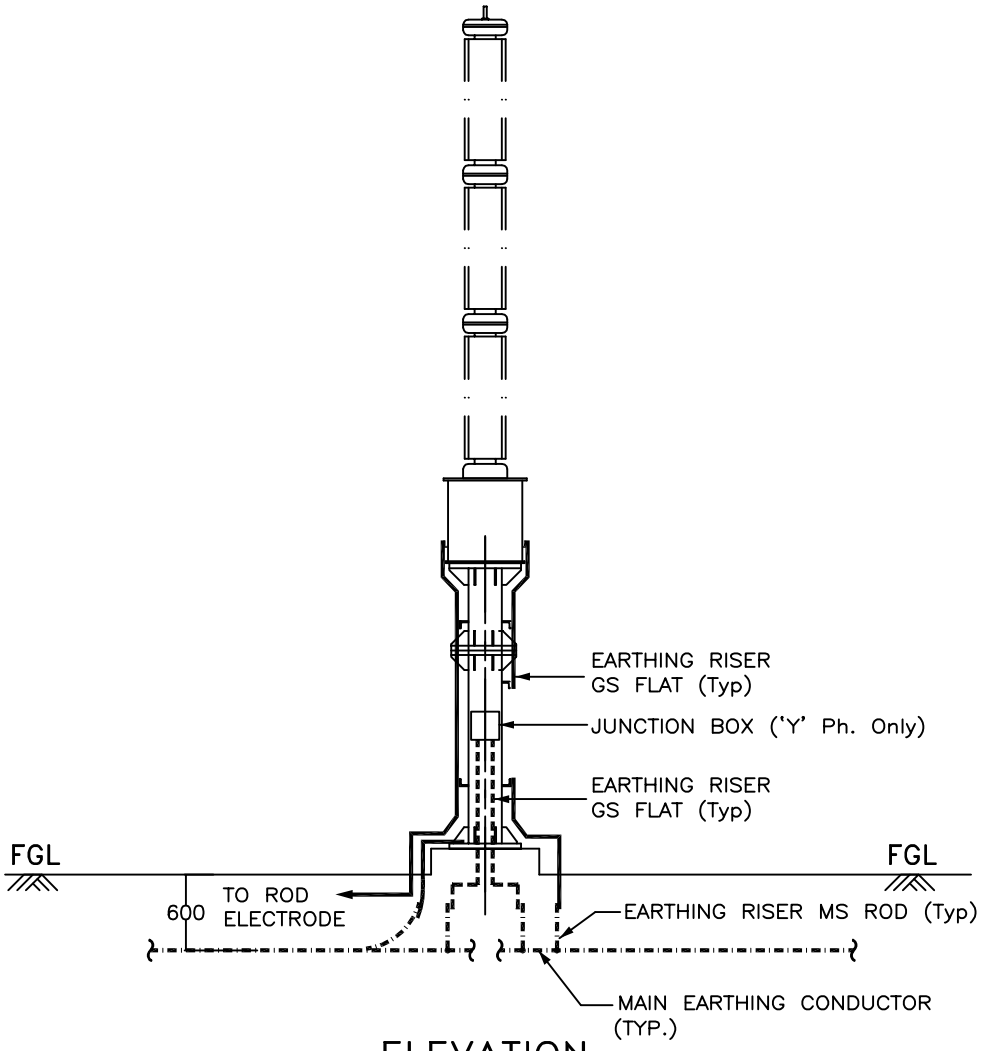
For Tender Purpose only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF CAPACITIVE VOLTAGE TRANSFORMER (1 PH)



ELEVATION

LEGEND

- 40mmø MS ROD
- 75 x 12 mm GS FLAT
- 50 x 6 mm GS FLAT

NOTES :–

1. No. OF RISERS = 3 Nos. / PHASE.
2. No. OF RISERS FOR J. BOX = 2 Nos.
3. No. OF ROD ELECTRODE REQUIRED = 1 No. / PHASE.
4. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

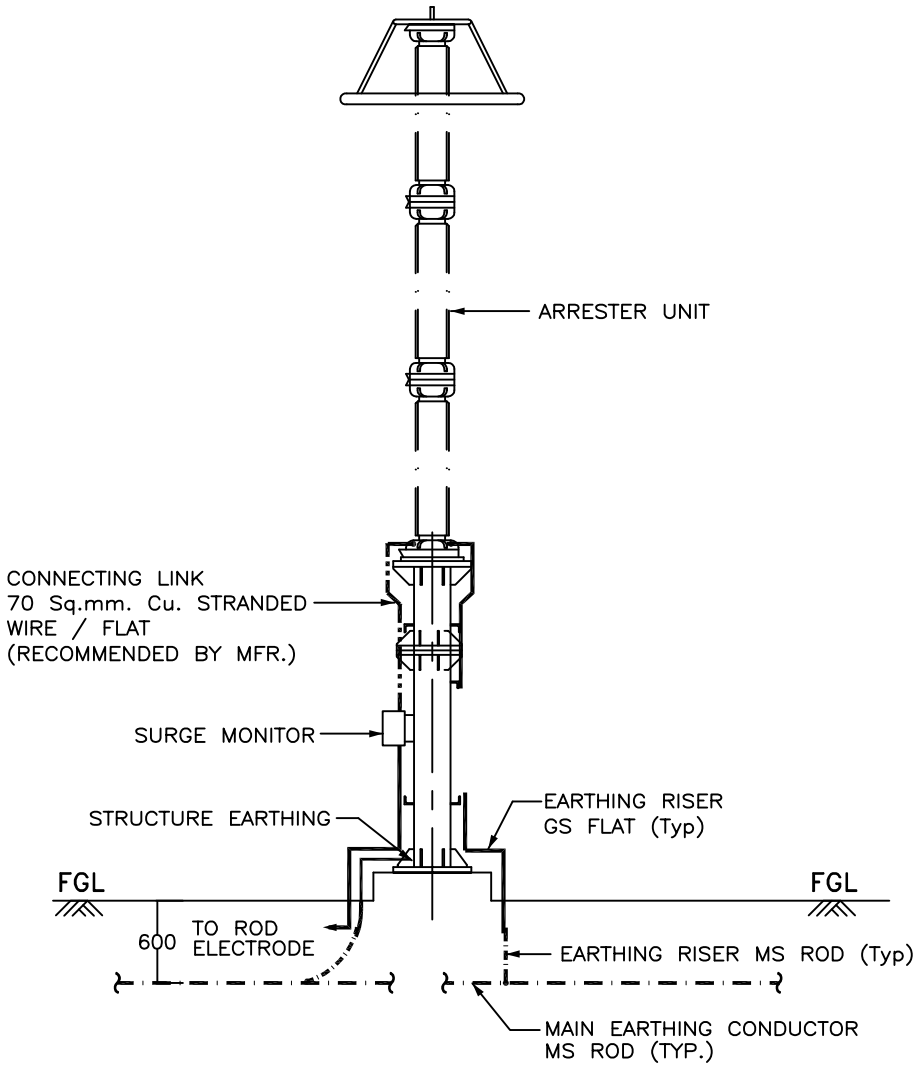
For Tender Purpose only

PROJECT :- **2x50 MVA, 220/33 KV nagrota substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF SURGE ARRESTER (1PH)



ELEVATION

LEGEND

40mmø MS ROD

75 x 12 mm GS FLAT

NOTES :–

1 . No. OF RISERS = 3 Nos. / PHASE.
2 . No. OF ROD ELECTRODE REQUIRED = 1 No. / PHASE.
3 . CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

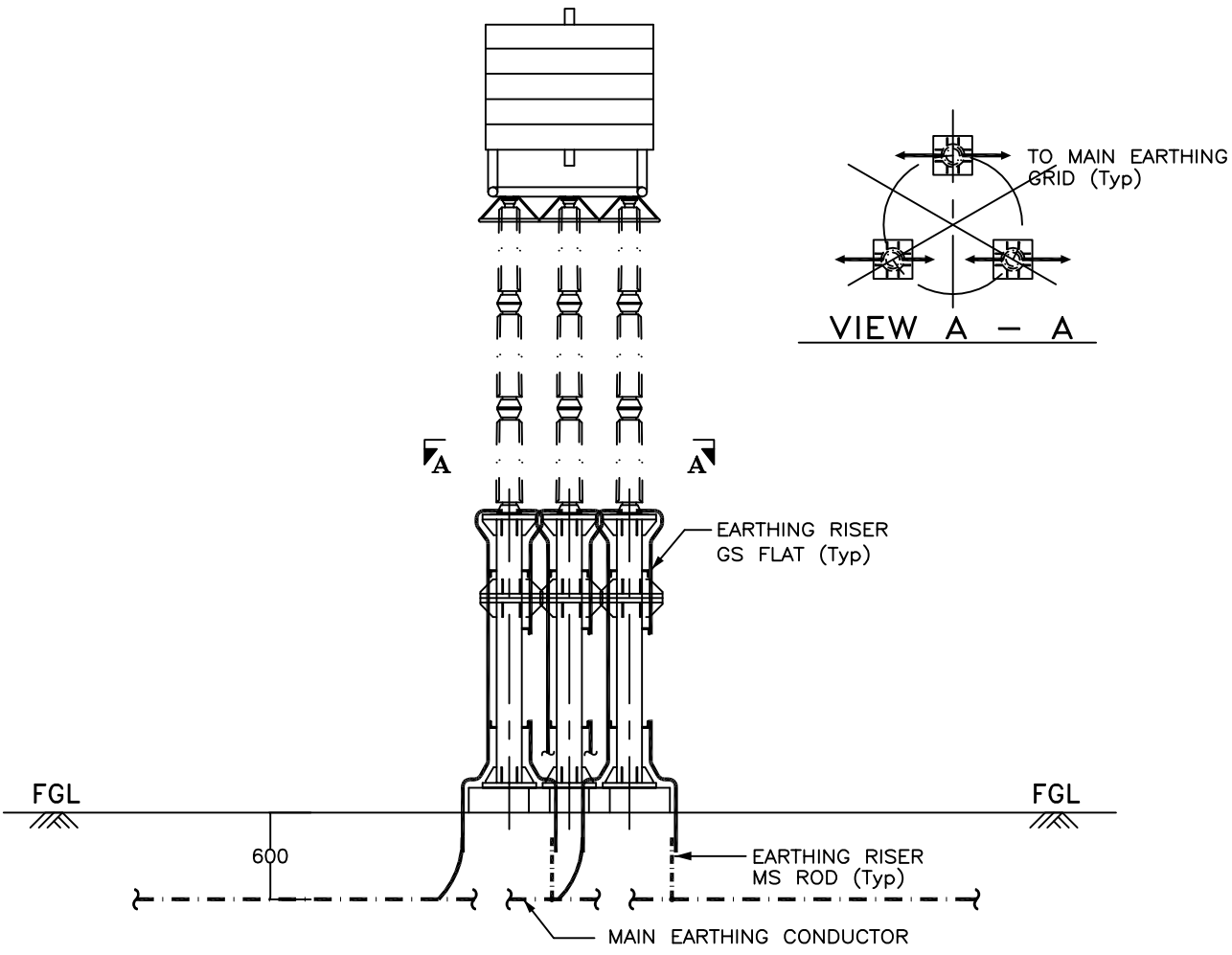
For tender purpose only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substatiuon**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF WAVE TRAP (1PH)



ELEVATION

LEGEND

40mmø MS ROD

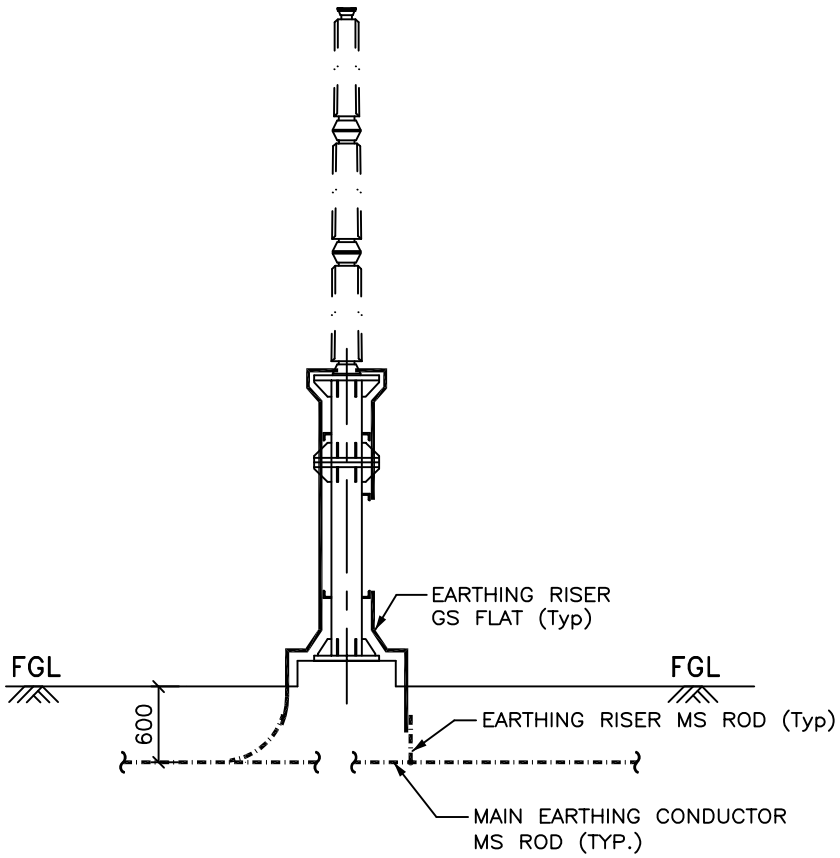
75 x 12 mm GS FLAT

NOTE :–

1. No. OF RISERS = 6 Nos. / PHASE.
2. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

For tender purpose only			
PROJECT :- **2x50 MVA, 220/33 KV nagrota Substation**			
TITLE:- STANDARD EARTHING DETAILS			

EARTHING OF POST INSULATOR (1PH)



ELEVATION

LEGEND

40mmø MS ROD

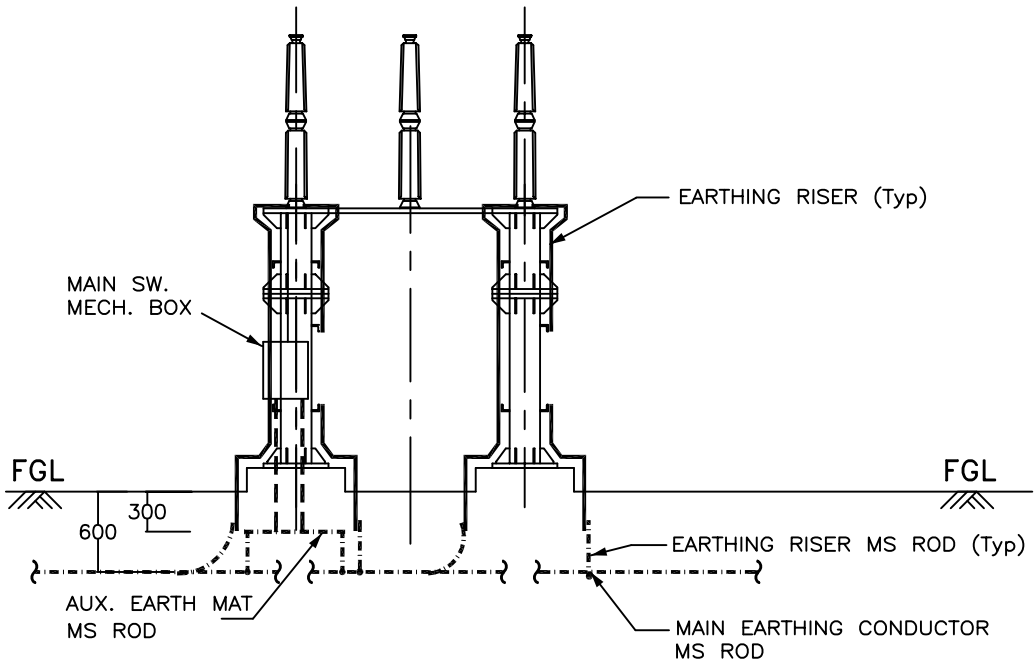
75 x 12 mm GS FLAT

NOTES :–

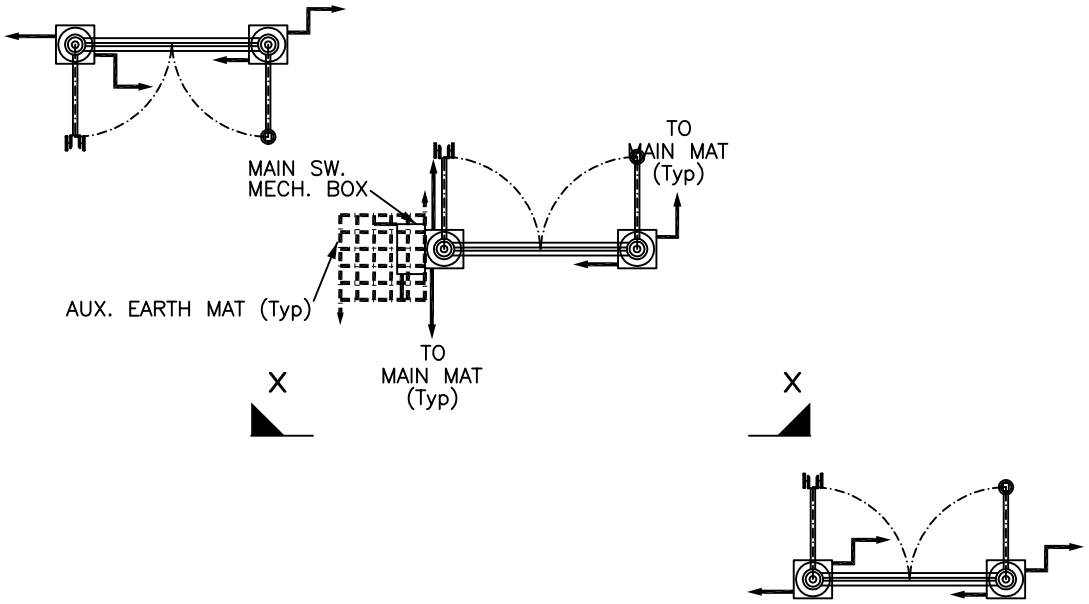
1. No. OF RISERS = 2 Nos. / PHASE.
2. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

For tender Purpose only			
PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**			
TITLE:- STANDARD EARTHING DETAILS			
CKD BY	PRPD BY	Date	

TANDEM ISOLATOR



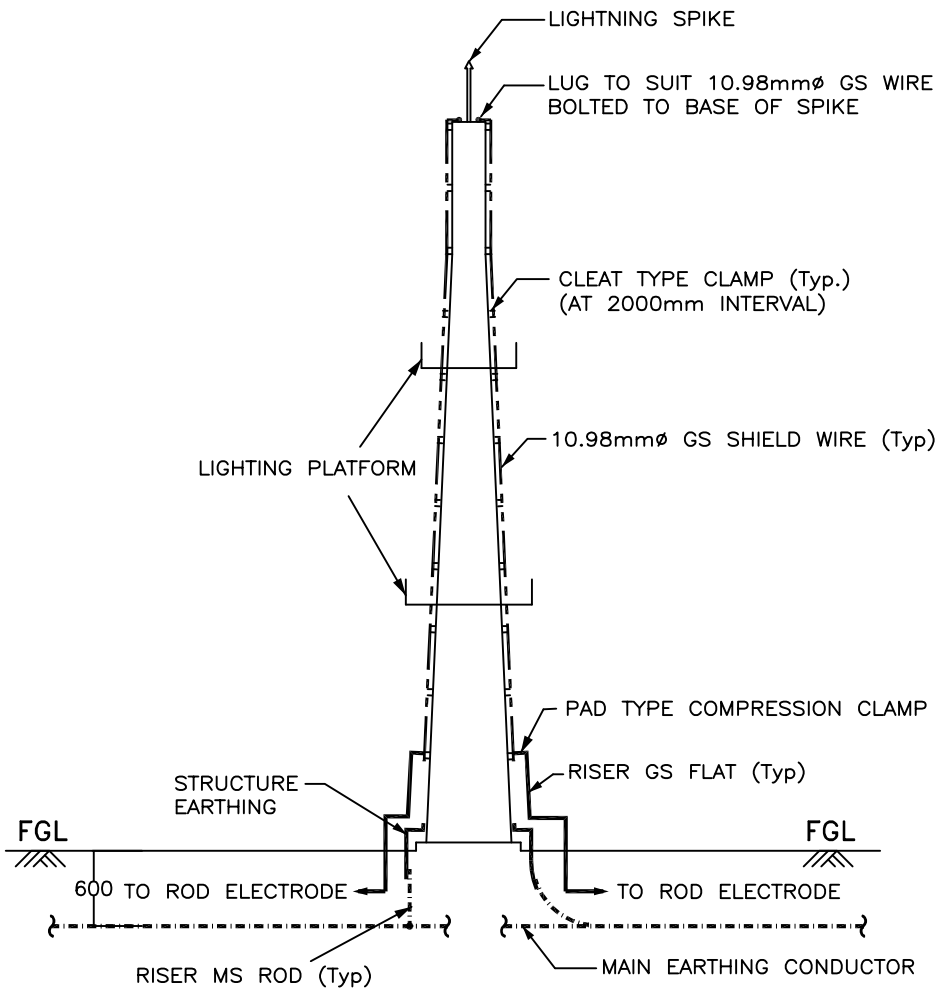
VIEW – X X



PLAN

For tender purpose only			
PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**			
TITLE:- STANDARD EARTHING DETAILS			
CKD BY	PRPD BY	Date	

EARTHING OF LIGHTNING MAST



ELEVATION

NOTES :–

1. No. OF RISERS = 4 Nos.
2. No. OF ROD ELECTRODE REQUIRED = 2 Nos.
3. No. OF PAD TYPE CLAMP = 2 Nos.

LEGEND

40mmø MS ROD

75 x 12 mm GS FLAT

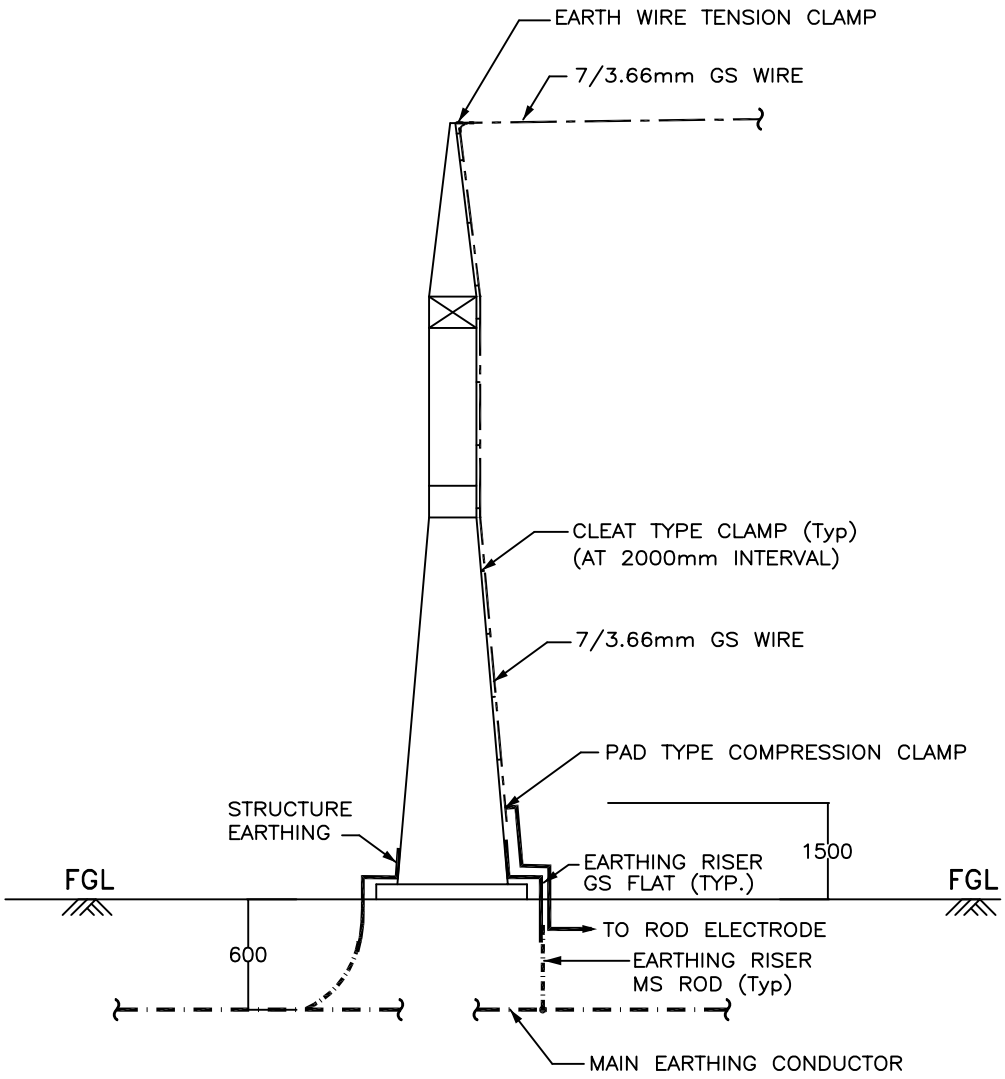
For tender Purpose only

PROJECT :- **2x50 MVA, 220/33 KV nagrota substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF TOWER WITH PEAK



ELEVATION

LEGEND

- 40mmø MS ROD
- 75 x 12 mm GS FLAT

NOTES :–

1. No. OF RISERS = 3 Nos.
2. No. OF ROD ELECTRODE REQUIRED = 1 No.
3. No. OF PAD TYPE CLAMP = 1 No.

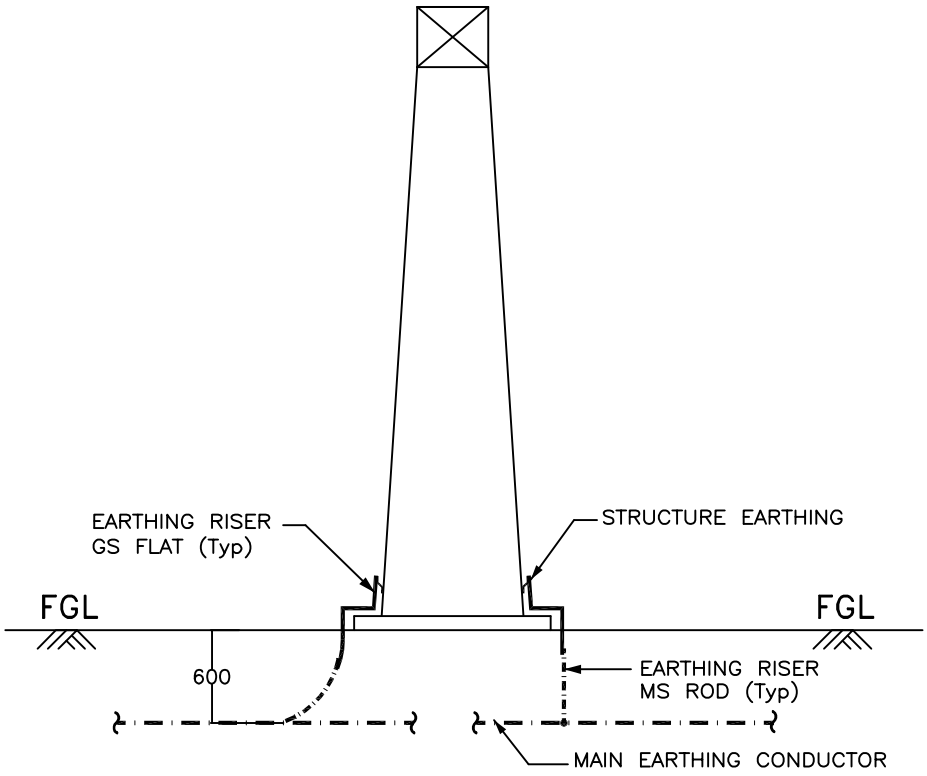
For Tender purpose only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF TOWER WITHOUT PEAK



ELEVATION

LEGEND

40mmø MS ROD

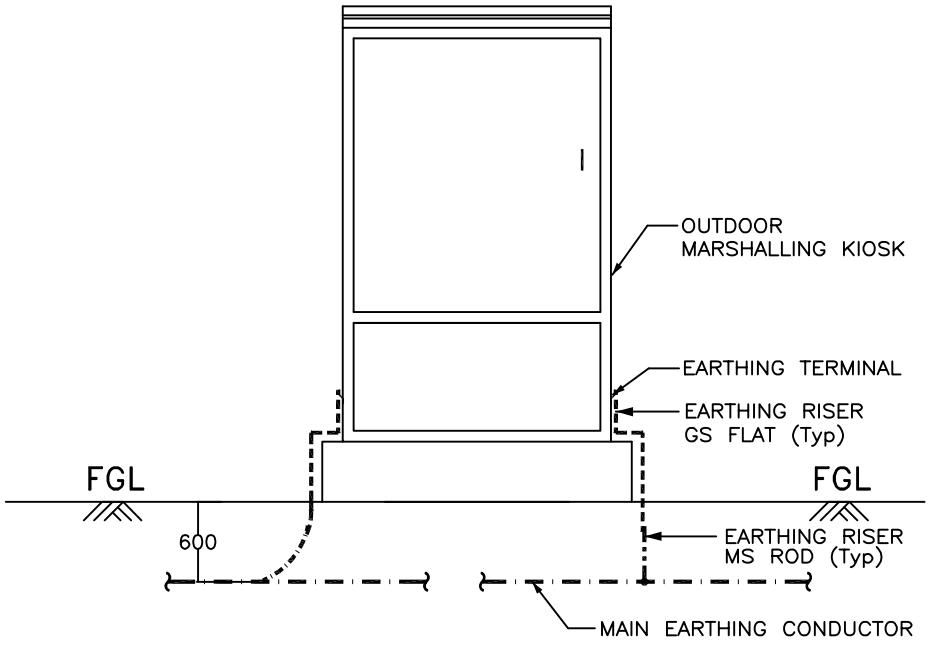
75 x 12 mm GS FLAT

NOTES :–

1. No. OF RISERS = 2 Nos.

For tender purpose only			
PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**			
TITLE:- STANDARD EARTHING DETAILS			
CKD BY	PRPD BY	Date	

EARTHING OF BAY MARSHALLING BOX



ELEVATION

LEGEND

—— · —— · ——	40mmø MS ROD
————————	75 x 12 mm GS FLAT
- - - - - - - - - - - - - - - -	50 x 6 mm GS FLAT

NOTE :–

1. No. OF RISERS = 2 Nos.

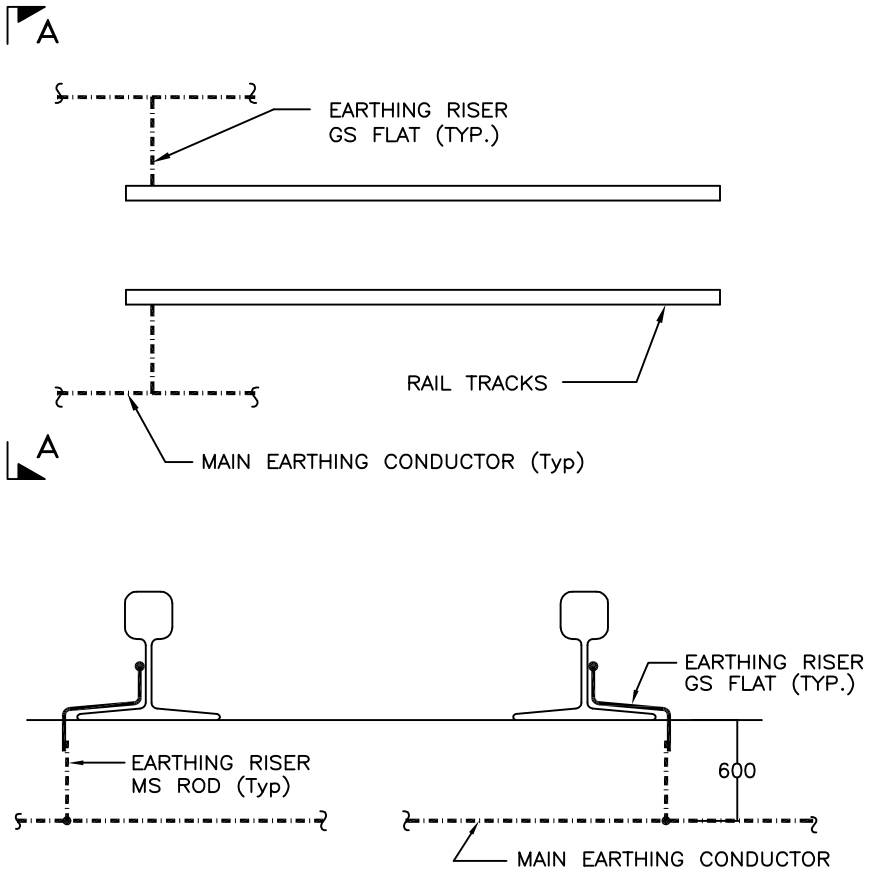
For Tender Purpose Only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF RAIL TRACK



SECTION A – A

LEGEND

40mmø MS ROD

75 x 12 mm GS FLAT

NOTES :–

1. EACH RAIL SHALL BE EARTHED AT 30M INTERVAL AND ALSO AT BOTH ENDS.

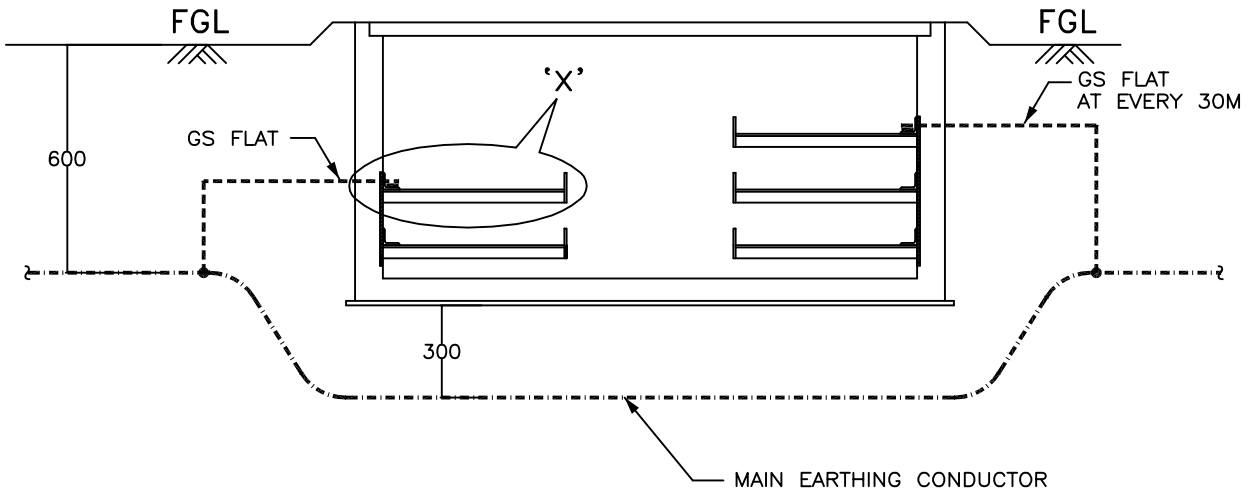
For tender Purpose only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

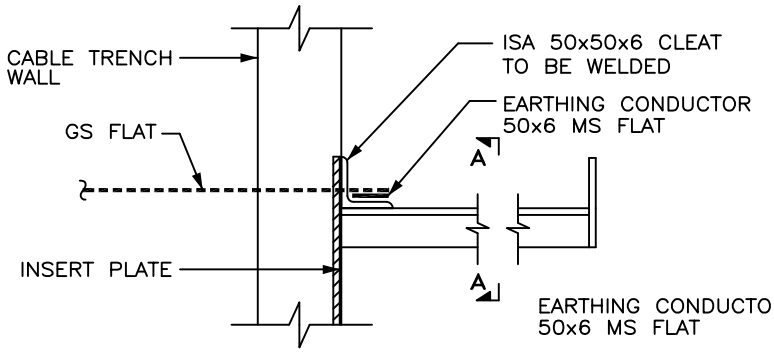
TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

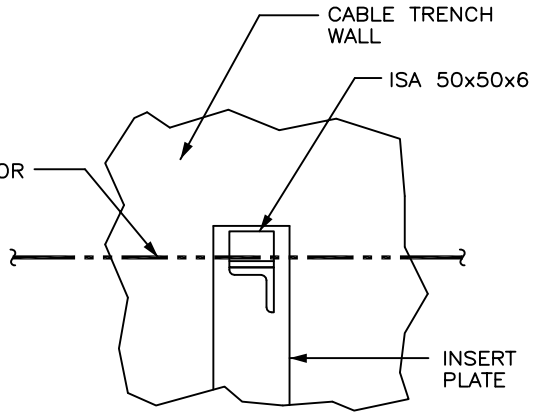
EARTHING OF CABLE TRENCH



TYPICAL CROSS SECTION OF CABLE TRENCH



DETAIL – X



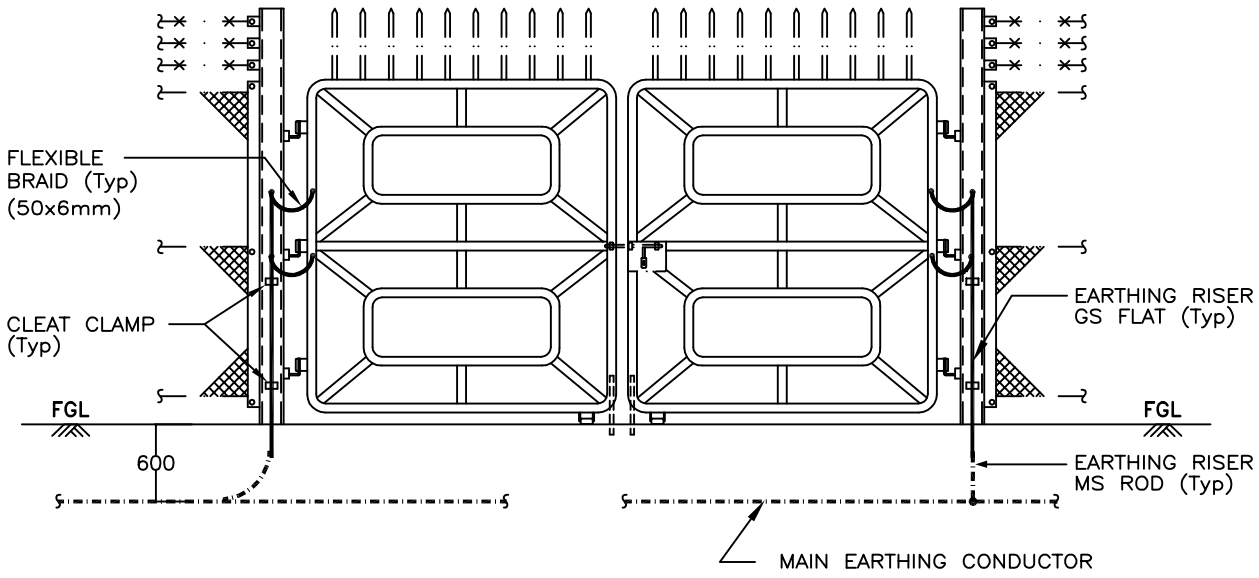
SECTION A – A

NOTES :–

1. MS FLAT SHALL RUN ON TOP TIER ALL ALONG THE CABLE TRENCHES & WELDED TO EACH OF THE RACKS.
2. MS FLAT SHALL BE EARTHED AT 30M INTERVAL AND ALSO AT BOTH ENDS.

For Tender Purpose only			
PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**			
TITLE:- STANDARD EARTHING DETAILS			
CKD BY	PRPD BY	Date	

EARTHING OF GATES



MAIN GATE

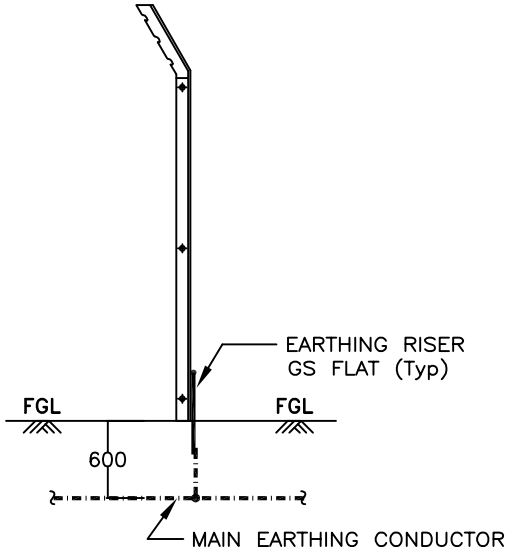
LEGEND

— · — · —	40mmø MS ROD
———	75 x 12 mm GS FLAT
— - - — - - —	50 x 6 mm MS FLAT

NOTES :–

	FENCE POST	MAIN GATE
1 . No. OF RISERS REQUIRED	1	2
2 . No. OF FLEXIBLE BRAID	–	4

3. ALL GATES & EVERY ALTERNATE FENCE SHALL BE CONNECTED TO EARTHING GRID.



FENCE POST
(ALTERNATE FENCE POST)

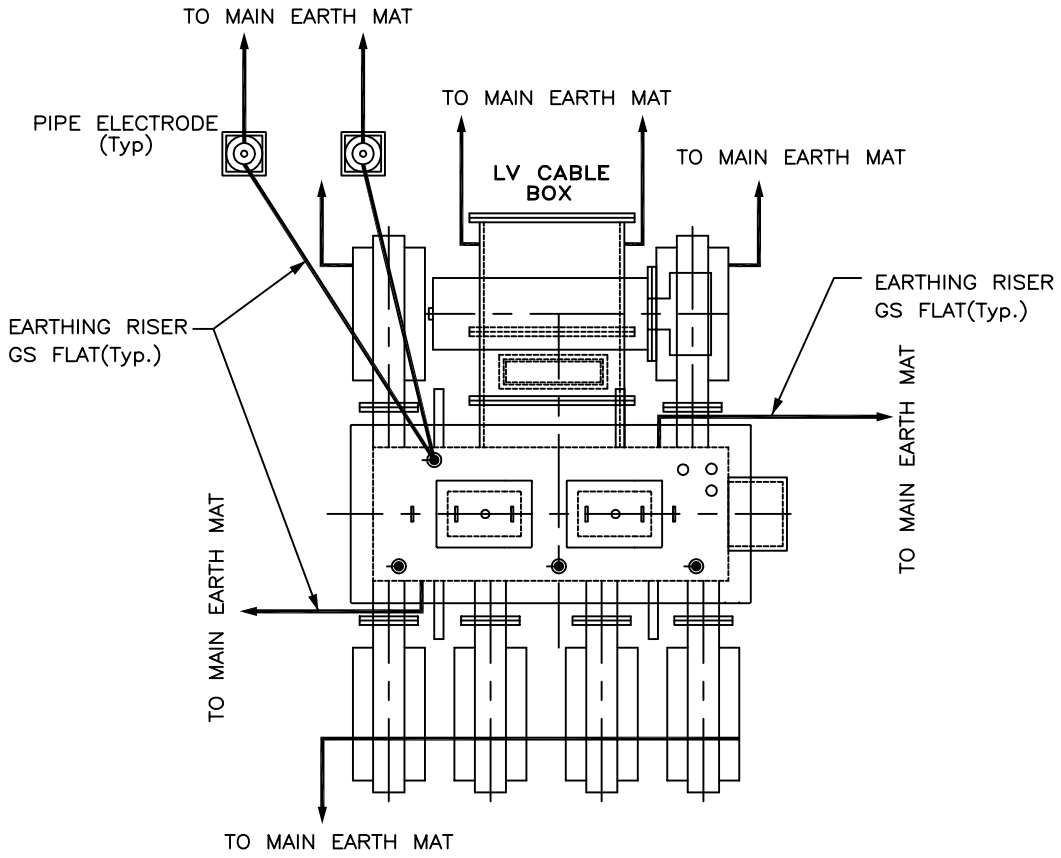
For tender purpose only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF LT TRANSFORMER



PLAN

LEGEND

- 40mmø MS ROD
- 75 x 12 mm GS FLAT
- 50 x 6 mm GS FLAT

NOTES :–

1. No. OF RISERS FOR MAIN TANK & T.M. MAR. BOX = 4 Nos.
2. No. OF RISERS FOR LV CABLE BOX & RADIATOR = 4 Nos.
3. No. OF RISERS FOR PIPE ELECTRODE = 2 Nos.
4. No. OF PIPE ELECTRODES REQUIRED = 2 Nos.

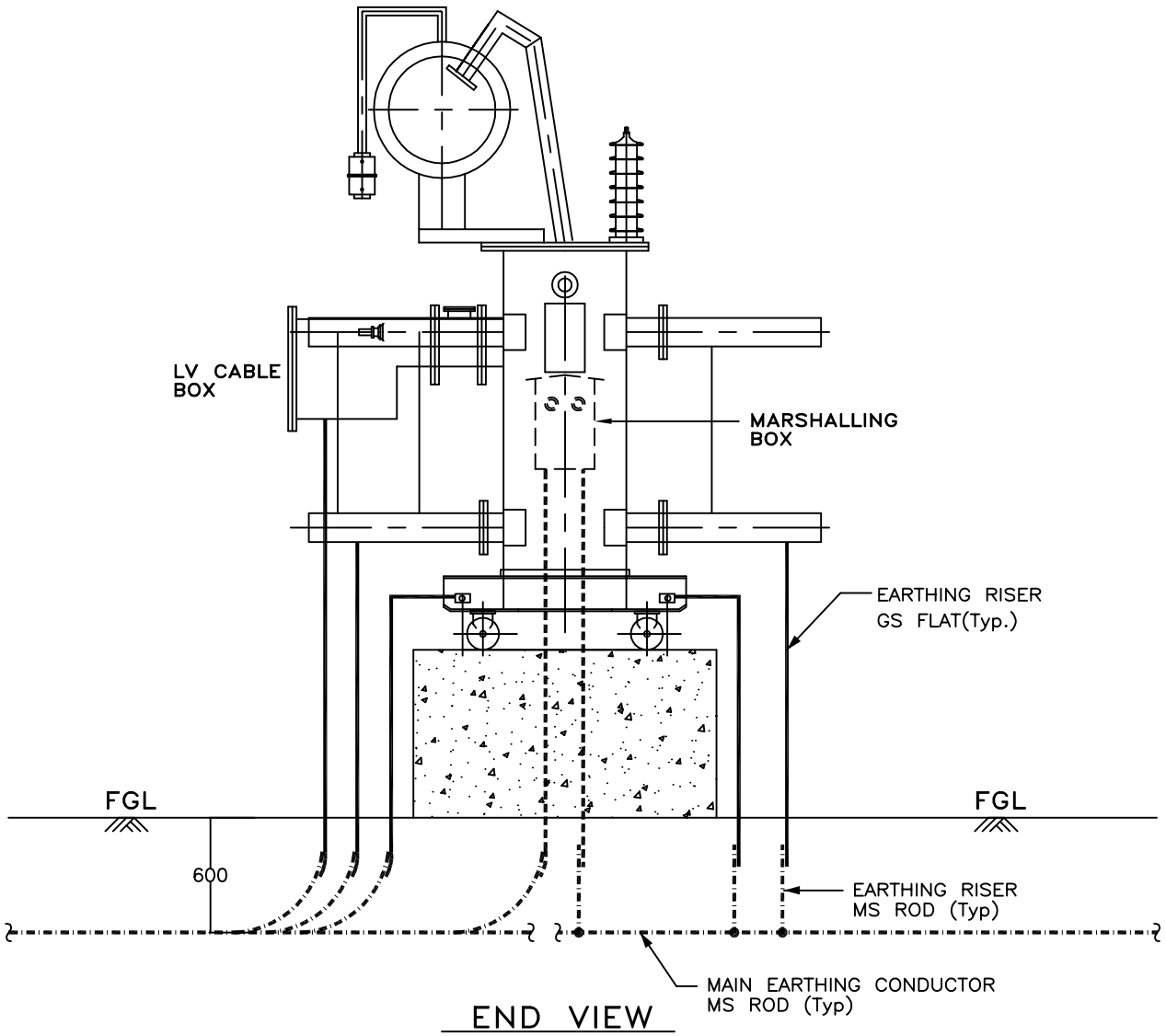
For tender purpose only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF LT TRANSFORMER



END VIEW

For tender purpose only

PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**

TITLE:- STANDARD EARTHING DETAILS

CKD BY	PRPD BY	Date	

EARTHING OF PYLON SUPPORTS

Pylon supports shall be grounded through 50x6mm GI flat to the ring around the Pylon supports of 75x12mm GI flat which in tu rn is connected to the main grid (40 mm dia MS rod) at 2 to3 points as available.

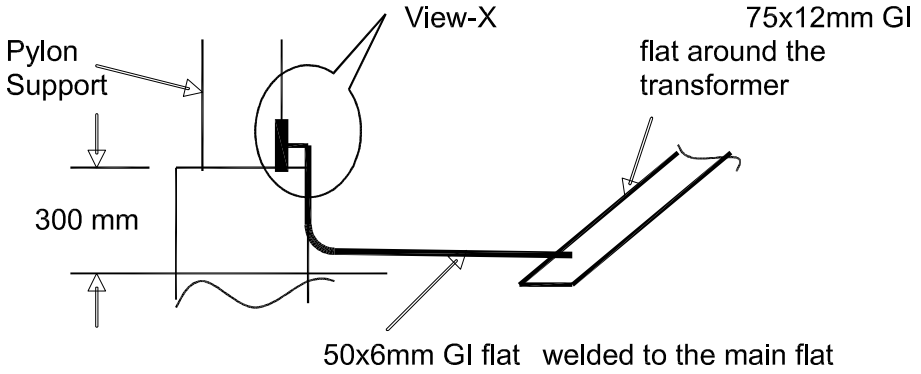


Fig.- Elevation (Earthing of Pylon Supports)

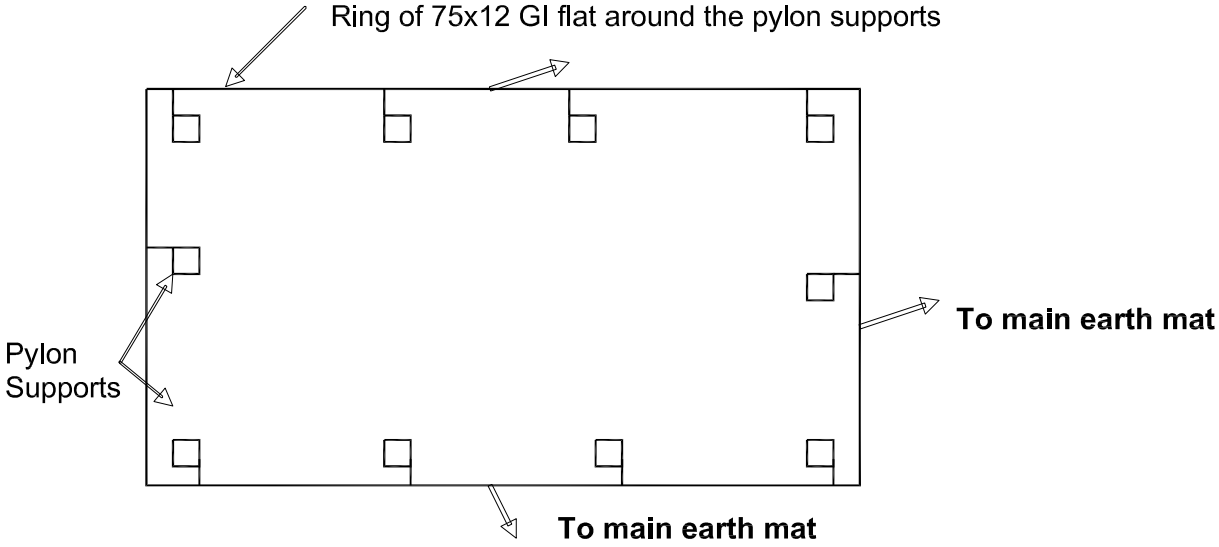


Fig.- Layout (Earthing of Pylon Supports)

For tender purpose only			
PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**			
TITLE:- STANDARD EARTHING DETAILS			
CKD BY	PRPD BY	Date	

EARTHING OFHYDRANT/ HVW SPRAY PIPING

These pipes shall be grounded at pump house through 50x6mm GI flat connected to the main flat, 75x12mm running around the room.

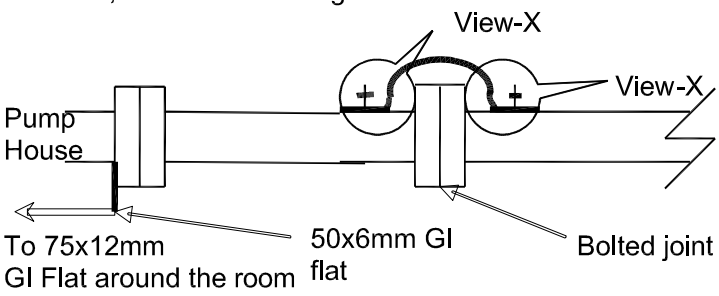


Fig.-Earthing of Hydrant / HVW Spray Piping

EARTHING OFHYDRANT POST/ HOSE BOX

A bolt shall be welded to these structures at the time of installation which can be used to connect them to the nearest riser or main 75x12mm GI flat through 50x6mm GI flat.

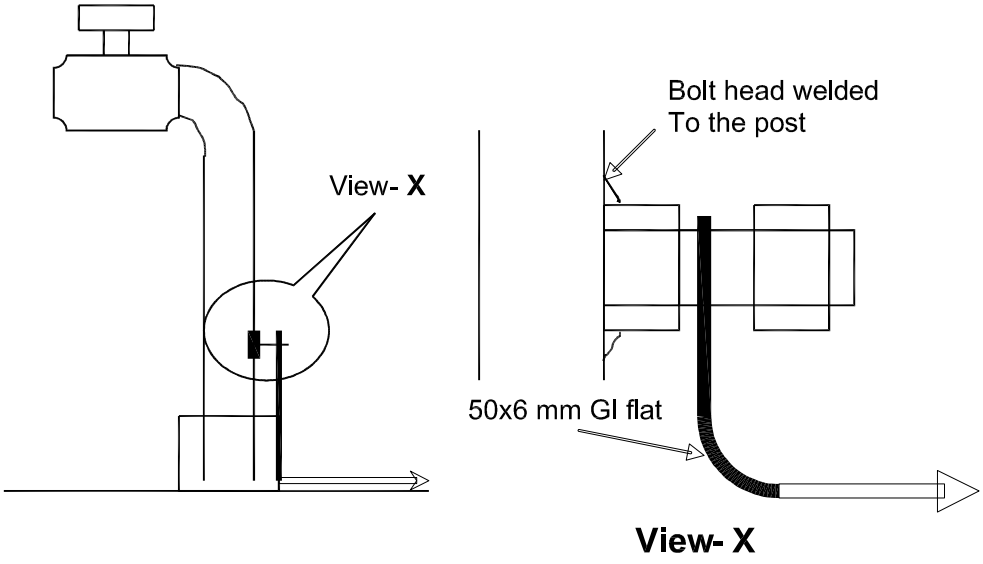
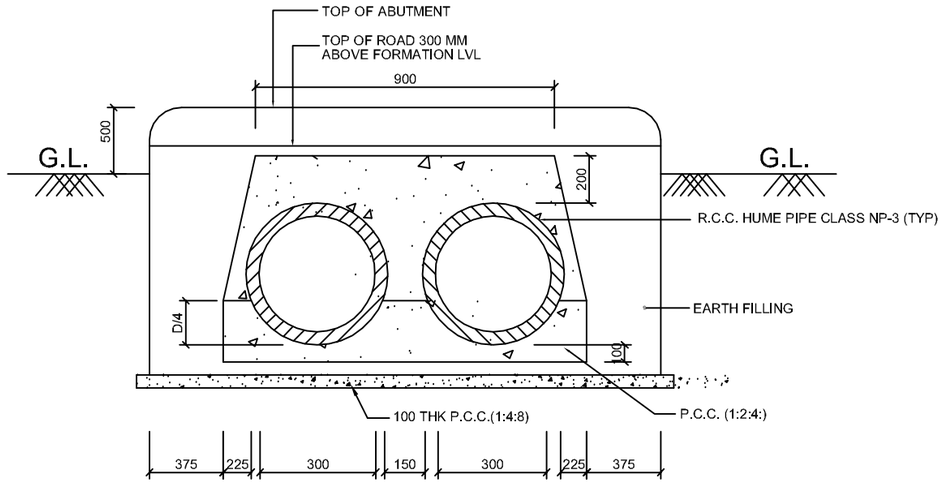


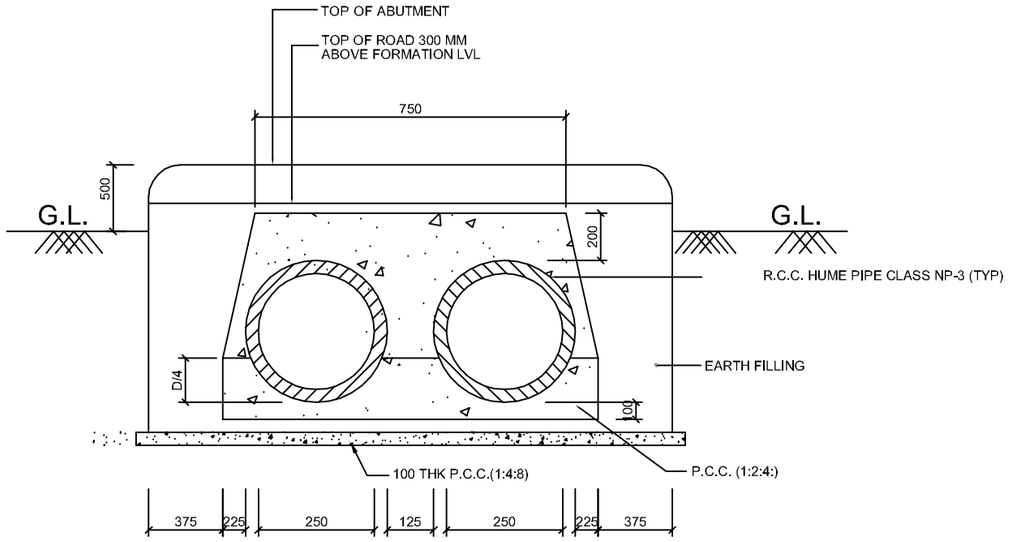
Fig.- Earthing of hydrant box / hose box

RELEASED FOR CONTRUCTION

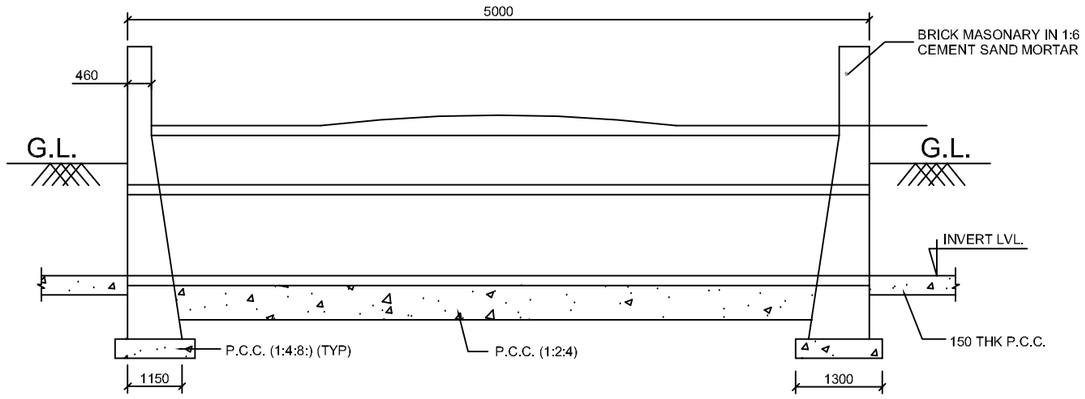
For tender purpose only			
PROJECT :- **2x50 MVA, 220/33 KV Nagrota Substation**			
TITLE:- STANDARD EARTHING DETAILS			
CKD BY	PRPD BY	Date	



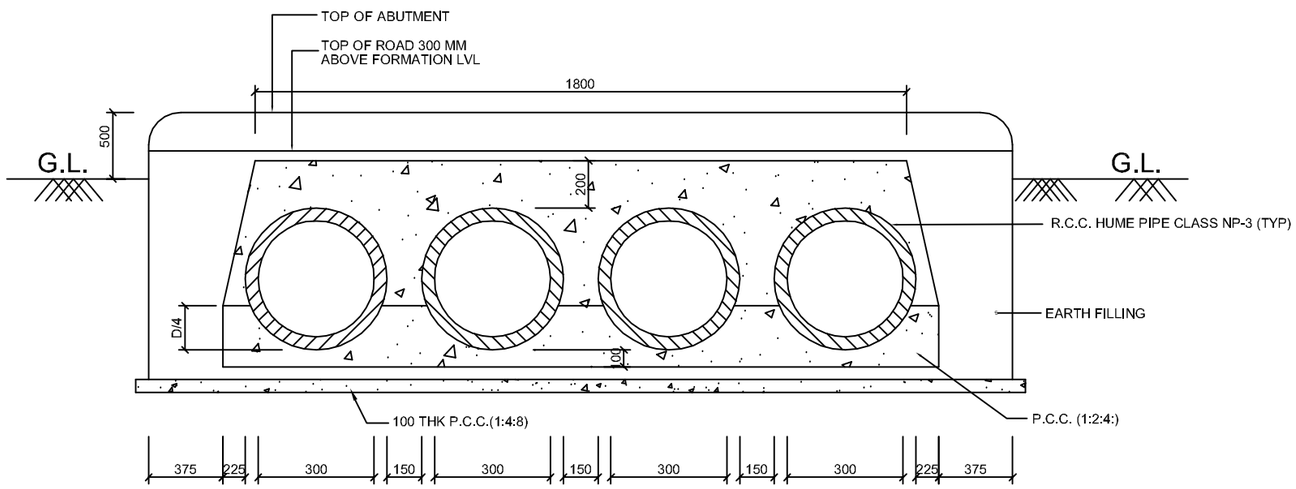
CABLE TRENCH SECTION 2-2 CROSSING ROAD



CABLE TRENCH SECTION 3-3 CROSSING ROAD



LONGITUDUNAL SECTION THROUGH CABLE TRENCH CROSSING ROAD



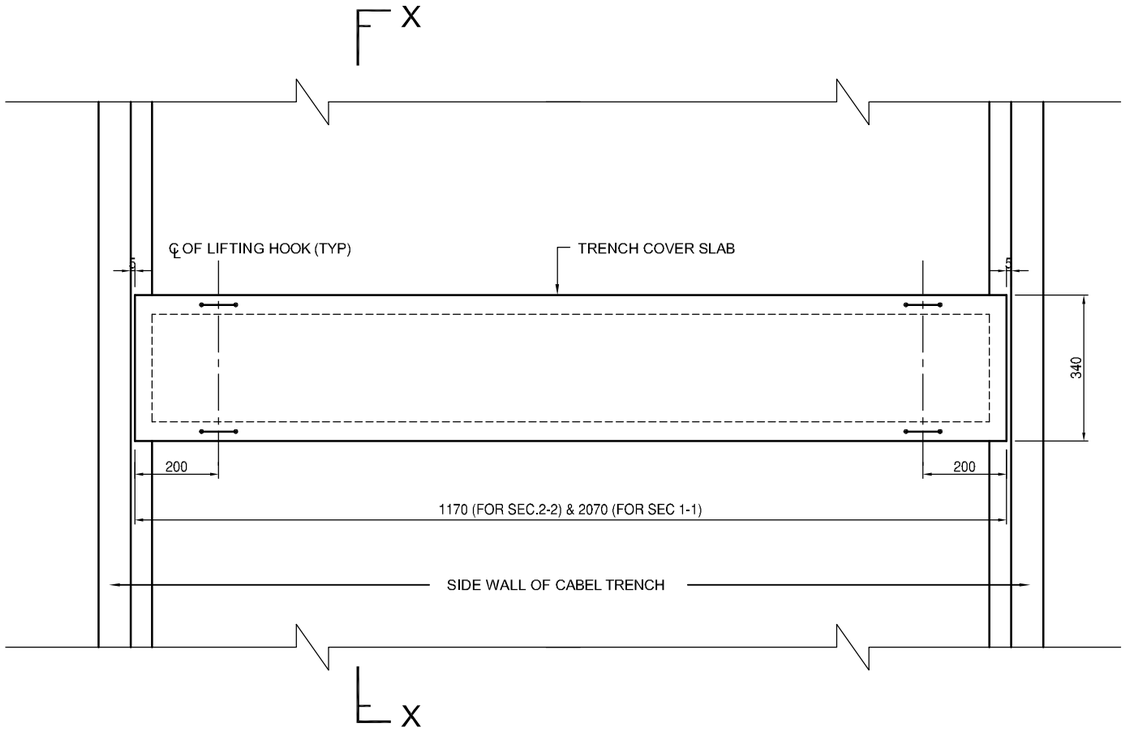
CABLE TRENCH SECTION 1-1 CROSSING ROAD

NOTES:-

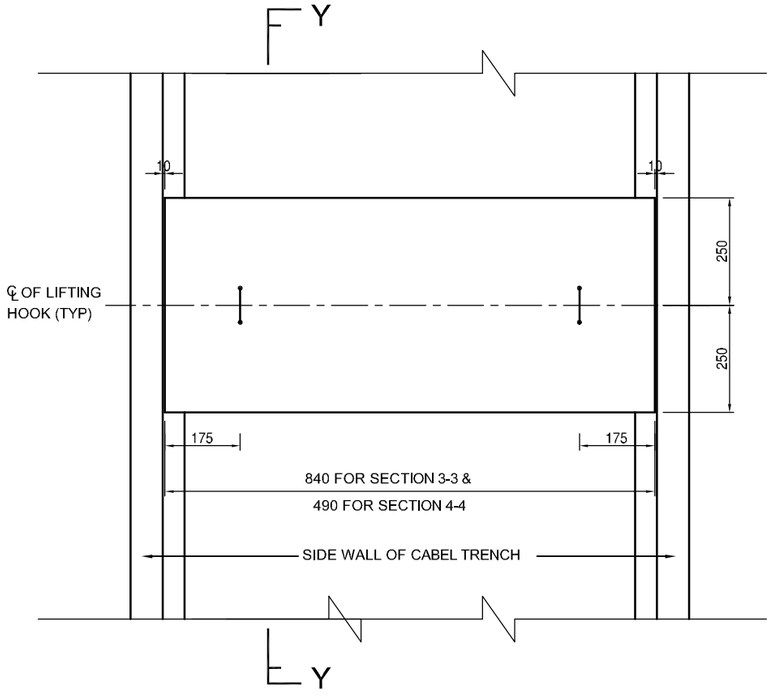
1. ALL DIMENSIONS ARE IN MM.
2. DO NOT SCALE THE DRG.
3. RCC HUME PIPE SHALL BE OF GRADE NP3.
4. CLASS 75 BRICKS SHALL BE USED.
5. CONCRITE MIX USE FOR COVRING RCC PIPE SHALL BE 1:2:4
   (1CEMENT: 2 COURSE SAND: 4 STONE AGGREGATE OF 20 MM NORMINAL SIZE)
6. ALL IN CONCRETE SHALL BE 1:4:8
   (1CEMENT: 4 COURSE SAND: 8 STONE AGGREGATE OF 40 MM NORMINAL SIZE)
7. BRICK MASSONARY SHALL BE DONE USING CEMENT MORTAR
   (1CEMENT: 6 FINE SAND)

FOR TENDER PURPOSE ONLY

REC TRANSMISSION PROJECTS COMPANY LIMITED	
PROJECT :	2x50 MVA, 220/33 KV Nagrota substation
TITLE :	DETAIL FOR CABLE TRENCH CROSSING
SHEET 1 OF 1	



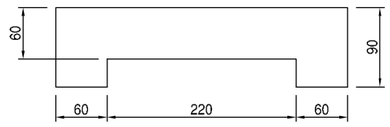
DETAIL OF TRENCH COVER SLAB
FOR SECTION (1-1) & (2-2)



DETAIL OF TRENCH COVER SLAB
FOR SECTION (3-3) & (4-4)

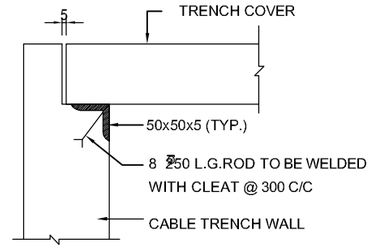
NOTE:

1. ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. DO NOT SCALE THE DRG. FOLLOW WRITTEN DIMENSION ONLY.
3. R.C.C. MIX SHALL BE 1:1.5:3
   (1CEMENT:1.5COARSE SAND:3 STONE AGGREGATE)
   20MM NOMINAL SIZE.
4. LEAN CONC. SHALL BE 1:4:8.
5. CLEAR COVER FOR BOTTOM SLAB REINF. ON TOP SIDE IS 25mm.
6. LIFTING HOOK ARE TO BE PROVIDED IN EVERY TENTH SLAB.
7. NECESSARY OPENING SHALL BE PROVIDED AT APPROPROATE
   LOCATION TO TAKE OUT CABLES.
8. FOR ACTUAL DEPTH OF TRENCHES REFER CABLE TRENCH LAYOUT.
9. F.G.L. DENOTES FINISHED GRADED LAVEL (FORMATION LEVEL).
10. F.G.L. TO BE TAKEN FROM LAYOUT DRG.
11. A SLOPE OF 1:250 SHALL BE GIVEN IN THE DIRECTION
    PERPENDICULAR TO THE RUN OF THE TRENCH FOR ALL SECTIONS.
12. ALL CABEL TRENCHES SHALL BE GIVEN A SLOPE OF 1:1000
    IN THE DIRECTION OF MAIN RUN.
13. EARTHING CONDUCTOR `E' 50X6 M.S.FLAT WOULD BE WELDED ON
    THE CABLE SUPPORTING STRUCTURES BEFORE INSTALATION OF CABLE.
14. ALL STEEL STRUCTURE PLATES WOULD BE PAINTED WITH NON
    CORROSIVE PAINT ON A SUITABLE PRIMER BEFORE INSTALLATION
    OF CABLES. EARTHING CONDUCTOR WOULD HAVE RED PAINT.
15. TRENCH WALL SHALL CLEAR THE EQUIPMENT FOUNDATION BY 100mm.(MINIMUM)
16. NECESSARY CONSTRUCTION JOINT SHALL BE PROVIDED AT
    EVERY 30M. MIN OR AS PER SITE REQUIREMENT.
17. 40mm CLEAR COVER FOR WALL AND BOTTOM SLAB REINFORCEMENT
    WHICH IS TOWARDS EARTH SIDE SHALL BE PROVIDED.
18. ALL SUPPORT ANGLE SHALL BE L50X50X6.
19. ANCHORING FLAT (75X6mm)SHALL BE PROVIDED AT EACH
    SUPPORT ANGLE POINT.
20. EARTHING CONDUCTOR MKD.`E' SHALL BE PROVIDED ON THE
    TOP TIER OF EACH CABLE TRENCH SECTIONS.
21. TRENCH WALL SHALL CLEAR THE TOWER FOUNDATION BY 1000mm (MIN.)

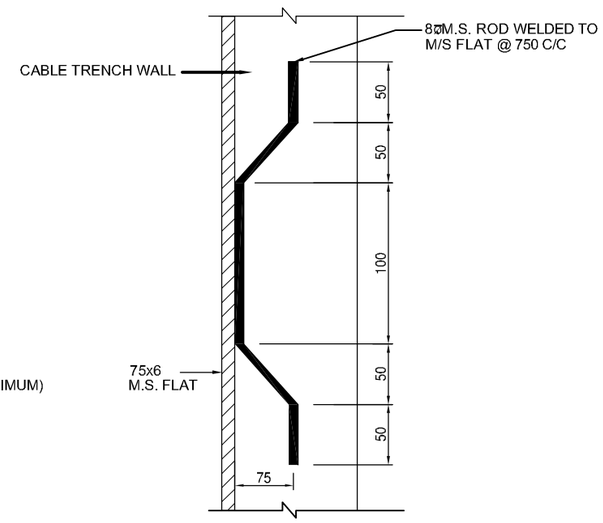


SECTION X-X

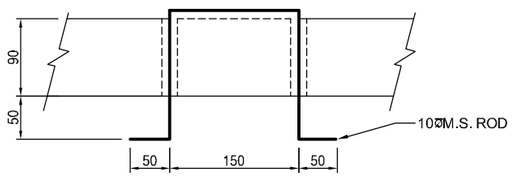
SECTION Y-Y



TYPICAL DETAIL OF
SLAB SUPPORT



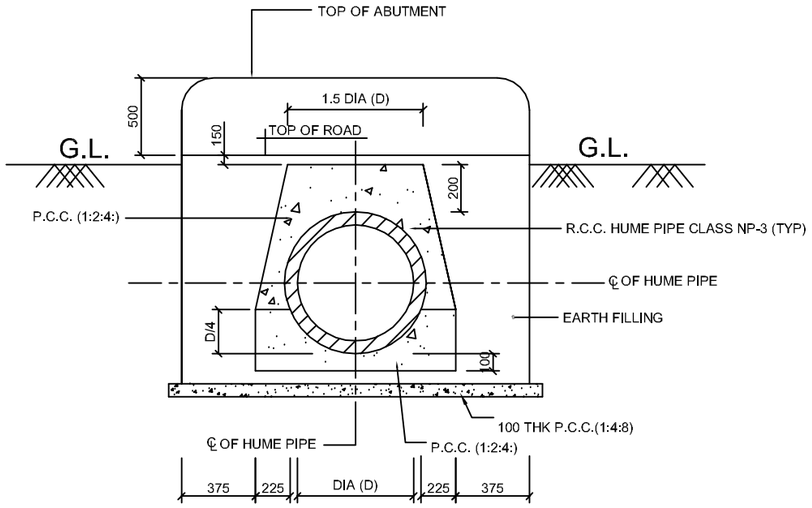
TYPICAL DETIAL OF ANCHORING
75X6 M.S.FLAT



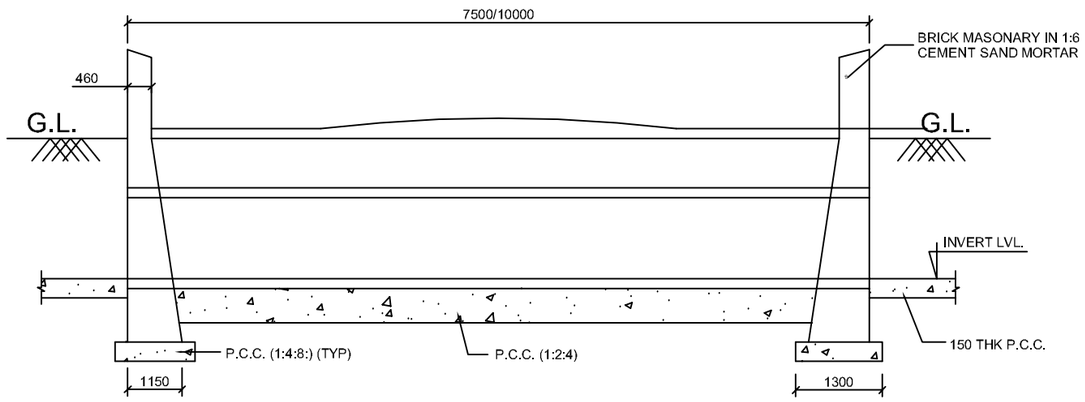
DETAIL OF LIFTING HOOK
FOR SECTION 1-1 & 2-2

FOR TENDER PURPOSE ONLY

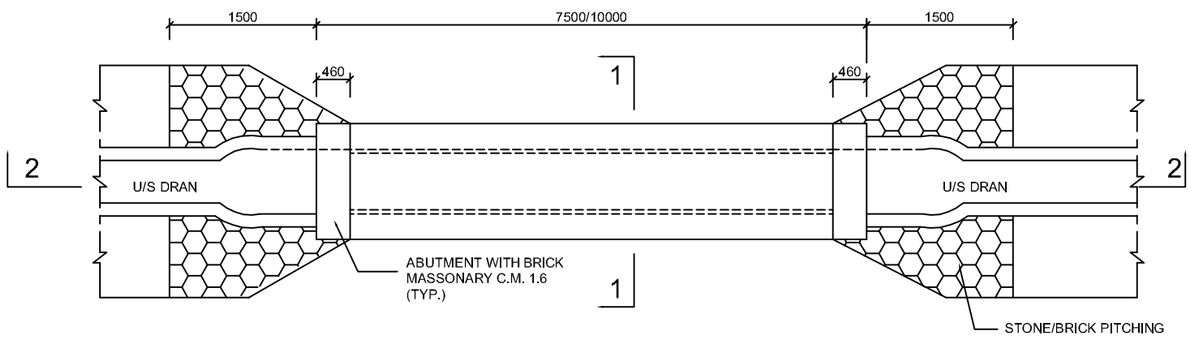
REC TRANSMISSION PROJECTS COMPANY LIMITED	
PROJECT :	2x50 MVA, 220/33 KV Nagrota Substation
TITLE :	**DETAIL FOR CABLE TRENCH SECTIONS**
SHEET 2 OF 2	



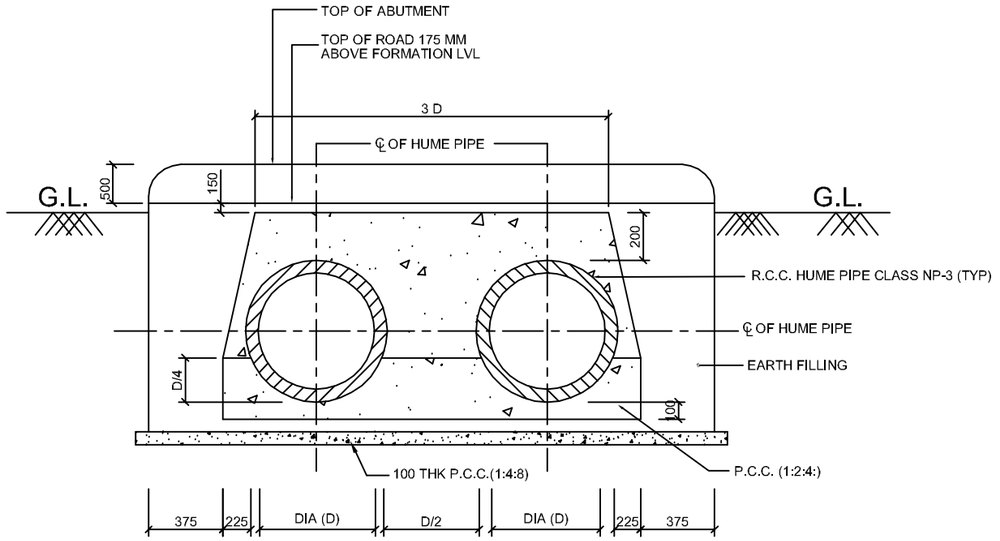
SECTION 1-1 FOR SINGLE PIPE



SECTION 2-2



PLAN OF PIPE CULVERT



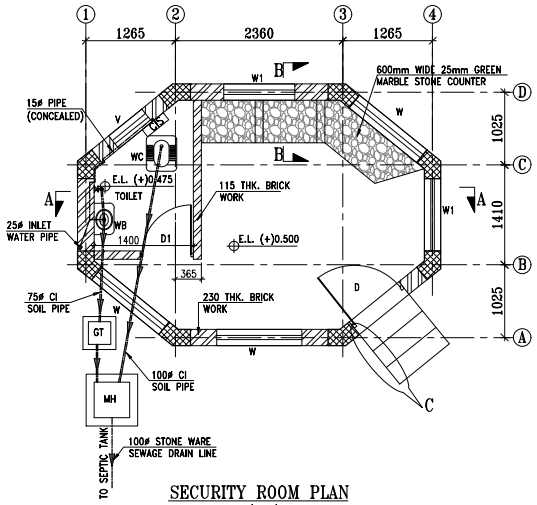
SECTION 1-1 FOR DOUBLE PIPE CULVERT

NOTES:-

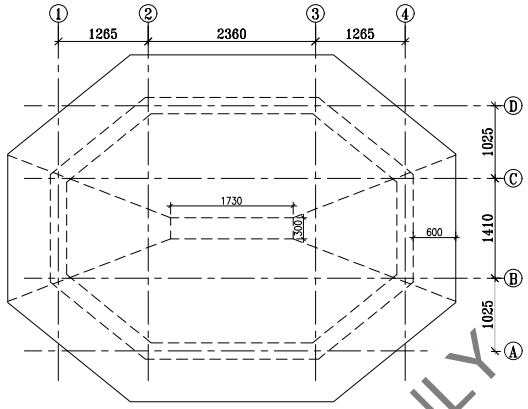
1. ALL DIMENSIONS ARE IN MM.
2. DO NOT SCALE THE DRG.
3. WORK SHALL BE DONE AS PER C.P.W.D. SPECIFICATION.

RELEASED FOR TENDER

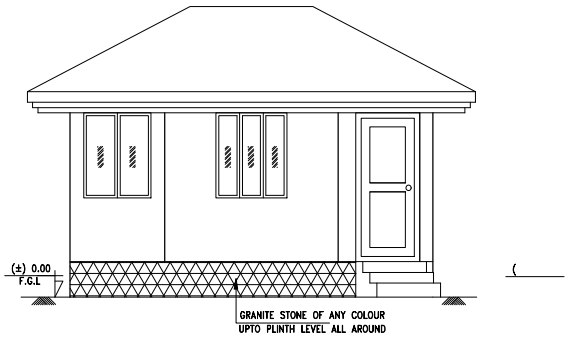
REC TRANSMISSION PROJECTS COMPANY LIMITED	
PROJECT :	**2x50 MVA, 220/33 KV Nagrota Substation**
TITLE :	**DETAIL OF ROAD CULVERTS**
SHEET 1 OF 1	



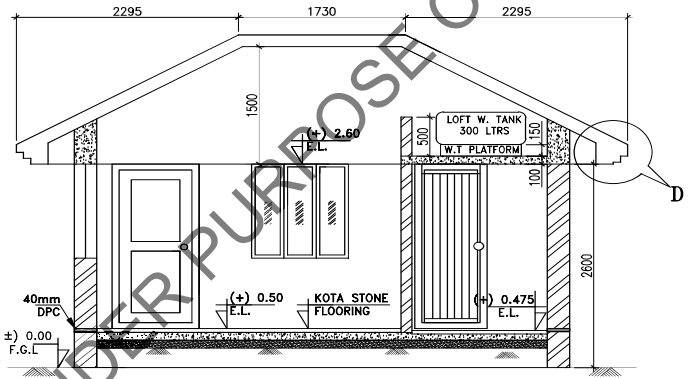
SECURITY ROOM PLAN
(1:50)



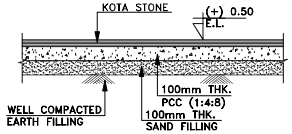
ROOF PLAN



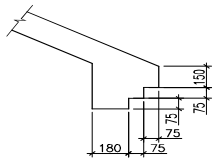
FRONT ELEVATION



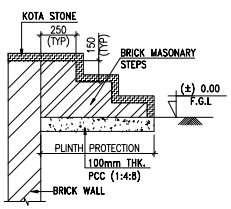
SECTION : A–A



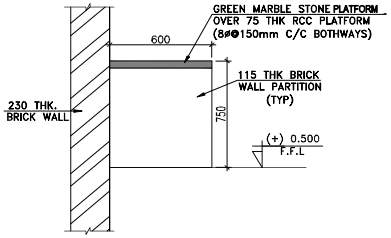
FLOORING DETAIL



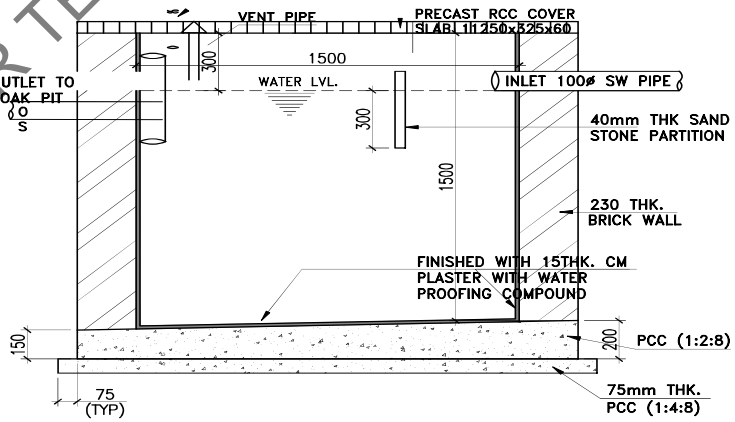
DETAIL – D



DETAIL – C



SECTION : B–B



TYPICAL SECTION OF SEPTIC TANK

(NOTE : INTERNAL DIMENSION OF SEPTIC TANK IS 750mm X 1500mm)

FOR TENDER PURPOSE ONLY

SCHEDULE OF DOOR & WINDOW

MKD.	SIZE		DESCRIPTION	NOS. REQD.
	WIDTH	HEIGHT		
D	900	2100	12mm THK TOUGHENED GLASS DOOR WITH DESIGNER FROSTED FILM ON PATCH FITTING	1
D1	750	2100	35mm FLUSH DOOR LAMINATED ON BOTH SIDE ON LOCAL WOOD FRAME PAINTED WITH ENAMEL PAITNS.	1
W1	1000	1200	2 EQUAL PANELS SLIDING UPVC WINDOW AS PER MANUFACTURER'S SPECIFICATION	1
W	1200	1200	3 EQUAL PANELS SLIDING UPVC WINDOW AS PER MANUFACTURER'S SPECIFICATION	4
V	600	450	UPVC TOP HUNG VENTILATOR WITH EXHAUST FAN AS PER MANUFACTURER'S SPECIFICATION.	1

FINISHING SCHEDULE

AREA/ROOM	FLOORING	SKIRTING/DADO	CEILING	INTERNAL PAINT ON WALLS	PAINTS ON CEILING
GUARD ROOM	20THK. KOTA STONE FLOOR	100 HIGH KOTA	RCC SLAB WITH 6mm PLASTER	OBD	OBD
TOILET	CERAMIC TILES	GLAZED TILE DADO UP TO 1.5 HIGH	RCC SLAB WITH PLASTER	OBD	OBD

PLUMBING & SANITARY SCHEDULE

SR. NO.	ITEM	DESCRIPTION	NOS. REQD.
1.	INTERNAL/EXTERNAL WATER SUPPLY PIPES	15ϕ GI PIPE AS PER SPECIFICATION FOR ALL SANITARY FIXTURES, CONNECTIONS AND LOFT TANK	–
2.	W.C. (INDIAN STYLE)	ORISSA PATTERNS WC ALONG WITH ALL FITTING OF APPROVED MAKE AS PER SPECIFICATION	1
3.	WASH BASIN	FLAT BACK WASH BASIN WITH ALL ITS ACCESSORIES AS PER SPECIFICATION	1
4.	MIRROR	ABOVE WASH BASIN SIZE– 600x450 AS PER SPECIFICATION	1
5.	TOWEL RAIL	CP BARS SIZE – 600 LONG 20ϕ ROD AS PER SPECIFICATION	1
6.	SOAP HOLDER	CP BARS AS PER SPECIFICATION	1

NOTES:–

1. ALL DIMENSION ARE IN MM.
2. ALL ELEVATION ARE IN METERS.
3. PLASTERING:–
   a. OUTER FACE SHALL HAVE TEXTURE PAINT FINISH OVER EXTERNAL 12mm THK. PLASTER IN 1:6 CEMENT SAND MORTAR MIXED WITH WATER PROOFING COMPOUND.
   b. INTERNAL – 15THK. PLASTER IN 1:6 CEMENT SAND MORTAR.
4. 900mm WIDE PLINTH PROTECTION SHALL BE PROVIDED AS PER SPECIFICATION.
5. SOAK PIT SHALL BE PROVIDED AS PER DSR2014ITEM NO. 19.33
6. LOCATION OF SEPTIC TANK AND SOAK PIT SHALL BE DECIDED BY SITE 8. WATER SUPPLY CONNECTION TO BE DECIDED TO BY SITE.
7. ALL FITTING REQUIRED FOR DOORS SHALL BE AS PER THE INSTRUCTION ON SITE–INCHARGE.
8. DOORS SHALL BE PROVIDED WITH LOCKING ARRANGEMENT.

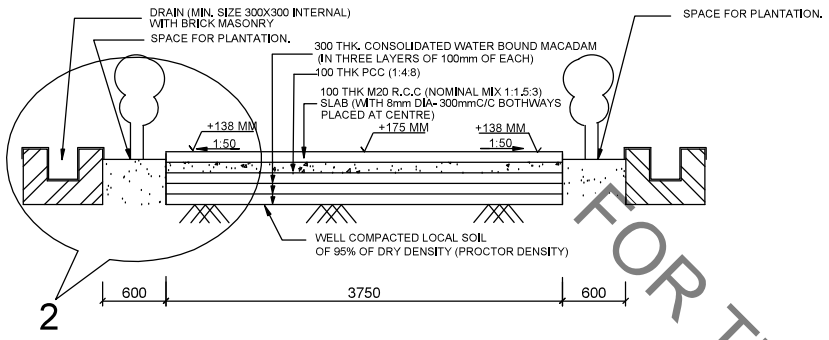
REC TRANSMISSION PROJECTS COMPANY LTD.

PROJECT : 220 kV GIS LADAKH

TITLE : ARCHITECTURE PLAN SECTION & ELEVATION OF SECURITY ROOM

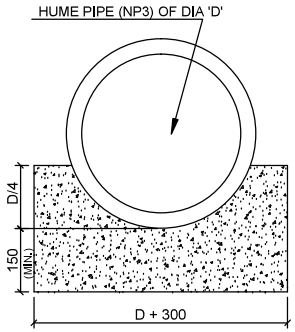
0295

Drg. No. - RECTPCL/J&K /CIVIL/DRG/05

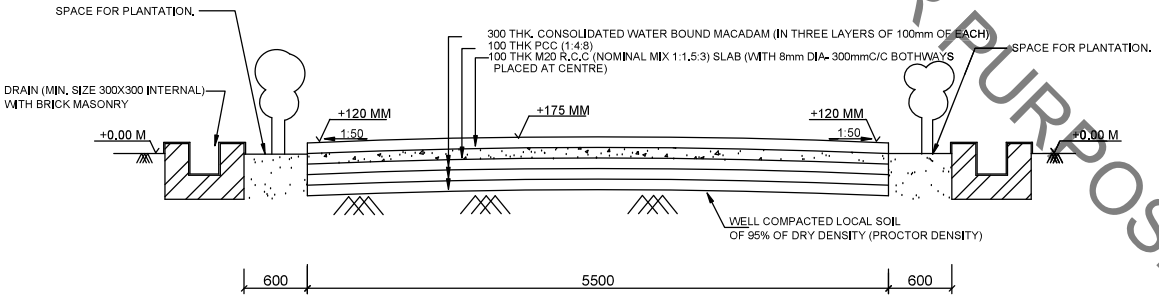


2

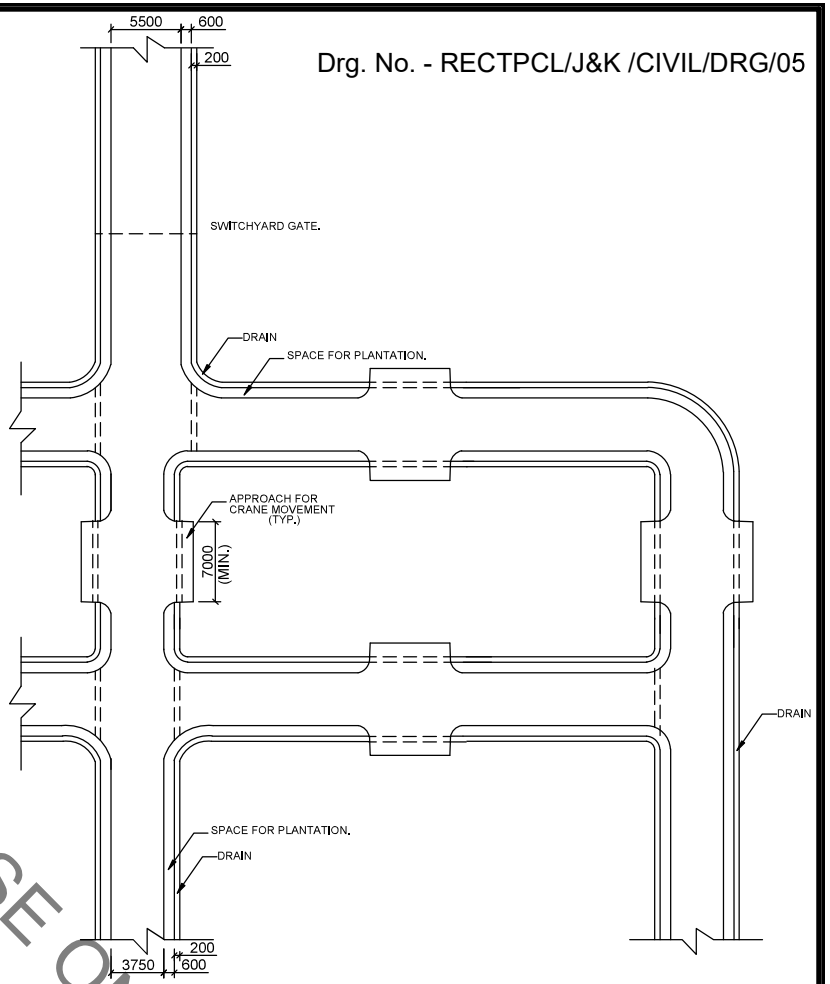
TYP. CROSS SECTION OF 3.75 M WIDE ROAD
(VALID FOR SWITCHYARD INTERNAL ROADS)



BEDDING FOR HUME PIPE



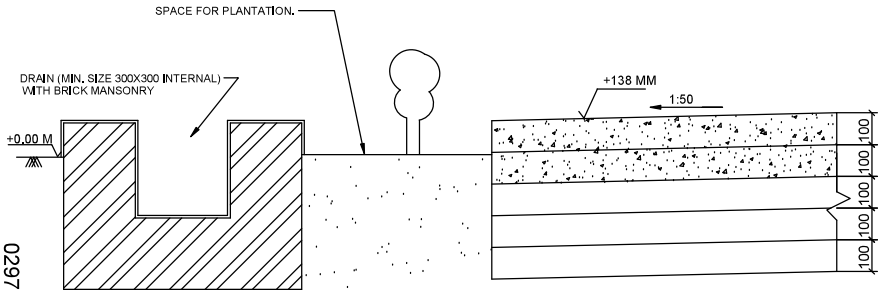
TYP. CROSS SECTION OF 5.5 M WIDE ROAD
(VALID FOR APPROACH TO SWITCHYARD)



TYP. SWICHYARD ROAD AND DRAIN LAYOUTPLAN

NOTES:

1. ALL DIMESION ARE IN MM UNLESS NOTED OTHERWISE.
2. CAMBER OF 1:50 SHALL BE PROVIDED
3. EXPANSION JOINT (12 MM THICK) SHALL BE PROVIDED AT EVERY 8.0M.
   EXPANSION JOINT SHALL ALSO BE PROVIDED AT CENTRE.
4. POLYTHENE SHEET OF 125 MICRONS SHALL BE PLACED BETWEEN THE PCC AND RCC SLAB. (TOP SLAB)
5. 100MM DIA. RCC HUME PIPE (NP-3) SHALL BE PLACED ACROSS THE ROAD AT EVERY 100M INTERVAL.
   ALONG THE ROAD.
6. FINISHED TOP OF ROAD CREST SHALL BE 175 MM (MIN.) ABOVE F.G.L. (SWITCHYARD FORMATION LEVEL)



0297

DETIAL - 2

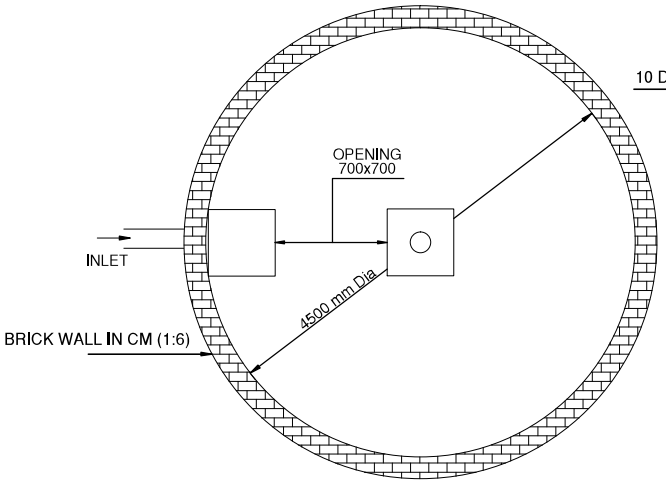
RELEASED FOR TENDER

REC TRANSMISSION PROJECTS COMPANY LTD.

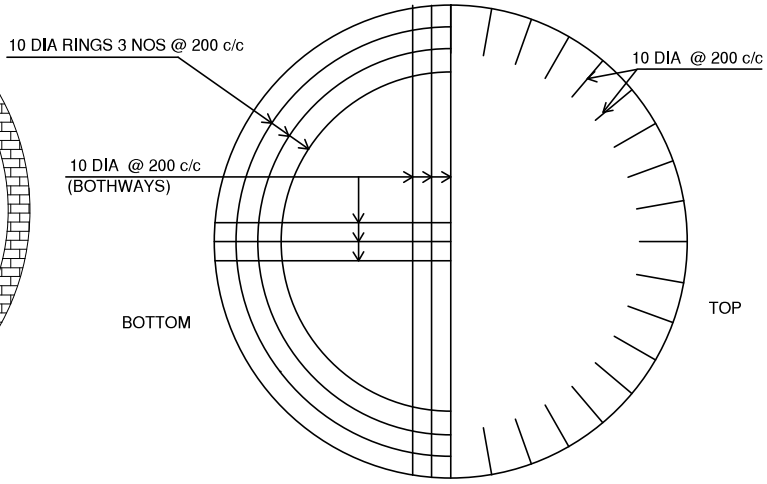
PROJECT : 765 / 400 / 220 Kv SUBSTATIONS

TITLE : DETAIL OF CONCRETE ROAD (RIGID PAVEMENT) IN SWITCHYARD AREA

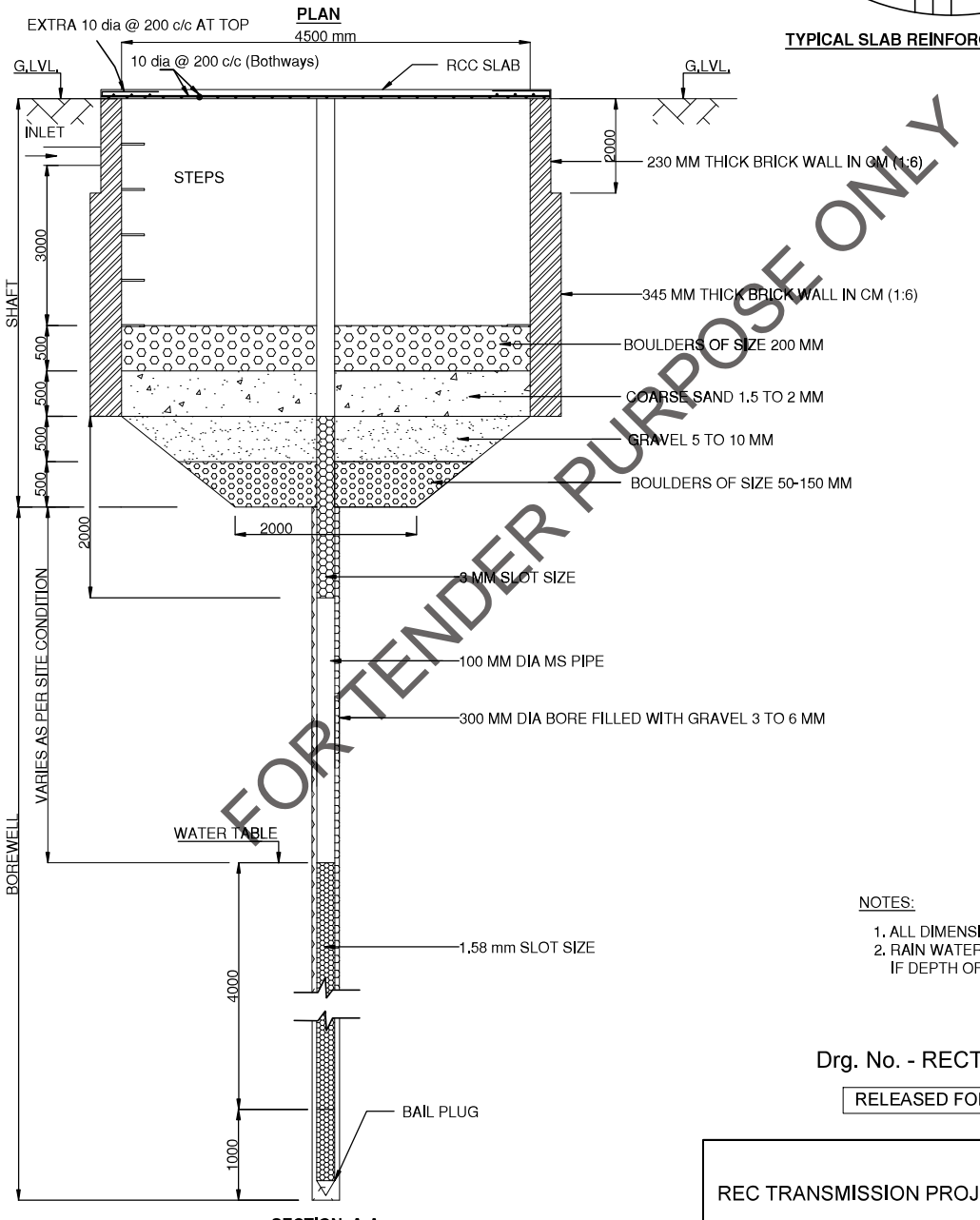
FOR TENDER PURPOSE ONLY



PLAN



TYPICAL SLAB REINFORCEMENT DETAILS



SECTION A-A

FOR TENDER PURPOSE ONLY

NOTES:

1. ALL DIMENSIONS ARE IN MM
2. RAIN WATER HARVESTING SHALL NOT BE DONE IF DEPTH OF WATER TABLE IS LESS THAN 8.0 M

Drg. No. - RECTPCL/J&K /CIVIL/DRG/14

RELEASED FOR TENDER

REC TRANSMISSION PROJECTS COMPANY LTD.

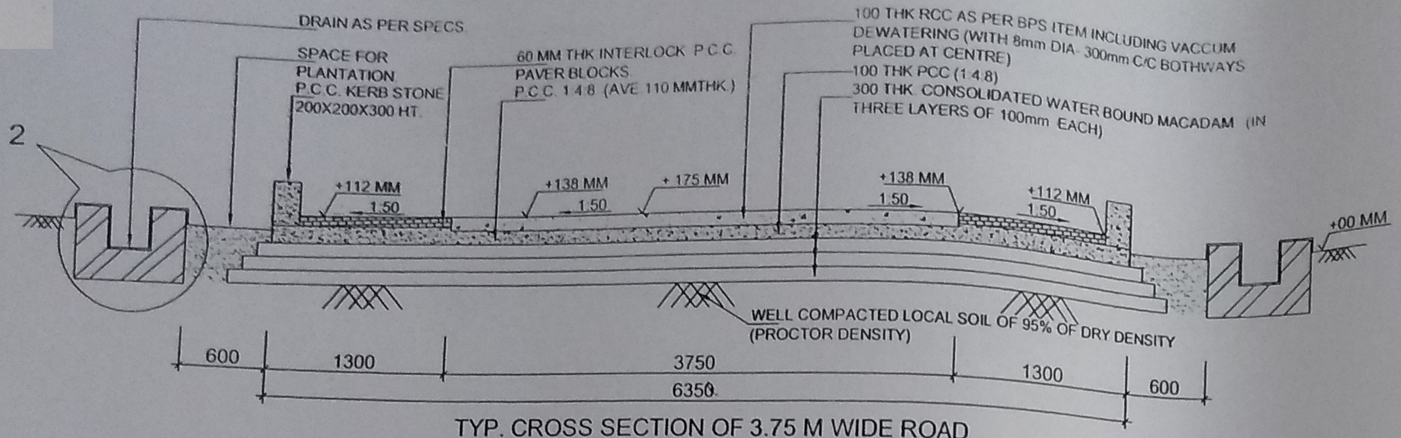
PROJECT : **TYPICAL DRAWING FOR RAIN WATER HARVESTING**

TITLE : DETAILS OF RECHARGE STRUCTURE FOR RAIN WATER HARVESTING

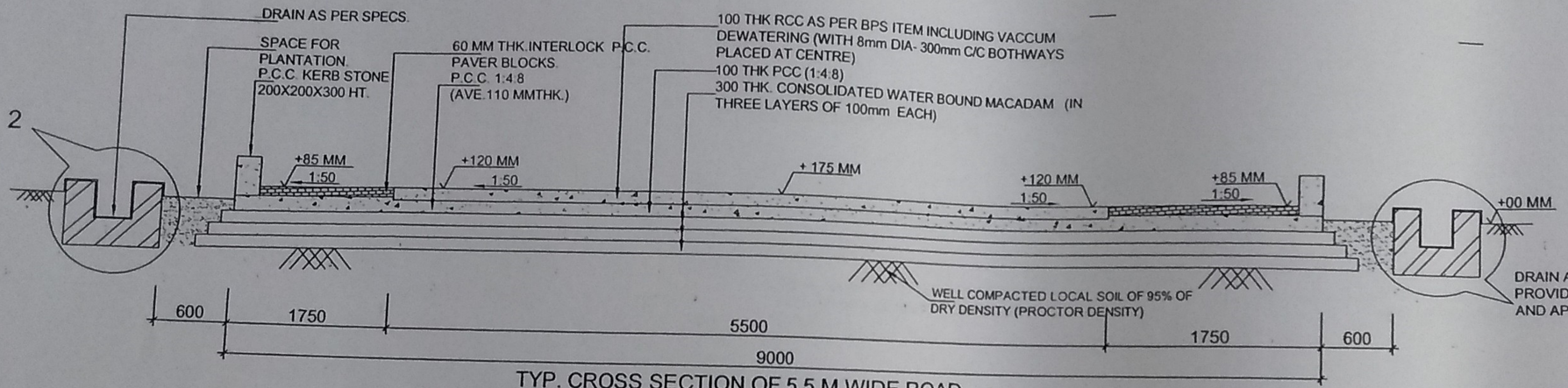
NTS

0303

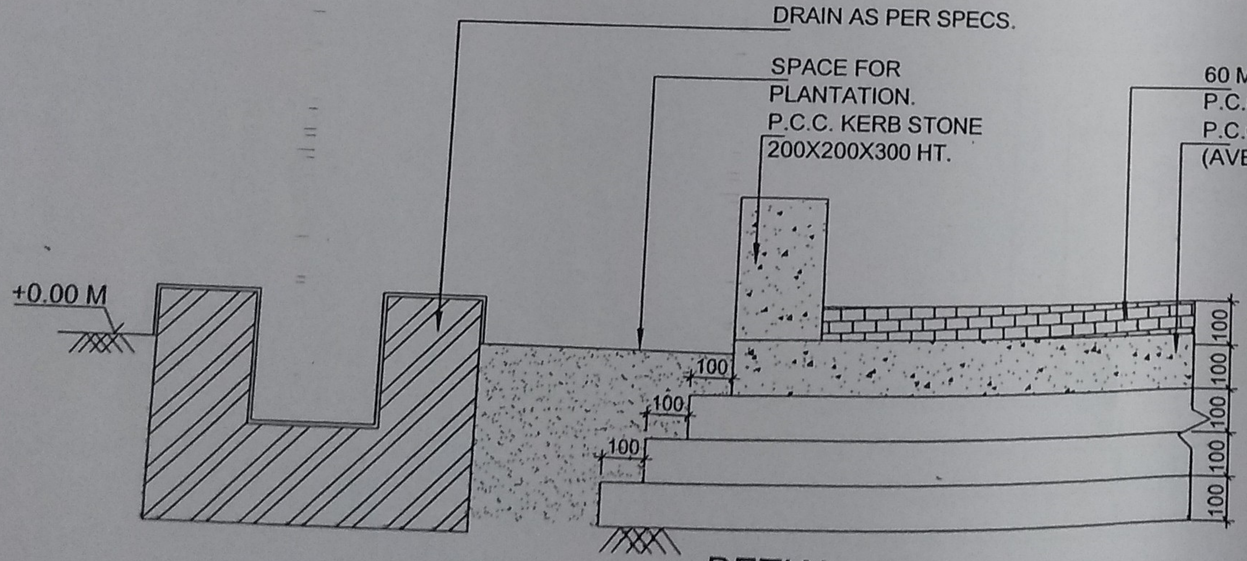
DETAIL OF CONCRETE ROAD (RIGID PAVEMENT)



TYP. CROSS SECTION OF 3.75 M WIDE ROAD
(SECTION B - B)



TYP. CROSS SECTION OF 5.5 M WIDE ROAD
(SECTION A-A)

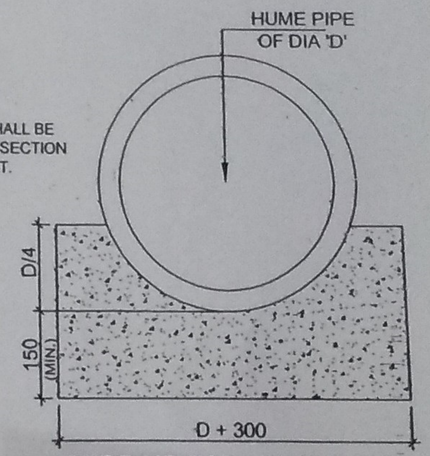


DETIAL - 2

NOTES

1. ALL DIMESION ARE IN MM UNLESS NOTED OTHERWISE
2. CAMBER OF 1:50 SHALL BE PROVIDED
3. EXPANSION JOINT (12 MM THICK) SHALL BE PROVIDED AT EVERY 8.0 M. EXPANSION JOINT SHALL ALSO BE PROVIDED AT CENTRE.
4. POLYTHENE SHEET OF 125 MICRONS SHALL BE PLACED BETWEEN THE PCC AND RCC SLAB. (TOP SLAB)
5. 100MM DIA. RCC HUME PIPE SHALL BE PLACED ACROSS THE ROAD AT EVERY 100M INTERVAL. ALONG THE ROAD.
6. THE KERBS ON BOTH SIDE OF THE ROAD SHALL BE PAINTED YELLOW AND BLACK ALTERNATIVELY
7. FINISHED TOP OF ROAD CREST SHALL BE 175 MM (MIN.) ABOVE F.G.L HOWEVER, IN CASE APPROACH ROAD IS BEING CONSTRUCTED IN UNLEVELLED AREA THEN CREST LEVEL OF ROAD SHALL BE MINIMUM 300 MM ABOVE H.F.L.
8. IF EXPANSIVE SOIL IS ENCOUNTERED AT FOUNDING LVL. IT SHALL BE REMOVVED TO A MIN. DEPTH OF 300 MM AND SHALL BE REPLACED WELL COMPACTED (IN 02 EQ LAYERS) C.N.S. MATERIAL
9. SUFFICIENT SPACE BETWEEN KERB STONES @ 5M C/C SHALL BE PROVIDED TO DRAIN OUT WATER
10. PAVER BLOCK SHALL BE FACTORY MADE AS PER DSR ITEM NO 16.68

DRAIN ARE INDICATIVE AND SHALL BE PROVIDED AS PER STD DRAIN SECTION AND APPROVED DRAIN LAYOUT.



BEDDING FOR HUME PIPE

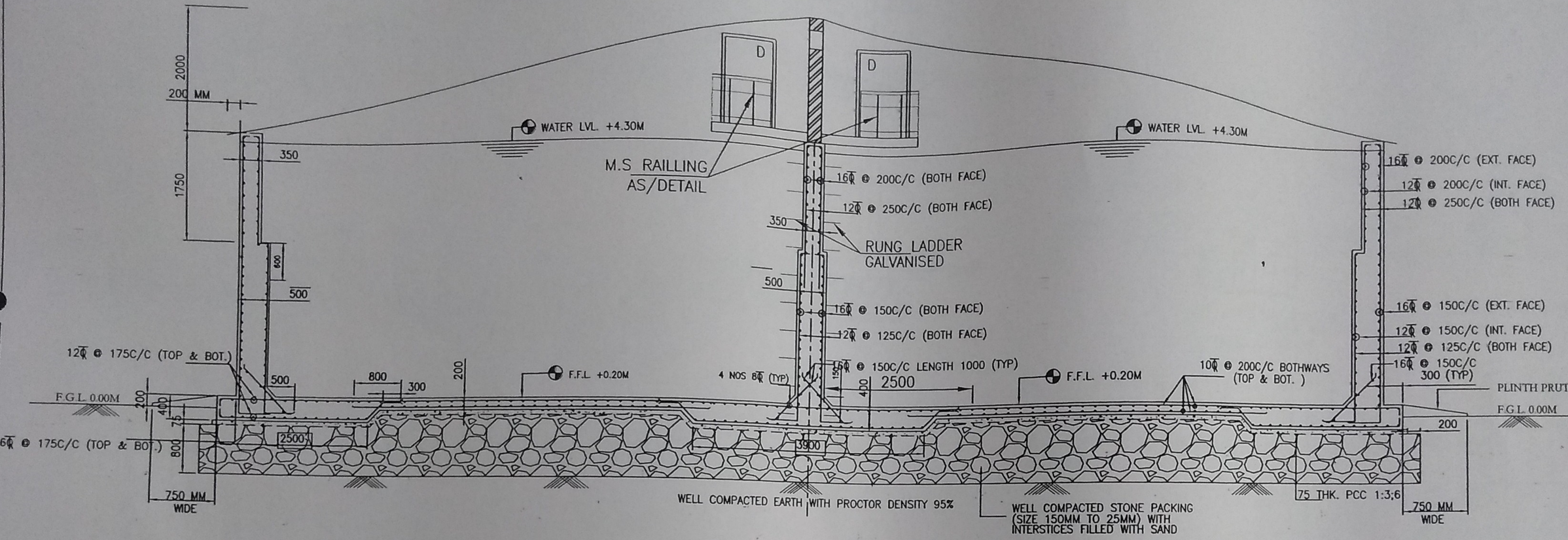
For Tender purpose Only

RELEASED FOR TENDER/CONSTRUCTION.

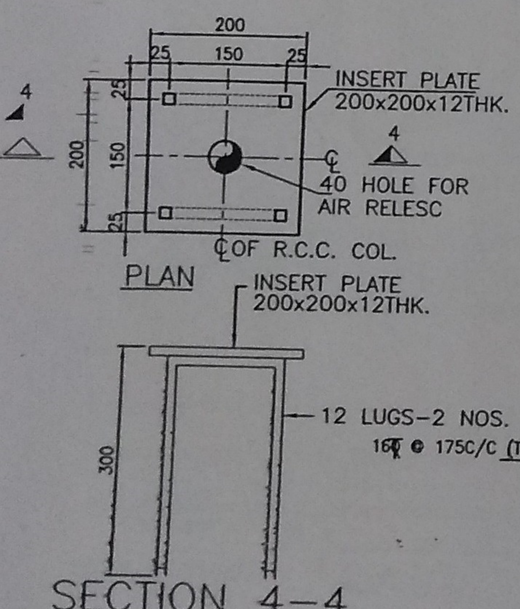
NO.	REVISED AS MARKED

STANDARD RCC ROAD

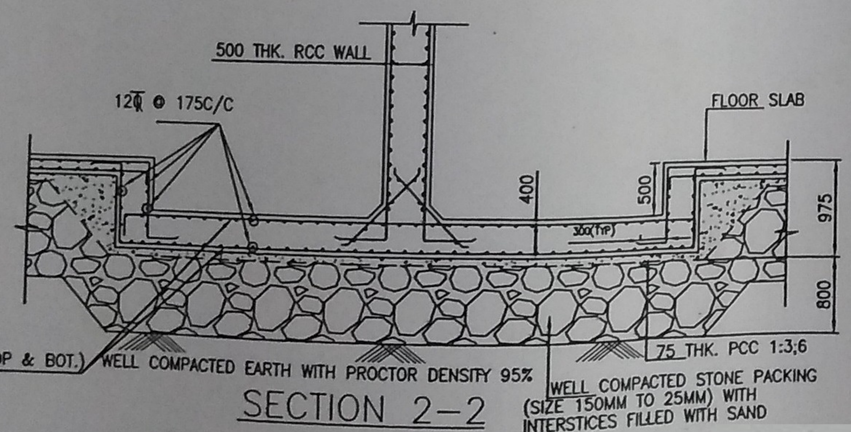
SUB TITLE:
DETAIL OF CONCRETE ROAD (RIGID PAVEMENT) WITH PAVER BLOCK SHOULDER



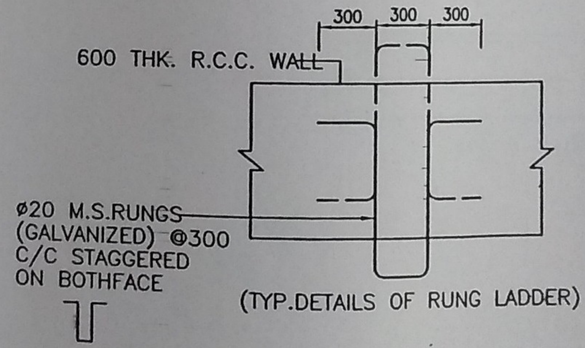
SECTION 1–1



SECTION 4–4



SECTION 2–2

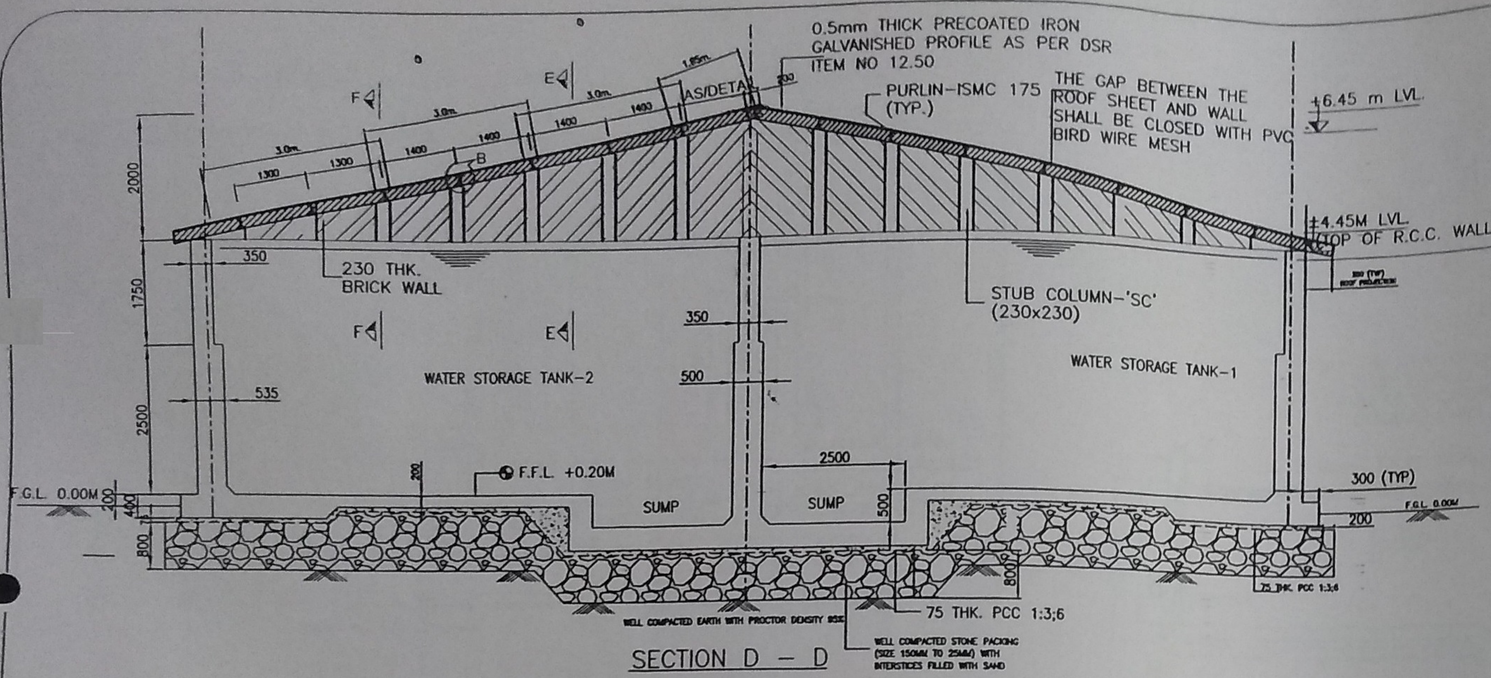


(TYP.DETAILS OF RUNG LADDER)

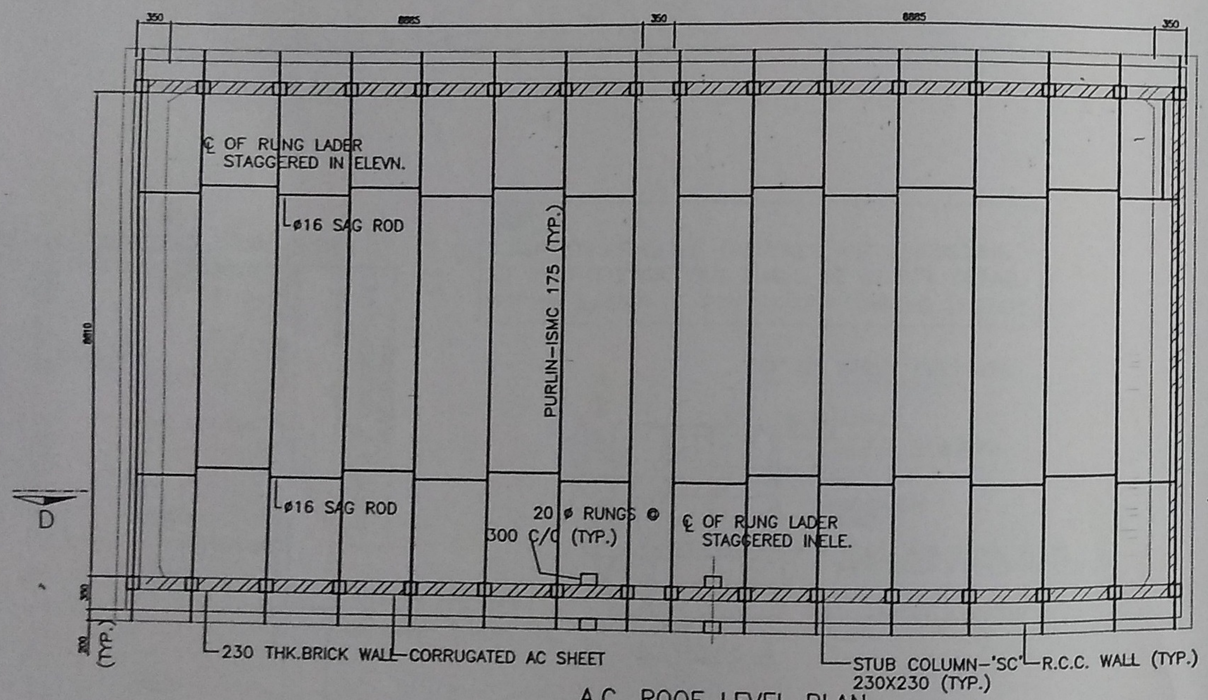
RELEASED FOR TENDER/CONSTRUCTION.

FOR NOTES REFER DRG. NO.:–
C/ENGG/STD/FFPH/16 OF 16

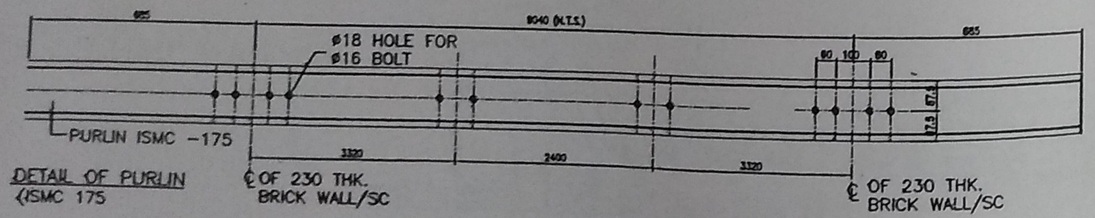
For Tender Purpose Only



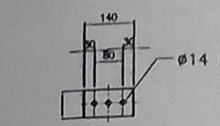
SECTION D – D



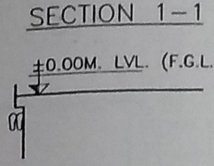
A.C. ROOF LEVEL PLAN

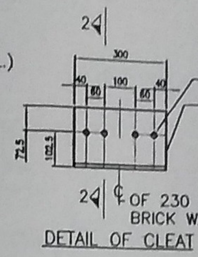


DETAIL OF PURLIN (ISMC 175

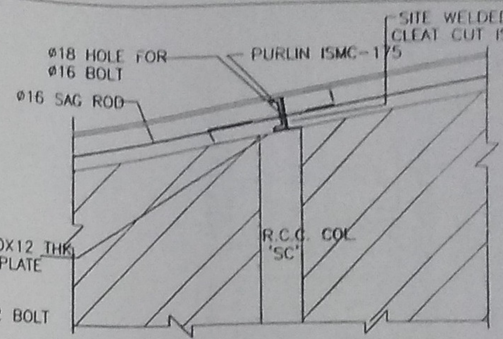


SECTION 1–1

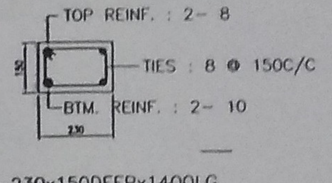




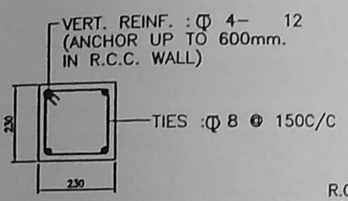
DETAIL OF CLEAT



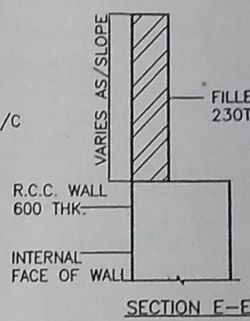
DETAIL AT 'B'



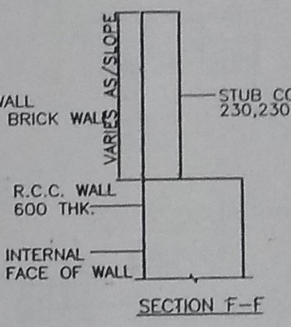
L1-230x150DEEPx1400LG.



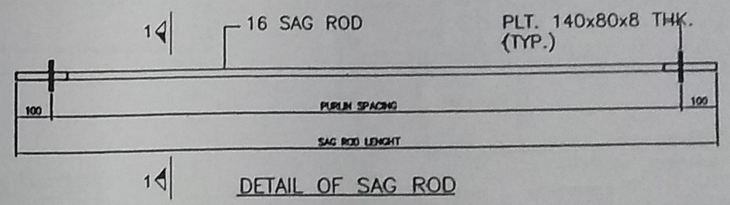
DETAIL OF 'SC'



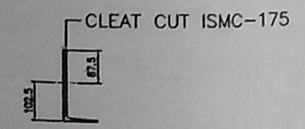
SECTION E–E



SECTION F–F

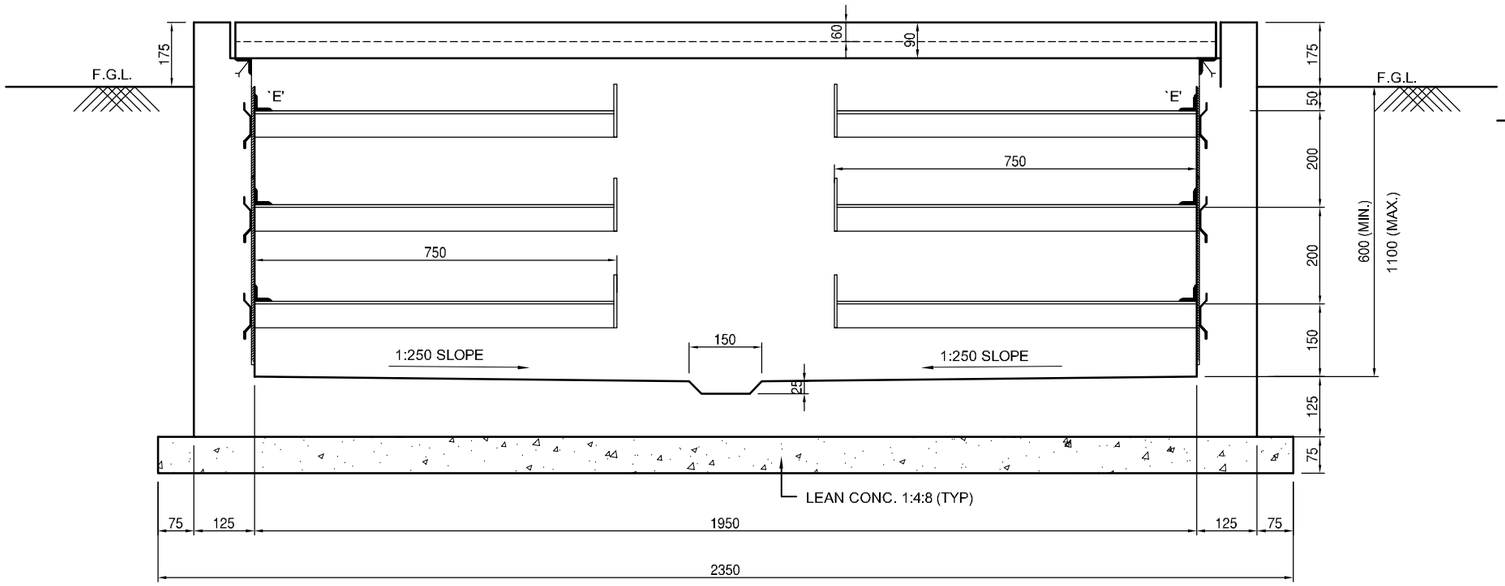


DETAIL OF SAG ROD

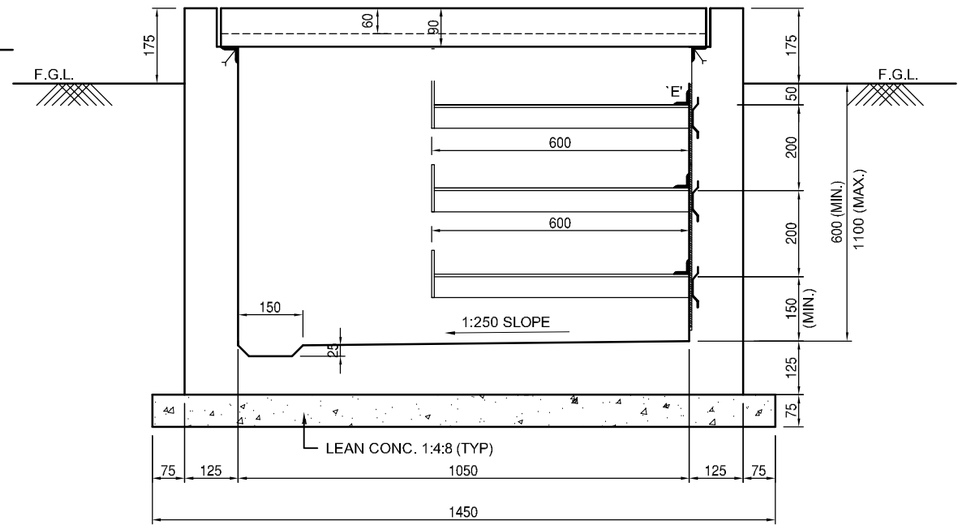


SECTION 2–2

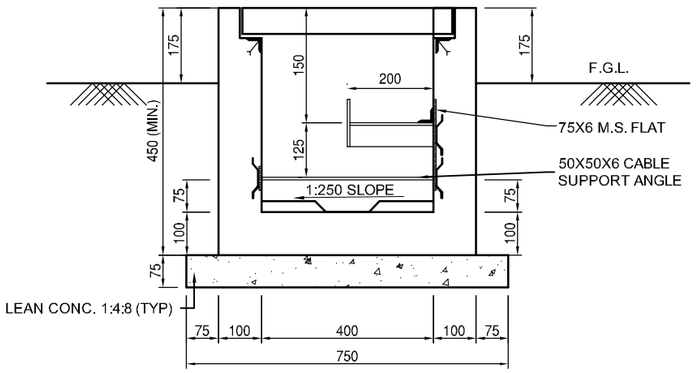
For Tender Purpose Only



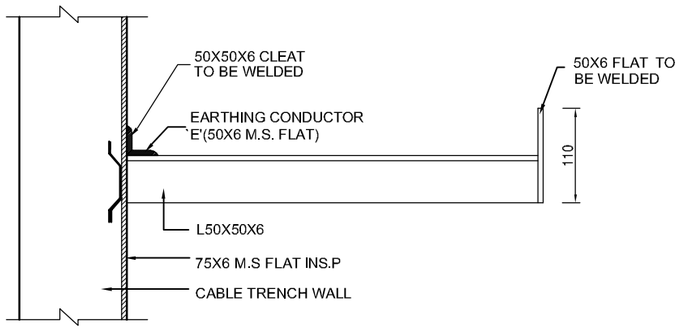
SECTION 1-1



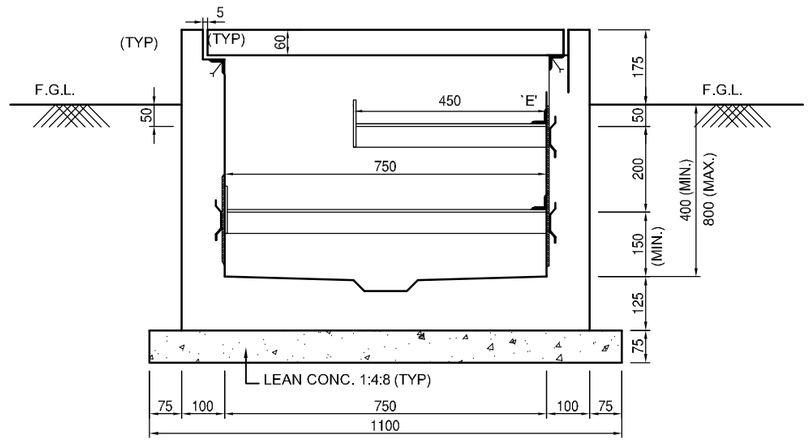
SECTION 2-2



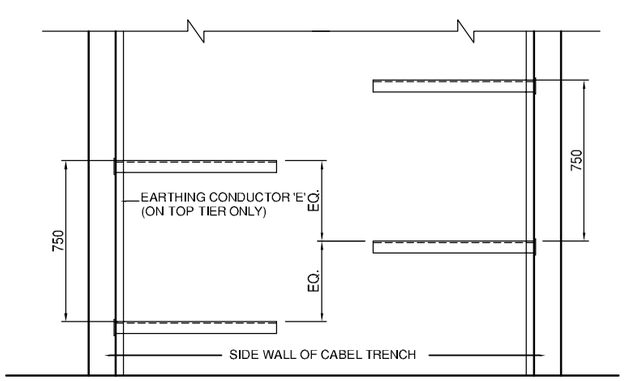
SECTION 4-4



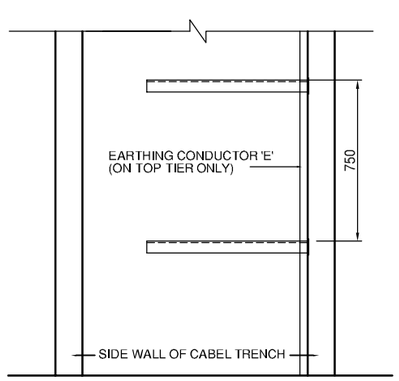
TYPICAL CABLE SUPPORT



SECTION 3-3



PLAN
CABLE TRAY SUPPORT FOR SECTION 1-1

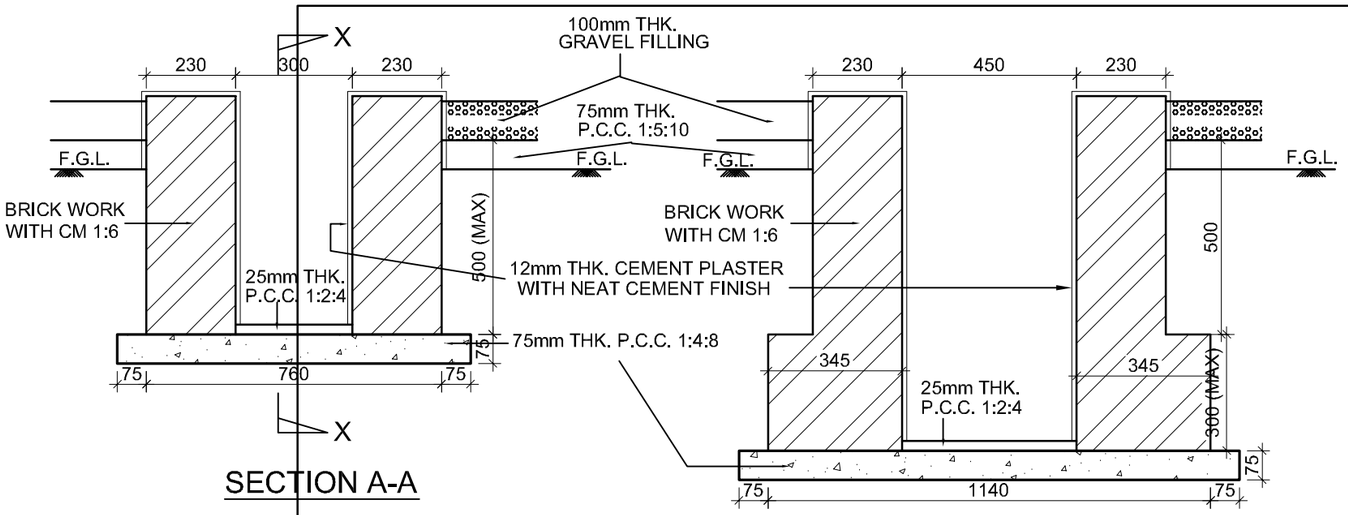


PLAN
CABLE TRAY SUPPORT FOR
SECTION 2-2 & 3-3

FOR TENDER PURPOSE ONLY

REC Transmission Projects Company Limited

PROJECT :	2x50 MVA, 220/33 KV Nagrota Substation
TITLE :	**DETAIL FOR CABLE TRENCH SECTIONS**
SHEET 1 OF 2	

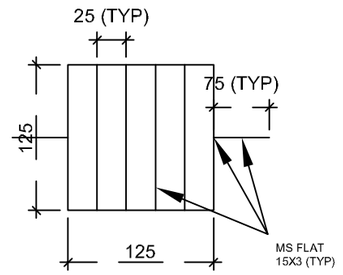


SECTION A-A

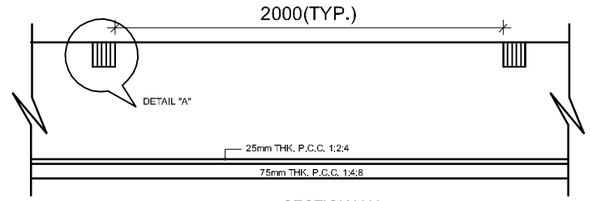
(FOR DEPTH UP TO 600 MM)

SECTION B-B

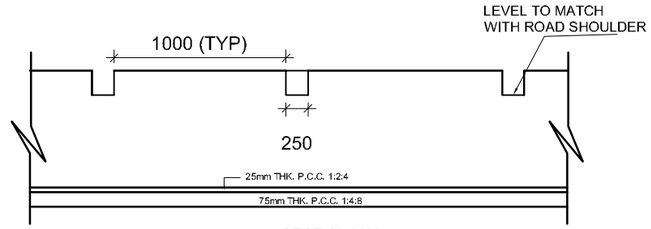
(FOR DEPTH FROM 600 TO 900 MM)



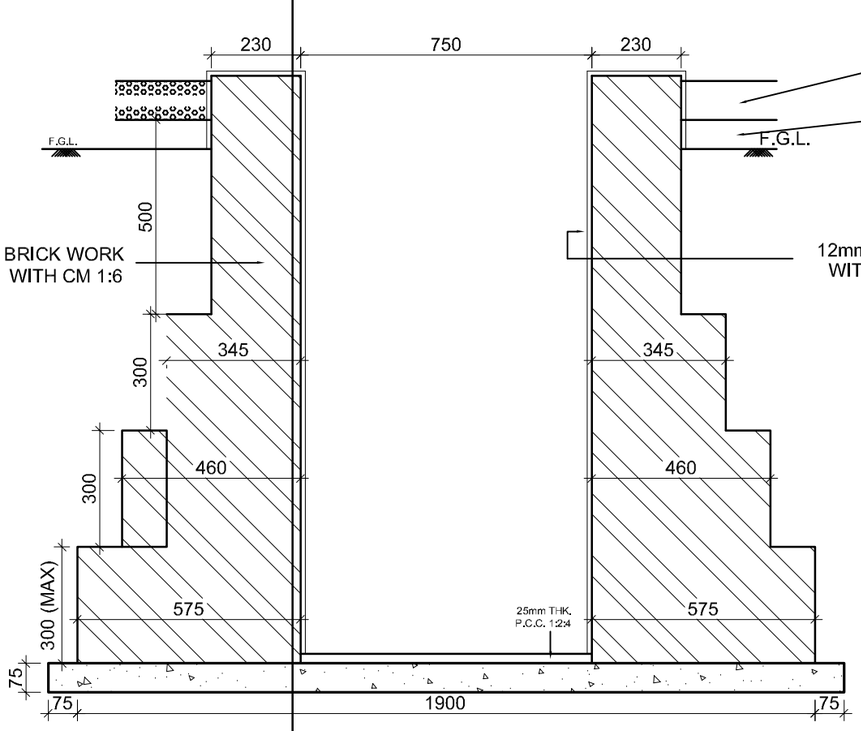
DETAIL "A"



SECTION X-X
(APPLICABLE FOR GRAVEL SIDE)

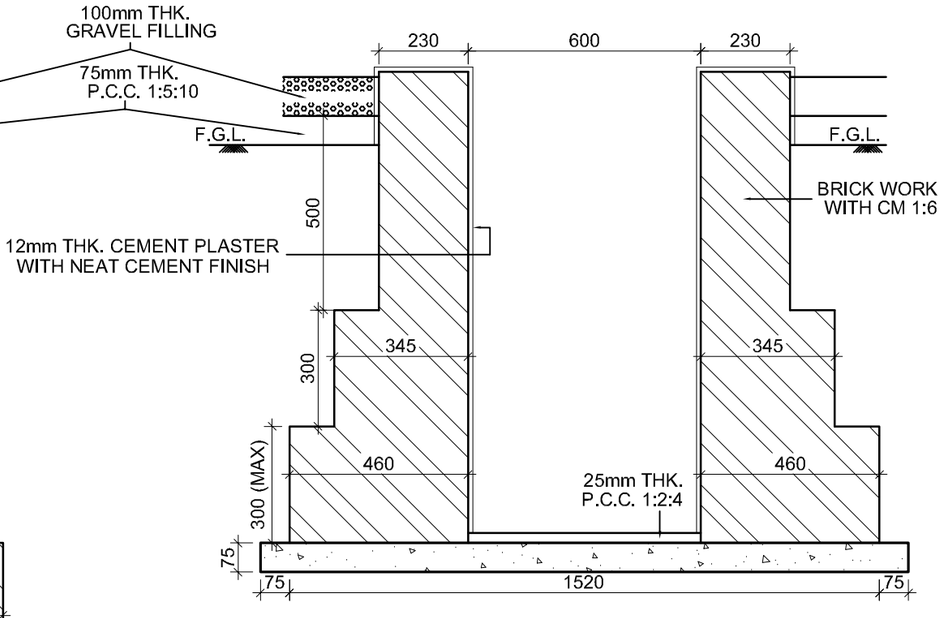


SECTION X-X
(APPLICABLE FOR ROAD SIDE)



SECTION D-D

(FOR DEPTH FROM 1200 TO 1500 MM)



SECTION C-C

(FOR DEPTH FROM 900 TO 1200 MM)

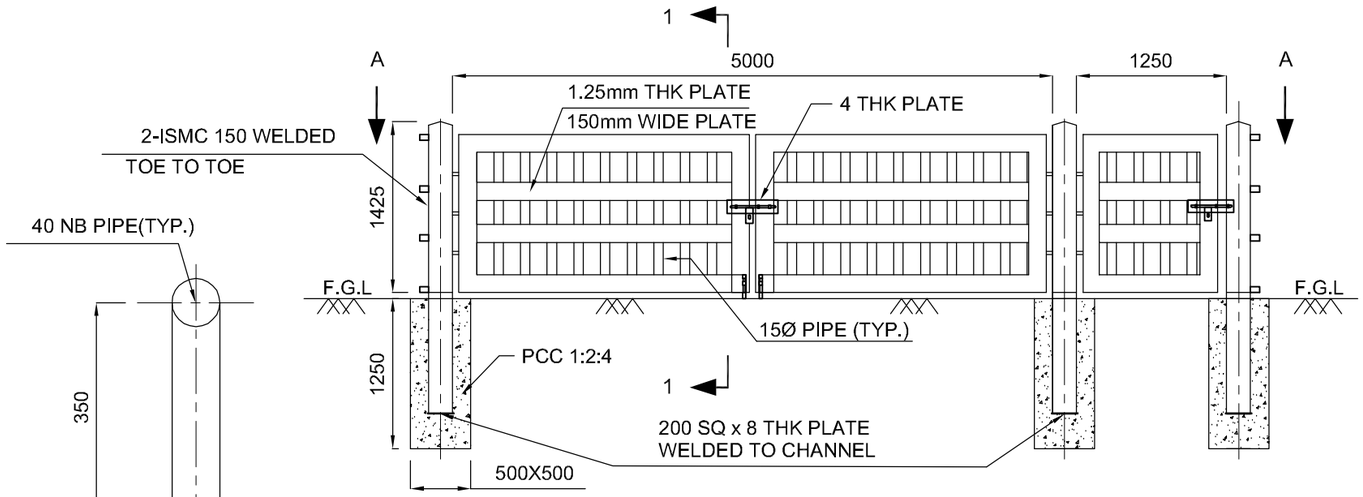
NOTES:-

1. ALL DIMENSIONS ARE IN MM. & ELEVATIONS ARE IN METRE UNLESS NOTED OTHERWISE.
2. ALL DRAINS SHALL BE GIVEN A MINIMUM SLOPE OF 1: 1000 IN THE LONGITUDINAL DIRECTION
3. MINIMUM DEPTH OF DRAIN SHALL BE 300MM BELOW FGL.
4. WHERE EVER TWO SECTIONS ARE MEETING A TRANSITION ZONE SHALL BE CONSTRUCTED HAVING LENGTH 1000mm.
5. 75X75mm WEEP HOLE SHALL BE PROVIDED AT SPACING OF 1500mm HORIZONTALY & 300mm VERTICALLY IN STAGGERED MANER.
6. DEPTH OFF DRAIN IS TAKEN AS HEIGHT FROM TOP OF DRAIN TO INVERT OF DRAIN
7. LAYOUT OF DRAIN WILL BE ISSUED DURING EXECUTION STAGE

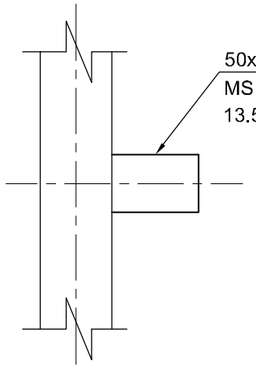
FOR TENDER PURPOSE ONLY

REC Transmission Projects Company Limited

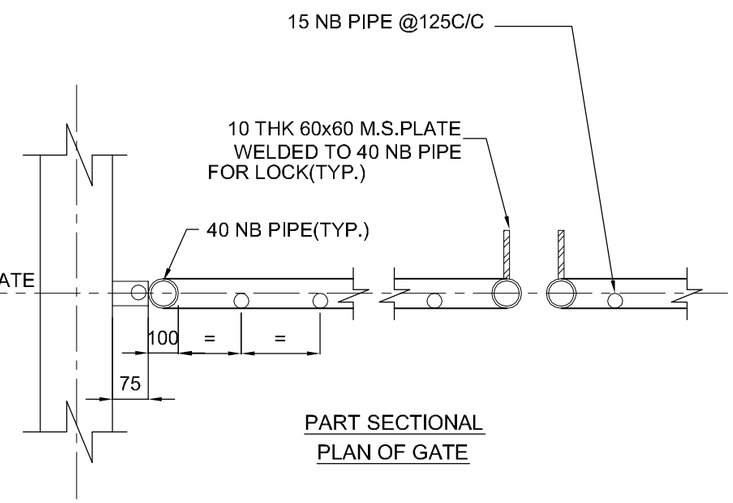
PROJECT :	2x50 MVA, 220/33 KV Nagrota Substation
TITLE :	DETAILS OF DRAIN
SHEET 1 OF 1	



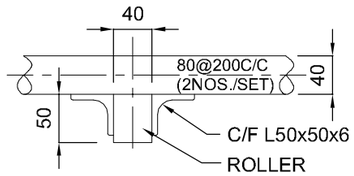
SWITCHYARD FENCING GATE DETAIL



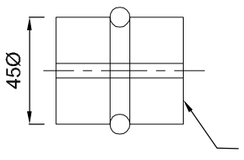
DETAIL -B



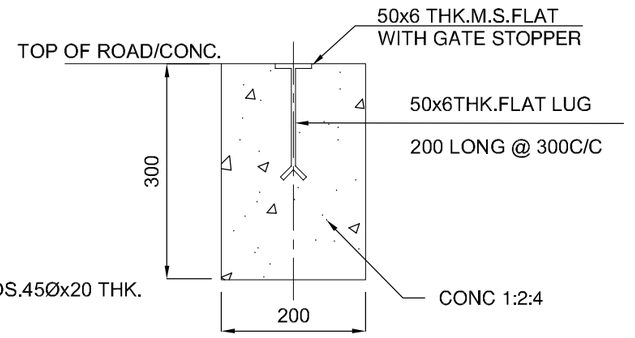
PART SECTIONAL
PLAN OF GATE



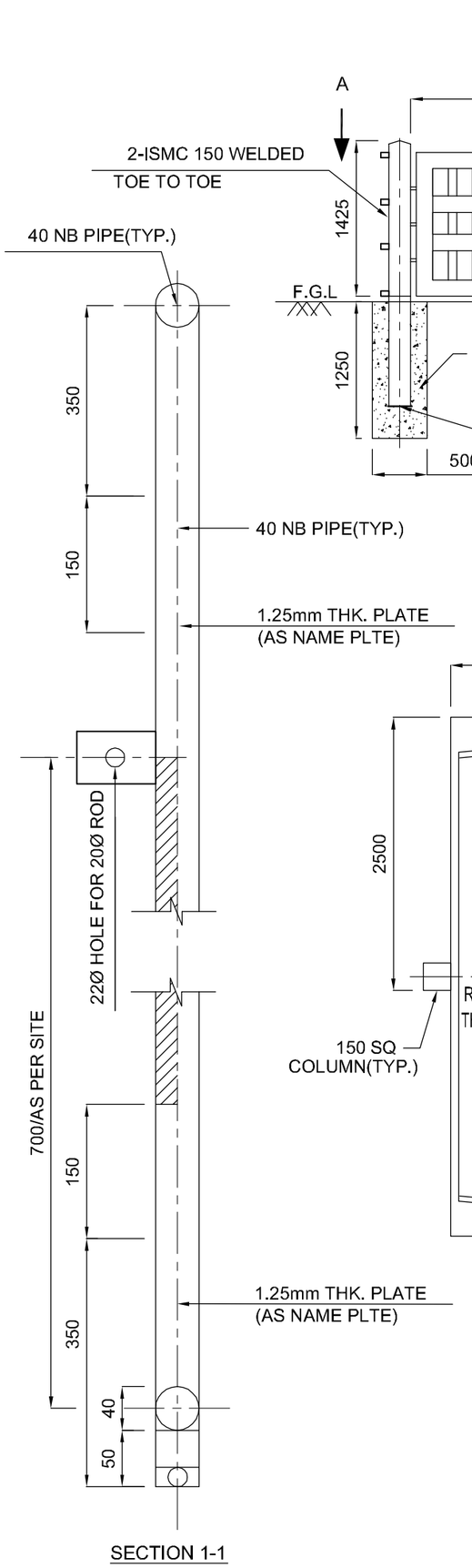
TYP.DETAIL OF
GATE ROLLER



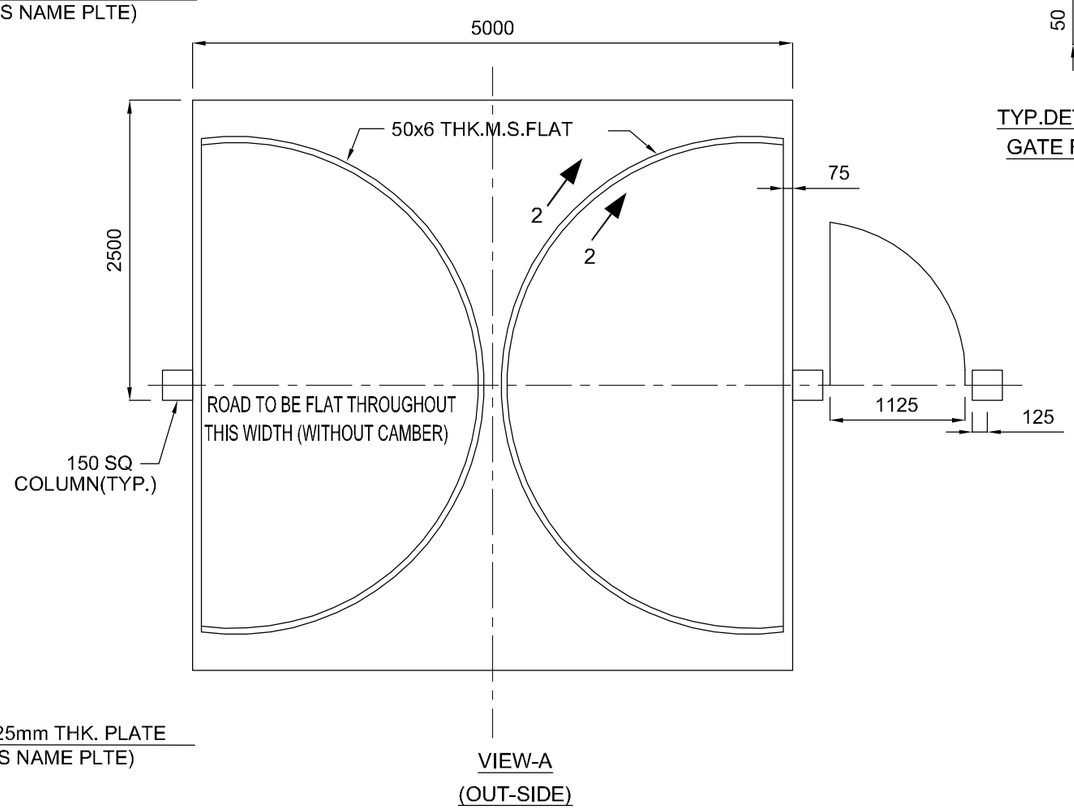
DETAIL -A
(ROLLER BEARING)



SECTION 2:2



SECTION 1-1



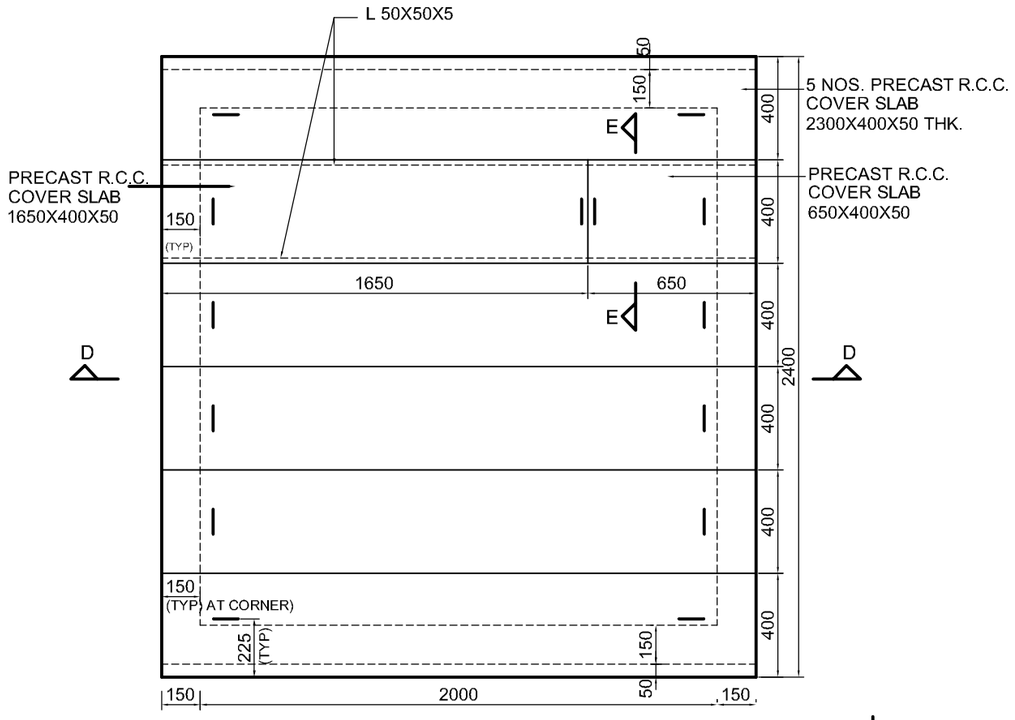
VIEW-A
(OUT-SIDE)

NOTES:

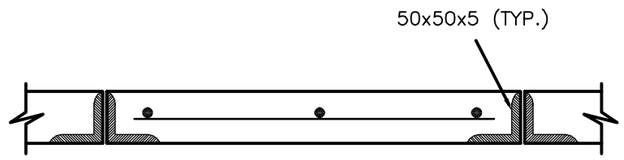
1. ALL DIMENSIONS ARE IN MM & ELEVATION ARE IN METER UNLESS NOTED OTHERWISE
2. ALL LEAN CONC. SHALL BE PCC (1:4:8)UNLESS NITED OTHERWISE.
3. UNLESS NOTED OTHERWISE LAP/ANCHOR LENGTH SHALL BE 50 TIMES THE DIA OF BARS
4. ALL STRUCTURAL STEEL CONFORM TO IS:2062 &SHALL PAINTED WITH A COAT OF APPROVED STEEL PRIMER &TWO COATS OF SYNTHETIC ENAMEL. PAINT UNLESS NOTED OTHERWISE.
5. DROP BOLTS SHOULD BO PROVIDED ON THE FAR SIDE ONLY.
6. ALL WELDS ARE 6MM THK. FILLET WELDS UNLESS NOTED OTHERWISE.
7. GATE & M.S.HOOKS TO BE PAINTED WITH ONE COAL APPROVED STEEL PRIMER BEFORE ERECTION &TWO COAT OF SYNTHETIC PAINTS AFTER ERECTION.
8. STRUCTURAL PIPES SHALL BE MEDIUM TYPE CONFORMING TO IS 1161/806

FOR TENDER PURPOSE ONLY

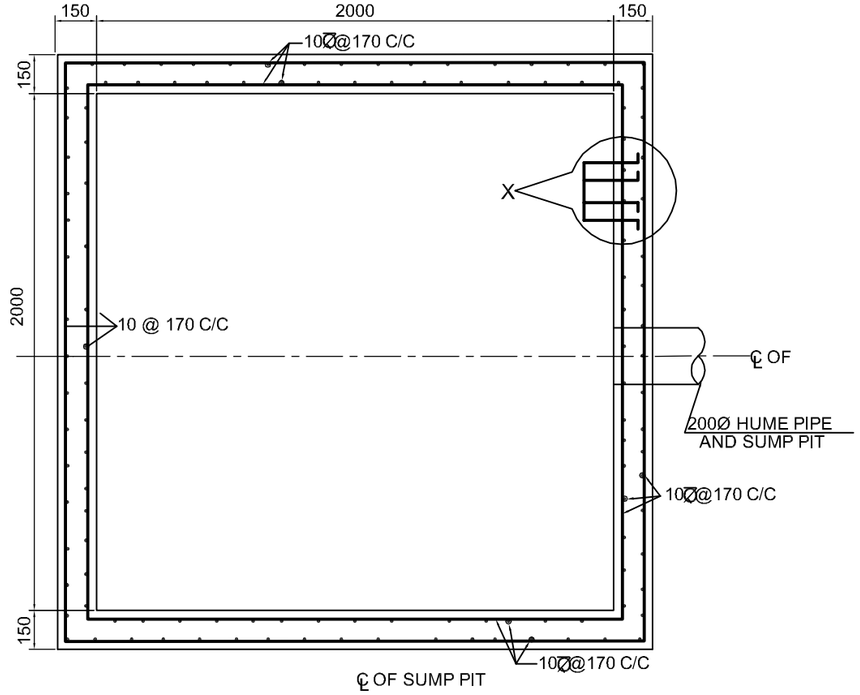
REC Transmission Projects Company Limited	
PROJECT :	2x50 MVA, 220/33 KV Nagrota Substation
TITLE :	DETAILS OF SWITCHYARD GATE
SHEET 1 OF 1	



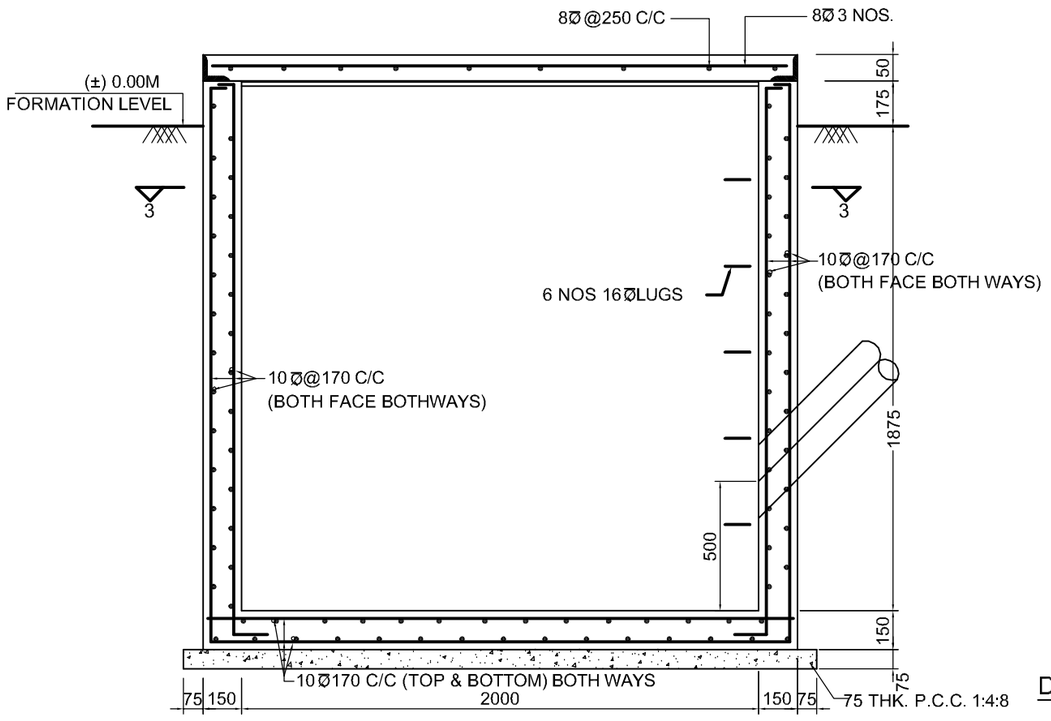
TOP PLAN OF SUMP PIT



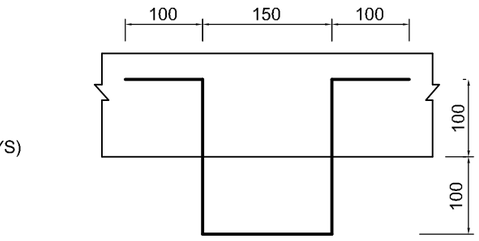
SECTION E-E



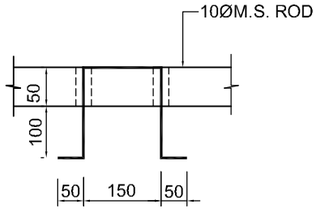
SECTION 3-3



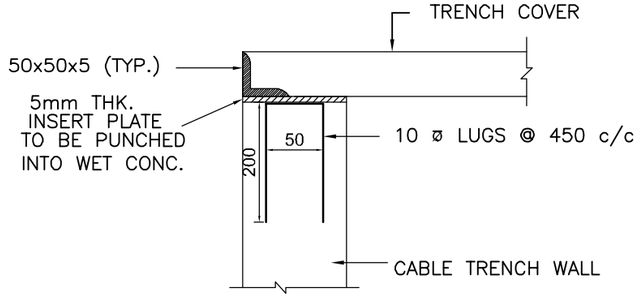
SECTION D-D



DETAIL 'X'



DETAIL OF LIFTING HOOK



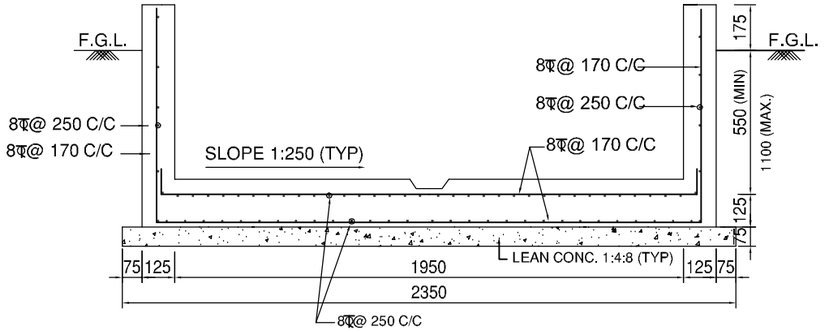
TYPICAL DETAIL OF SLAB SUPPORT

NOTE:

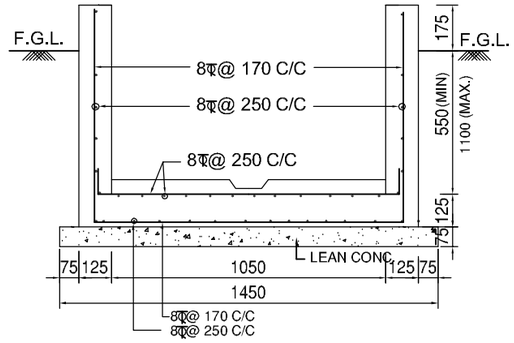
1. ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. R.C.C. MIX.SHOULD BE 1:1.5:3 (1 CEMENT: 1.5 COARSE SAND:3 STONE AGGREGATE 20mm NOMINAL SIZE.)
3. LEAN CONC. SHALL BE IN THE RATIO.1:4:8. (1 CEMENT:4 COURSE SAND: 8STONE AGGREGATE 40MM NORMINAL SIZE)
4. FOR ALL OTHER NOTES REF. DRG. No. C/ENGG/STD/CT-1(SHEET-2)

FOR TENDER PURPOSE ONLY

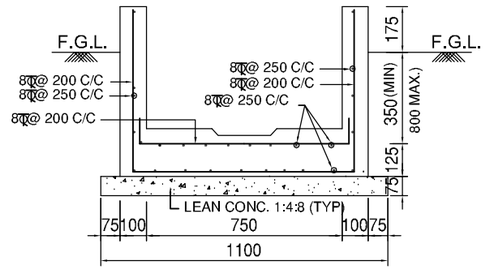
REC Transmission Projects Company Limited	
PROJECT :	2x50 MVA, 220/33 KV Nagrota Substation
TITLE :	**GA & RCC DETAIL OF SUMP PIT**
SHEET 1 OF 1	



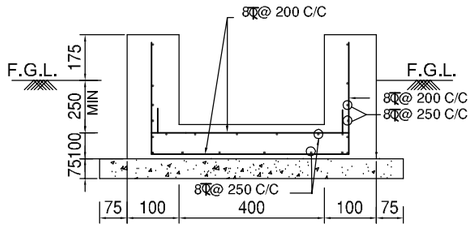
SECTION 1-1



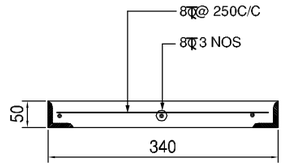
SECTION 2-2



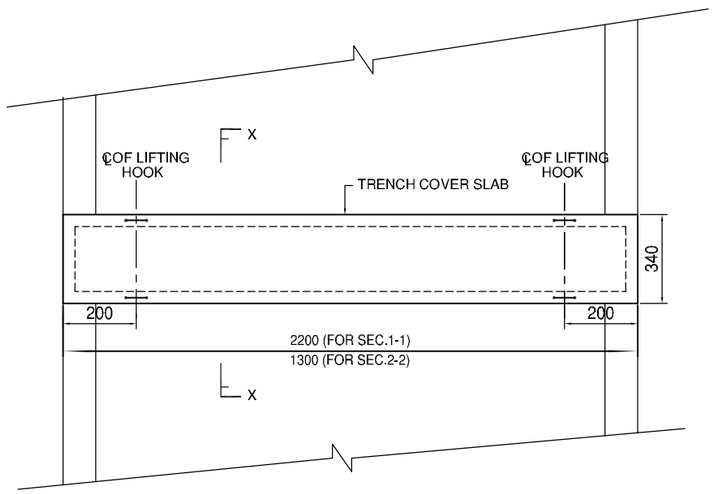
SECTION 3-3



SECTION 4-4

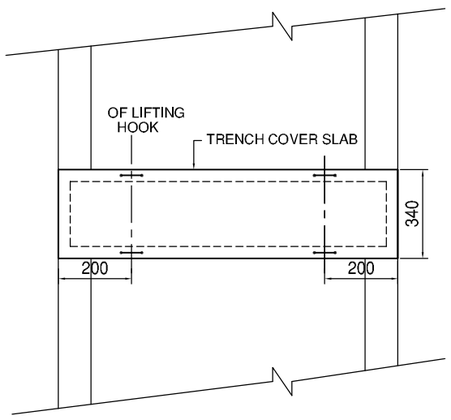


SECTION X-X



PLAN

(DETAIL OF TRENCH COVER FOR SECTION 1-1 & 2-2)



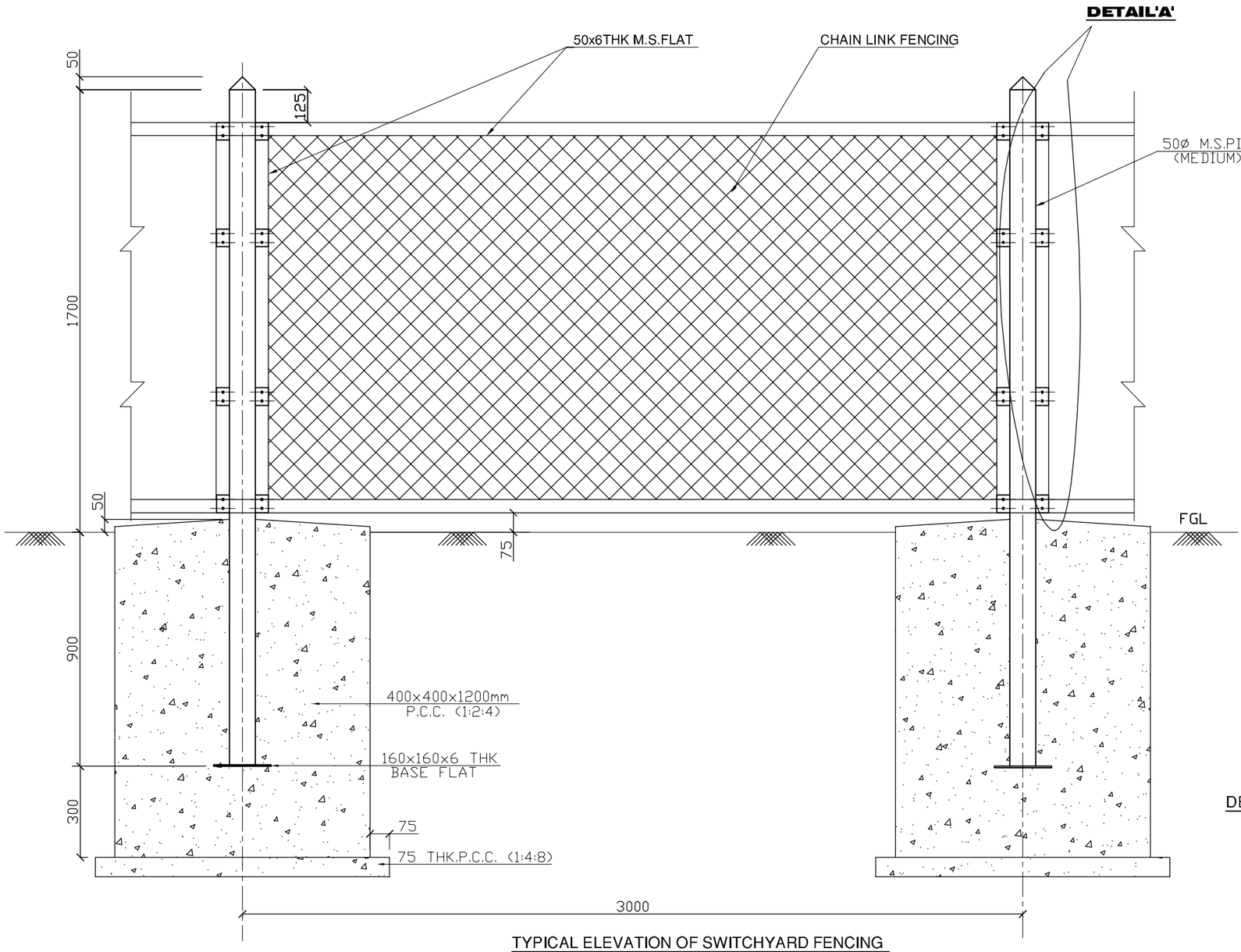
(DETAIL OF TRENCH COVER FOR SECTION 3-3 & 4-4)

NOTE:

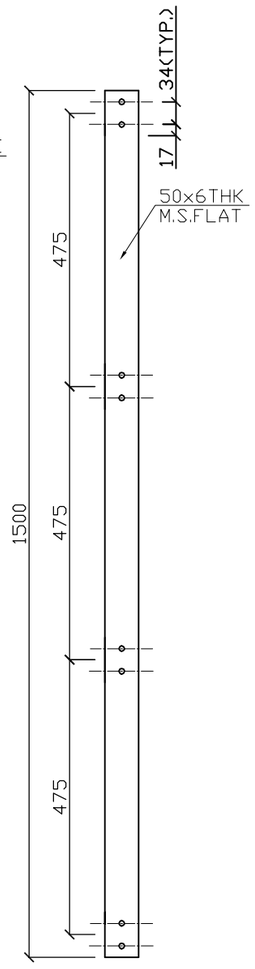
1. ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. R.C.C. MIX.SHOULD BE 1:1.5:3 (1 CEMENT: 1.5 COARSE SAND:3 STONE AGGREGATE 20mm NOMINAL SIZE.)
3. LEAN CONC. SHALL BE IN THE RATIO.1:4:8.
4. FOR ALL OTHER NOTES REF. DRG. No. C/ENGG/STD/CT–1(SHEET–2)

FOR TENDER PURPOSE ONLY

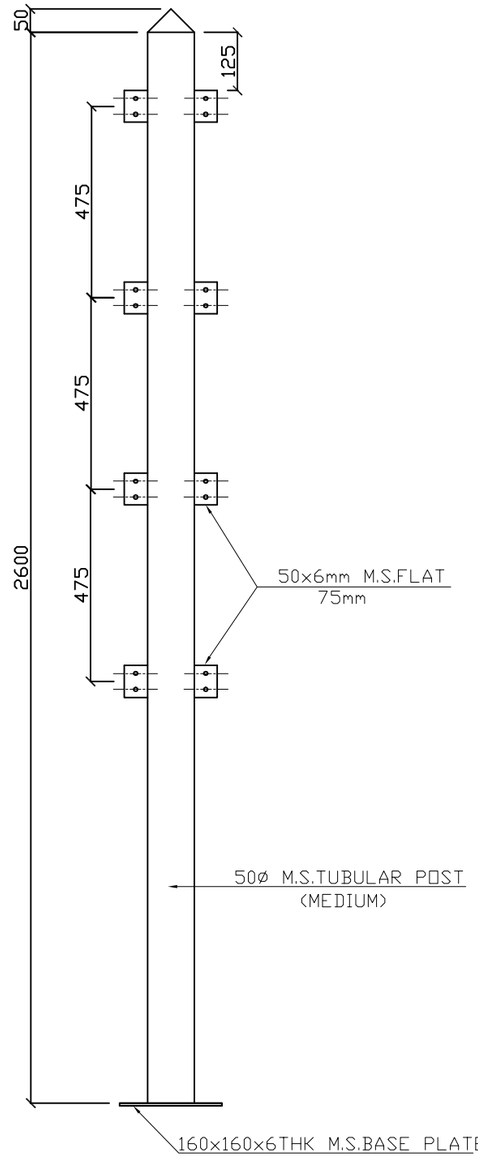
REC Transmission Projects Company Limited	
PROJECT :	**2x50 MVA, 220/33 KV Nagrota Substation**
TITLE :	**RCC DETAIL FOR CABLE TRENCH SECTIONS**
SHEET 1 OF 1	



TYPICAL ELEVATION OF SWITCHYARD FENCING



DETAIL VERTICAL M.S. FLAT
'A'



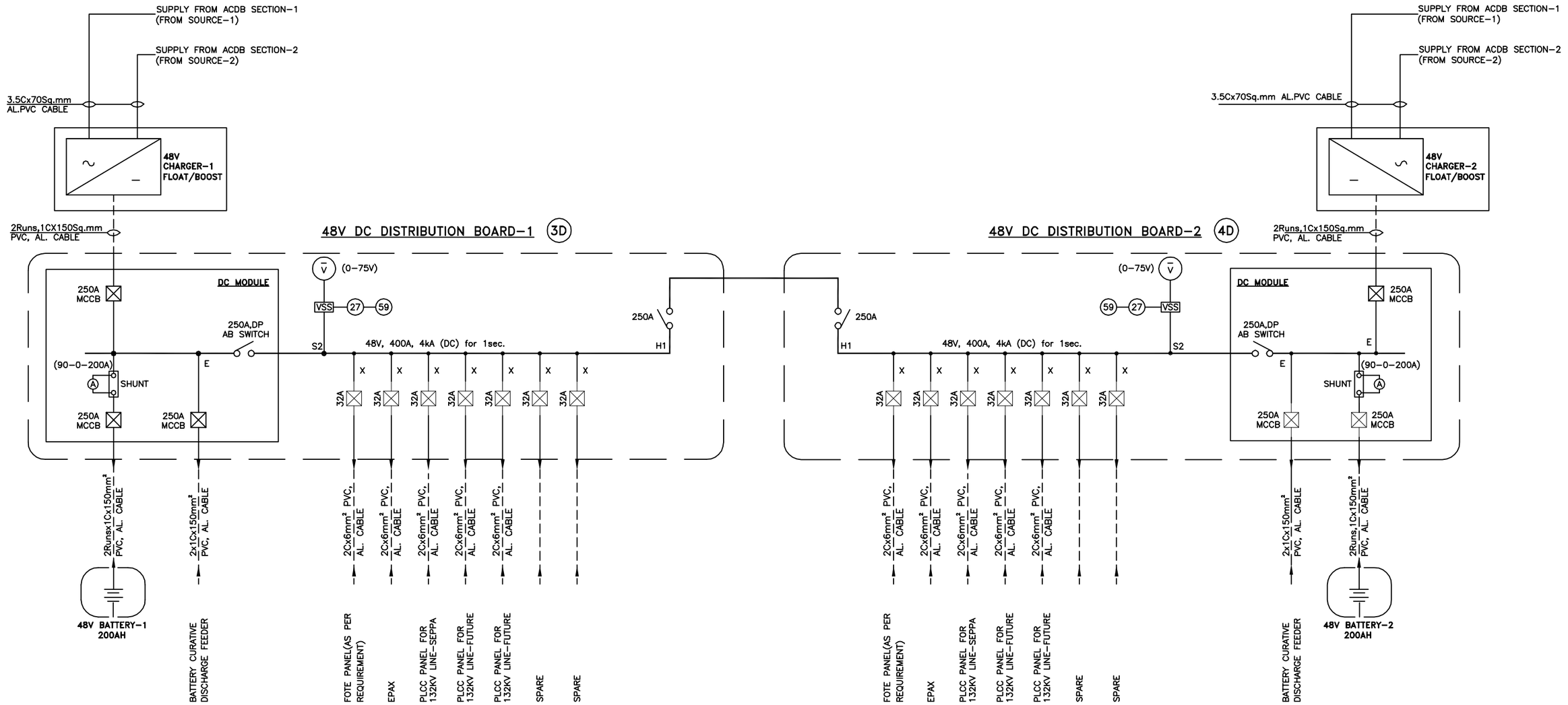
DETAIL OF TUBULAR POST

NOTES:

1. ±0.00 SHALL DENOTE SWITCHYARD FINISHED FORMATION LEVEL
2. CHAIN LINK FENCING SHALL HAVE 3.15 mm DIAMETER WIRE AS PER IS 2721 WITH 75x75 mm MESH SIZE AND PAINTED
3. TUBULAR POST SHALL BE PLACED @ 3.0m CENTRE TO CENTRE AND SHALL REST IN WELL COMPACTED EARTH
4. CORNER TUBULAR POST SHALL BE PROVIDED CLEATS IN FOUR SIDES SUITING TO REQUIREMENT
5. TUBES/PIPES OF POST SHALL BE GALVANIZED
6. CONCRETE GRADE FOR P.C.C. SHALL CONFORM IS 456: LATEST
7. EXPOSED SURFACE OF CONCRETE PAD (P.C.C.) SHALL BE PLASTERED WITH 12mm THICK CEMENT PLASTER (1:6)

FOR TENDER PURPOSE ONLY

REC Transmission Projects Company Limited	
PROJECT :	2x50 MVA, 220/33 KV Nagrota substation
TITLE :	STANDARED DETAILS FOR SWITCH YARD CHAIN LINK FENCING CHAIN LINK FENCING
SHEET 1 OF 1	



LEGEND:-

SYMBOL	DESCRIPTION
⊠	DOUBLE POLE MCCB
(A)	AMMETER
(V)	VOLTMETER
VSS	VOLTMETER SELECTOR SWITCH
(27)	U/V RELAY
(59)	O/V RELAY

REFERNCE DRAWING:-

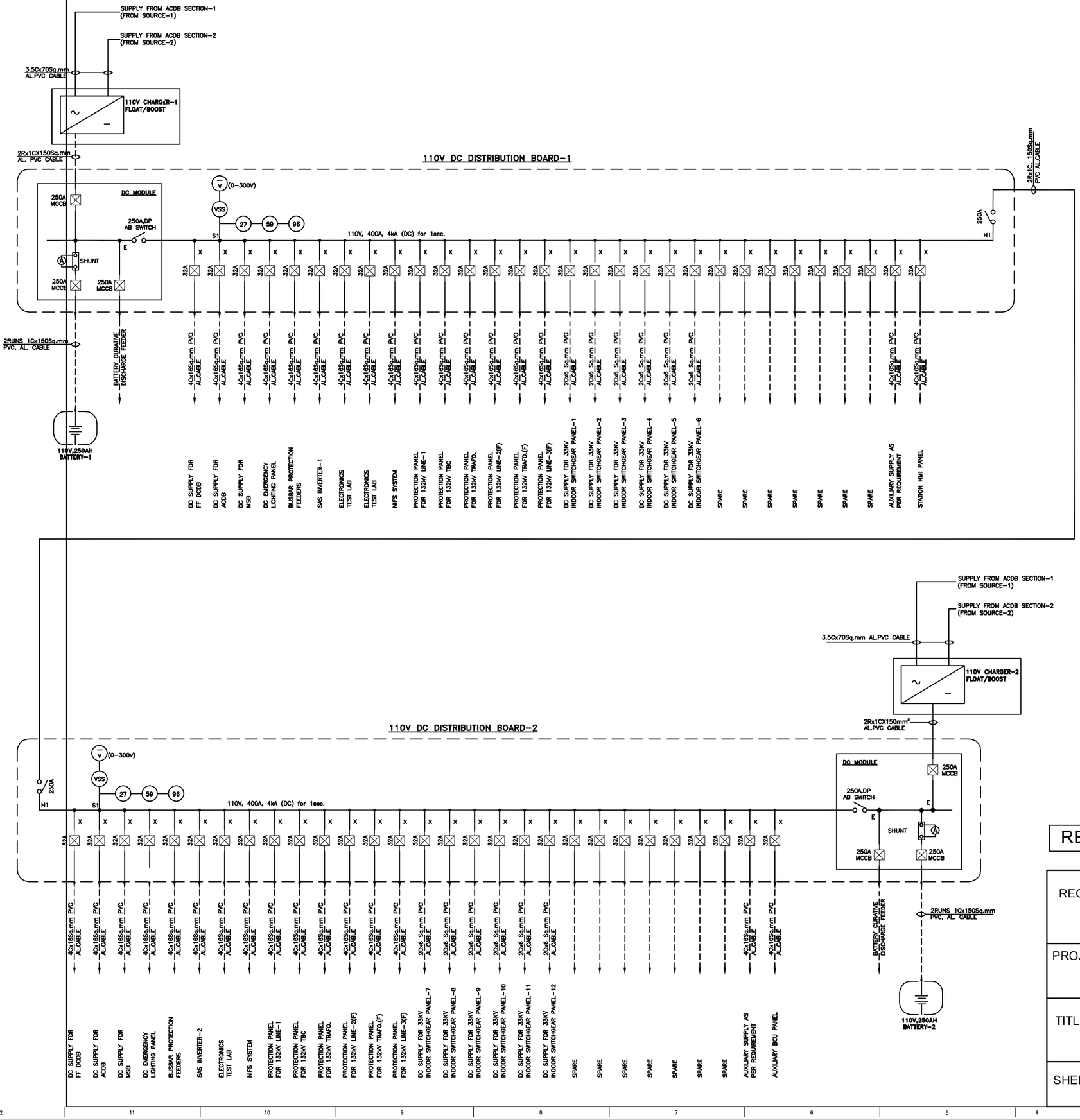
1. THIS DRAWING IS BASED ON PGCIL DWG NO : C/ENGG/NER/AC/SLD/01 (SHEET 2 OF 2)

NOTES:-

1. DCDB SHALL MEET REQUIREMENT AS PER SECTION LT SWITCHGEAR OF TECHNICAL SPECIFICATION.
2. ALL DIGITAL/ANALOGUE INPUT/OUTPUTS REQUIRED FOR SAS SYSTEM SHALL BE CONSIDERED BY THE LT SWITCHGEAR MANUFACTURER.

RELEASED FOR TENDER

REC TRANSMISSION PROJECTS COMPANY LIMITED	
PROJECT :	2X50 MVA, 220/33 KV NAGROTA SUBSTATION
TITLE :	SINGLE LINE DIAGRAM FOR 48V DCDB
SHEET 1 OF 1	



LEGEND:-

SYMBOL	DESCRIPTION
⊠	DOUBLE POLE MCCB
	DOUBLE POLE AIR BREAK SWITCH
	DOUBLE POLE MCB
(A)	AMMETER
(V)	VOLTMETER
(VSS)	VOLTMETER SELECTOR SWITCH
(27)	U/V RELAY
(59)	O/V RELAY
(96)	EARTH LEAKAGE RELAY

REFERENCE DRAWINGS :-

1. THIS DRAWING IS BASED ON PGCIL DWG.No : C/ENGG/NER/SLD/01. SHEET-2 OF 2.

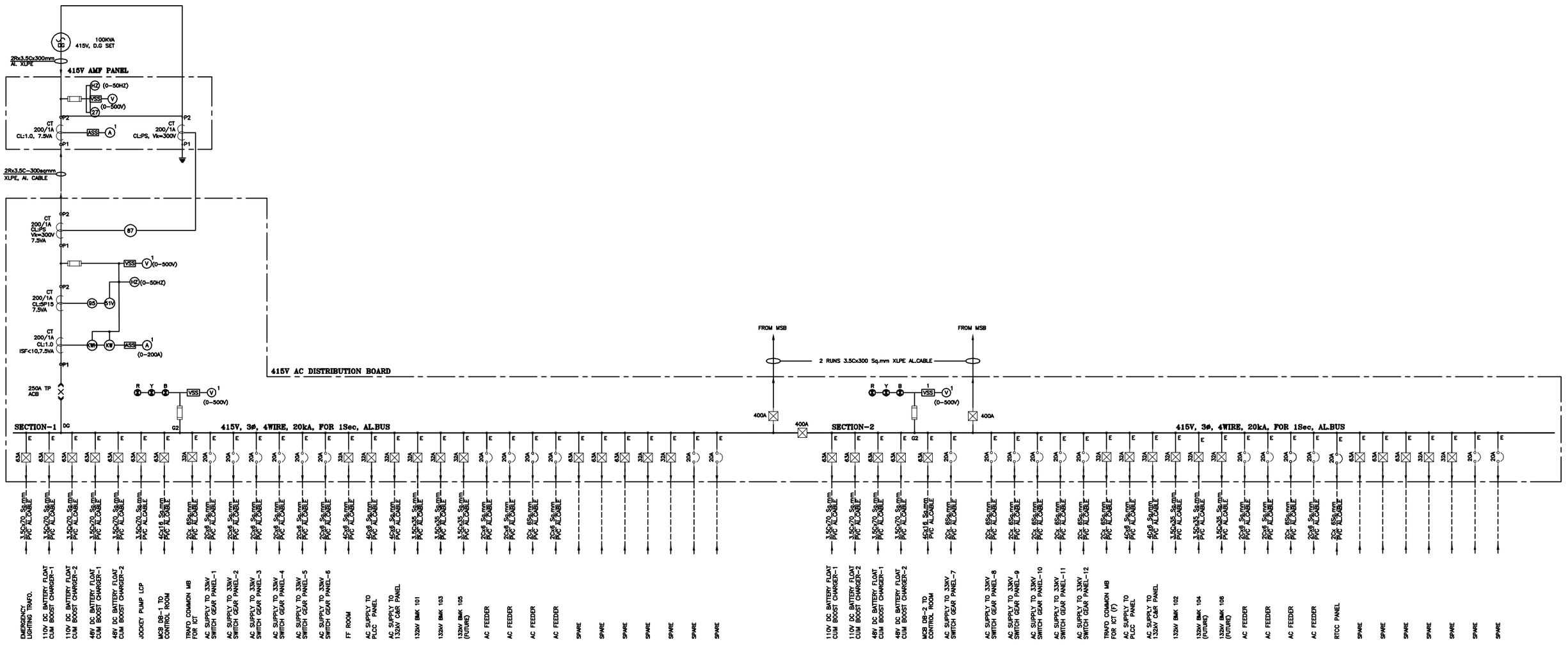
NOTE :-

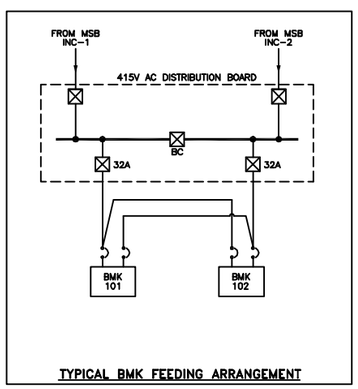
1. NUMBER OF FEEDERS SHALL BE PROVIDED IN EACH BOARD AS PER REQUIREMENT OF SUB-STATION.
2. ONE DC 'X' TYPE MODULE IN EACH 110V DCDB SHALL BE PROVIDED FOR EACH LINE, TRANSFORMER, BUS REACTOR, TBC, BC BAY INCLUDING FUTURE BAYS AS SHOWN IN SUBSTATION SLD.
3. RATING OF BUS BARS/FEEDERS INDICATED IN THIS DRAWING ARE MINIMUM REQUIREMENT AND MAY BE INCREASED DURING DETAILED ENGINEERING IF FOUND INADEQUATE RESPECT TO OFFERED LOADS / SYSTEM.
4. ALL DIGITAL/ANALOGUE, INPUT/OUTPUTS REQUIRED FOR SAS SYSTEM SHALL BE CONSIDERED BY THE LT SWITCHGEAR MANUFACTURER.
5. AS PER VENDOR DRAWINGS OF 33kV GIS PANEL ONLY ONE DC SUPPLY IS USED. HENCE WE HAVE INDICATED SIX GIS PANELS IN DCDB-I & ANOTHER SIX PANELS IN DCDB-II.

RELEASED FOR TENDER

REC TRANSMISSION PROJECTS COMPANY LIMITED	
PROJECT :	2X50 MVA, 220/33 KV NAGROTA SUBSTATION
TITLE :	SINGLE LINE DIAGRAM FOR 110V DCDB
SHEET 1 OF 1	

841 X 594 – A1





TYPICAL BMK FEEDING ARRANGEMENT

LEGEND:-

SYMBOL	DESCRIPTION
VSS	VOLTMETER SELECTOR SWITCH
KW	KILO WATT METER
KWH	KILO WATT HOUR METER
HZ	FREQUENCY METER
27	2 POLE INSTANTANEOUS UNDER VOLTAGE RELAY + AUXILIARY RELAY + TIMER
51	IDMT OVER CURRENT RELAY
51N	IDMT EARTH FAULT RELAY
51V	VOLTAGE CONTROLLED DEFINITE TIME O/C RELAY
87	DIFF. PROTECTION RELAY
	DIESEL GENERATOR SET
95	OVERLOAD ALARM RELAY

LEGEND:-

SYMBOL	DESCRIPTION
	DRAWOUT TYPE 3 POLE AIR CIRCUIT BREAKER (DRAWOUT TYPE)
	4POLE MOULDED CASE CIRCUIT BREAKER (MCCB) (NON DRAWOUT TYPE)
	DOUBLE POLE MCB
	FUSE
	INDICATING LAMP
	CURRENT TRANSFORMER
A	AMMETER
V	VOLTMETER
ASS	AMMETER SELECTOR SWITCH

REFERENCE DRAWING:-

1. THIS DRAWING IS BASED ON PGCIL DWG.No : C/ENGG/NER/AC/SLD/01 SHT 01 OF 02

NOTE :-

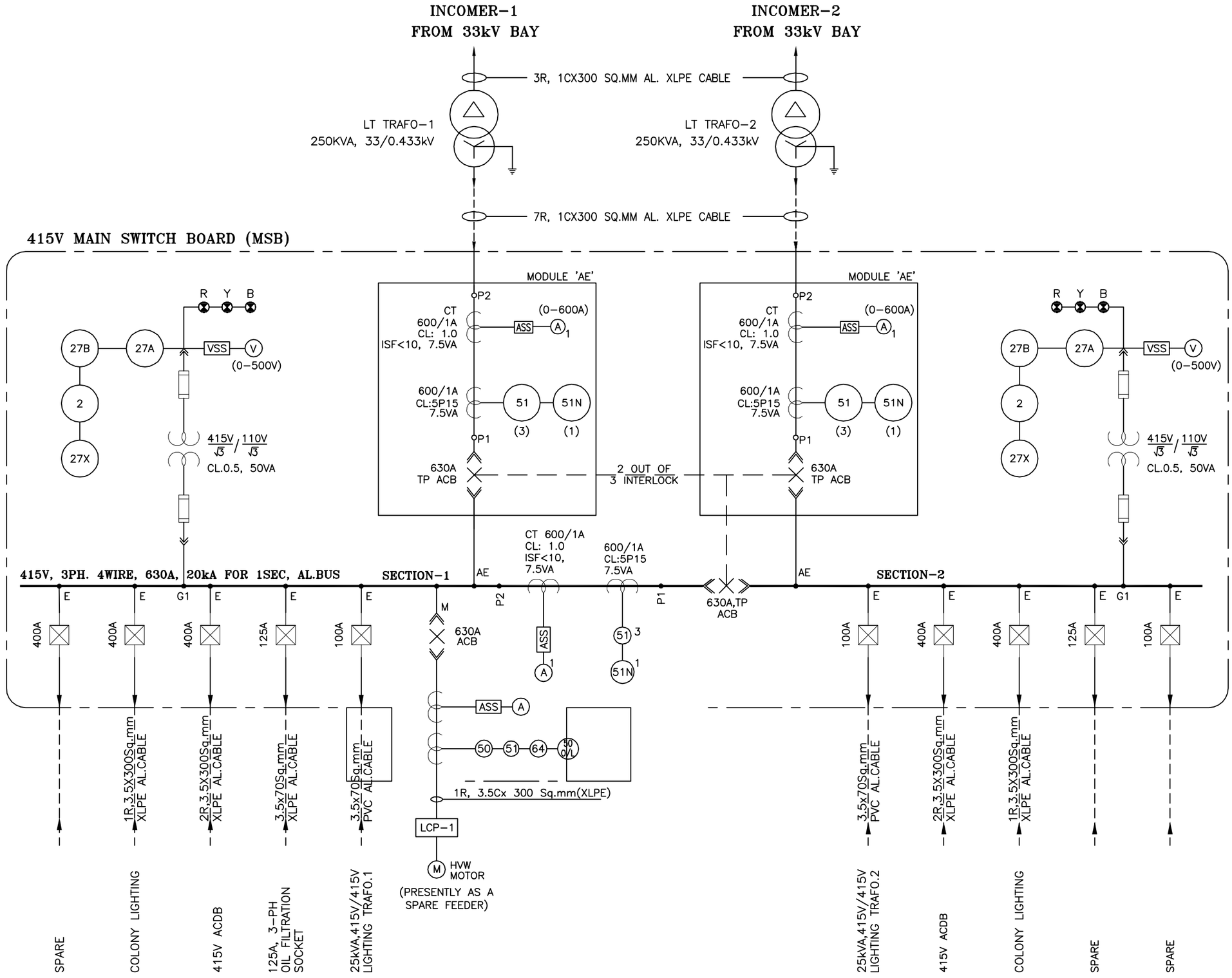
1. INTERLOCK SHALL BE PROVIDED BETWEEN INC1, INC2 & B/C SUCH THAT ONLY TWO BREAKERS SHALL BE IN SERVICE AT A TIME IN MAIN SWITCHBOARD.
2. NO TWO AC SOURCE SHALL BE PARALLELED AT ANY STAGE.
3. DG SET SHALL BE AUTO START TYPE.
4. EACH BAY MB & TRANSFORMER MB SHALL BE FED BY ATLEAST ONE SOURCE FROM 415V ACDB. SECOND SOURCE SHALL BE LOOPED FROM NEAREST BAY MB & TRANSFORMER MB WHICH SHALL BE FED FROM ANOTHER SOURCE FROM 415V ACDB.
5. 1PH & 3PH AC SUPPLY FOR ALL BAY EQUIPMENTS SHALL BE FED FROM THE BMK.
6. AUTOMATIC SUPPLY CHANGE OVER SHALL BE ACHIEVED AS PER TECHNICAL SPECIFEICATION, SECTION –LT SWITCHGEAR.
7. AS PER VENDOR DRAWINGS OF TRANSFORMER COMMON MARSHALLING BOX AND 33kV GIS PANEL, ONE SINGLE PHASE AC SUPPLY IS REQUIRED. HENCE WE HAVE INDICATED SINGLE PHASE FEEDERS.

RELEASED FOR TENDER

REC TRANSMISSION PROJECTS COMPANY LIMITED

PROJECT :	2X50 MVA, 220/33 KV NAGROTA SUBSTATION
TITLE :	SINGLE LINE DIAGRAM FOR 415V ACDB
SHEET 1 OF 1	

841 X 594 – A1



LEGEND:-

SYMBOL	DESCRIPTION
	3 POLE AIR CIRCUIT BREAKER (DRAWOUT TYPE)
	FOUR POLE MOULDED CASE CIRCUIT BREAKER (NON DRAWOUT TYPE)
	FUSE
	INDICATING LAMP
	CURRENT TRANSFORMER
	VOLTAGE TRANSFORMER
A	AMMETER
V	VOLTMETER
ASS	AMMETER SELECTOR SWITCH
VSS	VOLTMETER SELECTOR SWITCH
27A 27B	UNDER VOLTAGE RELAY
27X	VOLTAGE MONITARING RELAY
50	INSTANTANEOUS OVER CURRENT RELAY
50 O/L	OVER LOAD RELAY
51	IDMT OVER CURRENT RELAY
51N	IDMT EARTH FAULT RELAY
2	TIMER
64	EARTH FAULT RELAY

REFERENCE DARWING:-

1. THIS DRAWING IS BASED ON PGCIL DRAWING NO: C/ENGG/NER/AC/SLD/01 SHT 01 OF 02.

RELEASED FOR TENDER

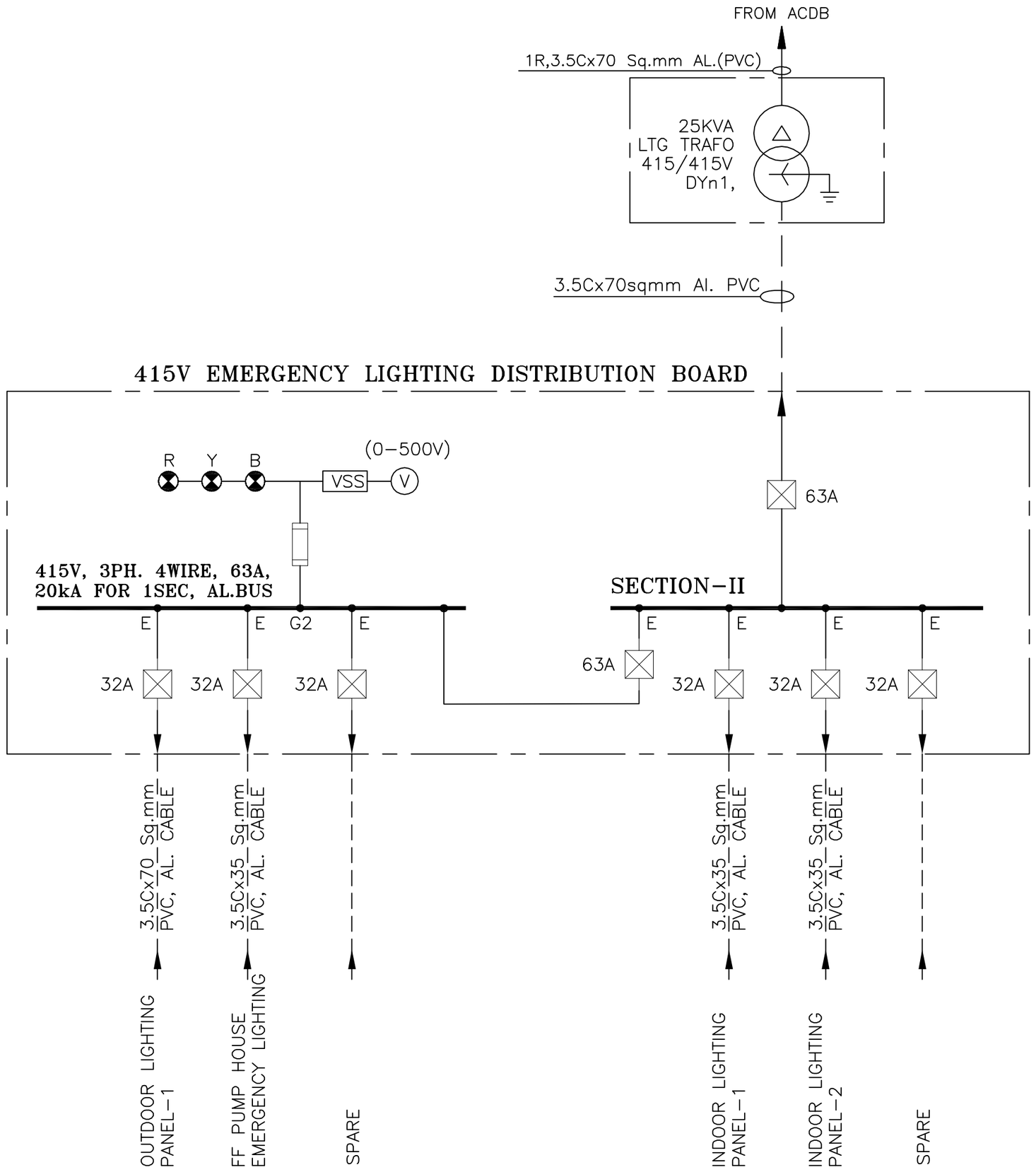
REC TRANSMISSION PROJECTS COMPANY LIMITED

PROJECT: 2X50 MVA, 220/33 KV NAGROTA SUBSTATION

TITLE: **SINGLE LINE DIAGRAM FOR 415V MAIN SWITCH BOARD**

SHEET 1 OF 1

420 X 297 – A3



LEGEND:-

SYMBOL	DESCRIPTION
	LTG TRANSFORMER
	4POLE MCCB
	FUSE
	INDICATING LAMP
VSS	VOLTAGE SELECTOR SWITCH
V	VOLTMETER

RELEASED FOR TENDER

REC TRANSMISSION PROJECTS COMPANY LIMITED	
PROJECT :	2X50 MVA, 220/33 KV TRANSMISSION COMPANY LIMITED
TITLE :	SLD FOR EMERGENCY LIGHTING DISTRIBUTION BOARD
SHEET 1 OF 1	

297 X 210 - A4

FROM
415V AC MAIN SWITCH BOARD

FROM
415V AC MAIN SWITCH BOARD

1R,3.5Cx70 Sq.mm AL.(PVC)

1R,3.5Cx70 Sq.mm AL.(PVC)

25KVA
LTG TRAFO-1
415/415V

25KVA
LTG TRAFO-2
415/415V

1R,3.5Cx70 Sq.mm AL.(PVC)

1R,3.5Cx70 Sq.mm AL.(PVC)

R Y B 1 VSS (V) (0-500V)

100A

100A

R Y B VSS 1 (V) (0-500V)

415V, 3PH. 4WIRE, 100A,
20kA FOR 1SEC, AL.BUS

SECTION-1

SECTION-2

100A

E E G2 E E E E E E E E E E E E G2 E

63A 63A 63A 63A 63A 100A 32A 63A 63A 32A 63A 32A 63A 32A

3.5Cx70 Sq.MM PVC AL.CABLE

3.5Cx70 Sq.MM PVC AL.CABLE

3.5Cx70 Sq.MM PVC AL.CABLE

3.5Cx70 Sq.MM PVC AL.CABLE

3.5Cx35 Sq.MM AL.PVC CABLE

3.5Cx70 Sq.MM AL.PVC CABLE

3.5Cx35 Sq.MM AL.PVC CABLE

3.5Cx70 Sq.MM AL.PVC CABLE

3.5Cx35 Sq.MM AL.PVC CABLE

SPARE

STREET LIGHTING PANEL-1

SWITCHYARD LIGHTING PANEL-1

SWITCHYARD LIGHTING PANEL-2

SWITCHYARD LIGHTING PANEL-3

INDOOR LIGHTING PANEL-1

63A OUTDOOR RECEPTACLE

SPARE

INDOOR LIGHTING PANEL-2

63A OUTDOOR RECEPTACLE

FF PUMPHOUSE NORMAL LIGHTING

SPARE

SPARE

LEGEND:-

SYMBOL	DESCRIPTION
	LTG TRANSFORMER
	4POLE MCCB
	FUSE
	INDICATING LAMP
VSS	VOLTAGE SELECTOR SWITCH
V	VOLTMETER

RELEASED FOR TENDER

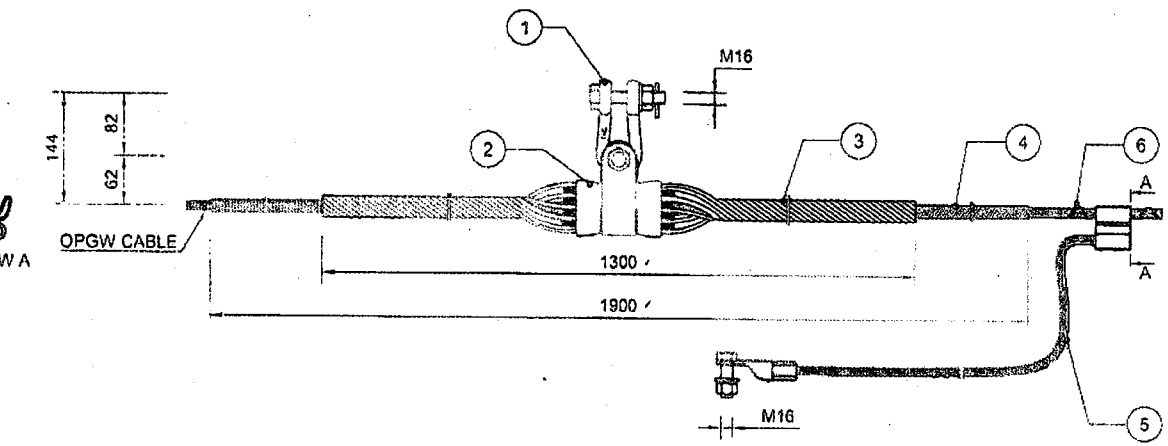
REC TRANSMISSION PROJECT COMPANY LIMITED

PROJECT : 2X50 MVA, 220/33 KV NAGROTA SUBSTATION

TITLE : SLD FOR MAIN LIGHTING DISTRIBUTION BOARD

SHEET 1 OF 1

420 X 297 – A3



ITEM CODE	F	0	0	5	0	5	0	0	1

TECHNICAL DATA

1. ASSEMBLY MINIMUM ULTIMATE TENSILE STRENGTH - 59 KN.
2. FERROUS PARTS HOT DIP GALVANIZED AS PER ISO:1461.
3. DIAMETER OF THE OPGW CABLE 11.4 MM, UTS :59 KN.
4. ALL DIMENSIONS ARE IN mm.
5. WEIGHT - 4.57 ± 0.46 Kg.
6. WEIGHT IS INDICATIVE ONLY.
7. HARDWARE FITTING TOLERANCES AS PER IEC 61284.

REC TRANSMISSION PROJECT COMPANY LIMITED

FOR TENDER PURPOSE ONLY

TITLE:

OPGW SINGLE SUSPENSION ASSEMBLY

ASSEMBLY DRG.NO:

	RETAINING ROD	AL.CLAD STEEL (IEC:1232)	TAG/RR/001/LP	-	1 SET
	FLEXIBLE ALUMINIUM BOND	ALUMINIUM ALLOY	TAG/FAB/002/LP	-	1
	PROTECTION ROD	AL.ALLOY (TYPE - 65032, IS: 733)	TAG/PR/005/LP	-	1 SET
	HELICAL ARMOUR ROD	AL.ALLOY (TYPE - 65032, IS: 733)	TAG/HAR/004/LP	-	1 SET
	A.G.CLAMP BODY	AL.ALLOY (TYPE - 4600, IS: 617)	AGSC/2000/LP	70	1 SET
	D-SHACKLE	FORGED STEEL(CL - IV, IS: 2004)	DS/1601/LP	70	1
O.	DESCRIPTION	MATERIAL	COMP. DRG NO.	UTS (KN)	QTY(NOS)

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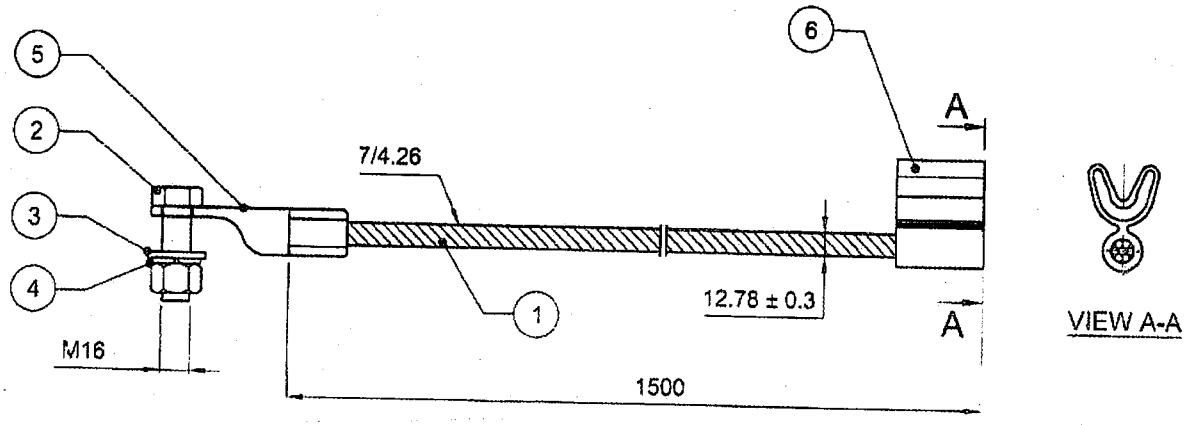

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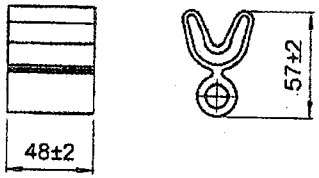


Y TYPE CLAMP (REFERENCE)

TECHNICAL DATA

1. FERROUS PARTS HOT DIP GALVANIZED AS PER ISO:1461.
2. SPRING WASHER ELECTROGALVANIZED AS PER SPEC.
3. GENERAL TOLERANCE UNLESS OTHERWISE SPECIFIED IS ± 3%.
4. ALL DIMENSIONS ARE IN mm.
5. WEIGHT - 0.69 ± 0.07 Kg.
6. WEIGHT IS INDICATIVE ONLY.
7. HARDWARE FITTING TOLERANCES AS PER IEC : 61284.

REC TRANSMISSION PROJECTS COMPANY LIMITED

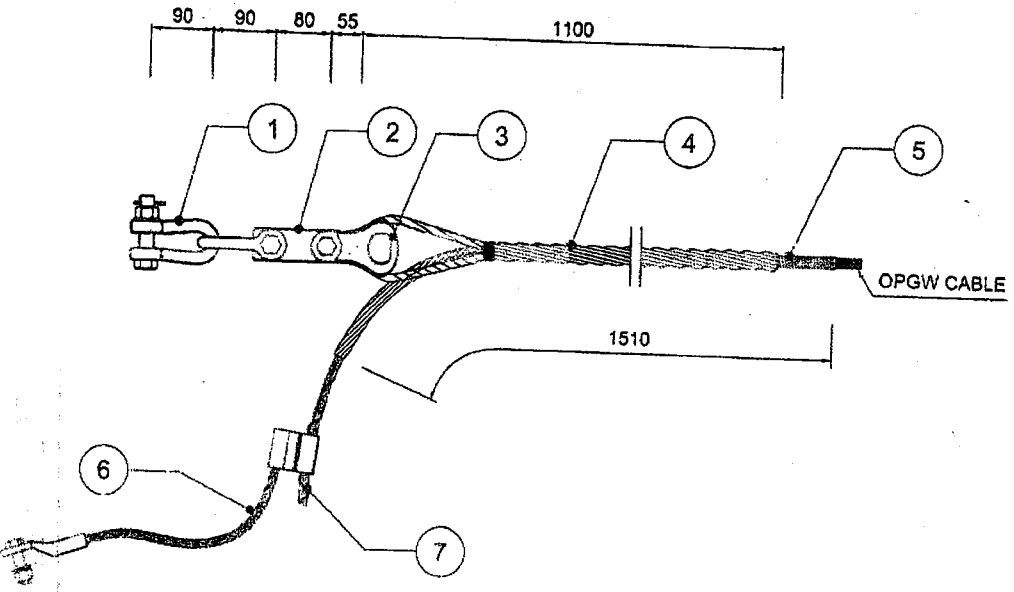
FOR TENDER PURPOSE ONLY

S.NO.	DESCRIPTION	MATERIAL	COMP. DRG NO.	QTY (NOS).	UTS (kN)
6	Y TYPE CLAMP	AL. ALLOY(TYPE-63400, IS: 733).	-	1	-
5	CONNECTING LUG	ALUMINIUM (TYPE-19500)	-	1	
4	SPRING WASHER (M16)	SP.S (IS:3063)	-	1	
3	FLAT WASHER (M16)	M.S (IS:2016)	-	1	
2	BOLT & NUT	M.S (P.C.5.6 / 5.0, IS: 6639)	-	1	
1	FLEXIBLE CABLE	ALUMINIUM ALLOY (IS:398)	-	1 SET	

TITLE: **FLEXIBLE ALUMINIUM BOND WITH Y-TYPE CLAMP**

DATE
DRAWN
CHECKED
APPROVED

SCALE NTS



ITEM CODE	F	0	0	5	0	6	0	0	1

TECHNICAL DATA

1. FERROUS PARTS ARE HOT DIP GALVANIZED AS PER IS0:1461.
2. DIAMETER OF THE OPGW CABLE 11.4 MM, UTS :59 KN.
3. HOLDING STRENGTH 95% UTS OF OPGW.
4. ALL DIMENSIONS ARE IN mm.
5. WEIGHT - 6.51 ± 0.65 Kg.
6. WEIGHT IS INDICATIVE ONLY
7. HARDWARE FITTING TOLERANCES ARE AS PER IEC . 61284.

REC TRANSMISSION PROJECTS COMPANY LIMITED

FOR TENDER PURPOSE ONLY

DESCRIPTION	MATERIAL	COMP. DRG NO.	UTS (KN)	QTY(NOS)
TAINING ROD	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/RR/001/LP	-	1 SET
XIBLE ALUMINIUM BOND	ALUMINIUM ALLOY	TAG/FAB/002/LP	-	1
OTECTION ROD	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/PR/1003/LP	-	1 SET
UCAL DEAD END	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/HDE/1003/LP	-	1 SET
MBLE	S.G.I / M.C.I (IS:226 / 2062)	9419/LP	100	1
ENSION PLATE	MILD STEEL (IS:2062)	EP/4012/LP	120	1
SHACKLE	FORGED STEEL (CL - IV, IS: 2004)	DS/1600/LP	120	2

TITLE:

TENSION ASSEMBLY FOR DEAD END LOCATION

DATE	
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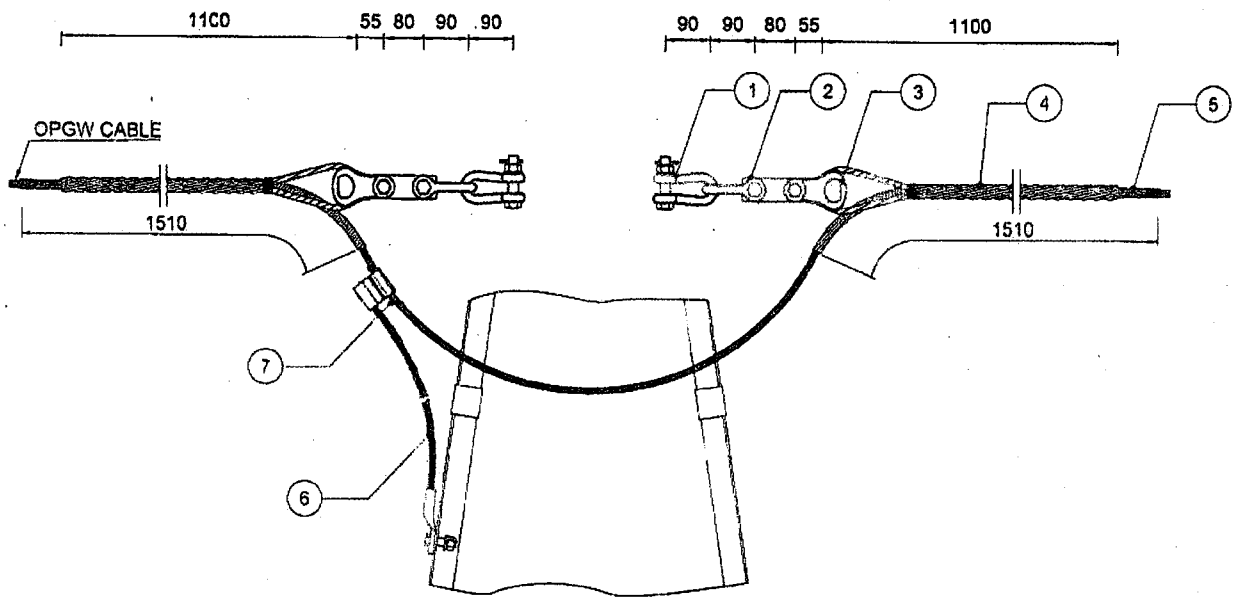
APPROVED	

SCALE : NTS



ITEM CODE	F	0	0	5	0	6	0	0	2

TECHNICAL DATA

1. FERROUS PARTS ARE HOT DIP GALVANIZED AS PER ISO:1461.
2. DIAMETER OF THE OPGW CABLE 11.4 MM, UTS :59 KN.
3. HOLDING STRENGTH 95% UTS OF OPGW
4. ALL DIMENSIONS ARE IN mm.
5. WEIGHT - 12.24 ± 1.2 Kg.
6. WEIGHT IS INDICATIVE ONLY.
7. HARDWARE FITTING TOLERANCES AS PER IEC : 61284.

REC TRANSMISSION PROJECTS COMPANY LIMITED

FOR TENDER PURPOES ONLY

S.NC.	DESCRIPTION	MATERIAL	COMP. DRG NO.	UTS (KN)	QTY(NOS)
7	RETAINING ROD	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/RR/001/LP	-	1 SET
6	FLEXIBLE ALUMINIUM BOND	ALUMINIUM ALLOY	TAG/FAB/002/LP	-	1
5	PROTECTION ROD	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/PR/1003/LP	-	2 SETS
4	HELICAL DEAD END	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/HDE/1003/LP	-	2 SETS
3	THIMBLE	S.G.I / M.C.I (IS.226 / 2062)	9419/LP	100	2
2	EXTENSION PLATE	MILD STEEL (IS:2062)	EP/4012/LP	120	2
1	D - SHACKLE	FORGED STEEL (CL - IV, IS: 2004)	DS/1600/LP	120	4

TITLE:

TENSION ASSEMBLY FOR PASS THROUGH LOCATION

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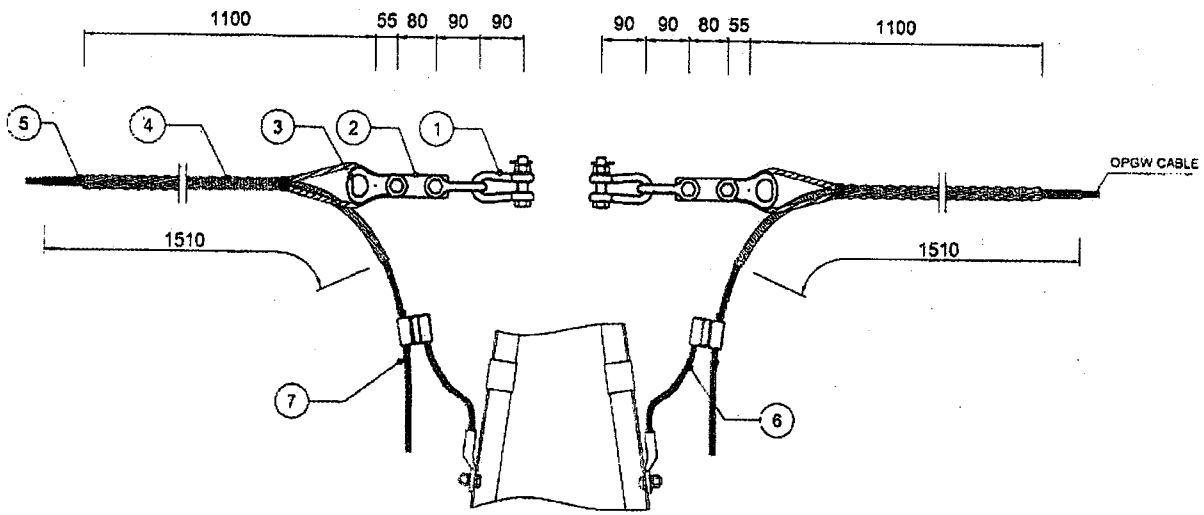

ITEM CODE	F	0	0	5	0	6	0	0	3

TECHNICAL DATA

1. FERROUS PARTS ARE HOT DIP GALVANIZED AS PER ISO:1461 .
2. DIAMETER OF THE OPGW CABLE 11.4 MM, UTS :59 KN.
3. HOLDING STRENGTH 95% UTS OF OPGW.
4. ALL DIMENSIONS ARE IN mm.
5. WEIGHT - 13.1 ± 1.3 Kg.
6. WEIGHT IS INDICATIVE ONLY
7. HARDWARE FITTING TOLERANCES AS PER IEC : 61284.

REC TRANSMISSION PROJECTS COMPANY LIMITED

FOR TENDER PURPOSE ONLY

S.NO.	DESCRIPTION	MATERIAL	COMP. DRG NO.	UTS (KN)	QTY(NOS)
7	RETAINING ROD	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/RR/001/LP	-	2 SETS
6	FLEXIBLE ALUMINIUM BOND	ALUMINIUM ALLOY	TAG/FAB/002/LP	-	2
5	PROTECTION ROD	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/PR/1003/LP	-	2 SETS
4	HELICAL DEAD END	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/HDE/1003/LP	-	2 SETS
3	THIMBLE	S.G.I / M.C.I (IS:226 / 2062)	9419/LP	100	2
2	EXTENSION PLATE	MILD STEEL (IS:2062)	EP/4012/LP	120	2
1	D - SHACKLE	FORGED STEEL (CL - IV, IS: 2004)	DS/1600/LP	120	4

TITLE:

TENSION ASSEMBLY FOR JOINT BOX LOCATION

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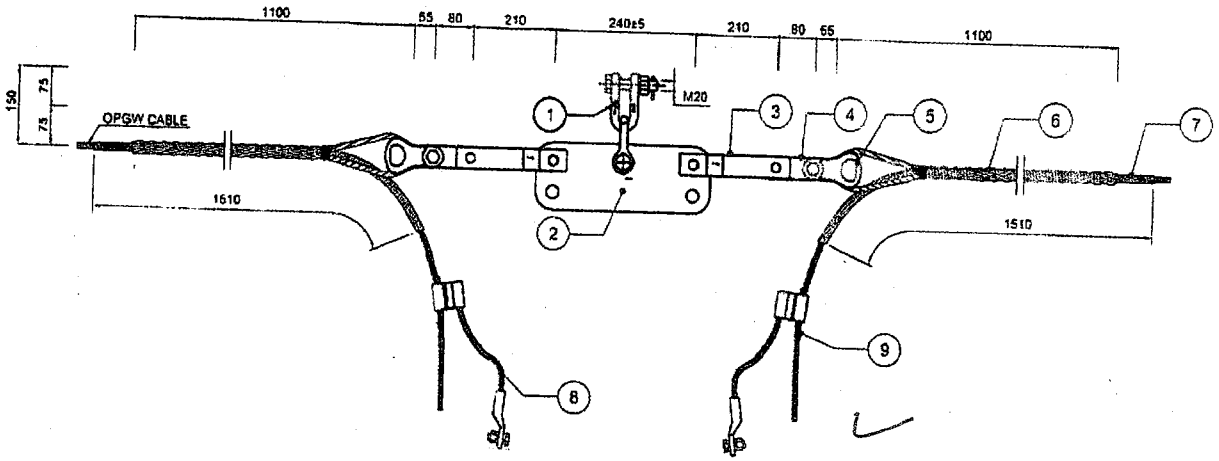

ITEM CODE	F	0	0	5	0	2	0	2	3

TECHNICAL DATA

1. FERROUS PARTS ARE HOT DIP GALVANIZED AS PER ISO:1461 .
2. DIAMETER OF THE OPGW CABLE 11.4 MM, UTS : 59 KN.
3. HOLDING STRENGTH 95% UTS OF OPGW.
4. ALL DIMENSIONS ARE IN mm.
5. WEIGHT - 20.78 ± 2.1 Kg.
6. WEIGHT IS INDICATIVE ONLY
7. HARDWARE FITTING TOLERANCES AS PER IEC : 61284.

REC TRANSMISSION PROJECTS COMPANY LIMITED

FOR TENDER PURPOSE ONLY

S.NO.	DESCRIPTION	MATERIAL	COMP. DRG NO.	UTS (KN)	QTY(NOS)
9	RETAINING ROD	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/RR/001/LP	-	2 SETS
8	FLEXIBLE ALUMINIUM BOND	ALUMINIUM ALLOY	TAG/FAB/002/LP	-	2
7	PROTECTION ROD	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/PR/1003/LP	-	2 SETS
6	HELICAL DEAD END	ALUMINIUM CLAD STEEL (IEC:1232)	TAG/HDE/1003/LP	-	2 SETS
5	THIMBLE	S.G.I / M.C.I (IS:226 / 2062)	9419/LP	100	2
4	EXTENSION PLATE	MILD STEEL (IS:2062)	EP/4012/LP	120	2
3	Y - TYPE EXTENSION LINK	MILD STEEL (IS:2062)	EL/3003A/LP	120	2 SETS
2	RECTANGULAR YOKE PLATE	MILD STEEL (IS:2062)	RYP/4014/LP	120	1
1	D - SHACKLE	FORGED STEEL (CL - IV, IS. 2004)	DS/1604/LP	120	2

TITLE:

TENSION ASSEMBLY ON SUSPENSION TOWER

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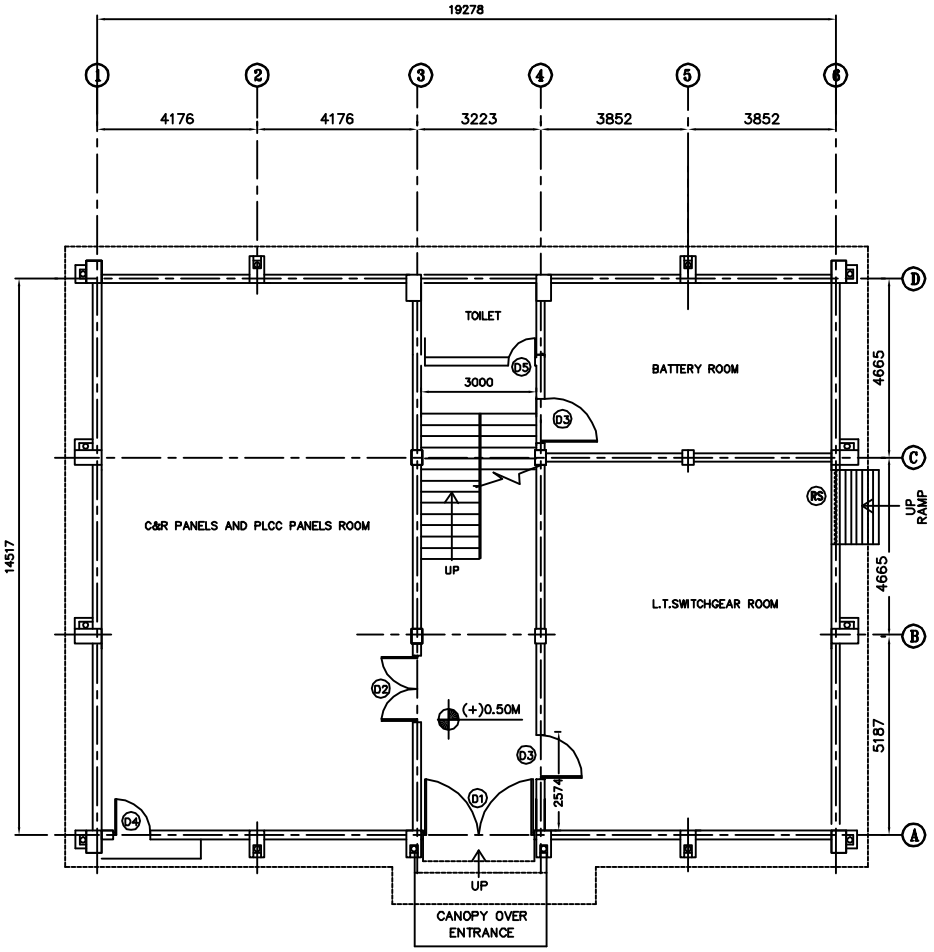
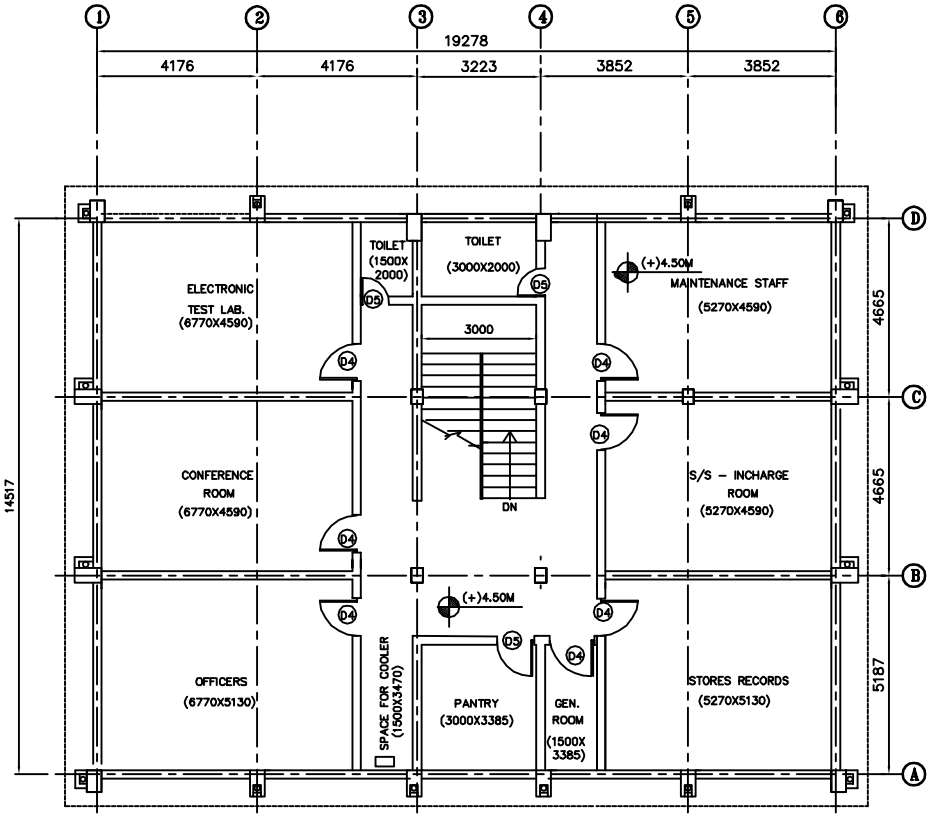


GROUND FLOOR PLAN



FIRST FLOOR PLAN

FOR TENDER PURPOSE ONLY

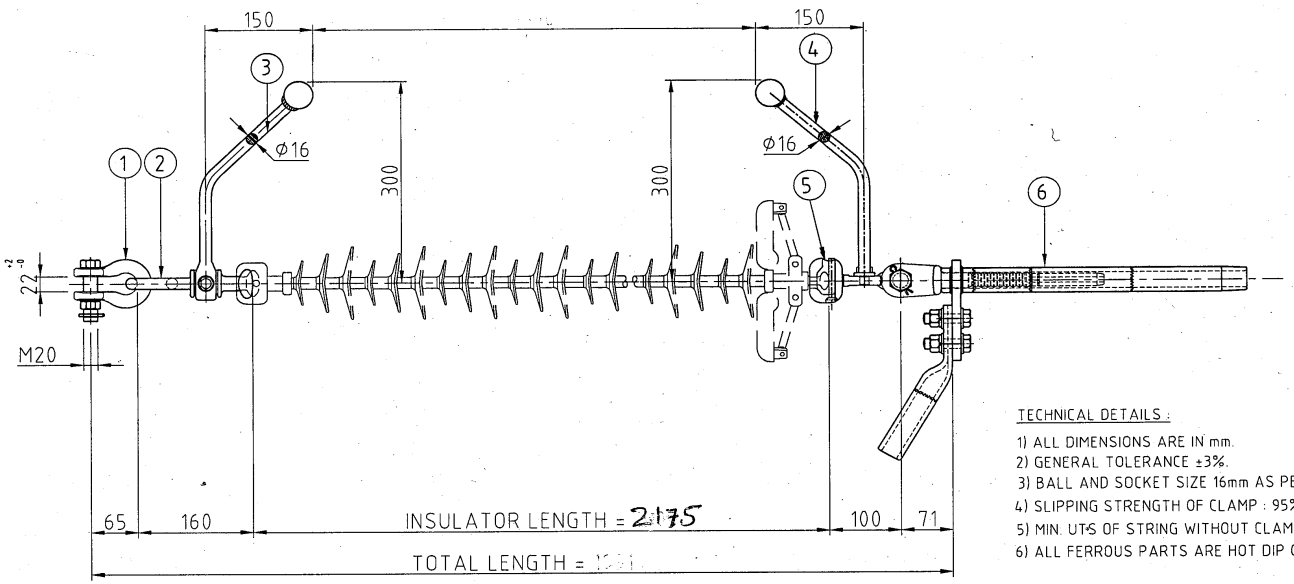
NOTES:

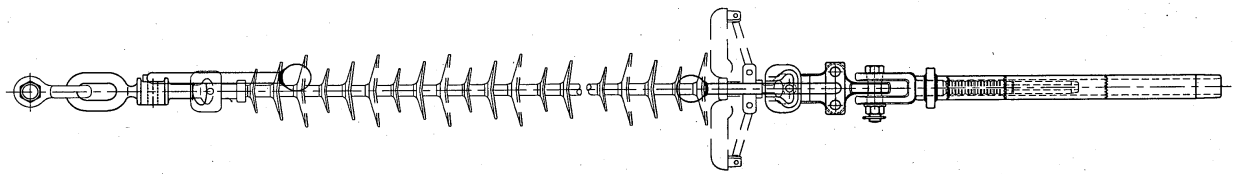
1. ALL DIMENSIONS ARE IN MM.
2. FINISHED FLOOR LEVEL OF CONTROL ROOM IS EL.(+)500MM ABOVE FINISHED GROUND LEVEL.
3. TOP OF ROOF IS AT EL(+)8250MM ABOVE FINISHED GROUND LEVEL

REC TRANSMISSSION PROJECTS PVT. LTD.

PROJECT: 2x50 MVA, 220/33 KV Nagrota Substation

TITLE: CONCEPTUAL LAYOUT PLAN OF CONTROL ROOM BUILDING





TECHNICAL DETAILS :

1) ALL DIMENSIONS ARE IN mm.
2) GENERAL TOLERANCE ±3%.
3) BALL AND SOCKET SIZE 16mm AS PER IS:2486/IEC:6012(
4) SLIPPING STRENGTH OF CLAMP : 95% of UTS OF CONDU
5) MIN. UTS OF STRING WITHOUT CLAMP - 90 kN.
6) ALL FERROUS PARTS ARE HOT DIP GALVANIZED AS PE

Itm.	Qty.	Description	Standard	Drg. No.	Material	Surface	UTS
6	1	Comp. Dead End clamp			Al. Alloy & steel	-----	-----
5	1	H.H.Socket Eye	IEC 16		Forged steel, CL-IV, IS:2004	Hot dip galvanized	90 kN
4	1	Arcing horn			Mild steel, Fe-410, IS:2062	Hot dip galvanized	1.5 kN
3	1	Arcing horn			Mild steel, Fe-410, IS:2062	Hot dip galvanized	1.5 kN
2	1	H H Ball link	IEC 16		Forged steel, CL-IV, IS:2004	Hot dip galvanized	90 kN
1	1	Anchor Shackle			Forged steel, CL-IV, IS:2004	Hot dip galvanized	90 kN

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Drg. No. I_AS11E0111 — Rev. 00

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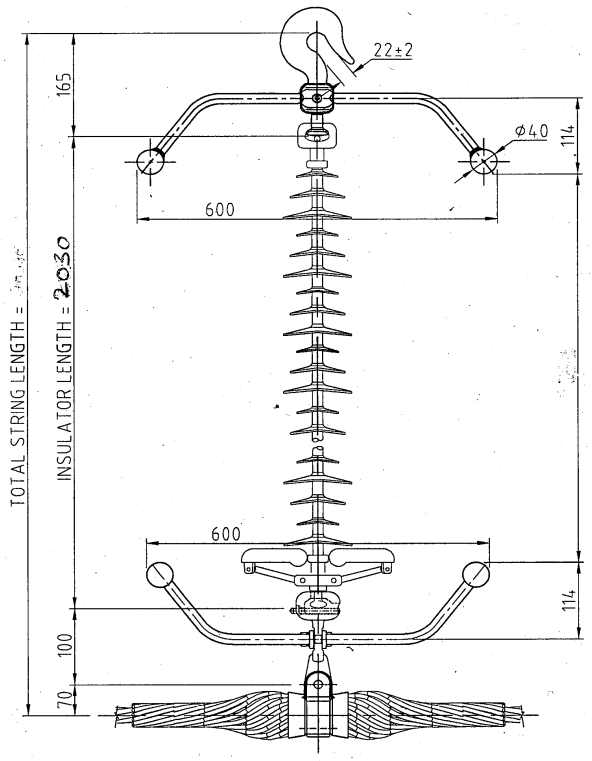

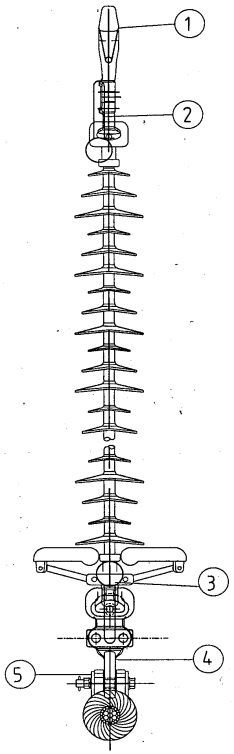

TECHNICAL DETAILS :

1) ALL DIMENSIONS ARE IN mm.
2) GENERAL TOLERANCE ±3%.
3) BALL AND SOCKET SIZE 16mm AS PER IS:2486/IEC:60120.
4) SLIPPING STRENGTH OF CLAMP : 11 to 16kN.
5) MIN. UTS OF STRING WITHOUT SUSPENSION CLAMP-70 kN.
6) ALL FERROUS PARTS ARE HOT DIP GALVANIZED AS PER IS :2629.

Itm.	Qty.	Description	Standard	Drg. no.	Material	Surface	UTS
5	1Set	Armour Rod			H.T. Alu. Alloy	----	35 kg/mm2
	1	HSU clamp			Al. Alloy LM-6, IS:617	----	70 kN
4	1	H.H Socket Eye Twisted	IEC 16		Forged steel, Cl-IV, IS:2004	hot dip galv.	70 kN
3	1	Arcing horn			Mild steel Fe-410, IS:2062	hot dip galv.	1.5kN
2	1	Arcing horn			Mild steel Fe-410, IS:2062	hot dip galv.	1.5kN
1	1	H.H. Ball Hook	IEC 16		Forged steel, Cl-IV, IS:2004	hot dip galv.	70 kN

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Checked		

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Title

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Art. No. I_HS11E0140

Drg. No. I_HS11E0140 — Rev. 00

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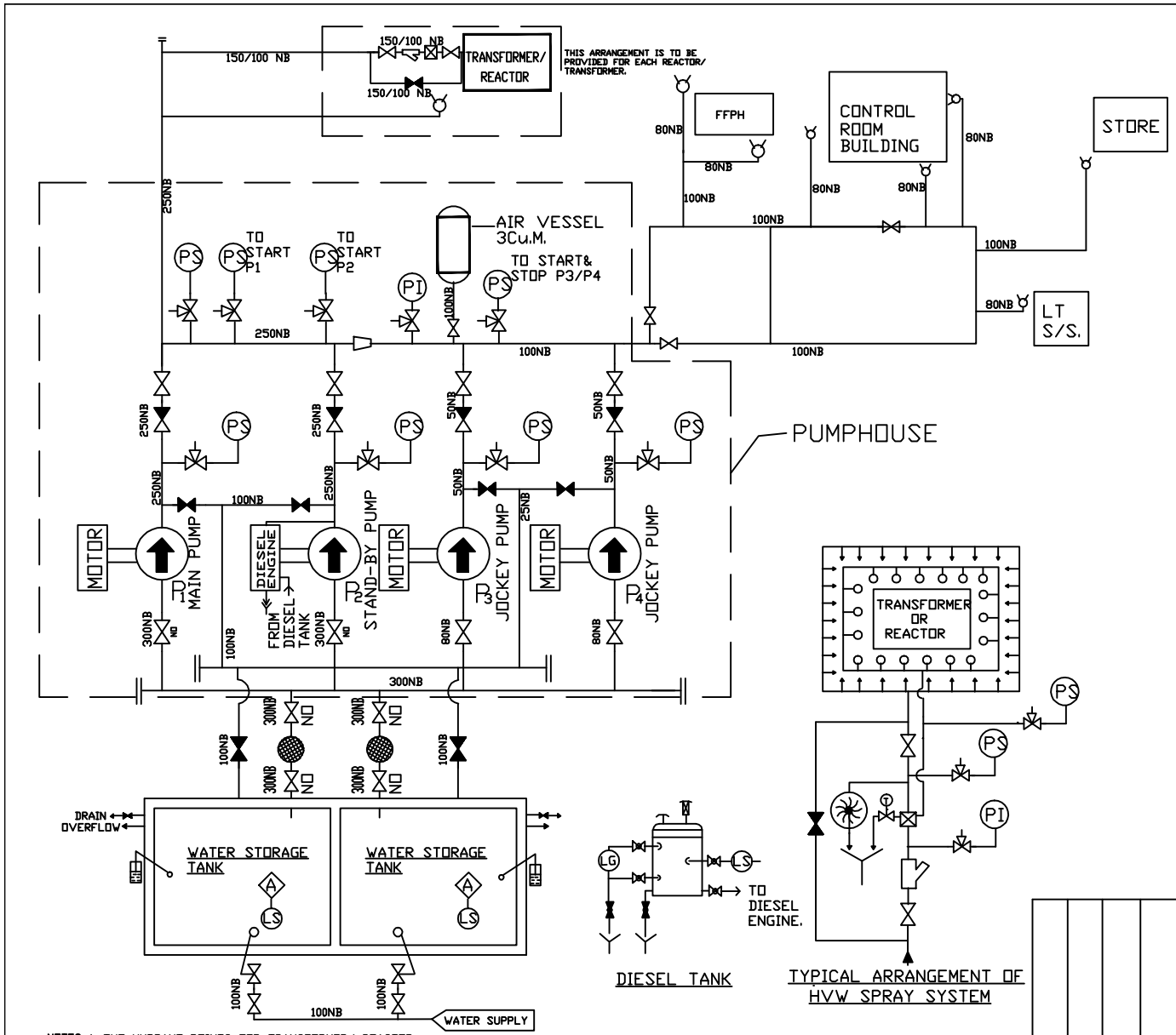
APPENDIX-I
TO TECHNICAL SPECIFICATION
FOR FIRE PROTECTION SYSTEM REV.-6



LEGEND

- ALARM
- GATE VALVE NORMALLY OPEN
- GATE VALVE NORMALLY CLOSED
- NON-RETURN VALVE
- GLOBE VALVE NORMALLY OPEN
- GLOBE VALVE NORMALLY CLOSED
- FLOAT OPERATED GATE VALVE
- TEST VALVE
- PRESSURE GAUGE
- PRESSURE SWITCH
- LEVEL GAUGE
- LEVEL SWITCH
- BASKET STRAINER
- FLOAT OPERATED LEVEL GAUGE
- Y-TYPE STRAINER
- WATER MOTOR GONG
- REDUCER
- THREE WAY COCK/ VALVE
- VENT
- DRAIN
- OUT DOOR HYDRANT
- QUARTZOID BULB DETECTOR
- HVW SPRAY NOZZLE
- PUMP
- WATER LINE
- DELUGE VALVE

NOTES: 1. THE HYDRANT POINTS FOR TRANSFORMER/ REACTOR SHALL BE LOCATED AT LEAST 20M AWAY FROM THEM.

2. AS SAFETY MEASURE, A WARNING PLATE SHALL BE PLACED NEAR HYDRANT POINTS FOR TRANSFORMER/ REACTOR TO CLEARLY INDICATE THAT WATER SHALL BE SPRAYED ONLY AFTER ENSURING THAT THE POWER TO THE TRANSFORMER/ REACTOR WHICH IS ON FIRE IS SWITCHED OFF AND THERE ARE NO LIVE PART WITHIN 20 M. DISTANCE OF THE PERSONNEL USING THE HYDRANT.

FOR TENDER PURPOSE ONLY

APPD.					
RECOMMENDED	DATE	DRAWN	CHKD.	APPD.	
	22.11.2001	A.J.XAVIER	A.J.XAVIER		

TITLE: PIPING & INSTRUMENTATION DIAGRAM FOR HYDRANT & HVW SPRAY SYSTEM.

NTS | DRG.NO. C/ENGG/STD/FP/1 Sheet 1 of 1 | REV. 4

VOLUME-II, PART-II
TECHNICAL SPECIFICATION (LILO)

VOLUME-II, PART-II
TECHNICAL SPECIFICATION (LILO)
CONTENTS

SECTION – I	**GENERAL INFORMATION & SCOPE**
SECTION – II	**GENERAL TECHNICAL CONDITIONS**
SECTION – III	**SURVEY & SOIL INVESTIGATION (PART-1 & 2)**
SECTION – IV	**TOWER, FOUNDATION, ERECTION, STRINGING & COMMISSIONING**
SECTION – V	**ACSR CONDUCTOR**
SECTION – VI	**OPTICAL FIBRE GROUND WIRE**
SECTION – VII	**COMPOSITE LONG ROD INSULATOR**
SECTION – VIII	**HARDWARE FITTINGS & ACCESSORIES**
SECTION – IX	**DRAWINGS**

VOLUME-II, PART-II
TECHNICAL SPECIFICATION (LILO)

VOLUME-II, PART-B
TECHNICAL SPECIFICATION (LILO)
CONTENTS

SECTION – I	**GENERAL INFORMATION & SCOPE**
SECTION – II	**GENERAL TECHNICAL CONDITIONS**
SECTION – III	**SURVEY & SOIL INVESTIGATION (PART-1 & 2)**
SECTION – IV	**TOWER, FOUNDATION, ERECTION, STRINGING & COMMISSIONING**
SECTION – V	**ACSR CONDUCTOR**
SECTION – VI	**OPTICAL FIBRE GROUND WIRE**
SECTION – VII	**DISC/POLYMER INSULATOR**
SECTION – VIII	**HARDWARE FITTINGS & ACCESSORIES**
SECTION – IX	**DRAWINGS**

SECTION – I
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Clause No.	Description	Page No.
1.0	General Information and Scope	3
2.0	Qualification requirement for Contractor's supplied Line Materials	5
3.0	Transmission Line data	8
4.0	Details of Line Materials	9
5.0	Service Conditions	11
6.0	Forms	12

SECTION – II
CONTENTS

Clause No.	Description	Page No.
1.0	General Technical Conditions	1
2.0	Environment and Social Policy and its Implementation	9

SECTION – III
CONTENTS

Clause No.	Description	Page No.
1.0	General information & Scope Of Work	3
2.0	Route Alignment	4
3.0	Detailed Survey	5
4.0	Geotechnical Investigations	12
5.0	Statutory Regulations and Standards	33
6.0	Field Quality Plan	33
7.0	Completion Period	33

SECTION – IV

CONTENTS

Clause No.	Description	Page No.
1.0	Transmission Tower	1
2.0	Foundations	26
3.0	Tower Erection, Stringing and Installation of Line Materials	40
4.0	Field Quality Plan	47

SECTION-V
CONTENTS

Clause No.	Description	Page No.
1.0	Technical Description of ACSR Conductor	3
2.0	Tests and Standards	5
3.0	Annexure-A : Tests on Conductor	13
4.0	Annexure-B : Standard Technical Particulars	15
5.0	Drum Drawing	17

SECTION –VI
CONTENTS

Clause No.	Description	Page No.
2	Specifications for OPGW cabling and Associated Hardware & fittings	
3	Inspection and Testing	
4	Support Services	
5	Documentation and Deliverables	
	APPENDIX – A Typical parameters	
	APPENDIX - B Data Requirement Sheet	

SECTION-VII
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Clause No.	Description	Page No.
1.0	Technical Description of Disc Insulators	1
2.0	Technical Description of Porcelain Long Rod Insulators	5
3.0	Equipment Marking	10
4.0	Bid Drawings	10
5.0	Tests and Standards	11
6.0	Annexure-A	23
7.0	Annexure-B	30

SECTION – VIII
CONTENTS

Clause No.	Description	Page No.
1.0	Technical Description of Hardware Fittings	1
2.0	Accessories for Conductor	9
3.0	G.S. Earthwire Accessories	13
4.0	Guaranteed Technical Particulars	17
5.0	Tests and Standards	23
	Annexure – A	34
	Annexure – B	34

APPENDIX – I

PRE – COMMISSIONING SCHEDULE

APPENDIX – II

STANDARD FIELD QUALITY PLAN

SECTION – IX
DRAWINGS

Clause No.	Description	Drawing No.
1.0	Typical 220 kV D/C Transmission Line Tower	TL/220KV/001
2.0	Tower Number Plate	TL/220KV/002
3.	Tower Phase Plate	TL/220KV/003
4.0	Danger Plate	220KV/DP
5.0	Circuit Plate	220KV/CP
6.0	Earthing Arrangement (Sheet 1/3 to 3/3)	220/EARTH
7.0	Detail of Anti Climbing Device	220/ACD
8.0	Protection of Tower Footing	TL/220KV/008
9.0	Step Bolt Drawing	220/SP
10.0	Tentative Shape of Tower Footing	TL/220KV/010
11.0	Single suspension String (Disc Insulator)	TL/220KV/ DISC/018
12.0	Single Tension String (Disc Insulator)	TL/220KV/DISC/014
13.0	Drum Drawing for ACSR Conductor	TL/220KV/012
14.0	Bird Guard	220KV/BG

PART-II

TECHNICAL SPECIFICATION

VOL-II, SEC-VIII

HARDWARE FITTING

SECTION - VIII
HARDWARE FITTINGS & ACCESSORIES
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1.0 Technical Description of Hardware Fittings

1.1 **Details of Hardware Fittings**

1.1.1 The hardware fittings shall be suitable for use with Disc/Composite long rod insulators having ball and socket fittings. The hardware fittings shall be as per the specification drawings enclosed with the specification. Each hardware fitting shall be supplied complete in all respects and shall include the following hardware parts:

1.1.2 Suitable arcing horn as specified in clause 1.7 hereinafter.

1.1.3 Suitable yoke plates complying with the specifications given hereinafter.

1.1.4 Suspension and dead end assembly to suit conductor size as detailed in clause 1.9 to 1.11 hereinafter.

1.1.5 Other necessary fittings viz D-shackles, eye links, extension links, ball clevis, socket clevis, clevis eye, U clevis and chain link etc. to make the hardware fittings complete.

1.1.6 2.5% extra fasteners.

1.2 **Dimensions of Insulator String Along with Hardware Fitting**

The various dimensions of the insulator strings along with hardware fittings shall be as per the specification drawings enclosed with this specification.

1.3 Interchangeability

1.3.1 The hardware for insulator strings with disc insulators / Composite long rod insulators together with ball and socket fittings shall be of standard design, so that these hardware are inter- changeable with each other and suitable for use with insulators of any make conforming to relevant Indian/International Standard.

1.4 **Maintenance**

1.4.1 The hardware fittings offered shall be suitable for employment of hot line maintenance technique so that usual hot line operations can be carried out with ease, speed and safety. The technique adopted for hot line maintenance shall be generally bare hand method & hot stick method. The Bidder should clearly establish in the bid, the suitability of his fittings for hot line maintenance.

1.4.2 The line side yoke plate shall have a notch & a working hole of suitable size. The design of corona control rings/grading ring shall be such that it can be easily replaced by employing hot line maintenance technique.

1.5 **Designation**

1.5.1 Ball and Socket Designation

The dimensions of the ball and socket **shall be 16mm designation for 70KN & 20mm designation for 120KN**. The designation should be in accordance with the standard dimensions stated in IS:2486-(Part-II)/IEC:120. The dimensions shall be checked by the appropriate gauge after galvanising only.

1.6 **Security Clips and Split Pins**

1.6.1 Security clips for use with ball and socket coupling shall be R-shaped, hump type which provides positive locking of the coupling as per IS:2486-(Part-III)/ IEC : 372. The legs of the security clips shall be spread after assembly in the works to prevent complete withdrawal from the socket. The locking device should be resilient, corrosion resistant and of suitable mechanical strength. There shall be no risk of the locking device being displaced accidentally or being rotated when in position. Under no circumstances shall the locking devices allow separation of fittings.

1.6.2 The hole for the security clip shall be countersunk and the clip should be of such design that the eye of clip may be engaged by a hot line clip puller to provide for disengagement under energised conditions. The force required to pull the security clip into its unlocked position shall not be less than 50 N (5 kg) or more than 500 N (50 kg).

1.6.3 Split pins shall be used with bolts & nuts.

1.7 **Arcing Horn/Intermediate Arcing Horn**

1.7.1 The arcing horn / Intermediate Arcing Horn shall be either ball ended rod type or tubular type.

1.7.2 The arcing horn shall be provided as shown on the drawing of the hardware fittings, in this specification.

1.7.3 The air gap shall be so adjusted to ensure effective operation under actual field conditions.

1.8 **Yoke Plates**

The strength of yoke plates shall be adequate to withstand the minimum ultimate tensile strength as specified in the bid drawings.

The plates shall be either triangular or rectangular in shape as may be necessary. The design of yoke plate shall take into account the most unfavorable loading conditions likely to be experienced as a result of dimensional tolerances for disc insulators as well as components of hardware fittings within the specified range. The plates shall have suitable holes for fixing corona control rings/grading ring/arcing horn. All the corners and edges should be rounded off with a radius of atleast 3 mm. Design calculations i.e. for bearing & tensile strength, for deciding the dimensions of yoke plate shall be furnished by the bidder. The holes provided for bolts in the yoke plate should satisfy shear edge condition as per Clause **No.10.2.4.2 of IS:800-2007**.

1.9 **Suspension Assembly**

1.9.1 The suspension assembly shall be suitable for the specific Conductor as given in Section – I of this Specification.

1.9.2 The suspension assembly shall include free center type suspension clamp along with standard preformed armour rods or armour grip suspension clamp.

1.9.3 The suspension clamp along with standard preformed armour rods set shall be designed to have maximum mobility in any direction and minimum moment of inertia so as to have minimum stress on the conductor in the case of oscillation of the same.

1.9.4 The suspension clamp along with standard preformed armour rods/armour grip suspension clamp set shall have the slip strength not less than that specified in the Standard Technical Particulars.

1.9.5 The suspension assembly shall be designed, manufactured and finished to give it a suitable shape, so as to avoid any possibility of hammering between suspension assembly and conductor due to vibration. The suspension assembly shall be smooth without any cuts, grooves, abrasions, projections, ridges or excrescence, which might damage the conductor.

1.9.6 The suspension assembly/clamp shall be designed so that it shall minimise the static & dynamic stress developed in the conductor under various loading conditions as well as during wind induced conductor vibrations. It shall also withstand power arcs & have required level of Corona/RIV performance.

1.9.7 The magnetic power loss shall not be more than that stipulated in the Standard Technical Particulars.

1.9.8 **Free Center Type Suspension Clamp**

For the Free Center Suspension Clamp seat shall be smoothly rounded and curved into a bell mouth at the ends. The lip edges shall have rounded bead. There shall be at least two U-bolts for tightening of clamp body and keeper pieces together.

1.9.10 **Standard Preformed Armour Rod Set**

1.9.10.1 The Preformed Armour Rods Set shall be used to minimise the stress developed in the sub-conductor due to different static and dynamic loads because of vibration due to wind, slipping of conductor from the suspension clamp as a result of unbalanced conductor tension in adjacent spans and broken wire condition. It shall also withstand power arcs. chafing and abrasion from suspension clamp and localised heating effect due to magnetic power losses from suspension clamps as well as resistance losses of the conductor.

1.9.10.2 The preformed armour rods set shall have right hand lay and the inside diameter of the helics shall be less than the outside diameter of the conductor to have gentle but permanent grip on the conductor. The surface of the armour rod when fitted on the conductor shall be smooth and free from projections, cuts and abrasions etc.

1.9.10.3 The pitch length of the rods shall be determined by the Bidder but shall be less than that of the outer layer of conductor and the same shall be accurately controlled to maintain uniformity and consistently reproducible characteristic wholly independent of the skill of linemen.

1.9.10.4 The length and diameter of each rod shall be furnished by the bidder in the GTP. The end of armour rod shall be parrot billed. The tolerance in length of the rods between the longest and shortest rods in complete set should be within the limits as specified in relevant Indian/International standards. The ends of armour rod shall be parrot billed.

1.9.10.5 The number of armour rods in each set shall be as per supplier design and shall be furnished by bidder in GTP. Each rod shall be marked in the middle with paint for easy application on the line.

1.9.10.6 The armour rod shall not lose their resilience even after five applications.

1.9.10.7 The conductivity of each rod of the set shall not be less than 40% of the conductivity of the International Annealed Copper Standard (IACS).

1.9.11 **Armour Grip Suspension Clamp**

1.9.11.1 The armour grip suspension clamp shall comprise of retaining strap, support housing, elastomer inserts with aluminium reinforcements and AGS preformed rod set.

1.9.11.2 Elastomer insert shall be resistant to the effects of temperature up to 95°C, Ozone, ultraviolet radiations and other atmospheric contaminants likely to be encountered in service. The physical properties of the elastomer shall be of approved standard. It shall be electrically shielded by a cage of AGS performed rod set. The elastomer insert shall be so designed that the curvature of the AGS rod shall follow the contour of the neoprene insert.

1.9.11.3 The AGS preformed rod set shall be as detailed in clause 1.9.10.1 to 1.9.10.7 in general except for the following.

1.9.11.4 The length of the AGS preformed rods shall be such that it shall ensure sufficient slipping strength and shall not introduce unfavorable stress on the conductor under all operating conditions. However the length of AGS preformed rods shall not be less than as specified in the standard technical particulars..

1.10 **Envelope Type Suspension Clamp**

1.10.1 The seat of the envelope type suspension clamp shall be smoothly rounded & suitably curved at the ends. The lip edges shall have rounded bead. There shall be at least two U-bolts for tightening of clamp body and keeper pieces together. Hexagonal bolts and nuts with split-pins shall be used for attachment of the clamp.

1.11 **Dead end Assembly**

1.11.1 The dead end assembly shall be suitable for specific Conductor.

1.11.2 The dead end assembly shall be compression type with provision for comprising jumper terminal at one end. The angle of jumper terminal to be mounted should be 30° with respect to the vertical line. The area of bearing surface on all the connections shall be sufficient to ensure positive electrical and mechanical contact and avoid local heating due to I^2R losses. The resistance of the clamp when compressed on Conductor shall not be more than 75% of the resistance of equivalent length of Conductor.

1.11.3 Die compression areas shall be clearly marked on each dead-end assembly designed for continuous die compressions and shall bear the words 'COMPRESS FIRST' suitably inscribed near the point on each assembly where the compression begins. If the dead end assembly is designed for intermittent die compressions it shall bear identification marks 'COMPRESSION ZONE' AND 'NON-COMPRESSION ZONE' distinctly with arrow marks showing the direction of compressions and knurling marks showing the end of the zones. The letters, number and other markings on the finished clamp shall be distinct and legible. The dimensions of dead end assembly before and after compression along with tolerances shall be guaranteed in the relevant schedule of bid and shall be decided by manufacturer so as to suit the conductor size & conform to electrical and mechanical requirements stipulated in the specifications. These shall be guaranteed in the relevant schedule of bid.

1.11.4 The assembly shall not permit slipping of, damage to, or failure of the complete conductor or any part thereof at a load less than 95% of the ultimate tensile strength of the conductor.

1.12 **Fasteners : Bolts, Nuts and Washers**

1.12.1 All bolts and nuts shall conform to IS:6639. All bolts and nuts shall be galvanised as per IS-1367 - (Part 13)/IS-2629. All bolts and nuts shall have hexagonal heads, the heads being forged out of solid truly concentric, and square with the shank, which must be perfectly straight.

1.12.2 Bolts up to M16 and having length up to 10 times the diameter of the bolt should be manufactured by cold forging and thread rolling process to obtain good and reliable mechanical properties and effective dimensional control. The shear strength of bolt for 5.6 grade should be 310 MPa minimum as per IS-.12427. Bolts should be provided with washer face in accordance with IS:1363 Part-1 to ensure proper bearing.

1.12.3 Nuts should be double chamfered as per the requirement of IS:1363 Part-III. It should be ensured by the manufacturer that nuts should not be over tapped beyond 0.4 mm oversize on effective diameter for size up to M16.

1.12.4 Fully threaded bolts shall not be used. The length of the bolt shall be such that the threaded portion shall not extend into the place of contact of the component parts.

1.12.5 All bolts shall be threaded to take the full depth of the nuts and threaded enough to permit the firm gripping of the component parts but no further. It shall be ensured that the threaded portion of the bolt protrudes not less than 3 mm and not more than 8 mm when fully tightened. All nuts shall fit and tight to the point where shank of the bolt connects to the head.

1.17.6 Flat washers and spring washers shall be provided wherever necessary and shall be of positive lock type. Spring washers shall be electro-galvanised. The thickness of washers shall conform to IS: 2016.

1.12.7 The Bidder shall furnish bolt schedules giving thickness of components connected, the nut and the washer and the length of shank and the threaded portion of bolts and size of holes and any other special details of this nature.

1.12.8 To obviate bending stress in bolt, it shall not connect aggregate thickness more than three time its diameter.

1.12.9 Bolts at the joints shall be so staggered that nuts may be tightened with spanners without fouling.

1.12.10 To ensure effective in-process Quality control it is essential that the manufacturer should have all the testing facilities for tests like weight of zinc coating, shear strength, other testing facilities etc. in-house. The manufacturer should also have proper Quality Assurance system, which should be in line with the requirement of this specification and IS-.14000 services Quality System standard.

1.12.11 Fasteners of grade higher than 8.8 are not to be used and minimum grade of bolts shall be 5.6.

1.13 **Materials**

The materials of the various components shall be as specified hereunder. The Bidder shall indicate the material proposed to be used for each and every component of hardware fittings stating clearly the class, grade or alloy designation of the material, manufacturing process & heat treatment details and the reference standards.

1.13.1 The details of materials for different component are listed as in Table-I

TABLE-1

Details of Material

Sl. No.	Name of Item Treatment	Material Standard	Process of	Reference	Remarks
1.	Security Clips Steel/Phos pher Bronze	Stainless	- 304-L / IS-1385	AISI 302 or	
2.	Arcing Horn Rod/Tube Type	Mild Steel galvanised	Hot dip or IS-2062	As per IS-226-	
3.	Ball Fittings., Socket, All shackles, links, clevis,	Class-IV Steel Hot dip galvanised	Drop forged& normalised	As per IS: 2004	
4.	Yoke Plate	Mild Steel galvanised	Hot dip 226/IS-2062	As per IS:	
5.	Sag Adjustment plate	Mild Steel	Hot dip galvanised	As per IS: 226/IS-2062	
6.	(a) Corona Control ring/Grading ring (400 kV) (6061/6063/1100 type or 65032/63400 Type)	High Strength Al. Alloy tube	Heat treated	ASTM-B429 or as per IS	Mech. strength of welded joint shall not be less than 20KN
	(b) Supporting Brackets & Mounting Bolts 65032/ 63400 Type) or Mild Steel	High Strength Al. alloy 6061/6063 Hot dip galvanised	Heat treated or IS-2062	ASTM-B429 or as per IS:226	
7.	Turn Buckle Steel	Class II Hot dip galvanised	Forged	As per IS:2004	

Sl. No.	Name of Item	Material	Process of Treatment	Reference Standard	Remarks
8.	Free Center clamp/Envelope type Clamp				
	(a) Clamp Body/ Keeper Piece 4600/ LM-6 or 6061/65032	High Strength Al. Alloy Heat treated	Casted or forged &	IS:617 or ASTM-B429	
	(b) Cotter bolts, Hangers, Shackles, Brackets	Mild Steel	Hot dip galvanised	IS-226/IS-2062	
	(c) U Bolts Steel or High Strength Al. alloy 6061/6063 or 65032/63400	Stainless heat treated	Forged & ASTM-B429	AISI 302 or 304-L	
9.	P.A. Rod gth Al. alloy type 6061/ 65032	High Strength treatment during manufacturing	Heat	ASTM-B429 strength of 35 kg/ mm^2	Min tensile
10.	AGS Clamp (a) Supporting House AL. Alloy LM6, 4600 or 6061/65032	High Strength Corros -ion resistant treated	Cast/ forged Heat	IS:617 or ASTM-B429	
	(b) Al. Insert & Retaining strap type 6061/ 65032	High Strength Al. Alloy of	forged & Heat treated	ASTM-B429 or as per IS	
	(c) Elastomer Cushion	Moulded on Al. reinforcement			
11.	Dead End Assembly				
	(a) Outer Sleeve	EC grade Al of			

purity not less than 99.50%			
(c) Steel Sleeve	Mild Steel Galvanised	Hot Dip	As per IS:226/IS-2062
12. Balancing Weights	Cast Iron /MCI/Mach-	Hot dip galvanised ined Mild Steel	

Note : Alternate materials conforming to other national standards of other countries also may be offered provided the properties and compositions of these are close to the properties and compositions of material specified. Bidder should furnish the details of comparison of material offered vis - a - vis specified in the bid or else the bids are liable to be rejected.

1.14 **Workmanship**

1.14.1 All the equipment shall be of the latest design and conform to the best modern practices adopted in the Extra High Voltage field. The Bidder shall offer only such equipment as guaranteed by him to be satisfactory and suitable for the rated transmission lines and will give continued good performance.

1.14.2 The design, manufacturing process and quality control of all the materials shall be such as to give the specified mechanical rating, highest mobility, elimination of sharp edges and corners to limit corona and radio-interference, best resistance to corrosion and a good finish.

1.14.3 All ferrous parts including fasteners shall be hot dip galvanised, after all machining has been completed. Nuts may, however, be tapped (threaded) after galvanising and the threads oiled. Spring washers shall be electro galvanised. The bolt threads shall be undercut to take care of the increase in diameter due to galvanising. Galvanising shall he done in accordance with IS:2629 / IS-1367 (Part 13) and shall satisfy the tests mentioned in IS:2633.

1.14.4 Before ball fittings are galvanized, all die flashing on the shank and on the bearing surface of the ball shall be carefully removed without reducing the dimensions below the design requirements.

1.14.5 The zinc coating shall be perfectly adherent of uniform thickness, smooth, reasonably bright, continuous and free from imperfections such as flux, ash rust, stains, bulky white deposits and blisters. The zinc used for galvanising shall be Zinc grade Zn 99.95 as per IS: 209.

1.14.6 Pin balls shall be checked with the applicable “GO” gauges in at least two directions, one of which shall be across the line of die flashing, and the other 90° to this line. "NO GO" gauges shall not pass in any direction.

1.14.7 Socket ends, before galvanising, shall be of uniform contour. The bearing surface of socket ends shall be uniform about the entire circumference without depressions of high spots. The internal contours of socket ends shall be concentric with the axis of the fittings as per IS:2486 / IEC : 120.

The axis of the bearing surfaces of socket ends shall be coaxial with the axis of the fittings. There shall be no noticeable tilting of the bearing surfaces with the axis of the fittings.

1.14.8 In case of casting, the same shall be free from all internal defects like shrinkage, inclusion, blow holes, cracks etc. Pressure die casting shall not be used for casting of components with thickness more than 5 mm.

1.14.9 All current carrying parts shall be so designed and manufactured that contact resistance is reduced to minimum.

1.14.10 No equipment shall have sharp ends or edges, abrasions or projections and cause any damage to the conductor in any way during erection or during continuous operation which would produce high electrical and mechanical stresses in normal working. The design of adjacent metal parts and mating surfaces shall be such as to prevent corrosion of the contact surface and to maintain good electrical contact under service conditions.

1.14.11 All the holes shall be cylindrical, clean cut and perpendicular to the plane of the material. The periphery of the holes shall be free from burrs.

1.14.12 All fasteners shall have suitable corona free locking arrangement to guard against vibration loosening.

1.14.13 Welding of aluminium shall be by inert gas shielded tungsten arc or inert gas shielded metal arc process. Welds shall be clean, sound, smooth, uniform without overlaps, properly fused and completely sealed. There shall be no cracks, voids incomplete penetration, incomplete fusion, under-cutting or inclusions. Porosity shall be minimised so that mechanical properties of the aluminium alloys are not affected. All welds shall be properly finished as per good engineering practices.

1.15 **Bid Drawings**

1.15.1 The Bidder shall furnish full description and illustrations of materials offered.

1.15.2 Fully dimensioned drawings of the complete insulator string hard wares and their component parts showing clearly the following arrangements shall be furnished along with the bid. Weight, material and fabrication details of all the components should be included in the drawings.

(i) Attachment of the hanger or strain plate.

(ii) Suspension or dead end assembly.

(iii) Arcing horn attachment to the string as specified in clause 1.7 of this technical Specification.

(iv) Yoke plates

(v) Hardware fittings of ball and socket type for inter connecting units to the top and bottom Yoke plates.

(vi) Corona control rings/grading ring attachment to conductor and other small accessories.

(vii) Links with suitable fittings.

(viii) Details of balancing weights and arrangements for their attachment in the single suspension pilot insulator string.

1.15.3 All drawings shall be identified by a drawing number and contract number. All drawings shall be neatly arranged. All drafting & lettering shall be legible. The

minimum size of lettering shall be 3 mm. All dimensions & dimensional tolerances shall be mentioned in mm.

The drawings shall include:

(i) Dimensions and dimensional tolerance.

(ii) Material, fabrication details including any weld details & any specified finishes & coatings. Regarding material designation & reference of standards are to be indicated.

(iii) Catalogue No.

(iv) Marking

(v) Weight of assembly

(vi) Installation instructions

(vii) Design installation torque for the bolt or cap screw.

(viii) Withstand torque that may be applied to the bolt or cap screw without failure of component parts.

(ix) The compression dies number with recommended compression pressure.

(x) All other relevant terminal details.

1.15.4 After placement of award, the Contractor shall submit fully dimensioned drawing including all the components in four (4) copies to the Employer for approval. After getting approval from the Employer and successful completion of all the type tests, the Contractor shall submit thirty (30) more copies of the same drawings to the Employer for further distribution and field use at Employer's end.

2.0 Accessories for Conductor

2.1 General

2.1.1 This portion details the technical particulars of the accessories for Conductor.

2.1.2 2.5% extra fasteners, filler plugs and retaining rods shall be provided.

2.2 Mid Span Compression Joint

2.2.1 Mid Span Compression Joint shall be used for joining two lengths of conductor. The joint shall have a resistively less than 75% of the resistivity of equivalent length of conductor. The joint shall not permit slipping off, damage to or failure of the complete conductor or any part thereof at a load less than 95% of the ultimate tensile strength of the conductor.

2.2.2 The joint shall be made of steel and aluminium sleeves for jointing the steel core and aluminium wires respectively. The steel sleeve should not crack or fail during compression. The steel sleeve shall be hot dip galvanised. The aluminium sleeve shall have aluminium of purity not less than 99.5%. The dimensions and dimensional tolerances of mid span compression joint shall be as specified in the standard technical particulars.

2.3 T-Connector

T-Connector of compression type shall be used for jumper connection at transposition tower. It shall be manufactured out of 99.5% pure aluminium and shall be strong enough to withstand normal working loads. The T-connector shall have a resistivity across jumper less than 75% resistivity of equivalent length of conductor. The T-connector shall not permit slipping off, damage to or failure of complete conductor. The welded portions shall be designed for 30 kN axial tensile load. Leg sleeve of T-connector should be kept at an angle of 15 deg. from vertical and horizontal plane of the conductor in order to minimise jumper pull at the welded portion. The dimensions and dimensional tolerances of T-connector shall as specified in the standard technical particulars..

2.4 Repair Sleeve

Repair Sleeve of compression type shall be used to repair conductor with not more than two strands broken in the outer layer. The sleeve shall be manufactured from 99.5% pure aluminium and shall have a smooth surface. The repair sleeve shall comprise of two pieces with a provision of seat for sliding of the keeper piece. The edges of the seat as well as the keeper piece shall be so rounded that the conductor strands are not damaged during installation. The dimensions and dimensional tolerances of repair sleeve shall be as specified in the standard technical particulars.

2.5 Vibration Damper

2.5.1 Vibration dampers of 4R-stockbridge type with four (4) different resonances spread within the specified aeolian frequency band width corresponding to wind speed of 1 m/s to 7 m/s shall be used at suspension and tension points on each conductor in each span along with bundle spacers to damp out aeolian vibration as mentioned herein after.

2.5.2 Alternate damping systems or "Dogbone" dampers offering equivalent or better performance also shall be accepted provided the manufacturer meets the qualifying requirements stipulated in the Specifications. Relevant technical documents to establish the technical suitability of alternate systems shall be furnished by the Bidder along with the bid.

2.5.3 One damper minimum on each side per Conductor/Sub-conductor for suspension points and two dampers minimum on each side per conductor/sub-conductor for tension points shall be used for ruling design span of 350 meters for 220 kV.

2.5.4 The Bidder may offer damping system involving more number of dampers per ruling design span than the specified. However suitable price compensation shall be considered for evaluation. For the purpose of price compensation 80% of the towers as suspension locations and 20% of the towers as tension locations and all the spans shall be assumed to be ruling design spans.

2.5.5 The clamp of the vibration damper shall be made of high strength aluminium alloy of type LM-6. It shall be capable of supporting the damper and prevent damage or chaffing of the conductor during erection or continued operation. The clamp shall have smooth and permanent grip to keep the damper in position on the conductor without damaging the strands or causing premature fatigue failure of the conductor under the clamp. The clamp groove shall be in uniform contact with the conductor over the entire clamping surface except for the rounded edges. The groove of the clamp body and clamp cap shall be smooth, free from projections, grit or other materials which could cause damage to the conductor when the clamp is installed. Clamping bolts shall be

provided with self-locking nuts and designed to prevent corrosion of threads or loosening in service.

2.5.6 The messenger cable shall be made of high strength galvanised steel /stain less steel with a minimum strength of 135kg/sqmm. It shall be of preformed and post formed quality in order to prevent subsequent droop of weight and to maintain consistent flexural stiffness of the cable in service. The number of strands in messenger cable shall be 19. The messenger cable other than stainless steel shall be hot dip galvanised in accordance with the recommendations of IS:4826 for heavily coated wires.

2.5.7 The damper mass shall be made of hot dip galvanised mild steel /cast iron or a permanent mould cast zinc alloy. All castings shall be tree from defects such as cracks, shrinkage, inclusions and blow holes etc. The surface of the damper masses shall be smooth.

2.5.8 The damper clamp shall be casted over the messenger cable and offer sufficient and permanent grip on it. The messenger cable shall not slip out of the grip at a load less than the mass pull-off value of the damper. The damper masses made of material other-than zinc alloy shall be fixed to the messenger cable in a suitable manner in order to avoid excessive stress concentration on the messenger cables which shall cause premature fatigue failure of the same. The messenger cable ends shall be suitably and effectively sealed to prevent corrosion. The damper mass made of zinc alloy shall be casted over the messenger cable and have sufficient and permanent grip on the messenger cable under all service conditions.

2.5.9 The damper assembly shall be so designed that it shall not introduce radio interference beyond acceptable limits.

2.5.10 The vibration damper shall be capable of being installed and removed from energised line by means of hot line technique. In addition, the clamp shall be capable of being removed and reinstalled on the conductor at the designated torque without shearing or damaging of fasteners.

2.5.11 The contractor must indicate the clamp bolt tightening torque to ensure that the slip strength of the clamp is maintained between 2.5 kN and 5 kN. The clamp when installed on the conductor shall not cause excessive stress concentration on the conductor leading to permanent deformation of the conductor strands and premature fatigue failure in operation.

2.5.12 The magnetic power loss of vibration damper shall not exceed the limit as specified in the standard technical particulars.

2.5.13 The vibration analysis of the system, with and without damper and dynamic characteristics of the damper as detailed under Annexure-A, shall have to be submitted.

The technical particulars for vibration analysis and damping design of the system are as follows:

Sl. No.	Description		Technical Particulars
			220 kV
1.	Span length in meters		
(i)	Ruling design span	:	350 meters

(ii) Maximum span	:	1100 meters
(iii) Minimum span	:	100 meters
2. Configuration	:	As per Section – I of this Specifications
3. Tensile load in each sub-conductor At temperature of 0 deg.C and still air	:	As per sag tension calculations
4. Armour rods used	:	Standard preformed armour rods/AGS
5. Maximum permissible dynamic strain	:	+/- 150 micro strains

2.5.14 The damper placement chart for spans ranging from 100m to 1100m shall be submitted by the Bidder. Placement charts should be duly supported with relevant technical documents and sample calculations.

2.5.15 The damper placement charts shall include the following

(1) Location of the dampers for various combinations of spans and line tensions clearly indicating the number of dampers to be installed per conductor per span.

(2) Placement distances clearly identifying the extremities between which the distances are to be measured.

(3) Placement recommendation depending upon type of suspension clamps (viz Free center type/Armour grip type etc.)

(4) The influence of mid span compression joints, repair sleeves and armour rods (standard and AGS) in the placement of dampers.

2.6 Material and Workmanship

2.6.1 All the equipment shall be of the latest proven design and conform to the best modern practice adopted in the extra high voltage field. The Bidder shall offer only such equipment as guaranteed by him to be satisfactory and suitable for 220/132 kV transmission line application with single conductor and will give continued good performance at all service conditions.

2.6.2 The design, manufacturing process and quality control of all the materials shall be such as to achieve requisite factor of safety for maximum working load, highest mobility, elimination of sharp edges and corners, best resistance to corrosion and a good finish.

2.6.3 All ferrous parts shall be hot dip galvanised, after all machining has been completed. Nuts may, however, be tapped (threaded) after galvanising and the threads oiled. Spring washers shall be electro galvanised as per grade 4 of IS-1573. The bolt threads shall be undercut to take care of increase in diameter due to galvanizing. Galvanising shall be done in accordance with IS:2629 / IS-1367 (Part-13) and satisfy the tests mentioned in IS-2633. Fasteners shall withstand four dips while spring washers shall withstand three dips. Other galvanised materials shall have a minimum overall coating

of Zinc equivalent to 600 gm/sq.m and shall be guaranteed to withstand at least six dips each lasting one minute under the standard Preece test for galvanising unless otherwise specified.

2.6.4 The zinc coating shall be perfectly adherent, of uniform thickness, smooth, reasonably bright, continuous and free from imperfections such as flux, ash, rust stains, bulky white deposits and blisters. The zinc used for galvanising shall be of grade Zn.99.95 as per IS:209.

2.6.5 In case of castings, the same shall be free from all internal defects like shrinkage, inclusion, blow holes, cracks etc.

2.6.6 All current carrying parts shall be so designed and manufactured that contact resistance is reduced to minimum and localised heating phenomenon is averted.

2.6.7 No equipment shall have sharp ends or edges, abrasions or projections and shall not cause any damage to the conductor in any way during erection or during continuous operation which would produce high electrical and mechanical stresses in normal working. The design of adjacent metal parts and mating surfaces shall be such as to prevent corrosion of the contact surface and to maintain good electrical contact under all service conditions.

2.6.8 Particular care shall be taken during manufacture and subsequent handling to ensure smooth surface free from abrasion or cuts.

2.8.9 The fasteners shall conform to the requirements of IS:6639. All fasteners and clamps shall have corona free locking arrangement to guard against vibration loosening.

2.7 Compression Markings

Die compression areas shall be clearly marked on each equipment designed for continuous die compressions and shall bear the words 'COMPRESS FIRST' 'suitably inscribed on each equipment where the compression begins. If the equipment is designed for intermittent die compressions, it shall bear the identification marks 'COMPRESSION ZONE' and 'NON-COMPRESSION ZONE' distinctly with arrow marks showing the direction of compression and knurling marks showing the end of the zones. The letters, number and other markings on finished equipment shall be distinct and legible.

2.8 Bid Drawings

2.8.1 The Bidder shall furnish detailed dimensioned drawings of the equipment's and all component parts. Each drawing shall be identified by a drawing number and Contract number. All drawings shall be neatly arranged. All drafting and lettering shall be legible. The minimum size of lettering shall be 3 mm. All dimensions and dimensional tolerances shall be mentioned in mm.

2.8.2 The drawings shall include

(i) Dimensions and dimensional tolerances

(ii) Material. fabrication details including any weld details and any specified finishes and coatings. Regarding material, designations and reference of standards are to be indicated.

(iii) Catalogue No.

(iv) Marking

(v) Weight of assembly

(vi) Installation instructions

(vii) Design installation torque for the bolt or cap screw

(viii) Withstand torque that may be applied to the bolt or cap screw without failure of component parts

(ix) The compression die number with recommended compression pressure.

(x) All other relevant technical details

2.8 .3 Placement charts for spacer and damper

2.8.4 The above drawings shall be submitted with all the details as stated above along with the bid document. After the placement of award. the Contractor shall again submit the drawings in four copies to the Purchaser for approval. After Purchaser's approval and successful completion of all type tests, 10 (ten) more sets of drawings shall be submitted to Purchaser for further distribution and field use at Purchaser's end.

3.0 Standard technical particulars

3.1 The Standard technical particulars to be adhered by the contractor / manufacturer are furnished below:

Standardised Technical Particulars of Hardware Fittings and Accessories for Conductor for 220 kV Transmission Line with ACSR ZEBRA

1. Suspension hardware fittings for ACSR ZEBRA Conductor						
Sl.	**Description**	**Unit**	**Particulars/ Value**			
			Single "I" Suspension Fittings with		**Double "I" Suspension Fittings with**	
			AGS clamp	**Free Centre clamp**	**AGS clamp**	**Free Centre clamp**
1.	Maximum magnetic power loss of one suspension assembly at sub-conductor current of 350 amperes	Watt	2	2	2	2
2.	Slipping strength of suspension assembly	KN	16-24	16-24	16-24	16-24
3.	Particulars of standard/ AGS preformed armour rod set for suspension assembly					
	a) No. of rods per set	No.	12	12	12	12
	b) Direction of lay		Right hand	Right hand	Right hand	Right hand

	c) Overall length after fitting on conductor	mm	2080	2540	2080	2540
	d) Diameter of each rod	mm	7.87	7.87	7.87	7.87
	e) Tolerance in					
	i) Diameter of each rod	±mm	0.10	0.10	0.10	0.10
	ii) Length of each rod	±mm	25	25	25	25
	iii) Difference of length between the longest and shortest rod in a set	±mm	13	13	13	13
	f) Type of Aluminium alloy used for manufacture of PA rod set		6061/ 65032	6061/ 65032	6061/ 65032	6061/ 65032
	g) Minimum UTS of each rod	Kg/m	35	35	35	35
4.	**Particulars of Elastomer (For AGS Clamp only)**					
	a) Type of elastomer		Chloroprene/Neoprene Rubber	NA	Chloroprene /Neoprene Rubber	NA
	b) Shore hardness of elastomer		65 to 80	NA	65 to 80	NA
	c) Temperature range for which elastomer is designed		Upto 95° C	NA	Upto 95° C	NA
	d) Moulded on insert		Yes	NA	Yes	NA
5.	Mechanical strength of suspension fitting(excluding suspension clamp)	KN	70		2 x 70	
6.	Mechanical strength of suspension clamp	KN	70		70	
7.	Galvanising					
a)	Minimum weight of Zinc coating for steel parts	gm/m	600			
b)	Purity of Zinc used for galvanising	%	99.95 (IS 209) or 98.5 (IS 13229)			
c)	Min. No. of dips in standard preece test the ferrous parts can withstand (wherever applicable)	No.	a) Fasteners: 4 dips of 1 minute b) Spring washers: 3 dips of 1 minute & c) all others: 6 dips of 1 minute			

2. Tension hardware fittings for ACSR ZEBRA Conductor

Sl.	**Description**	**Unit**	**Particulars/ Value**	
			Single Tension	**Double Tension**
1.	Mechanical strength of Tension fitting(excluding dead end clamp)	KN	120	2 X 120
2.	Type of dead end assembly		Compression	
3.	Compression pressure	MT	100	
4.	Maximum electrical resistance of dead end assembly as a percentage of equivalent length of Conductor	%	75	
5.	Slip strength of dead end assembly	KN	123.5	
6.	**Galvanising**			

a)	Minimum weight of Zinc coating for steel parts	gm/m²	600
b)	Purity of Zinc used for galvanising	%	99.95 (IS 209) or 98.5 (IS 13229)
c)	Min. No. of dips in standard preece test the ferrous parts can withstand (wherever applicable)	No.	a) Fasteners: 4 dips of 1 minute b) Spring washers: 3 dips of 1 minute & c) all others: 6 dips of 1 minute

3. Mid span compression Joint for ACSR ZEBRA Conductor				
Sl.	**Description**	**Unit**	**Particulars/ Value**	
			Aluminium Sleeve	Steel Sleeve
1.	**Material of Joint**		Aluminium of minimum purity 99.5%	Mild Steel(Fe-410, IS:2062)
2.	Range of Hardness of the steel sleeve (Brinnel hardness)	BHN	From 100 to 200	
3.	**Dimension of sleeve Before compression**		Aluminum sleeve	Steel sleeve
i)	Inside diameter	mm	31.00 ± 0.5	10 ± 0.2
ii)	Outside diameter	mm	48.00 ± 1.0	20.00 ± 0.5
iii)	Length	mm	710 ± 5	240 ± 5
4.	**Dimensions of Sleeve after compression**		Aluminum sleeve	Steel sleeve
i)	Outside dimension(Corner to corner)	mm	47.00 ± 0.5	19.0 ± 0.5
ii)	Outside dimension (face to face)	mm	41.00 ± 0.5	16.00 ± 0.5
5.	Slip strength	KN	123.5	
6.	Maximum resistance of the compressed unit expressed, as percentage of the resistance of equivalent length of bare conductor.	%	75	
7.	Galvanising			
a)	Minimum weight of Zinc coating for steel parts	gm/m²	600	
b)	Purity of Zinc used for galvanising	%	99.95 (IS 209) or 98.5 (IS 13229)	
c)	Min. No. of dips in standard preece test the ferrous parts can withstand (wherever applicable)	No.	a) Fasteners: 4 dips of 1 minute b) Spring washers: 3 dips of 1 minute & c) all others: 6 dips of 1 minute	
4. Mid span compression Joint for 7/3.15 mm GS Earthwire				
Sl.	**Description**	**Unit**	**Particulars/ Value**	
			Aluminium / Filler	Steel Sleeve

			Sleeve		
1.	**Material of Joint**		Aluminium of minimum purity 99.5%		Mild Steel(Fe-410, IS:2062)
2.	Range of Hardness of the steel sleeve (Brinnel hardness)	BHN	From 100 to 200		
3.	**Dimension of sleeve Before compression**				
			Aluminium Sleeve	Steel Sleeve	Alu filler sleeve
i)	Inside diameter	mm	22.00 ± 0.5	10.00 ± 0.2	11.50 ± 0.2
ii)	Outside diameter	mm	30.00 ± 0.5	21.00 ± 0.5	21.00 ± 0.5
iii)	Length	mm	315 ± 5	230 ± 5	25 ± 2
4.	**Dimensions of Sleeve after compression**				
			Aluminium Sleeve		Steel Sleeve
i)	Outside dimension(Corner to Corner)	mm	29.40 ± 0.5		20.20 ± 0.5
ii)	Outside dimension (face to face)	mm	25.00 ± 0.5		17.50 ± 0.5
5.	Slip strength	KN	53.20		
6.	Maximum resistance of the compressed unit expressed, as percentage of the resistance of equivalent length of bare Earthwire	%	75		
7.	Galvanising				
a)	Minimum weight of Zinc coating for steel parts	gm/m	600		
b)	Purity of Zinc used for galvanising	%	99.95 (IS 209) or 98.5 (IS 13229)		
c)	Min. No. of dips in standard preece test the ferrous parts can withstand (wherever applicable)	No.	a) Fasteners: 4 dips of 1 minute b) Spring washers: 3 dips of 1 minute & c) all others: 6 dips of 1 minute		
5. Repair sleeve for ACSR ZEBRA Conductor					
Sl.	**Description**	**Unit**	**Particulars/ Value**		
1.	**Material**		Aluminium of minimum purity 99.5%		

2.	**Dimension of Aluminum sleeve Before compression**		
i)	Inside diameter	mm	31.00 ± 0.5
ii)	Outside diameter	mm	48.00 ± 1.0
iii)	Length	mm	275.00 ± 5.0
3.	**Dimensions of Aluminum Sleeve after compression**		
i)	Outside dimension(Corner to corner)	mm	47.00 ± 0.5
ii)	Outside dimension (face to face)	mm	41.00 ± 0.5
6. Flexible Copper Bond for 7/3.15 mm GS Earthwire			
Sl.	**Description**	**Unit**	**Particulars/ Value**
1.	Stranding		37/7/0.417
2.	Cross sectional area	Sq.mm	35.4
3.	Minimum copper equivalent area	Sq.mm	34
4.	Length of copper cable	mm	500 + 5
5.	Material of lugs		Tinned copper as IS:9567
6.	Bolt Size		
	i) Diameter	mm	16
	ii) Length	mm	40
7. Vibration Damper for ACSR ZEBRA Conductor			
Sl.	**Description**	**Unit**	**Particulars/ Value**
1.	Type of Damper		4R-Stockbridge type
2.	Materials of components		
	a) Damper masses		Cast iron/ mild steel hot dip galvanised / Zinc alloy
	b) Clamp		Aluminum alloy 4600
	c) Messenger cable		High tensile strength galvanized steel
3.	Number of strands in stranded messenger cable	Nos.	19
4.	Minimum ultimate tensile strength of stranded messenger cable	Kg/mm^2	135
5.	Slip strength of stranded messenger cable (mass pull off)	KN	5
6.	Slipping strength of damper clamp		
	(a) Before fatigue test	KN	2.5
	(b) After fatigue test	KN	2
7.	Resonance frequencies range	Hz	5 to 45
8.	Maximum magnetic power loss per vibration damper watts for 350 amps, 50 Hz Alternating Current	Watts	1
9.	Percentage variation in reactance after fatigue test in comparison with that . before fatigue test	%	+/-40 (Maximum)
10.	Percentage variation in power dissipation after fatigue test in comparison with	%	+/-40 (Maximum)

	that before fatigue test		
11.	Galvanising		
a)	Minimum weight of Zinc coating for steel parts	gm/m^2	600
b)	Purity of Zinc used for galvanising	%	99.95 (IS 209) or 98.5 (IS 13229)
c)	Min. No. of dips in standard preece test the ferrous parts can withstand (wherever applicable)	No.	a) Fasteners: 4 dips of 1 minute b) Spring washers: 3 dips of 1 minute & c) all others: 6 dips of 1 minute
8. Vibration Damper for 7/3.15 mm GS Earthwire			
Sl.	**Description**	**Unit**	**Particulars/ Value**
1.	Type of Damper		4R-Stockbridge type
2.	Materials of components		
	a) Damper masses		Cast iron/ mild steel hot dip galvanised / Zinc alloy
	b) Clamp		Aluminum alloy 4600
	c) Messenger cable		High tensile strength galvanized steel
3.	Number of strands in stranded messenger cable	Nos.	19
4.	Minimum ultimate tensile strength of stranded messenger cable	Kg/mm^2	135
5.	Slip strength of stranded messenger cable (mass pull off)	kN	2.5
6.	Slipping strength of damper clamp		
	(a) Before fatigue test	kN	2.5
	(b) After fatigue test	kN	2
7.	Resonance frequencies range	Hz	10 to 60
8.	Percentage variation in reactance after fatigue test in comparison with that . before fatigue test	%	+/-40 (Maximum)
9.	Percentage variation in power dissipation after fatigue test in comparison with that before fatigue test	%	+/-40 (Maximum)
10.	Galvanising		
a)	Minimum weight of Zinc coating for steel parts	gm/m^2	600
b)	Purity of Zinc used for galvanising	%	99.95 (IS 209) or 98.5 (IS 13229)
c)	Min. No. of dips in standard preece test the ferrous parts can withstand (wherever applicable)	No.	a) Fasteners: 4 dips of 1 minute b) Spring washers: 3 dips of 1 minute & c) all others: 6 dips of 1 minute
9. Suspension Clamp for 7/3.15 mm GS Earthwire			
Sl.	**Description**	**Unit**	**Particulars/ Value**
1.	**Material of components**		

	(a) Shackle		Forged Steel
	(b) Clamp Body & Keeper		Malleable cast iron / SGI
	(c) U- Bolt		Mild Steel (Fe 410, IS 2062)
2.	Total Drop (Maximum)	mm	150
3.	Breaking Strength (Minimum)	kN	25
4.	Slipping Strength	kN	9 to 14
5.	Galvanising		
a)	Minimum weight of Zinc coating for steel parts	gm/m^2	600
b)	Purity of Zinc used for galvanising	%	99.95 (IS 209) or 98.5 (IS 13229)
c)	Min. No. of dips in standard preece test the ferrous parts can withstand (wherever applicable)	No.	a) Fasteners: 4 dips of 1 minute b) Spring washers: 3 dips of 1 minute & c) all others: 6 dips of 1 minute

10. Tension Clamp for 7/3.15 mm GS Earthwire

Sl.	Description	Unit	Particulars/ Value		
1.	**Material of components**				
	(i) Anchor Shackle		Forged Steel		
	(ii) Compression Clamp				
	a) Steel Sleeve		Mild Steel (Fe 410, IS 2062)		
	b) Aluminium sleeve		Aluminium of purity 99.5%		
	c) Aluminium Filler sleeve		Aluminium of purity 99.5%		
2.	Range of Hardness of the steel sleeve (Brinnel hardness)	BHN	100-200		
3.	**Dimension of sleeve Before compression**				
			Aluminium Sleeve	Steel Sleeve	Alu filler sleeve
i)	Inside diameter	mm	22.00 ± 0.5	10.00 ± 0.2	11.50 ± 0.2
ii)	Outside diameter	mm	30.00 ± 0.5	21.00 ± 0.5	21.00 ± 0.5
iii)	Length	mm	220 ± 5	180 ± 5	25 .0±2
4.	**Dimensions of Sleeve after compression**				
			Aluminium Sleeve	Steel Sleeve	
i)	Outside dimension(Corner to Corner)	mm	29.40 ± 0.5	20.20 ± 0.5	
ii)	Outside dimension (face to face)	mm	25.00 ± 0.5	17.50 ± 0.5	
5.	Slip strength	KN	53.20		
6.	Minimum Breaking strength of assembly (excluding clamp)	KN	70		

7.	Compression Pressure	Ton	100
8.	Galvanising		
a)	Minimum weight of Zinc coating for steel parts	gm/m^2	600
b)	Purity of Zinc used for galvanising	%	99.95 (IS 209) or 98.5 (IS 13229)
c)	Min. No. of dips in standard preece test the ferrous parts can withstand (wherever applicable)	No.	a) Fasteners: 4 dips of 1 minute b) Spring washers: 3 dips of 1 minute & c) all others: 6 dips of 1 minute

5.0 Tests and Standards

5.1 Type Tests

5.1.1 On the complete Insulator String with Hardware Fittings

(a) Power frequency voltage withstand test with corona control rings/grading ring and arcing horns under wet condition — IEC:60383

(b) Impulse voltage with-stand test under dry condition — IEC:60383

(c) Impulse voltage flash-over test under dry condition — IEC:60383

(d) Voltage distribution test

(e) Mechanical Strength test

(f) Vibration test — Annexure-A

5.1.2 On Suspension Hardware Fittings only

(a) Magnetic power loss test for suspension assembly

(b) Clamp slip strength Vs torque test for suspension clamp — Annexure-A

(c) Mechanical strength Test

(d) OZONE Test on elastomer

5.1.3 On Tension Hardware fittings only

(a) Electrical resistance test

:	for dead end Assembly)	)	
(b)	Heating cycle test for dead end Assembly)	)	IS:2486-(Part-I), Clause 5.4&5.6
(c)	Slip strength test for dead-end assembly	))	
(d)	Mechanical strength test	)	Annexure-A

5.1.4 **Mid Span Compression Joint for Conductor and Earth wire**

(a)	Chemical analysis of materials	))	Annexure - A
(b)	Electrical resistance test)	)	IS:2121-(Part-II), Clause 6.5&6.6
(c)	Heating cycle test)	)	

(d)Slip strength test)

Note : Tests mentioned at (c) is not applicable to mid span compression joints for earth wire.

5.1.5 **T-Connector for Conductor**

(a)	Chemical analysis of materials	))	Annexure-A
(b)	Electrical resistance test	))	IS:2121-(Part-II) -1981Clause6.5 & 6.6
(c)	Heating cycle test	)	
(d)	Axial tensile load test for welded portion	))	Annexure-A

5.1.6 **Repair Sleeve for Conductor**

(a)	Chemical analysis of materials	)	Annexure- A

5.1.7 **Flexible Copper Bond**

(a)	Slip, Strength Test	)	Annexure-A

5.1.8 **Vibration Damper for Conductor and Earth wire**

(a)	Chemical analysis of materials	)	
(b)	Dynamic characteristics test	)	
(c)	Vibration analysis	)	
(d)	Clamp slip test	)	
(e)	Fatigue tests	)	Annexure-A
(f)	Magnetic power loss test	)	
(g)	Damper efficiency test	)	IS:9708

Note : Tests mentioned at (f) is not applicable to dampers for earth wire.

5.1.9 **Earth wire Suspension Clamp Assembly**

(a)	Chemical analysis of materials	)	
(b)	Mechanical strength test	)	Annexure-A
(c)	Clamp slip strength Vs Torque test for suspension assembly	)	

5.1.10 **Earth wire Tension Clamp Assembly**

(a)	Chemical analysis of materials	)	
(b)	Mechanical strength test (excluding clamp)	)	Annexure - A
(c)	Slip strength test on tension assembly	)	
(d)	Electrical resistance test on tension clamp	)	

5.1.11 All the type tests given under clause no. 5.1.1 above shall be conducted on Single suspension and Single tension insulator string along with hardware fittings.

5.1.12 The tests specified under Clause No. 5.1.1 (a) to (e) shall be conducted on single suspension pilot, Double suspension and Double tension Insulator string along with hardware fittings.

5.1.13 The magnetic power loss test specified under clause no. 5.1.2 (a) shall be conducted on Single suspension, Double suspension and Single suspension pilot assembly.

5.1.14 **Type Test specified under clause 5.1.1 to 5.1.10 shall not be required to be carried out if a valid test certificate is available for a similar design, i.e., tests**

conducted earlier should have been conducted in accredited laboratory (accredited based on ISO/IEC guide 25/17025 or EN 45001 by the National Accreditation body of the country where laboratory is located) or witnessed by the representative (s) of RECPDCL/JKPTCL. The test reports submitted shall be for the tests conducted within the last 5 (five) years prior to the date of Bid opening.

In case the tests have been conducted earlier than the above stipulated period or in the event of any discrepancy in the test report (i.e., any test report not applicable due to any design / manufacturing change including substitution of components or due to non-compliance with the requirement stipulated in the Technical Specification) the tests shall be conducted by the Contractor at no extra cost to the Employer.

5.2 Acceptance Tests

5.2.1 On Both Suspension and Tension Hardware Fittings

(a)	Visual Examination	)	IS:2486-(Part-I),
(b)	Verification of dimensions	)	
(c)	Galvanising / Electroplating test	)	
(d)	Mechanical strength test of each component (excluding arcing horn)	)	Annexure-A
(e)	Mechanical Strength test of welded joint	)	
(f)	Mechanical strength test for arcing horn	)	BS:3288- (Part-I), Clause 7.3.2
(g)	Test on locking device for ball and socket coupling	)	IEC:372 (2)
(h)	Chemical analysis, hardness tests, grain size, inclusion rating & magnetic particle inspection for forgings/castings	)	Annexure - A

5.2.2 On Suspension Hardware Fitting only

(a)	Clamp Slip strength Vs Torque test for suspension clamp	)	Annexure-A
(b)	Shore hardness test of elastomer cushion for AG suspension clamp	)	
(c)	Bend test for armour rod	)	IS:2121-(Part-I),

	set	) Clause 7.5, 7.10, 7.11
(d)	Resilience test for armour rod set	) IS:2121-(Part-I) -) Clause7.5,7.10,) 7.11
(e)	Conductivity test for armour rods set	

5.2.3 On Tension Hardware Fittings Only

(a)	Slip strength test for dead end assembly	) IS:2486 (Part-I)) Clause 5.4

5.2.4 Mid Span Compression Joint for Conductor and Earth wire

(a)	Visual examination and dimensional verification	) IS:2121 -(Part-II)-) Clause 6.2, 6.3 and 6.7
(b)	Galvanising test	) Annexure - B
(c)	Hardness test	)

5.2.5 T-Connector for Conductor

(a)	Visual examination and dimensional verification	) IS:2121 -(Part-II)-) Clause 6.2, 6.3
(b)	Axial tensile load test for welded portion	) As per Specification)

5.2.6 Repair Sleeve for Conductor

(a)	Visual examination and dimensional verification	) IS:2121 -(Part-II)-) Clause 6.2, 6.3

5.2.7 Flexible Copper Bond

(a)	Visual examination and dimensional verification	) IS:2121-(Part-II)-) Clause 6.2, 6.3
(b)	Slip strength test	) Annexure - B

5.2.8 Vibration Damper for Conductor and Earthier

(a)	Visual examination and dimensional verification	)) IS:2121-(Part- II)-) Clause 6.2, 6.3
(b)	Galvanising test	) and 6.7

	(i) On damper masses	)	
	(ii) On messenger cable	)	
(c)	Verification of resonance frequencies	)	
(d)	Clamp slip	)	
(e)	Clamp bolt torque test	)	
(f)	Strength of the messenger cable	)	Annexure - B
(g)	Mass pull off test	)	
(h)	Dynamic characteristics test	)	

5.2.9 Earth wire Suspension Clamp Assembly

(a)	Visual examination and dimensional verification	)	IS:2121-(Part-II)
(b)	Galvanising test	)	
(c)	Clamp slip strength test	)	Annexure - A
(d)	Mechanical strength test on each component	)	

5.2.10 Earth wire Tension Clamp Assembly

(a)	Visual examination and dimensional verification	)	IS:2121(Part-II)
(b)	Galvanising test	)	
(c)	Slip strength test for tension clamp	)	
(d)	Mechanical strength test on each component (excluding clamp)	)	Annexure - A
(e)	Hardness test	)	

5.3 Routine Tests

5.3.1 For Hardware Fittings

(a)	Visual examination	)	IS:2486-(Part-I)
(b)	Proof Load Test	)	Annexure - A

5.3.2 For Conductor and Earth wire Accessories

(a)	Visual examination and dimensional verification	)	IS:2121-(Part-II) Clause 6.2 & 6.3

5.4 Tests During Manufacture

On all components as applicable

(a)	Chemical analysis of Zinc used for galvanising	
(b)	Chemical analysis mechanical metallographic test and magnetic particle inspection for malleable castings.	Annexure-A
(c)	Chemical analysis, hardness tests and magnetic particle inspection for forgings	

5.5 Testing Expenses

5.5.1 As indicated in clause 5.1.14, no type test charges shall be payable.

5.5.2 In case type testing is required due to non-availability of type test reports, then to carry out type test on complete insulator string, Contractor has to arrange similar insulators at their own cost.

5.5.3 In case of failure in any type test, bidder/Contractor whose material has failed, is either required to modify the design of the material and successfully carry out all the type test as detailed out in Clause 5.1 of this specification or to repeat that particular type test atleast three times successfully at his own expenses.

5.5.4 Bidder shall indicate the laboratories in which they propose to conduct the type tests. They shall ensure that adequate facilities for conducting type tests are available in the laboratory and tests can be completed in these laboratories within the time schedule guaranteed by them in appropriate schedule.

5.5.5 The entire cost of testing for the type tests, acceptance and routine tests and tests during manufacturing specified herein shall be treated as included in the quoted ex-works price.

5.5.6 Due to failure in any type test, repeat type tests are required to be conducted, then, all the expenses for deputation of Inspector/Employer's representative shall be deducted from the contract price. Also if on receipt of the Contractor's notice of testing, the Employer's representative / Inspector does not find 'plant' to be ready for testing, the expenses incurred by the Employer for re-deputation shall be deducted from contract price.

5.5.7 The Contractor shall intimate the Employer about carrying out of the type tests along with detailed testing programme at least 3 weeks in advance (in case of Domestic Contractor and at least 6 weeks advance in case of Foreign Contractor) of the scheduled date of testing during which the Employer will arrange to depute his representative to be present at the time of carrying out the tests.

5.6 **Sample Batch For Type Testing**

5.6.1 The Contractor shall offer material for sample selection for type testing only after getting Quality Assurance Programme approved by the Employer. The Contractor shall offer at least three times the quantity of materials required for conducting all the type

tests for sample selection. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Programme approved by the Employer.

5.6.2 Before sample selection for type testing the Contractor shall be required to conduct all the acceptance tests successfully in presence of Employer's representative.

5.7 **Schedule of Testing and Additional Tests**

5.7.1 The Bidder has to indicate the schedule of following activities in their bids

(a) Submission of drawing for approval.

(b) Submission of Quality Assurance programme for approval.

(c) Offering of material for sample selection for type tests.

(d) Type testing.

5.7.2 The Employer reserves the right of having at his own expense any other test(s) of reasonable nature carried out at Contractor's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the specifications.

5.7.3 The Employer also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Contractor's premises or at any other test center. In case of evidence of non compliance, it shall be binding on the part of Contractor to prove the compliance of the items to the technical specifications by repeat tests, or correction of deficiencies, or replacement of defective items, all without any extra cost to the Employer.

5.8 **Co-ordination for testing**

The Contractors shall have to co-ordinate testing of their hardware fittings with insulators to be supplied by other Supplier and shall also have to guarantee overall satisfactory performance of the hardware fittings with the insulators.

5.9 **Test Reports**

5.9.1 Copies of type test reports shall be furnished in at least six copies along with one original. One copy shall be returned duly certified by the Employer, only after which the commercial production of the concerned material shall start.

5.9.2 Copies of acceptance test report shall be furnished in at least six copies. One copy shall be returned, duly certified by the Employer, only after which the materials will be despatched.

5.9.3 Record of routine test report shall be maintained by the Contractor at his works for periodic inspection by the Employer's representative.

5.9.4 Test certificates of tests during manufacture shall be maintained by the Contractor. These shall be produced for verification as and when desired by the Employer.

5.10 **Inspection**

5.10.1 The Employer 's representative shall at all times be entitled to have access to the works and all places of manufacture, where the material and/or its component parts shall be manufactured and the representatives shall have full facilities for unrestricted

inspection of the Contractor's, sub-Contractor's works raw materials, manufacturers of all the material and for conducting necessary tests as detailed herein.

5.10.2 The material for final inspection shall be offered by the Contractor only under packed condition as detailed in clause 5.11 of this part of the Specification. The engineer shall select samples at random from the packed lot for carrying out acceptance tests.

5.10.3 The Contractor shall keep the Employer informed in advance of the time of starting and of the progress of manufacture of material in its various stages so that arrangements could be made for inspection.

5.10.4 Material shall not be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the Employer in writing. In the latter case also the material shall be dispatched only after all tests specified herein have been satisfactorily completed.

5.10.5 The acceptance of any quantity of material shall in no way relieve the Contractor of his responsibility for meeting all the requirements of the Specification, and shall not prevent subsequent rejection, if such materials are later found to be defective.

5.11 **Packing and Marking**

5.11.1 All material shall be packed in strong and weather resistant wooden cases/crates. The gross weight of the packing shall not normally exceed 200 Kg to avoid handling problems.

5.11.2 The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.

5.11.3 Suitable cushioning, protective padding, dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.

5.11.4 Bolts, nuts, washers, cotter pins, security clips and split pins etc. shall be packed duly installed and assembled with the respective parts and suitable measures shall be used to prevent their loss.

5.11.5 Each component part shall be legibly and indelibly marked with trade mark of the manufacturer.

5.11.6 All the packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each wooden case/crate shall have all the markings stenciled on it in indelible ink.

5.12 **Standards**

5.12.1 The Hardware fittings; conductor and earth wire accessories shall conform to the following Indian/International Standards which shall mean latest revisions, with amendments / changes adopted and published, unless specifically stated otherwise in the Specification.

5.12.2 In the event of the supply of hardware fittings; conductor and earth wire accessories conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent to those specified. In case of award, salient features of comparison between the Standards proposed by the Contractor and those specified in this document will be provided by the Contractor to establish their equivalence.

Sl. No.	Indian Standard	Title	International Standards
1.	IS : 209	Specification for Zinc	BS:3436-1986
2.	IS : 398 - Part-V Galvanised Steel-	Aluminium Conductor Reinforced for Extra High Voltage (400 KV) and above	IEC:1089-1991
3.	IS 1573 ing of Zinc on iron	Electroplated Coat- and Steel	
4.	IS : 2121	Specification for Conductor and Earth- wire Accessories for Overhead Power lines	
	Part-I Mid-span Joints and	Repair Sleeves for Conductors	
5.	IS:2486	Specification for Insulator Fittings for Overhead power Lines with Nominal Voltage greater than 1000 V	
	Part-I General Requirements	and Tests	
6.	IS:2629	Recommended Practice for Hot Dip Galvanising of Iron and Steel	
7.	IS:2633	Method of Testing Uniformity of Coating on Zinc Coated Articles	
8.	Ozone test on Elastomer	ASTM-D1171	
9.	Tests on insulators of Ceramic material or glass for overhead lines with a nominal voltage greater than 100OV		IEC:383-1993

10.	IS:4826 on Round Steel Wires	Galvanised Coating BS:443-1969	ASTMA472-729
11.	IS:6745 mination of Weight of Zinc Coating of Zinc Coated Iron and Steel Articles	Methods of Deter- ISO : 1460 (E)	BS:433-1969
12.	IS:8263 Interference Tests on High Voltage Insulators	Method of Radio NEMA:107-1964 CISPR	IEC:437-1973
13.	IS:6639 for Steel Structures	Hexagonal Bolts 1968	ISO/R 272-
14.	IS:9708 Stock Bridge Vibration Dampers for Overhead Power Lines	Specification for	
15.	IS:10162	Specification for Spacers	
	Dampers for Twin Horiz- ontal Bundle Conductors		

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The standards mentioned above are available from

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Reference Abbreviation	Name and Address
BS	British Standards, British Standards Institution 101 Pentonvile Road. N 19-ND UK
IEC/CISPR	International Electro technical Commission, Bureau Central de la Commission, Electro Technique International, 1 Rue de verembe. Geneva SWITZERLAND
BIS/IS	Bureau Of Indian Standards, Manak Bhavan, 9, Bahadur Shah Zafar Marg, New Delhi - 110001. INDIA
ISO	International Organisation for

Standardization.
Danish Board of Standardization
Danish Standardising Sraat.
Aurehoegvej-12
DK-2900. Heeleprup.
DENMARK.

NEMA National Electric Manufacture
Association,
155, East 44th Street,
New York, NY 10017
U.S.A.

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1.0 **Tests on Complete Strings with Hardware Fittings**

1.1 **Voltage Distribution Test (For Insulator String with Disc Insulators)**

The voltage across each insulator unit shall be measured by sphere gap method. The result obtained shall be converted into percentage. The voltage across any disc shall not exceed 6.5% for suspension and tension insulator string for 765 kV, the maximum voltage across any disc shall not exceed 9% for suspension insulator strings and 10% for tension insulator strings for 400 kV and the maximum voltage across any disc shall not exceed 20% for suspension insulator string & 22% for tension insulator string. The maximum voltage across any disc shall not exceed 13% for suspension insulator strings and 14% for tension insulator strings for 220kV.

1.2 Mechanical Strength Test

The complete insulator string along with its hardware fitting excluding arcing horn, corona control ring, grading ring and suspension assembly/dead end assembly shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. The load shall be held for five minutes and then removed. After removal of the load, the string components shall not show any visual deformation and it shall be possible to disassemble them by hand. Hand tools may be used to remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

1.3 **Vibration Test**

The suspension string shall be tested in suspension mode, and tension string in tension mode itself in laboratory span of minimum 30 meters. In the case of suspension string a load equal to 600 kg shall be applied along the axis of the suspension string by means of turn buckle. The insulator string along with hardware fittings and one / two sub conductors each tensioned at 35 KN shall be secured with clamps. The system shall be suitable to maintain constant tension on each sub-conductors throughout the duration of the test. Vibration dampers shall not be used on the test span. Both the sub-conductors shall be vertically vibrated simultaneously at one of the resonance frequencies of the insulators string (more than 10 Hz) by means of vibration inducing equipment. The peak to peak displacement in mm of vibration at the antinode point nearest to the string shall be measured and the same shall not be less than $1000/f^{18}$ where f is the frequency of vibration in cycles/sec. The insulator string shall be vibrated for not less than 10 million cycles without any failure. After the test the disc insulators shall be examined for looseness of pins and cap or any crack in the cement. The hardware shall be examined for looseness, fatigue failure and mechanical strength test. There shall be no deterioration of properties of hardware components and disc insulators after the vibration test. The disc insulators shall be subjected to the following, tests as per relevant standards:

Test	Percentage of insulator units to be tested

(a)	Temperature cycle test followed by mechanical performance test	60
(b)	Puncture test/steep wave front test	40

2.0 **Tests on Hardware Fittings**

2.1 **Galvanising/Electroplating Test**

The test shall be carried out as per Clause no. 5.9 of IS:2486-(Part-1) except that both uniformity of zinc coating and standard preecee test shall be carried out and the results obtained shall satisfy the requirements of this specification.

2.2 **Mechanical Strength Test of Each Component**

Each component shall be subjected to a load equal to the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. The load shall be held for five minutes and then removed. The component shall then again be loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified UTS and held for one minute. No fracture should occur. The applied load shall then be increased until the failing load is reached and the value recorded.

2.3 **Mechanical Strength Test of Welded Joint**

The welded portion of the component shall be subjected to a Load of 2000 kgs for one minute. Thereafter, it shall be subjected to die-penetration/ultrasonic test. There shall not be any crack at the welded portion.

2.4 **Clamp Slip Strength Vs Torque Test for Suspension Clamp**

The suspension assembly shall be vertically suspended by means of a flexible attachment. A suitable length of ACSR conductor shall be fixed in the clamp. The clamp slip strength at various tightening torques shall be obtained by gradually applying the load at one end of the conductor. The Clamp slip strength vs. torque curve shall be drawn. The above procedure is applicable only for free center type suspension clamp. For AG suspension clamp only clamp slip strength after assembly shall be found out.

2.5 **Shore Hardness Test for Elastomer Cushion for AG Suspension Assembly**

The shore hardness at various points on the surface of the elastomer cushion shall be measured by a shore hardness meter and the shore hardness number shall be between 65 to 80.

2.6 **Proof Load Test**

Each component shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength which shall be increased at a steady rate to 67% of the UTS specified. The load shall be held for one minute and then removed. After removal of the load the component shall not show any visual deformation.

2.7 **Tests for Forging Casting and Fabricated Hardware**

The chemical analysis, hardness test, grain size, inclusion rating and magnetic particle inspection for forging, castings and chemical analysis and proof load test for fabricated

hardware shall be as per the internationally recognised procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding test will be as in the Quality Assurance programme.

2.8 **Mechanical Strength Test for Suspension/Tension Hardware Fittings**

2.8.1 **Suspension/Tension Hardware Fittings**

The complete string without insulators excluding arcing horn, corona control rings/grading ring and suspension assembly/dead end assembly shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. This load shall be held for five minutes and then removed. After removal of the load, the string component shall not show any visual deformation and it shall be possible to disassemble them by hand. Hand tools may be used to remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS is reached and held for the one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

2.9 **Ozone Test for Elastomer**

This test shall be performed in accordance with ASTM D-1171 by the Ozone chamber exposure method (method B). The test duration shall be 500 hours and the ozone concentration 50 PPHM. At the test completion, there shall be no visible crack under a 2 x magnification.

3.0 Tests on Conductor and Earth wire Accessories

3.1 **Mid Span Compression Joint for Conductor and Earth wire**

(a) Slip Strength Test

The fitting compressed on conductor/earth wire shall not be less than one meter in length. The test shall be carried out as per IS:2121 (Part-II) clause 6.4 except that the load shall be steadily increased to 95% of minimum ultimate tensile strength of conductor/earth wire and retained for one minute at this load. There shall be no movement of the conductor/ earth wire relative to the fittings and no failure of the fit tings during this one minute period.

3.2 **T-Connector for Conductor**

Axial Tensile Load Test for Welded Portion

The sleeve portion of the T-Connector shall be compressed on conductor. The compressed portion shall be held rigidly on some fixtures and axial load shall be applied along with the jumper terminal The load shall be increased gradually till breaking of welded joint occurs. The breaking load should be above 30 kN.

3.3 **Flexible Copper Bond**

Slip Strength Test

On applying a load of 3 kN between the two ends, stranded flexible copper cable shall not come out of the connecting lugs and none of its strands shall be damaged. After the test, the lugs shall be cut open to ascertain that the gripping of cable has not been affected.

3.4 **Vibration Damper for Conductor and Earth wire**

(a)Dynamic Characteristics, Test

The damper shall be mounted with its clamp tightened with torque recommended by the manufacturer on shaker table capable of simulating sinusoidal vibrations for aeolian vibration frequency band ranging from 5 to 45 Hz for ZEBRA conductor and 10 to 60 Hz for damper for earth wire. The damper assembly shall be vibrated vertically with a $\pm$ 1 mm amplitude from 5 to 15 Hz frequency and beyond 15 Hz at ± 0.5mm to determine following characteristics with the help of suitable recording instruments:

(i)Force Vs frequency

(ii)Phase angle Vs frequency

(iii) Power dissipation Vs frequency

The Force Vs frequency curve shall not show steep peaks at resonance frequencies and deep troughs between the resonance frequencies. The resonance frequencies shall be suitably spread within the aeolian vibration frequency-band between the lower and upper dangerous frequency, limits determined by the vibration analysis of conductor/earth wire without dampers.

Acceptance criteria for vibration damper.

(i)The above dynamic characteristics test on five damper shall be conducted.

(ii)The mean reactance and phase angle Vs frequency curves shall be drawn with the criteria of best fit method.

(iii)The above mean reactance response curve should lie within following limits :

V.D. for "ZEBRA" – 0.0135f to 0.540f kgf/mm*

V.D. for "7/3.15" Earth wire - 0.050 f to 0.300 f kgf/mm*

Where f is frequency in Hz.

(iv)The above mean phase angle response curve shall be between 25° to 130° within the frequency range of interest.

(v) If the above curve lies within the envelope, the damper design shall be considered to have successfully met the requirement.

(vi)Visual resonance frequencies of each mass of damper is to be recorded and to be compared with the guaranteed values.

(b)Vibration Analysis

The vibration analysis of the conductor/earthwire shall be done with and without damper installed on the span. The vibration analysis shall be done on a digital

computer using energy balance approach. The following parameters shall be taken into account for the purpose of analysis:

(i)The analysis shall be borne for single conductor/earthwire without armour rods as per the parameters given under clause 2.5.13 and 3.3.8 of this part of the Specification. The tension shall be taken as 35 KN for ACSR 'ZEBRA conductor and 12 KN for 7/3.15 mm earth wire respectively for a span ranging from 100 m to 1100 m.

(ii)The self damping factor and flexural stiffness (El) for conductor and earthwire shall be calculated on the basis of experimental results. The details of experimental analysis with these data should be furnished.

(iii)The power dissipation curve obtained from Dynamic Characteristics Test shall be used for analysis with damper.

*strike out whichever is not applicable

(iv)Examine the aeolian vibration level of the conductor/earthwire with and without vibration damper installed at the recommended location or wind velocity ranging from 0 to 30 Km per hour, predicting amplitude, frequency and vibration energy input.

(v)From vibration analysis of conductor/earthwire without damper, antinode vibration amplitude and dynamic strain levels at clamped span extremities as well as antinodes shall be examined and thus lower and upper dangerous frequency limits between which the aeolian vibration levels exceed the specified limits shall be determined.

(vi)From vibration analysis of conductor/earthwire with damper/dampers installed at the recommended location, the dynamic strain level, at the clamped span extremities, damper attachment point and the antinodes on the conductor/earthwire shall be determined. In addition to above damper clamp vibration amplitude and antinode vibration amplitudes shall also be examined.

The dynamic strain levels at damper attachment points, clamped span extremities and antinodes shall not exceed the specified limits. The damper vibration amplitude shall not be more than that of the specified fatigue limits.

c)Clamp Slip and Fatigue Tests

(i)Test Set Up

The clamp slip and fatigue tests shall be conducted on a laboratory set up with a minimum effective span length of 30 m. The ACSR "ZEBRA" conductor shall be tensioned at 35KN and 7/3.15 mm earth wire at 12 kN and shall not be equipped with protective armour rods at any point. Constant tension shall be maintained within the span by means of lever arm arrangement. After the conductor/earthwire has been tensioned, clamps shall be installed to support the conductor/earthwire at both ends and thus influence of connecting hardware fittings are eliminated from the free span. The clamps shall not be used for holding the tension on the conductor/earthwire. There shall be no loose parts, such as suspension clamps, U bolts on the test span supported between clamps mentioned above. The span shall be equipped with vibration inducing equipment suitable for producing steady standing vibration. The inducing equipment shall have facilities for stepless speed control as well as stepless amplitude arrangement. Equipment shall be available for measuring the frequency, cumulative number of cycles and amplitude of vibration at any point along the span.

(ii)Clamp Slip test

The vibration damper shall be installed on the test span. The damper clamp, after lightning with the manufacturer's specified tightening torque, when subjected to a longitudinal pull of 2.5 kN parallel to the axis of conductor/earthwire for a minimum duration of one minute shall not slip i.e. the permanent displacement between conductor/earthwire and clamp measured after removal of the load shall not exceed 1.0 mm. The load shall be further increased till the clamp starts slipping. The load at which the clamp slips shall not be more than 5 kN.

(iii)Fatigue Test

The vibration damper shall be installed on the test span with the manufacturer's specified tightening torque. It shall be ensured that the damper shall be kept minimum three loops away from the shaker to eliminate stray signals influencing damper movement.

The damper shall then be vibrated at the highest resonant frequency of each damper mass. For dampers involving torsional resonant frequencies, tests shall be done at torsional modes also in addition to the highest resonant frequencies at vertical modes. The resonance frequency shall be identified as the frequency at which each damper mass vibrates with the maximum amplitude on itself. The amplitude of vibration of the damper clamp shall be maintained not less than ± 25/f mm, where f is the frequency in Hz.

The test shall be conducted for minimum ten million cycles at each resonant frequency mentioned above. During the, test if resonance shift is observed the test frequency shall be tuned to the new resonant frequency.

The clamp slip test as mentioned hereinabove shall be repeated after fatigue test without retorquing or adjusting the damper clamp, and the clamp shall withstand a minimum load equal to 80% of the slip strength for a minimum duration of one minute.

After the above tests, the damper shall be removed from conductor / earthwire and subjected to dynamic characteristics test. There shall not be any major deterioration in the characteristic of the damper. The damper then shall be cut open and inspected. There shall not be any broken, loose, or damaged part. There shall not be significant deterioration or wear of the damper. The conductor/earthwire under clamp shall also be free from any damage.

For the purpose of acceptance, the following criteria shall be applied.

(1)There shall not be any frequency shift by more than ±2 Hz for frequencies lower than 15 Hz and ± 3 Hz for frequencies higher than 15 Hz.

(2)The force response curve shall generally lie within guar anteed % variation in reactance after fatigue test in comparison with that before fatigue test by the Contractor.

(3)The power dissipation of the damper shall not be less than guaranteed % variation in power dissipation before fatigue test by the Contractor. However, it shall not be less than minimum power dissipation which shall be governed by lower limits of reactance and phase angle indicated in the envelope.

3.7 Mechanical Strength Test for Earthwire Suspension/Tension Clamp

(a)The suspension assembly/tension assembly (excluding tension clamp) shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. This load shall be held for five minutes and then removed. After removal of the load, the components shall not show any visual deformation and it shall be possible to disassemble them by hand. Hand tools may be used to loosen the nuts initially. The assembly shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS is reached and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

(b)Clamp Slip Strength Vs Torque Test for Suspension Assembly

The suspension assembly shall be vertically suspended by means of a flexible attachment. A suitable length of Earthwire shall be fixed in the clamps. The clamp slip strength at various tightening torques shall be obtained by gradually applying the load at one end of the earthwire. The clamp slip strength Vs torque curve shall be drawn. The clamp slip strength at the recommended tightening torque shall be more than 9 kN but less than 14 kN for 7/3.15 mm earthwire.

(c)Slip Strength Test of Tension Clamp

Tension clamps shall be compressed on a 5 m length of earthwire on both ends. The assembly shall be mounted on a tensile testing machine and anchored in a manner similar to the arrangement to be used in service. A tensile load of 50% of the specified breaking load of the earthwire shall be applied & the sample shall be marked in such a way that movement relative to the fitting can easily be detected. Without any subsequent adjustment of the fitting, the load shall be steadily increased to 95% of the specified breaking load and maintained for one minute. There shall be no movement of the earthwire relative to the fitting during this one minute period and no failure of the fitting also.

(d)Electrical Resistance Test of Tension Clamp

The tension clamp and the jumper shall be compressed on two suitable lengths of earthwire. The electrical resistance shall be measured between points on earthwire near the clamp and near the jumper mouth keeping 25 mm clearance of the fitting and should not exceed 75% of the measured resistance of equivalent length of earthwire. The test shall be conducted with direct current. The current connections shall be at a distance not less than 50 times the diameter of earthwire from the fitting and shall be made so that effective contact is ensured with all those strands of the earth wire which would be taken into account in calculating its equivalent resistance. The test shall be repeated with the polarity reversed and the average of the two results considered as the measured value.

3.8 Chemical Analysis Test

Chemical analysis of the material used for manufacture of items shall be conducted to check the conformity of the same with Technical Specification and approved drawing.

4.0 Tests on All components (As applicable)

4.1 Chemical Analysis of Zinc used for Galvanizing

Samples taken from the zinc ingot shall be chemically analysed as per IS-209-1979. The purity of zinc shall not be less than 99.95%.

4.2 Tests for Forgings

The chemical analysis hardness tests and magnetic particle inspection for forgings, will be as per the internationally recognised procedures for these tests. The, sampling will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Contractor and Purchaser in Quality Assurance Programme.

4.3 Tests on Castings

The chemical analysis, mechanical and metallographic tests and magnetic particle inspection for castings will be as per the internationally recognised procedures for these tests. The samplings will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Contractor and Purchaser in Quality Assurance Programme.

Acceptance Tests

1 **Mid Span Compression Joint for Conductor and Earthwire**

(a) Hardness Test

The Brinnel hardness at various points on the steel sleeve of conductor core and of the earthwire compression joint and tension clamp shall be measured.

2. **T-Connector for Conductor**

(a) Axial Tensile Load Test for Welded Portion

Same as clause 3.2 of Annexure - A .

3. **Flexible Copper Bond**

(a) Slip Strength Test

Same as clause 3.3 of Annexure - A.

4. **Vibration Damper for Conductor and Earthwire**

(a) Verification of Resonance Frequencies

The damper shall be mounted on a shaker table and vibrate at damper clamp displacement of +/-0.5 mm to determine the resonance frequencies. The resonance shall be visually identified as the frequency at which damper mass vibrates with maximum displacement on itself. The resonance frequency thus identified shall be compared with the guaranteed value. A tolerance of ± 1 Hz at a frequency lower than 15 Hz and ± 2 Hz at a frequency higher than 15 Hz only shall be allowed.

(b) Clamp Slip Test

Same as Clause 3.5 (b) of Annexure - A.

(c) Clamp Bolt Torque Test

The clamp shall be attached to a section of the conductor/earthwire. A torque of 150 percent of the manufacturer's specified torque shall be applied to the bolt. There shall be no failure of component parts. The test set up is as described in Clause 3.4 (c) (i), Annexure-A.

(d) Strength of the Messenger Cable

The messenger cable shall be fixed in a suitable tensile testing machine and the tensile load shall be gradually applied until yield point is reached. Alternatively, each strand of message caste may be fixed in a suitable tensile testing machine and the tensile load shall be gradually applied until yield point is reached. In such a case, the 95% of yield strength of each wire shall be added to get the total strength of the caste. The load shall be not less than the value guaranteed by the Contractor

(e)Mass Pull off Test

Each mass shall be pulled off in turn by fixing the mass in one jaw and the clamp in the other of a suitable tensile testing machine. The longitudinal pull shall be applied gradually until the mass begins to pull out of the messenger cable. The pull off loads shall not be less than the value guaranteed by the Contractor.

(f)Dynamic Characteristics Test

The test will be performed as acceptance test with the procedure mentioned for type test with sampling mentioned below

Vibration Damper of-Conductor	1 Sample for 1000 Nos. & below
-	3 Samples for lot above 1 000 & up to 5000 nos.
-	Additional 1 sample for every additional 1500 pieces above 5000.

The acceptance criteria will be as follows

(i)The above dynamic characteristics curve for reactance & phase angle will be done for frequency range of 5 Hz to 40 Hz for vibration damper for 'MOOSE' conductor, 5 Hz to 45 Hz for vibration damper for 'ZEBRA' conductor, 8 Hz to 60 Hz for vibration damper for 'ZEBRA' conductor and 10 Hz to 60 Hz for vibration damper for 7/3.66 mm earth wire & 15 Hz to 70 Hz for vibration damper for 7/3.15 mm earth wire .

(ii)If all the individual curve for dampers are within the envelope as already mentioned for type test for reactance & phase angle, the lot passes the test.

(iii)If individual results do not fall within the envelope, averaging of characteristics shall be done.

(a)Force of each damper corresponding to particular frequency shall be taken & average force of three dampers at the frequency calculated.

(b)Similar averaging shall be done for phase angle.

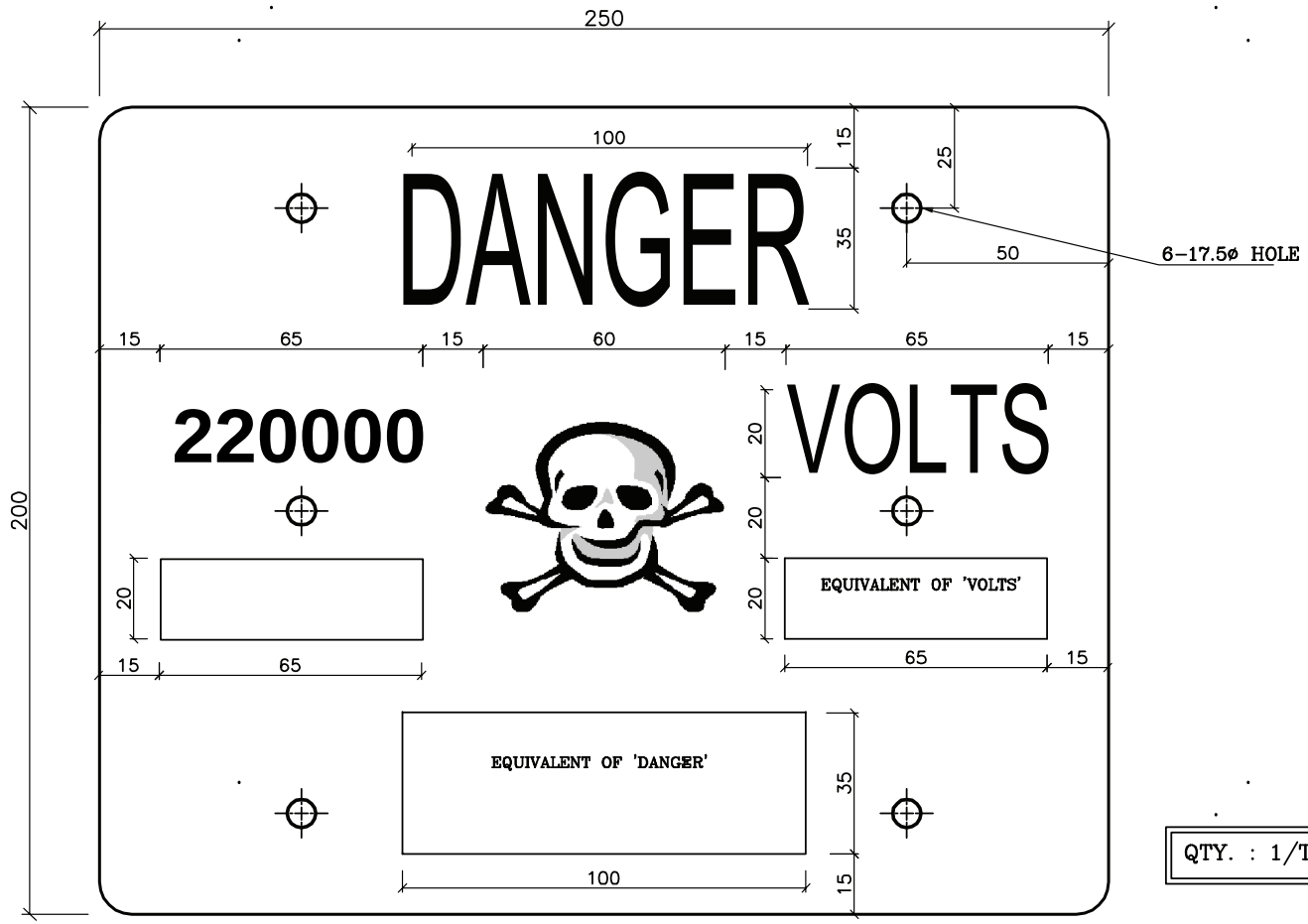
(c)Average force Vs frequency and average phase Vs frequency curves shall be plotted on graph paper. Curves of best fit shall be drawn for the entire frequency range.

(d)The above curves shall be within the envelope specified.

PART-B

VOLUME-II, SECTION-IX

INDICATIVE TENDER DRAWINGS FOR LILO



BILL OF MATERIALS/TOWER							
Sl NO.	Qty (Nos)	Section (mmxmmxmm)	Length (mm)	U/wt (kg)	Wt/Pc (kg)	Total Wt (kg)	
1	1	SHEET 2MM THK. 200	250	15.70	00.79	00.79	
					SUBTOTAL=	00.79	
Total List of Bolts&Nuts							
2	2	16 Dia HRH Bolt&Nut	35.0	0.1220		00.24	
3	2	Spring Washer for M16 Bolt	03.5	0.0090		00.02	
					SUBTOTAL=	00.26	
(FOR 1 NO. OF DANGER PLATE) TOTAL WT / TOWER=						01.05	

QTY. : 1/TOWER

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. MATERIALS :
   MILD STEEL - IS2062:2006 E250 (fy=250N/sqmm)
   BOLTS & NUTS 16ø - GRADE 5.6/5 (IS: 12427-1988)
   BOLT SET: ONE BOLT+ONE NUT+ONE SPRING WASHER.
3. DRAWING IS MADE AS PER IS:2551-1983.
4. SIZE OF PLATE SHALL BE 250mm X 200mm X 2mm.
5. LETTERS AND NUMBERING SHALL BE RED ENAMELLED.
6. BACK GROUND: WHITE VITREOUS ENAMELLED.
7. BACK/REAR: BLACK VITREOUS ENAMELLED.
8. ALL LETTERING SHOULD BE CENTRALLY SPACED.
9. THE DIMENSIONS FOR THE WORDS IN DISTRICT LANGUAGE ARE MAINLY FOR GUIDANCE, HOWEVER, CARE SHOULD BE TAKEN TO SPACE THEM CENTRALLY BETWEEN THE EDGES AND THE AREA OF THE SKULL AND BONES.
10. THE LOCATION OF THE FIXING HOLES SHALL BE LEFT TO THE CHOICE OF THE USER.
11. THE CORNER OF THE PLATE SHOULD BE ROUNDED OFF.

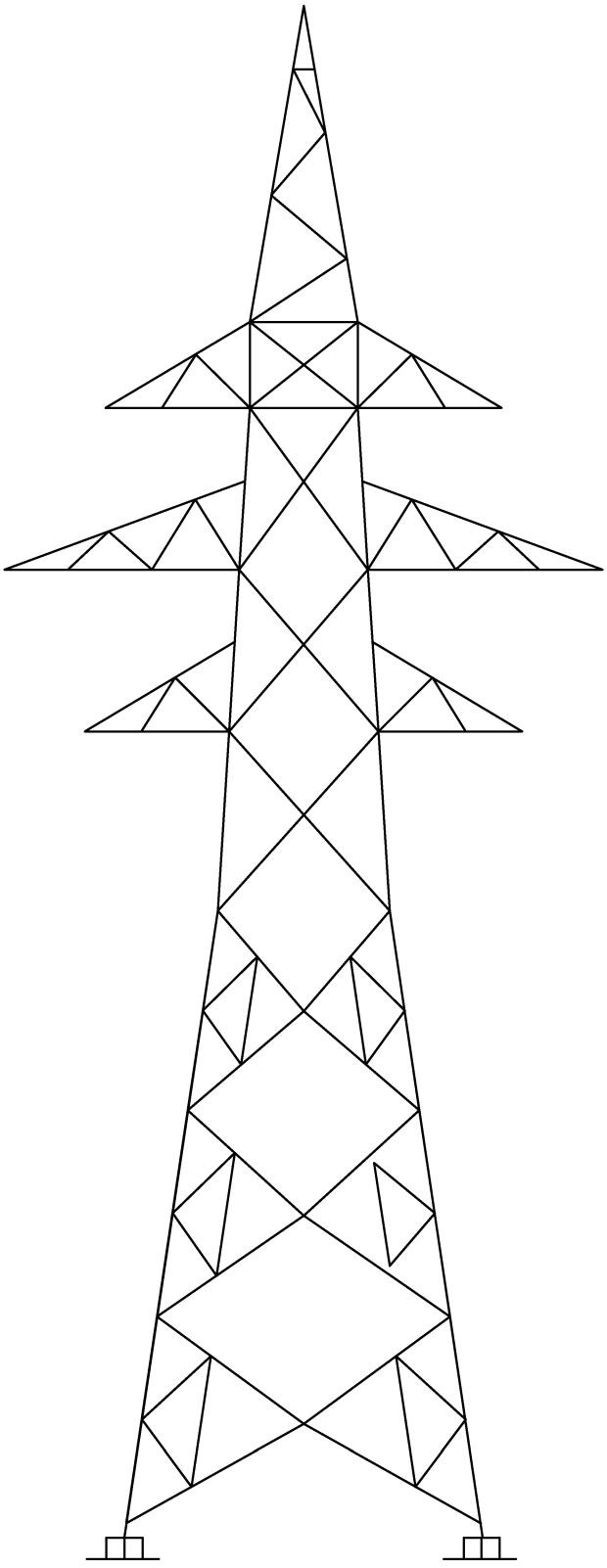
FOR TENDER PURPOSE ONLY

REC TRANSMISSION PROJECTS COMPANY LTD.

PROJECT : **LILO Line Associated with 2x 50 MV, 220/33 KV Nagrota Substation**

TITLE : DANGER PLATE

SHEET. NO. : 1/1

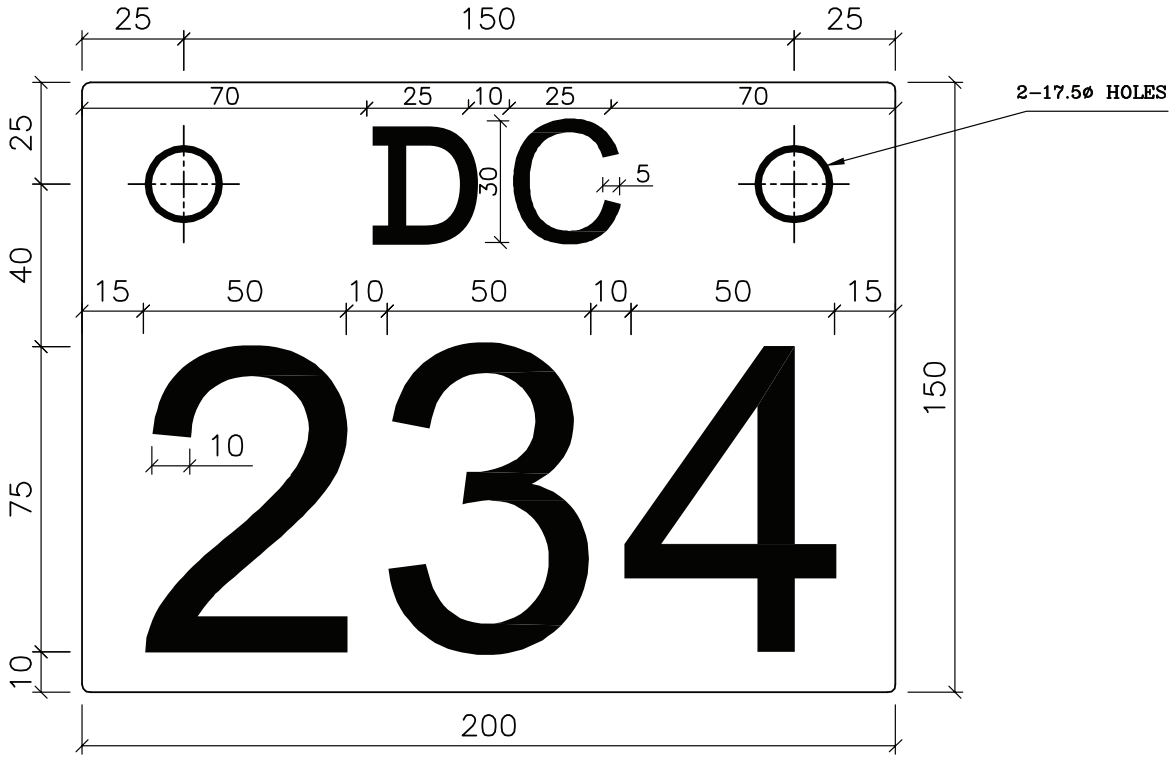


FOR TENDER PURPOSE ONLY

REC TRANSMISSSION PROJECTS COMPANY LTD.

PROJECT: LILO associated with 2x50 MVA, 220/33 KV Nagrota Substation

TITLE: **DOUBLE CIRCUIT TOWER**



BILL OF MATERIALS/TOWER							
Sl NO.	Qty (Nos)	Section (mmxmmxmm)		Length (mm)	U/wt (kg)	Wt/Pc (kg)	Total Wt (kg)
1	1	SHEET 2MM THK.	150	200	15.70	00.47	00.47
						SUBTOTAL=	00.47
Total List of Bolts&Nuts							
2	2	16 Dia HRH Bolt&Nut			35.0	0.1220	00.24
3	2	Spring Washer for M16 Bolt			03.5	0.0090	00.02
						SUBTOTAL=	00.26
(FOR 1 NO. OF NUMBER PLATE) TOTAL WT / TOWER=							00.73

NUMBER PLATE

QTY. : 1/TOWER

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. MATERIALS :
   MILD STEEL - IS2062:2006 E250 (fy=250N/sqmm)
   BOLTS & NUTS 16ø - GRADE 5.6/5 (IS: 12427-1988)
   BOLT SET: ONE BOLT+ONE NUT+ONE SPRING WASHER.
3. DRAWING IS MADE AS PER IS:5613 (PART2/SEC I) -1985.
4. SIZE OF PLATE SHALL BE 200mm X 150mm X 2mm.
5. LETTERS AND NUMBERING SHALL BE RED ENAMELLED.
6. BACK GROUND: WHITE VITREOUS ENAMELLED.
7. BACK/REAR: BLACK VITREOUS ENAMELLED.
8. 'SC' REPRESENTS FIRST LETTER OF STARTING & ENDING PLACE OF LINE.
9. '234' REPRESENTS TOWER NOS.
10. THE CORNER OF THE PLATE SHOULD BE ROUNDED OFF.

FOR TENDER PURPOSE ONLY

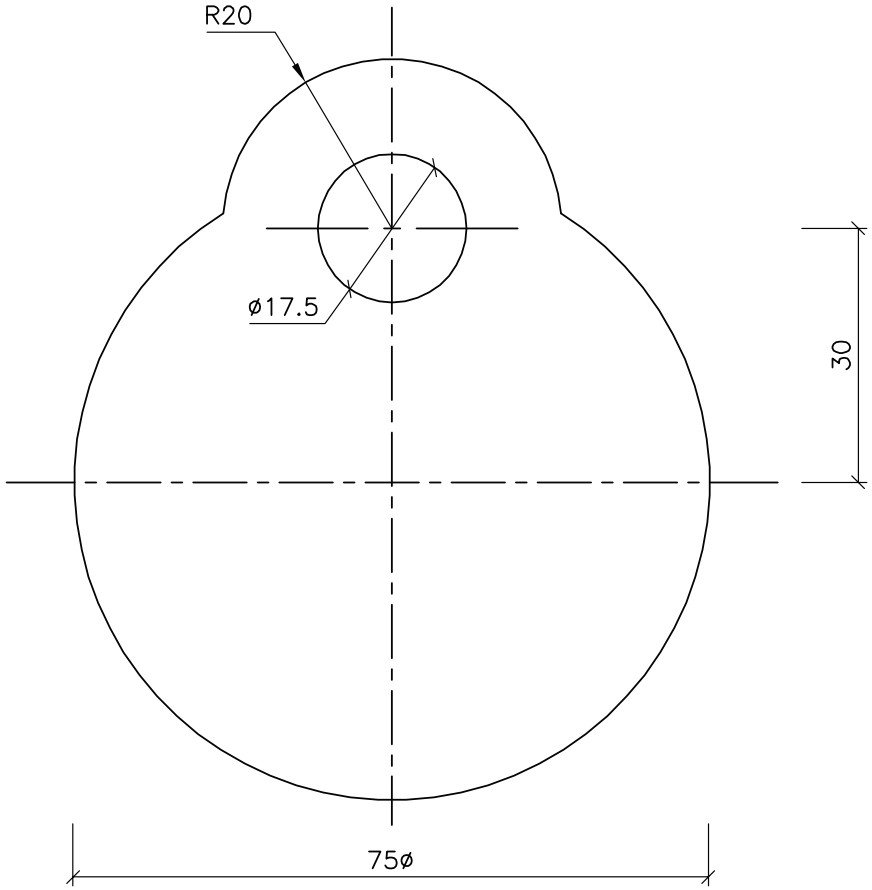
REC TRANSMISSION PROJECTS COMPANY LTD.

PROJECT : LILO associated with 2x50 MVA, 220/33 KV Nagrota Substation

TITLE : NUMBER PLATE

SHEET. NO. : 1/1

BILL OF MATERIALS/TOWER							
Sl NO.	Qty (Nos)	Section (mmxmmxmm)		Length (mm)	U/wt (kg)	Wt/Pc (kg)	Total Wt (kg)
1	6	SHEET 2MM THK.	75	88	15.70	00.103	00.62
						SUBTOTAL=	00.62
Total List of Bolts&Nuts							
2	6	16 Dia HRH Bolt&Nut			35.0	0.1220	00.73
3	6	Spring Washer for M16 Bolt			03.5	0.0090	00.06
						SUBTOTAL=	00.79
(FOR 6 NOS. OF PHASE PLATES) TOTAL WT / TOWER=							01.41



PHASE PLATE

QTY. :2 OR 1 SETS OF 3 PLATES

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. MATERIALS :
   MILD STEEL – IS2062:2006 E250 (fy=250N/sqmm)
   BOLTS & NUTS 16ø – GRADE 5.6/5 (IS: 12427–1988)
   BOLT SET: ONE BOLT+ONE NUT+ONE SPRING WASHER.
3. DRAWING IS MADE AS PER IS:5613 (PART2/SEC I) –1985.
4. SIZE OF PLATE SHALL BE 88mm X 75mm X 2mm.
5. TWO SETS EACH CONSISTING OF 3 PLATES HAVING RED, BLUE & YELLOW COLOURS FOR D/C LINE.
6. FRONT: WITH COLOUR AS PER NOTE 5.
7. BACK/REAR: BLACK VITREOUS ENAMELLED.

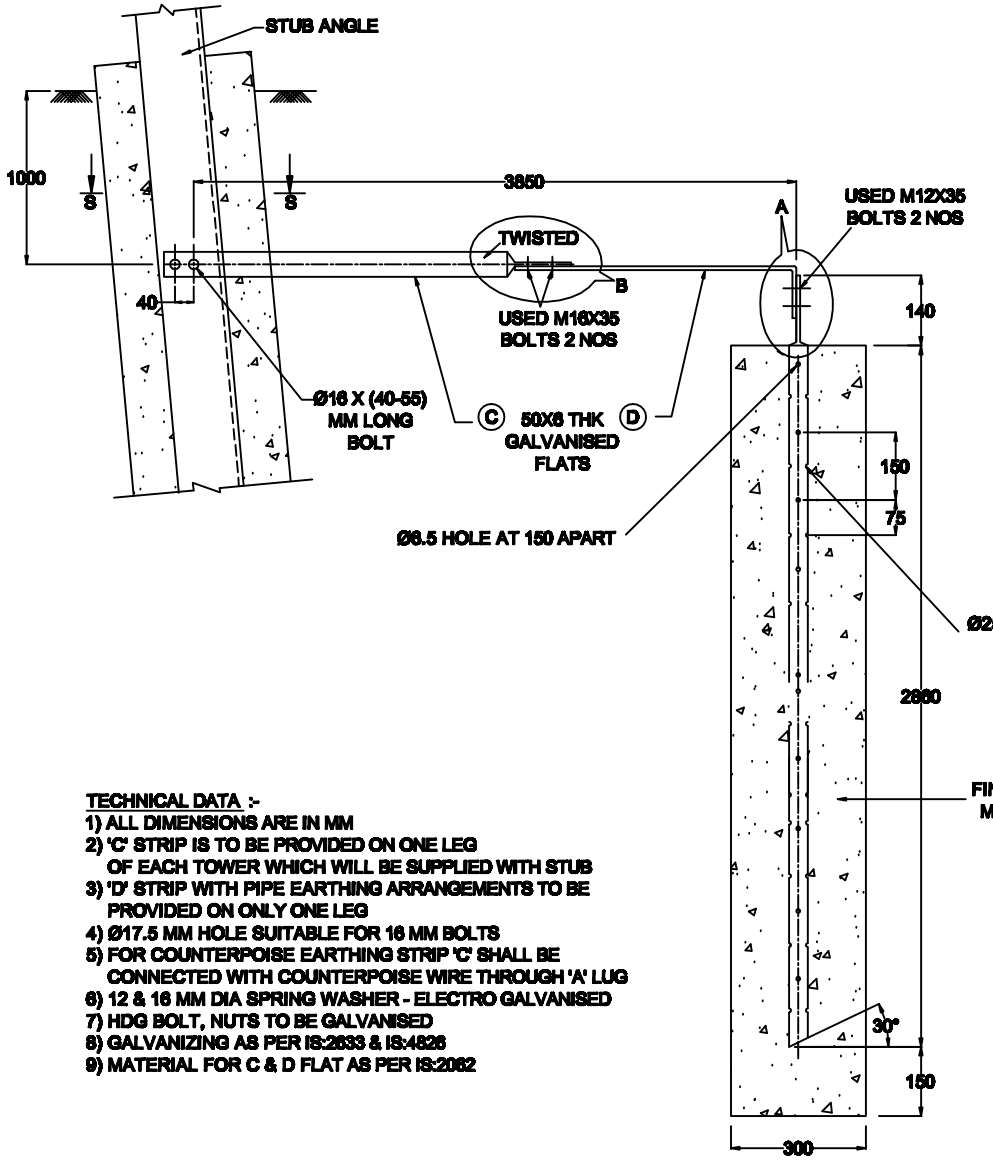
FOR TENDER PURPOSE ONLY

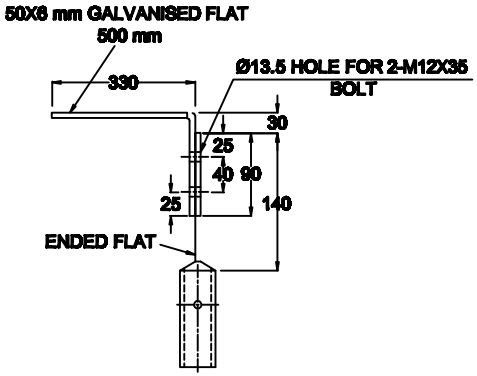
REC TRANSMISSION PROJECTS COMPANY LTD.

PROJECT : LILO associated with 2x50 MVA, 220/33 KV Nagrota Substation

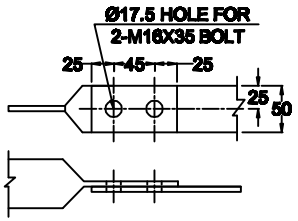
TITLE : PHASE PLATE

SHEET. NO. : 1/1





DETAIL AT - 'A'



DETAIL AT- 'B'

TECHNICAL DATA :-

1) ALL DIMENSIONS ARE IN MM
2) 'C' STRIP IS TO BE PROVIDED ON ONE LEG OF EACH TOWER WHICH WILL BE SUPPLIED WITH STUB
3) 'D' STRIP WITH PIPE EARTHING ARRANGEMENTS TO BE PROVIDED ON ONLY ONE LEG
4) Ø17.5 MM HOLE SUITABLE FOR 16 MM BOLTS
5) FOR COUNTERPOISE EARTHING STRIP 'C' SHALL BE CONNECTED WITH COUNTERPOISE WIRE THROUGH 'A' LUG
6) 12 & 16 MM DIA SPRING WASHER - ELECTRO GALVANISED
7) HDG BOLT, NUTS TO BE GALVANISED
8) GALVANIZING AS PER IS:2633 & IS:4826
9) MATERIAL FOR C & D FLAT AS PER IS:2062

LIST OF BOLTS & NUTS / TOWER

SL NO.	SIZE	QTY.
1	16X35 LG	2
2	12X35 LG	2
3	16 MM DIA SPRING WASHER	2
4	12 MM DIA SPRING WASHER	2

SHEET NO. : 1/1

FOR TENDER PURPOSE ONLY

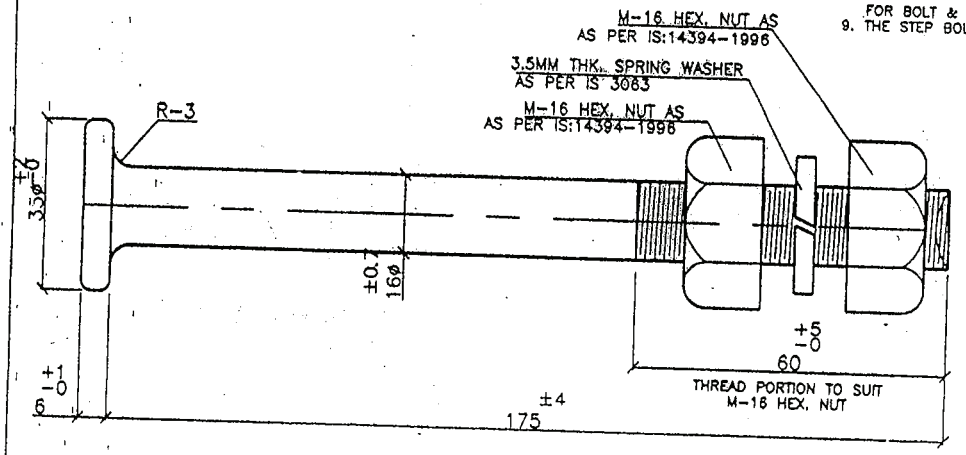
REC TRANSMISSION PROJECTS COMPANY LTD.

PROJECT : LILO associated with 2x50 MVA, 220/33 KV Nagrota Substation

TITLE : PIPE EARTHING ARRANGEMENT

NOTE :-

1. ALL DIMENSIONS ARE IN MM.
2. STEP-BOLT SHALL BE HOT-DIP GALVANISED AS PER IS:1367(P.13)-1983.
3. WEIGHT/PIECE WITH TWO NUTS AND ONE SPRING WASHER=0.417 Kg
4. THREADS TO BE UNDER CUT BY 0.3MM.
5. THE STEP-BOLT SHALL BE CAPABLE OF WITHSTANDING A VERTICAL LOAD NOT LESS THAN 1.5KN.
6. SPRING WASHER SHALL CONFORM TO IS:3063 & ELECTRO GALVANIZED AS PER IS: 1573 SERVICE CONDITION 4.
7. GENERAL REQUIREMENT SHALL CONFORM TO IS 10238.
8. MECHANICAL PROPERTIES SHALL CONFORM TO CLASS 4.6 AS PER IS:1367(PART-3) FOR BOLT & CLASS 5 AS PER IS:1367 (P-VI) FOR NUT.
9. THE STEP BOLT SHALL WITH STAND CANTILEVER TEST AS PER IS:10238

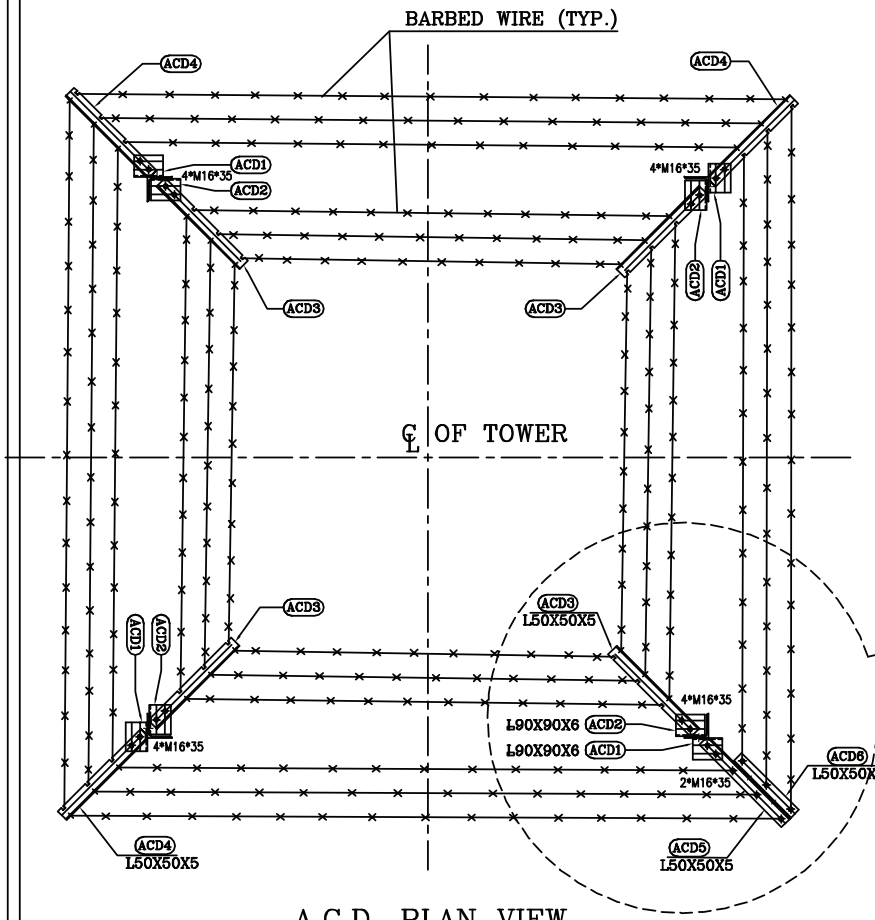


FOR TENDER PURPOSE ONLY

REC TRANSMISSION PROJECTS COMPANY LTD.

PROJECT LILO Line associated with Nagrota Substation

TITLE : STEP BOLT

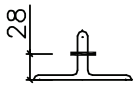


A.C.D. PLAN VIEW



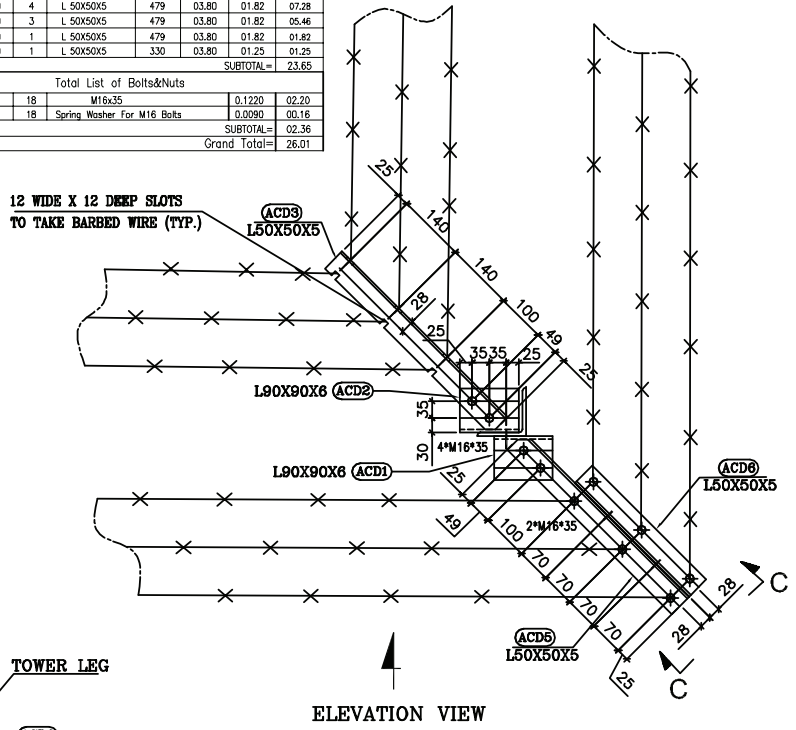
SECTION B–B

(BARBED WIRE WRAPPING METHOD)



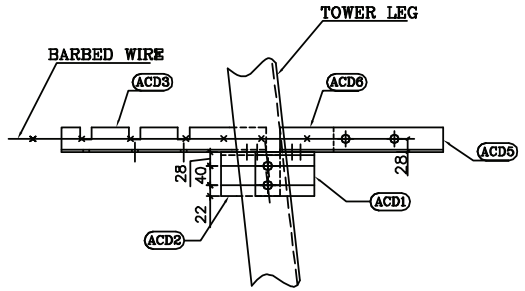
SECTION C–C

BILL OF MATERIALS/TOWER								
Sl. NO.	Mark No	Material Grade	Qty (Nos)	Section (mmxmmxmm)	Length (mm)	U/wt (kg)	Wt/Pc (kg)	Total Wt (kg)
1	ACD1	E250	4	L 90X90X6	120	08.20	00.98	03.92
2	ACD2	E250	4	L 90X90X6	120	08.20	00.98	03.92
3	ACD3	E250	4	L 50X50X5	479	03.80	01.82	07.28
4	ACD4	E250	3	L 50X50X5	479	03.80	01.82	05.46
5	ACD5	E250	1	L 50X50X5	479	03.80	01.82	01.82
6	ACD6	E250	1	L 50X50X5	330	03.80	01.25	01.25
							SUBTOTAL=	23.65
Total List of Bolts&Nuts								
7	M16	5.6	18	M16x35			0.1220	02.20
8	M16		18	Spring Washer For M16 Bolts			0.0090	00.16
							SUBTOTAL=	02.36
							Grand Total=	26.01



ELEVATION VIEW

DETAIL 'A' (GATE DETAILS)



ELEVATION FOR A.C.D.

MARK NOS. ACD1 TO ACD6

NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. MATERIALS :
   HIGH TENSILE STEEL – IS2062:2006 E350 (fy=350N/sqmm)
   MILD STEEL – IS2062:2006 E250 (fy=250N/sqmm)
   BOLTS & NUTS 16ø – GRADE 5.6/5 (IS: 12427–1988)
   BOLT SET: ONE BOLT+ONE NUT+ONE SPRING WASHER.
3. ALL STEEL MEMBERS SHALL BE HOT DIP GALVANIZED AS PER IS:2629.
4. BLANK HOLES ARE PROVIDED AT GATE TO RECEIVE BARBED WIRE.
5. ⊕ INDICATES HOLES OF 17.5mm DIA FOR 16mm DIA BOLTS.
6. THE BARBED WIRE SHALL CONFORM TO A–1, IS:278.
7. THE BARBED WIRE SHALL BE GIVEN CHROMATING DIP AS PER PROCEDURE LAID DOWN IN IS:1340.
8. DRAWING IS MADE AS PER IS:5613 (PART2/SEC I) –1985.

SPECIAL NOTES:–

#. NOMINAL LENGTH OF BARBED WIRE SHALL BE WORKED OUT AS PER FOLLOWING FORMULAE:

L = B + (X–H) x 2 x Tanø x N

B = B/B WIDTH AT CL FOR NORMAL TOWER IN m.
X = ALT. HEIGHT OF BODY EXTN IF ANY IN m.
H = ALT. HEIGHT FROM CL TO ACD LEVEL IN m.
ø = TOWER SLOPE
N = NUMBER OF BARBED WIRE TURNS.

FOR TENDER PURPOSE ONLY

REC TRANSMISSION PROJECTS COMPANY LTD.

PROJECT LILO Line associated with 2x50 MVA, 220/33 KV Nagrota substation

TITLE : ACD(BARBED WIRE TYPE)

PART-I

TECHNICAL SPECIFICATION

VOL-II, SEC-I

General Information and Scope

SECTION – I
CONTENTS

Clause No.	Description
1.0	General Information and Scope
2.0	Qualification requirement for Contractor's supplied Line Materials
3.0	Transmission Line data
4.0	Details of Line Materials
5.0	Service Conditions
6.0	Forms

SECTION-I

TECHNICAL SPECIFICATIONS

1. General Information and Scope

1.1 Scope

1.1.1 The following LILO of 220kV existing S/C transmission lines is included in the scope of the Contractor for package:

TS-PART-B- LILO of 220kV existing S/C Udhampur-Gladni Transmission Line at Nagrota (15 KM) on 220 kV D/C Tower.

1.1.2 This Specification covers the following scope of works:

(i) Detailed survey including route alignment, profiling, tower spotting, optimisation of tower locations, soil resistivity measurement & geotechnical investigation (excluding special foundation locations, viz. pile/well foundation locations)

(ii) Check survey;

(iii) Fabrication and supply of all type of 220 kV double circuit transmission line towers (**Suitable for Wind Zone IV**) as per Contractor/supplier **tested design** & drawings, including fasteners, step bolts, hangers, D-shackles etc.

(iv) All types of tower accessories like phase plate, circuit plate (where ever applicable), number plate, danger plate, anti-climbing device, Bird guard (where ever applicable)

(v) Supply of Conductor, OPGW and its hardware & accessories, Composite Long rod Insulators, Hardware Fittings and Conductor Accessories,

(vi) Classification of foundation for different type of tower and casting of foundation for tower footings as per Contractor/Supplier 220 kV foundations drawing;

(vii) Erection of towers, tack welding of bolts and nuts including supply and application of zinc rich primer & two coats of enamel paint, tower earthing, fixing of insulator strings, stringing of conductors and OPGWs along with all necessary line accessories,

(viii) Painting of towers & supply and erection of span markers, obstruction lights (wherever applicable) for aviation requirements (as required)

(ix) Testing and commissioning of the erected transmission lines and

(x) Other items not specifically mentioned in this Specification and / or BPS but are required for the successful commissioning of the transmission line, unless specifically excluded in the Specification.

Note: Bidders are requested to note that LILO of Nagrota Sub-station will be tapped ~~either~~ from 220 kV Udhampur- Gladni S/C Transmission Line depending upon various Technical Parameters.

1.1.2.1 RECPDCL intends to procure tested Towers, Conductor, OPGW, insulator, Hardware fittings, Conductor and OPGW accessories. Type tests shall not be required to be carried out for which valid type test certificates are available. If the offered design has not been tested earlier, bidder shall be required to carry out the testing. However, no extra payment shall be made to the contractor.

1.1.2.2 ~~Contractor~~ Employer/Owner shall provide ~~Tower design,~~ structural drawings, shop drawings & Bill of Materials of all type of transmission line towers and its extensions to successful bidder after placement of award, in sequence, suiting the project requirement~~, river crossing towers/special towers to Employer for approval after placement of award, in sequence, suiting the project requirement~~. Similarly, the design

and drawings for all type of foundations for the towers shall also be provided by ~~Contractor to~~Owner/Employer ~~Employer for approval~~ to successful bidder. The scope of this specification also provides for fabrication of prototype tower, its assembly and proto-inspection at no extra cost to Employer.

1.1.2.3 (a) The provisional quantities of fabricated & galvanised steel parts as per specifications required for towers, concrete, excavation volume & reinforcement steel for foundation and other items are given in appropriate Schedule of Bid Proposal Sheet (BPS) for package. However, the work shall be executed as per approved construction drawings.

(b) The various items of work are described very briefly in the appropriate Schedule of BPS. The various items of the BPS shall be read in conjunction with the corresponding sections in the Technical Specifications including amendments and, additions, if any. The Bidder's quoted rates shall be based on the description of activities in the BPS as well as other necessary operations required to complete the works detailed in these Technical Specifications.

(c) The Unit rates quoted shall include minor details which are obviously and fairly intended, and which may not have been included in these documents but are essential for the satisfactory completion of the various works.

(d) The unit rate quoted shall be inclusive of all plant equipment, men, material skilled and unskilled labour etc. essential for satisfactory completion of various works.

(e) All measurements for payment shall be in S.I. units, lengths shall be measured in meters corrected to two decimal places. Areas shall be computed in square meters & volume in cubic meters rounded off to two decimals.

1.1.2.4 The Bidder shall submit his offer taking into consideration that

a) Tested tower shall be supplied by them and

b) Foundation designs / drawings shall be developed and provided by them.
Bidder shall quote the unit rates for various items of towers and foundations as per units mentioned in appropriate schedule of (BPS). However, payment of these items identified in the schedule of prices shall be made as follows:

TOWER

Supply items	: On supply of respective complete tower
Foundation items	: On completion of respective foundation in all respect
Erection items	: On erection of respective complete tower

The payment to be made for towers/foundations shall be worked out based on the unit rates and approved Bill of Materials (BOM) for towers and quantities/volumes as per approved tower foundation drawings.

1.1.3 This specification also includes the supply of Conductor, OPGW and its hardware & accessories, Composite long rod Insulators, hardware fittings and all type of accessories for conductor as detailed in the specification. Contractor shall clearly indicate in their offer, the sources from where they propose to procure these materials in appropriate Schedule of BPS. The technical descriptions of these items are given in SECTION – V, VI, VII & VIII of this Volume.

1.1.4 All the raw materials such as steel, zinc for galvanising, reinforcement steel, cement, coarse and fine aggregates for tower foundation, coke and salt for tower earthing etc. are included in the Contractor's scope of supply.

1.1.5 Bidder shall also indicate in the offer, the sources from where they propose to procure the fasteners, step bolts, hangers, D-shackles etc., tower accessories, aviation signal (if required) etc.

1.1.6 **Stringing**

For transmission line with Single Conductor per phase:

The entire stringing work of conductor and OPGW shall be carried out by standard stringing practice. The bidder shall indicate in the offer, the detail description of the procedure to be deployed for stringing operation.

1.2 **Details of Transmission Line Routes and Terrain**

Detailed survey including route alignment, profiling, tower spotting, optimization of tower locations of lines soil resistivity measurement & geotechnical investigation etc. shall be in the scope of Contractor. For this part, quantity of detailed survey including route alignment, profiling, tower spotting, optimization of tower locations, soil resistivity measurement & geotechnical investigation etc. of lines have been included in the BPS.

Bidders may *however* visit the line route to acquaint themselves with terrain conditions and associated details of the proposed transmission lines. For this purpose they are requested to contact the following address:

CHIEF MANAGER,(Tech.)
RECPDCL,
NEW DELHI-110001

1.3 **Location Details and Terminal Points**

1.3.1 The transmission line shall emanate from .Nagrota substation in the State of Jammu and terminate at LILO point of Udhampur - Gladni Transmission Line in the State of Jammu.

1.3.2 The Contractor shall have to construct the 220 kV transmission line completely up to Gantry at Nagrota Substation from angle towers at LILO point. Stringing shall also be carried out from dead end tower to terminal arrangements/terminal points.

1.4 **Access to the Line and Right of Way**

Right of way and way leave clearance shall be arranged by the Employer in accordance with work schedules. Employer will secure way leave and Right of way in the Forest area.

2.0 Technical Requirement for Transmission Line sub-contractor:

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Before engaging a sub-contractor for erection works of Transmission line, the successful bidder shall ensure to take prior approval from RECPDCL and should meet the following requirement:

The Transmission line contractor shall have completed physical construction of transmission line project(s) involving tower foundation, erection and stringing of not less than 10kM route length of 220kV or higher voltage class transmission line as a prime contractor or as a partner in a Joint Venture # within the last seven (07) years as on the date of the originally scheduled date of bid submission.

Note - : In case of works executed under a contract that had been awarded on a Joint Venture, the experience of individual Joint Venture partner shall be considered limited to the scope of that partner under the said contract.

3.0 Qualification Requirement for Contractor's Supplied Line Materials

The Bidder should have assured access to supply Conductor, OPGW, Composite long rod Insulators, Hardware fittings and Conductor & OPGW accessories from Qualified Manufacturers meeting the following minimum requirement and must demonstrate that based on known commitments they will be available for use in the proposed contract.

3.1 Conductor

The qualified manufacturer should have manufactured, tested and supplied at least One Thousand (1000) km. of ACSR Zebra or above size of Conductor**.**

3.2 OPGW

2.2.1 TECHNICAL EXPERIENCE

(a) The OPGW manufacturer should be a manufacturer who has been manufacturing OPGW for the last three (03) years and at least 100 Kms of OPGW manufactured by such manufacturer should have been in satisfactory operation# on 66 KV or above transmission line(s) for at least two (02) years as on the date of award of Contract (NOA).

In addition to this, if OPGW manufacturer is foreign entity then he should have manufactured & supplied at least 100Kms of OPGW to any country other than the home country and same should be in satisfactory operation# on 66kV or above transmission lines as on date of award of Contract (NOA)

(i) In case of Foreign OPGW manufacturer, its Subsidiary or Group Company or a JVC shall have manufacturing facilities of OPGW cable in India or Foreign OPGW manufacturer shall incorporate within six months of NOA a Subsidiary or Group Company or a JVC as per companies Act of India to manufacture OPGW cable in India

(ii) Foreign OPGW manufacturer would supply at least 25% of OPGW cable manufactured in said facilities in India for which bidders should furnish an undertaking (as per enclosed format in……. of bidding documents) during detailed engineering.

iii) The Foreign OPGW manufacturer can supply more than 25% quantity of OPGW cable from Indian works provided he should have manufactured and supplied OPGW cable for 66kV or above voltage line from said Indian works.

OR

(b) The OPGW manufacturer should be a manufacturer who must have established manufacturing and routine test facility for OPGW in India and at least 100 Km of OPGW manufactured by such manufacturer should have been installed on 66 kV or above Transmission line(s) as on the date of bid opening mentioned above. Further, the bidder shall submit, along with its bid, a legally enforceable undertaking for extended warranty

of two (2) years over and above the warranty period specified for OPGW Cable during detailed engineering.

OR

(c) The OPGW manufacturer should be a manufacturer who must have established manufacturing and routine test facility for OPGW in India based on technological support of a parent company (principal) or collaborator and has commenced manufacturing. The parent company (principal) or collaborator should meet the criteria of clause 1.1.1 (a) above and bidder furnishes along with its bid a legally enforceable joint deed of undertaking along with the collaborator / principal for extended warranty obligations of additional two (2) years over and above the warranty period specified for the OPGW and a confirmation letter from the parent company or the collaborator to furnish performance guarantee for an amount of 10% of the cost of OPGW cable during detailed engineering.

In case OPGW manufacturer is a holding company, the technical experience referred to in clause 1.1.1(a) above shall be of that holding company only (i.e. excluding its subsidiary / group companies). In case bidder is a subsidiary of a holding company, the technical experience referred to in clause 1.1.1(a) above shall be of that subsidiary company only (i.e. excluding its holding company).

Note# . Satisfactory operation means certificate issued by the employer certifying the operation without any adverse remarks.

2.2.2 For Live Line Installation (if applicable)

The agency must have installed at least 50 Kms of OPGW cable in live-line condition on 66 kV or higher voltage transmission line(s), as on date of award of contract (NOA).

.2.3 Polymer Insulators

The Qualified Manufacturer shall be a manufacturer of Insulators of similar nature for the last five years. The Qualified Manufacturer's experience should include the following:-

2.3.1 The Qualified Manufacturer should have designed, manufactured, tested and supplied 70/120 KN or above electro mechanical strength of Composite Long rod insulators for 220KV or above voltage transmission line of quantities not less than 5000 nos. Long rod Polymer insulators of each rating and the same should have been in satisfactory operation for a minimum period of two years as on originally scheduled date of bid opening. Further, the manufacturer should also have successfully completed at least the following tests on insulator units and insulator strings of standard Composite Long rod insulators as on originally scheduled date of bid opening as mentioned in the bidding documents.

2.3.2 Tests on individual units as per IEC 60383-I

2.3.3 Following Type tests on insulator strings assembly for 220KV or above Voltage transmission lines with 70 KN & 120KN or above electromechanical strength insulators:

- Power Frequency Voltage withstand test (Wet)
- Lightning Impulse Voltage Withstand test (Dry)

2.4 Hardware Fittings

The qualified manufacturer should have designed, manufactured, tested and supplied hardware fittings for at least 450 sets of tension strings and 1,013 sets of suspension strings for 220 kV or above voltage transmission line and same should have been in satisfactory operation for a minimum period of three years as on date of bid opening.

2.5 Accessories for Conductor

The qualified manufacturer (s) for any individual item(s) of accessories for conductor covered under the package should have designed, manufactured, tested and supplied the item(s) of accessories for conductor covered under the package or item(s) of similar/comparable nature. The experience should include at least the supply of 5850 nos. of vibration dampers for conductor for 220 kV or above voltage transmission line respectively and the same should have been in satisfactory operation for a minimum period of three years as on date of bid opening.

The manufacturer(s) meeting the above requirement for any individual item or items shall be considered qualified for the respective item or items only.

2.5.1 However, if the proposed manufacturer of Hardware fittings and Accessories for conductor is not meeting the above requirements of its own, he should be qualified licensee of a qualified manufacturer meeting the above specified requirements.

i) Manufacturer/licensees shall have adequate design infrastructure and manufacturing facility and capacity and procedures including quality control.

ii) A qualified Licensee of a qualified manufacturer shall mean all of the following:

a) any design undertaken by the licensee shall be approved by the licenser

b) Manufacture by the licensee shall be done with the approval of the licensor and Employer under a quality assurance program-me approved and monitored by the licenser.

c) Licensee must furnish back-up guarantee from the licenser for individual and overall performance of all equipment and materials supplied under the contract.

d) Licenser must guarantee sequential and timely supply of equipment's and materials and submission of technical information and data as desired by the Employer so as to meet the overall construction schedule and

e) The agreement between licensee and licenser submitted along with the bid (Proforma enclosed as Annexure – A to this Section) shall be valid for a period of at least five (5) years after the guarantee period of equipment and materials under supply is over.

3.0 Transmission Line data

3.1 Electrical System Data for 220 kV Tr. Line

a	Nominal Voltage	KV	220
b	Maximum system voltage	KV	245
c	BIL(Impulse)	KV (Peak)	1050
d	Power frequency withstand voltage (Wet)	Kv (rms)	460
e.	Minimum Corona extinction voltage at 50 Hz AC system under dry condition	KV (rms) phase to earth.	154 Min
f.	Radio interference voltage at one MHz for phase to earth voltage of 154 KV under dry condition.	Micro Volts	1000 Max

4.0 DETAILS OF LINE MATERIALS

4.1 Conductor for 220 kV line

Sl. No.	Description	Unit	Conductor
1.	Name/Type		ACSR Zebra
2.	Size	mm	54/3.18Aluminium +7/3.18 steel
3.	Conductor per phase	No.	1
4.	Configuration		Vertical
6.	Overall diameter	mm	28.62
7.	Unit mass	Kg/Km.	1621
8.	Min. UTS	KN	130.32
9.	Ruling Design Span	Meters	350

4.2 Details of long Rod Polymer Insulator Strings for 220 kV line

Sl. No.	Type of string	Size of long rod insulators (mm)	Minimum creep age distance of each unit (mm)	No. of individual units per string	Electro-mechanical strength of long rod insulator unit(KN)	Mechanical strength of insulator string along with hardware fittings (KN)
1.	Single 'I' suspension	60-75	2045	1 x 2	70	70
2.	Single suspension Pilot	60-75	2045	1 x 2	70	70
3.	Single Tension	60-75	2840	1 x 2	120	120
4.	Double Tension	60-75	2840	2 x 2	120	2 x 120

5.0 Service Conditions:

Equipment/material to be supplied against this specification shall be suitable for satisfactory continuous operation under tropical conditions as specified below:

Maximum ambient temperature (Degree Celsius)	:	**48
Minimum ambient temperature (Degree Celsius)	:	**4
Relative humidity (% range)	:	91
Wind zone (as per IS: 875)	:	II
Maximum wind velocity (m/sec.)	:	39
Maximum altitude above mean sea level (Meters)	:	335
Isoceraunic level (days/years)	:	30
Seismic forces	:	As per IS 1893

Moderately hot and humid tropical climate conducive to rust and fungus growth.

Note: - Even though Line comes under Wind Zone – II, All towers to be provided shall be suitable & tested for Wind Zone IV loading.

Forms

(i) Joint Deed of undertaking by the bidder-warranty obligations for extended warranty of additional two (2) years over and above the warranty period specified for OPGW CABLE as per stipulated clause 1.1.1 (b) of Qualifying Requirements (QR) for indigenous manufacturer of OPGW cable.

(ii) Joint deed of undertaking by the bidder and the collaborator / principal company declaration by bidder as per stipulated clause 1.1.1 (c) of Qualifying Requirements (QR) for indigenous manufacturer of OPGW cable.

(iii) Form of Deed of Joint Undertaking to be executed by the Bidder/ Supplier and the Subsidiary Company/ Joint Venture Company/ Group Company (already Incorporated /After Incorporation) of the Bidder/ Supplier for Supply at least 25% of OPGW Cable manufactured in the said facilities in India

(iv) Form of Deed of Joint Undertaking to be executed by the Bidder and the Promoter of the group company (when the group company is yet to be incorporated under Indian companies act) of the bidder for supply at least 25% of OPGW Cable manufactured in the said facilities in India

(v) Form of Deed of Undertaking to be executed by the bidder [where the Subsidiary company / Joint Venture company is to be incorporated] for supply at least 25% of OPGW Cable manufactured in the said facilities in India

FORM OF DEED OF JOINT UNDERTAKING TO BE EXECUTED BY THE BIDDER AND THE PROMOTER OF THE GROUP COMPANY (WHEN THE GROUP COMPANY IS YET TO BE INCORPORATED UNDER INDIAN COMPANIES ACT) OF THE BIDDER FOR SUPPLY AT LEAST 25% OF OPGW MANUFACTURED IN THE SAID FACILITIES IN INDIA [STIPULATED IN CLAUSE 1.1.1(a) (i) & (ii) OF QUALIFICATION REQUIREMENT]

(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

This DEED OF UNDERTAKING executed this ..... day of ..... Two Thousand ..... by M/s....., a Company incorporated under ..... having its Registered Office at ..... hereinafter called the "Bidder" which expression shall include its successors, administrators, executors and permitted assigns and M/s. ……., a Company incorporated under …….. having its Registered Office at ..... hereinafter called the "Promoter" which expression shall include its successors, administrators, executors and permitted assigns, in favour of …….. (insert names of the Purchaser) ……., a Company incorporated under the Indian Companies Act of 1956 having its registered office at ……..(insert registered address of the Purchaser)…… (hereinafter called the "Purchaser" which expression shall include its successors, executors and permitted assigns)

WHEREAS the "Purchaser" invited Bid as per its Specification No. …….. for the execution of …. (insert name of the package alongwith project name) ……

AND WHEREAS Clause No. ……., Section ……., of ……., Vol.–… forming part of the Bidding Documents inter-alia stipulates that the Bidder must fulfill the Qualifying Requirements for the *…… and be jointly and severally bound and responsible along with the Group Company for the successful performance of the *…….. offered in the event the Bid submitted by the Bidder is accepted by the Purchaser resulting in a Contract.

AND WHEREAS the Bidder has submitted its Bid to the Purchaser vide Proposal No. ……..…….. dated …….. based on the association of the Promoter of the Group Company and confirmed that the Group Company shall be incorporated as per Indian Companies Act, within six (06) months from the date of award.

AND WHEREAS the Bidder and the Promoter are required to jointly execute and furnish an irrevocable Deed of Joint Undertaking and be jointly and severally liable to the Purchaser for ensuring manufacturing facilities of OPGW Cable in India (hereinafter called as the "Equipment") such that the Equipment to be supplied by the Supplier can be repaired and maintained without necessitating it to be taken outside the country and for supply at least 25% of OPGW Cable from such works of Group Company to be set up in India.

AND WHEREAS the Bidder has submitted its Bid to the Purchaser based on above stipulation and has agreed to furnish this Deed of Undertaking to be enforceable in the event of the award of the Contract by the Purchaser.

1.0 In consideration of the award of Contract by the Purchaser to the Bidder/Supplier (hereinafter referred to as the "Contract") we, the Bidder/Supplier and the Promoter do hereby agree and undertake to provide requisite Manufacturing and testing facilities for the Equipment, after sales service and supply of spare parts as per the terms of the Contract.

2.0 Without in any way affecting the generality and total responsibility in terms of this Deed of Undertaking, the Bidder/Supplier hereby agrees to depute their technical experts from time to time to the Group Company Works/ Purchaser's Project site as mutually considered necessary by the Purchaser, Bidder/Supplier and the Group Company to ensure:

(i) A valid technology transfer agreement, including license to manufacture and supply from India, between the Bidder / Supplier, the technology provider and the Group Company covering the type, size and rating of the OPGW Cable specified, valid minimum up to the end of the defect liability period of the contract. The technology transfer agreement necessarily covers transfer of technological know-how for OPGW Cable in the form of complete transfer of design dossier, design software, drawings and documentation, quality system manuals and imparting relevant training by the Bidder / Supplier to the personnel of the Group Company.

(ii) Design of the Equipment's manufactured in India shall be identical to the design of equipment's to be manufactured and supplied by the Bidder/Supplier

(iii) Adequate up gradation of the testing facilities including quality systems at Indian works

(iv) Training to staff of the Group Company and certification to its trained personnel for carry out each activity

(v) Involvement and supervision during all phases of manufacturing by expert of Bidder/Supplier for the OPGW Cable

(vi) MQP of Group Company shall be same as that of Bidder/Supplier

(vii) Source of raw material / major bought out components shall be same as that of Bidder/Supplier

(viii) Timely supply on FOR destination delivery at site basis.

(ix) Supervision of unloading at site, storage, erection, testing & commissioning and successful performance of the equipment in accordance with contract specifications

(x) If necessary the Bidder/Supplier shall advise the Group Company, suitable modifications of designs and implement necessary corrective measures to discharge the obligations under the Contract.

(xi) Warranty obligations as per GCC clause 22.1 of the biding documents for the entire quantity to be supplied from the Group Company.

3.0 This Deed of Undertaking shall be construed and interpreted in accordance with the laws of India and the Courts in Delhi shall have exclusive jurisdiction in all matters arising under the Undertaking.

4.0 We, agree that this undertaking shall be irrevocable and shall form an integral part of the Contract.

5.0 We hereby confirm that the above undertaking has also been approved by our Board of Directors and the Resolution passed by our Board(s) is attached with this undertaking.

IN WITNESS WHEREOF the Bidder / Supplier and Promoter of the Group Company have through their Authorised Representatives executed these presents and affixed Common seals of their respective Companies on the day, month and year first above mentioned.

WITNESS

Signature ……..

Name ……..

Office Address …….

[For Bidder]

(Signature of the authorized representative)

Name ……..

Common Seal of Company …..……..

WITNESS

Signature ……..

Name ……..

Office Address ……..

[For Promoter of the Group Company]

(Signature of the authorized representative)

Name ……..

Common Seal of Company …..……..

Note:

1. For the purpose of executing the Deed of Undertaking, the non-judicial stamp papers of appropriate value shall be purchased in the name of executant.

2. The Undertaking shall be signed on all the pages by the authorised representative(s) of the Bidder and Promoter of the Group Company and should invariably be witnessed.

3. The Resolution of the Board of Directors of the Bidder and Promoter of the Group Company, as per the format, shall be attached with this Undertaking.

4. This Deed of Undertaking duly attested by Notary Public of the place(s) of the respective executant, shall be submitted along with the bid.

FORM OF DEED OF UNDERTAKING TO BE EXECUTED BY THE BIDDER [WHERE THE SUBSIDIARY COMPANY / JOINT VENTURE COMPANY IS TO BE INCORPORATED] FOR SUPPLY AT LEAST 25% OF OPGW CABLEMANUFACTURED IN THE SAID FACILITIES IN INDIA [STIPULATED IN CLAUSE 1.1.1(a) (i) & (ii) OF QUALIFICATION REQUIREMENT]

(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

This DEED OF UNDERTAKING executed this ..... day of ..... Two Thousand ..... by M/s....., a Company incorporated under ..... having its Registered Office at ..... hereinafter called the "Bidder" which expression shall include its successors, administrators, executors and permitted assigns, in favour of …….. (insert name of the Purchaser) ……., a Company incorporated under the Indian Companies Act of 1956 having its registered office at ……..(insert registered address of the Purchaser)…… (hereinafter called the "Purchaser" which expression shall include its successors, executors and permitted assigns)

WHEREAS the "Purchaser" invited Bid as per its Specification No. ……. for the execution of …. (insert name of the package alongwith project name) …….

AND WHEREAS Clause No. ……., Section ……., of ……., Vol.–… forming part of the Bidding Documents inter-alia stipulates that the Bidder must fulfill the Qualifying Requirements for the *…… and be jointly and severally bound and responsible along with the Subsidiary Company / Joint Venture Company for the successful performance of the *…….. offered in the event the Bid submitted by the Bidder is accepted by the Purchaser resulting in a Contract.

AND WHEREAS the Bidder has submitted its Bid to the Purchaser vide Proposal No. …….. dated ……. and confirmed that the Subsidiary Company / Joint Venture Company shall be incorporated as per Indian Companies Act, within six (06) months from the date of award.

AND WHEREAS the Bidder and the Subsidiary Company / Joint Venture Company are required to jointly execute and furnish an irrevocable Deed of Joint Undertaking and be jointly and severally liable to the Purchaser for ensuring supply at least 25% of OPGW Cable manufactured in the said facilities in India (hereinafter called as the "Equipment") such that the Equipment to be supplied by the Supplier can be repaired and maintained without necessitating it to be taken outside the country and for supply at least 25% of OPGW Cable from such works of Subsidiary Company / Joint Venture Company to be set up in India.

AND WHEREAS the Bidder has submitted its Bid to the Purchaser based on above stipulation and has agreed to furnish this Deed of Undertaking to be enforceable in the event of the award of the Contract by the Purchaser.

1.0 In consideration of the award of Contract by the Purchaser to the Bidder/Supplier (hereinafter referred to as the "Contract") we, the Bidder/Supplier do hereby agree and undertake to provide requisite Manufacturing and testing facilities for the Equipment, after sales service and supply of spare parts as per the terms of the Contract.

2.0 Without in any way affecting the generality and total responsibility in terms of this Deed of Undertaking, the Bidder/Supplier hereby agrees to depute their technical experts from time to time to the Subsidiary Company / Joint Venture Company Works/ Purchaser's Project site as mutually considered necessary by the Purchaser, Bidder/Supplier and the Subsidiary Company / Joint Venture Company to ensure:

(i) A valid technology transfer agreement, including license to manufacture and supply from India, between the Bidder / Supplier, the technology provider and the Subsidiary Company / Joint Venture Company covering the type, size and rating of the OPGW Cable specified, valid minimum up to the end of the defect liability period of the contract. The technology transfer agreement necessarily covers transfer of technological know-how for OPGW Cable in the form of complete transfer of design dossier, design software, drawings and documentation, quality system manuals and imparting relevant training by the Bidder / Supplier to the personnel of the Subsidiary Company / Joint Venture Company.

(ii) Design of the Equipment's manufactured in India shall be identical to the design of equipment's to be manufactured and supplied by the Bidder/Supplier

(iii) Adequate up gradation of the testing facilities including quality systems at Indian works

(iv) Training to staff of the Group Company and certification to its trained personnel for carry out each activity

(v) Involvement and supervision during all phases of manufacturing by expert of Bidder/Supplier for the OPGW Cable

(vi) MQP of Group Company shall be same as that of Bidder/Supplier

(vii) Source of raw material / major bought out components shall be same as that of Bidder/Supplier

(viii) Timely supply on FOR destination delivery at site basis.

(ix) Supervision of unloading at site, storage, erection, testing & commissioning and successful performance of the equipment in accordance with contract specifications

(x) If necessary the Bidder/Supplier shall advise the Subsidiary Company / Joint Venture Company, suitable modifications of designs and implement necessary corrective measures to discharge the obligations under the Contract.

(xi) Warranty obligations as per GCC clause 22.1 of the biding documents for the entire quantity to be supplied from the Subsidiary Company / Joint Venture Company.

3.0 This Deed of Undertaking shall be construed and interpreted in accordance with the laws of India and the Courts in Delhi shall have exclusive jurisdiction in all matters arising under the Undertaking.

4.0 We, agree that this undertaking shall be irrevocable and shall form an integral part of the Contract.

5.0 We hereby confirm that the above undertaking has also been approved by our Board of Directors and the Resolution passed by our Board(s) is attached with this undertaking.

IN WITNESS WHEREOF the Bidder / Supplier have through their Authorised Representatives executed these presents and affixed Common seals of their respective Companies on the day, month and year first above mentioned.

WITNESS

Signature ……..

Name ……..

Office Address ……..

[For Bidder]

(Signature of the authorized representative)

Name ……..

Common Seal of Company …..……..

WITNESS

Signature ……..

Name ……..

Office Address ……..

Note:

1. For the purpose of executing the Deed of Undertaking, the non-judicial stamp papers of appropriate value shall be purchased in the name of executant.

2. The Undertaking shall be signed on all the pages by the authorised representative(s) of the Bidder and should invariably be witnessed.

3. The Resolution of the Board of Directors of the Bidder, as per the format, shall be attached with this Undertaking.

4. This Deed of Undertaking duly attested by Notary Public of the place(s) of the respective executant, shall be submitted along with the bid.

1. **FORM OF DEED OF UNDERTAKING BY THE CONTRACTOR**

[STIPULATED IN CLAUSE ……]

(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

(Declaration by Contractor regarding …….. OF GTR/Qualifying Requirements for Indigenous manufacturer of OPGW)

THIS DEED OF UNDERTAKING executed this …….. day of …….. Two Thousand and …… by M/s. ……., a Company incorporated under the laws of …….. having its Registered Office at …….. (hereinafter called the "Contractor" which expression shall include its successors, executors and permitted assigns) in favour of …….. (insert names of the Employer) ……., a Company incorporated under the Companies Act of1956 having its registered office at ……..(insert registered address of the Employer)…… (hereinafter called the "Employer" which expression shall include its successors, executors and permitted assigns)

WHEREAS the "Employer" invited Bid as per its Specification No. …….. for the execution of …… (insert name of the package along with project name)……..

AND WHEREAS Clause No. ……., Section ……., of ……., Vol.–… forming part of the Bid Documents inter-alia stipulates that the Contractor must fulfill the General Technical Requirements/Qualifying Requirement for OPGW in the event of award/or post award stage and shall be bound and responsible for the successful performance of OPGW offered in the event the Bid submitted by the Contractor is accepted by the Employer resulting in a Contract.

AND WHEREAS the Bidder/Contractor has submitted its Bid to the Employer vide Proposal No. …….…….. dated ……..

NOW THEREFORE THIS UNDERTAKING WITNESSETH as under:

1.0 In consideration of the award of Contract by the Employer to the Contractor (hereinafter referred to as the "Contract") we, the Contractor do hereby undertake that we shall be bound unto the …… (insert name of the Employer) ……., for the successful performance of OPGW and shall be fully responsible for the design, manufacture, testing, supply on FOR destination delivery at site basis and unloading at site, storage, erection, testing & commissioning and successful performance of OPGW in accordance with the Contract Specifications.

2.0 We confirm 3 (three) years Warranty obligations for the entire quantity to be supplied under this contract.

3.0 We, the Contractor agree that this Undertaking shall be irrevocable and shall form an integral part of the Contract and further agree that this Undertaking shall continue to be enforceable till the Employer discharges it. It shall become operative from the effective date of Contract.

4.0 This Deed of Undertaking shall be construed and interpreted in accordance with the laws of India and the Courts in Delhi shall have exclusive jurisdiction in all matters arising under the Undertaking.

IN WITNESS WHEREOF the Contractor have through their Authorised Representatives executed these presents and affixed Common seals of their respective Companies, on the day, month and year first above mentioned.

WITNESS

Signature ……..

Name ……..

Office Address ……..

(For Contractor)

(Signature of the authorized representative)

Name ……..

Common Seal of Company …..……..

WITNESS

Signature ……..

Name ……

Office Address ……..

WITNESS

Signature ……..

Name ……

Office Address ……..

Note:

1. For the purpose of executing the Deed of Undertaking, the non-judicial stamp papers of appropriate value shall be purchased in the name of executants parties.

2. The Undertaking shall be signed on all the pages by the authorised representatives of Contractor should invariably be witnessed.

3. This Deed of Joint Undertaking attested by Notary Public of the place(s) of the respective executant(s) or registered with the Indian Embassy/High Commission in that country shall be submitted by the Contractor after finalization of vendor for OPGW as per TS in the event of award/ post award stage.

* Strike-off whichever is not applicable.

3. **FORM OF BANK GUARANTEE FOR CONTRACT PERFORMANCE**

(TO BE SUBMITTED BY THE COLLABORATOR / PARENT COMPANY OF INDIGENOUS MANUFACTURER OF OPGW)

[STIPULATED IN CLAUSE ……]

(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

Bank Guarantee No. …… Date.....

Contract No.....

……..[Name of Contract]……..

To: [Name and address of the Employer]

Dear Ladies and/or Gentlemen,

We refer to the Contract ("the Contract") signed on .....(insert date of the Contract)..... between you and M/s…….. (Name of Contractor) ....., having its Principal place of business at ……..(Address of Contractor) ..... and Registered Office at ……..(Registered address of Contractor) ..... ("the Contractor") concerning ……..... (Indicate brief scope of work) ..... for the complete execution of the …… (insert name of Package alongwith name of the Project)……..

Whereas, the Contractor has agreed to supply the OPGW Manufactured by M/s .....(the Manufacturer), Having its Principal place of business and Registered office at ……(Herein after Referred to as the 'Manufacturer') in collaboration with (the manufactures) M/s. ..... (Name of Collaborator) ....., having its Principal place of business at ……..(Address of Collaborator) ..... and Registered Office at ……..(Registered address of Collaborator) ..... (hereinafter referred to as the "Collaborator"), as a pre-requisite for qualification of the Contractor/Manufacturer and have submitted a deed of joint undertaking declaring that they are jointly and severally bound and responsible for

the successful performance of the said equipment in accordance with the Contract Specifications and that the Collaborator having agreed to furnish a Contract Performance Guarantee for the faithful performance/compliance of the Deed of Undertaking equivalent to (10%) ten per cent of the Ex-works cost of OPGW to be supplied by the Manufacturer under the Contract during finalization of OPGW Vendor in the event of award/ post award stage, in addition to Contract Performance Guarantee equivalent to 10% (ten per cent) of the value of the Contract to be provided by the Contractor for the faithful performance of the entire Contract.

By this letter we, the undersigned, ……(insert name & address of the issuing bank) ……., a Bank (or Company) organized under the laws of ..... and having its Registered/Head Office at …..……(insert address of registered office of the bank)……..... do hereby irrevocably guarantee payment to you up to …….. i.e., ten percent (10%) of the Ex-works cost of OPGW to be supplied by the Manufacturer under the Contract until ninety (90) days beyond the Defect Liability Period i.e., upto and inclusive of …….. (dd/mm/yy).

We undertake to make payment under this Letter of Guarantee upon receipt by us of your first written demand signed by your duly authorized officer declaring the Contractor/Manufacturer/Collaborator to be in default under the Contract and without cavil or argument any sum or sums within the above named limits, without your need to prove or show grounds or reasons for your demand and without the right of the Contractor/Manufacturer/Collaborator to dispute or question such demand.

Our liability under this Letter of Guarantee shall be to pay to you whichever is the lesser of the sum so requested or the amount then guaranteed hereunder in respect of any demand duly made hereunder prior to expiry of the Letter of Guarantee, without being entitled to inquire whether or not this payment is lawfully demanded.

This letter of Guarantee shall remain in full force and shall be valid from the date of issue until ninety (90) days beyond the Defect Liability Period of the said equipment i.e. upto and inclusive of …….. (dd/mm/yy) and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s. …… on whose behalf this Letter of Guarantee has been given.

Except for the documents herein specified, no other documents or other action shall be required, notwithstanding any applicable law or regulation.

Our liability under this Letter of Guarantee shall become null and void immediately upon its expiry, whether it is returned or not, and no claim may be made hereunder after such expiry or after the aggregate of the sums paid by us to you up shall equal the sums guaranteed hereunder, whichever is the earlier.

All notices to be given under shall be given by registered (airmail) posts to the addressee at the address herein set out or as otherwise advised by and between the parties hereto.

We hereby agree that any part of the Contract may be amended, renewed, extended, modified, compromised, released or discharged by mutual agreement between you and the Collaborator, and this security may be exchanged or surrendered without in any way impairing or affecting our liabilities hereunder without notices to us and without the necessity for any additional endorsement, consent or guarantee by us, provided, however, that the sum guaranteed shall not be increased or decreased.

No action, event or condition which by any applicable law should operate to discharge us from liability hereunder shall have any effect and we hereby waive any right we may have to apply such law so that in all respects our liability hereunder shall be irrevocable and, except as stated herein, unconditional in all respects.

For and on behalf of the Bank

[Signature of the authorisedsignatory(ies)]

Signature_____

Name_____

Designation_____

POA Number_____

Contact Number(s): Tel._____Mobile_____

Fax Number_____

email _____

Common Seal of the Bank_____

Witness:

Signature_____

Name_____

Address_____

Contact Number(s): Tel._____Mobile_____

email _____

Note :

1. For the purpose of executing the Bank Guarantee, the non-judicial stamp papers of appropriate value shall be purchased in the name of Bank who issues the 'Bank Guarantee'.

2. The Bank Guarantee shall be signed on all the pages by the Bank Authorities indicating their POA nos. and should invariably be witnessed.

3. In case the bid is submitted by a Collaborator/Parent Company, either individually or as a partner of Joint Venture, the additional performance guarantee of 10% shall not be applicable.

4. The Bank Guarantee should be in accordance with the proforma as provided. However, in case the issuing bank insists for additional paragraph for limitation of liability, the following may be added at the end of the proforma of the Bank Guarantee [i.e., end paragraph of the Bank Guarantee preceding the signature(s) of the issuing authority(ies) of the Bank Guarantee]:

Quote

"Notwithstanding anything contained herein:

1. Our liability under this Bank Guarantee shall not exceed _____ (value in figures)_____ [_____ (value in words)_____].

2. This Bank Guarantee shall be valid upto_____(validity date)_____.

3. We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only & only if we receive a written claim or demand on or before _____ (validity date) _____."

Unquote

FORM OF JOINT DEED OF UNDERTAKING BY THE COLLABORATOR/ PARENT COMPANY ALONGWITH THE BIDDER/MANUFACTURER

[In line with Clause …… : Qualifying Requirements for Indigenous manufacturer of OPGW of Section-I: Technical Specifications, Volume-II (Applicable for OPGW to be supplied by Indigenous manufacturer)]

(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

THIS DEED OF UNDERTAKING executed this …….. day of …….. Two Thousand and …… by M/s. ……., a Company incorporated under the laws of …… and having its Registered Office at …….. (hereinafter called the "Collaborator" which expression shall include its successors, executors and permitted assigns), and M/s. ……., a Company incorporated under the laws of …….. having its Registered Office at …….. (hereinafter called the "Manufacturer" which expression shall include its successors, executors and permitted assigns) and Ms/. ……., a Company incorporated under the laws of …….. having its Registered Office at …….. (hereinafter called the "Bidder/Contractor" which expression shall include its successors, executors and permitted assigns) in favour of …….. (insert names of the Employer) ……., a Company incorporated under the Companies Act of 1956 having its registered office at ……..(insert registered address of the Employer)…… (hereinafter called the "Employer" which expression shall include its successors, executors and permitted assigns)

WHEREAS the "Employer" invited Bid as per its Specification No. …….. for the execution of …… (insert name of the package along with project name)……..

AND WHEREAS Clause No. ……., Section ……., of ……., Vol.–… forming part of the Bid Documents inter-alia stipulates that the Contractor and Manufacturer alongwith its Collaborator must fulfill the Qualifying Requirements for OPGW and be jointly and severally bound and responsible for the successful performance of OPGW offered in the event the proposal for supply of OPGW from the Manufacturer submitted by the Contractor is accepted by the Employer.

AND WHEREAS the Contractor has submitted its proposal to the Employer vide Proposal No. …….. dated …….. for supply of OPGW from the Manufacturer based on the collaboration/association of the Collaborator with the Bidder/Manufacturer.

NOW THEREFORE THIS UNDERTAKING WITNESSETH as under:

1.0 In consideration of the award of Contract by the Employer to the Contractor (hereinafter referred to as the "Contract") we, the Collaborator and the Contractor and the Manufacturer do hereby declare that we shall be jointly and severally bound unto the …… (insert name of the Employer) ……., for the successful performance of OPGW and shall be fully responsible for the design, manufacture, testing, supply on FOR destination delivery at site basis and supervision of unloading at site, storage, erection, testing & commissioning and successful performance of OPGW in accordance with the Contract Specifications.

2.0 Without in any way affecting the generality and total responsibility in terms of this Deed of Undertaking, the Collaborator in particular hereby agrees to depute their technical experts from time to time to the Contractor's/Indian Manufacturer's Works/Employer's Project site as mutually considered necessary by the Employer, Contractor, Manufacturer and the Collaborator to ensure proper design, engineering, manufacture, testing, supply on FOR destination delivery at site basis and supervision of unloading at site, storage, erection, testing & commissioning and successful performance of the equipment in accordance with Contract Specifications and if necessary, the Collaborator shall advise the Indian Manufacturer /Contractor suitable modifications of designs, manufacturing process and implement necessary corrective measures to discharge the obligations under the contract.

2.1 Without in any way affecting the generality and total responsibility in terms of this Deed of Undertaking, the Collaborator/Parent Company in particular hereby agrees to depute their technical experts from time to time to the Contractor's/Indian Manufacturer's Works / Employer's Project site as mutually considered necessary by the Employer, Contractor, Manufacturer and the Collaborator/Parent Company to ensure the warranty obligations for Three (3) years for the entire quantity to be supplied from the Contractor/Manufacturer.

3.0 As a security, Collaborator shall apart from the Bidder's performance guarantee, furnish additional Contract Performance Guarantee from its Bank in favour of the Employer in a form acceptable to the Employer. The value of such guarantee shall be equivalent to 10% of the Ex works cost of OPGW as identified in the Contract awarded by the Employer to the Contractor. The guarantee shall be unconditional, irrevocable and valid for the entire period of the Contract, and till the end of the Defect Liability Period of …….. under the Contract. The Bank Guarantee amount shall be payable to the Employer on demand without any reservation or demur.

4.0 We, the Collaborator and Contractor and/or Manufacturer agree that this Undertaking shall be irrevocable and shall form an integral part of the Contract and further agree that this Undertaking shall continue to be enforceable till the Employer discharges it. It shall become operative from the effective date of Contract.

5.0 This Deed of Undertaking shall be construed and interpreted in accordance with the laws of India and the Courts in Delhi shall have exclusive jurisdiction to adjudicate any dispute arising under or in connection with this agreement.

IN WITNESS WHEREOF the Collaborator, the Manufacturer and the Contractor have through their Authorised Representatives executed these presents and affixed Common seals of their respective Companies, on the day, month and year first above mentioned.

WITNESS

Signature ……..

Name ……..

Office Address ……..

(For Collaborator)

(Signature of the authorized representative)

Name ……..

Common Seal of Company …..……..

WITNESS

Signature ……..

Name ……..

Office Address …….. (For Contractor)

(Signature of the authorized representative)

Name ……..

Common Seal of Company …..……

WITNESS

Signature ……..

Name ……..

Office Address …….. (For Manufacturer)

(Signature of the authorized representative)

Name ……..

Common Seal of Company …..……

Note:

1. For the purpose of executing the Deed of Joint Undertaking, the non-judicial stamp papers of appropriate value shall be purchased in the name of executants parties.

2. The Undertaking shall be signed on all the pages by the authorised representatives of each of the partners and should invariably be witnessed.

3. This Deed of Joint Undertaking duly certified by the Company Secretary shall be submitted alongwith the bid. Further, the Deed of Joint Undertaking attested by Notary Public of the place(s) of the respective executant(s) or registered with the Indian Embassy/High Commission in that country shall be submitted by the bidder within ten (10) days from the date of intimation of post-bid discussion.

FORM OF DEED OF JOINT UNDERTAKING TO BE EXECUTED BY THE BIDDER / SUPPLIER AND THE SUBSIDIARY COMPANY/JOINT VENTURE COMPANY/GROUP COMPANY (ALREADY INCORPORATED / AFTER INCORPORATION) OF THE BIDDER / SUPPLIER FOR SUPPLY AT LEAST 25% OF OPGW CABLE MANUFACTURINED IN THE SAID FACILITIES IN INDIA [STIPULATED IN CLAUSE 1.1.1(a) (i) & (ii) OF QUALIFICATION REQUIREMENT]

(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

This DEED OF UNDERTAKING executed this ..... day of ..... Two Thousand ..... by M/s....., a Company incorporated under ..... having its Registered Office at ..... hereinafter called the "Bidder/Supplier" which expression shall include its successors, administrators, executors and permitted assigns and M/s. ....., registered under the Indian Companies Act of 1956 or 2013, as the case may be, and having its Registered Office at ..... hereinafter called the "Subsidiary Company/Group Company /Joint Venture Company (JVC)" which expression shall include its successors, administrators, executors and permitted assigns, in favour of …..... (insert names of the Purchaser) ……..., a Company incorporated under the Indian Companies Act of 1956 having its registered office at ……..(insert registered address of the Purchaser)…… (hereinafter called the "Purchaser" which expression shall include its successors, executors and permitted assigns)

WHEREAS the "Purchaser" invited Bid as per its Specification No. …….. for the execution of …. (insert name of the package alongwith project name) ……

AND WHEREAS Clause No. ……..., Section ……., of ……., Vol.–… forming part of the Bidding Documents inter-alia stipulates that the Bidder/Supplier along with the Subsidiary Company/Joint Venture Company/Group Company must fulfill the Qualifying Requirements for the *…… and be jointly and severally bound and responsible for the successful performance of the *…….. offered in the event the Bid submitted by the Bidder is accepted by the Purchaser resulting in a Contract.

AND WHEREAS the Bidder has submitted its Bid to the Purchaser vide Proposal No. …….. dated ……. based on the association of the Subsidiary Company / Group Company / Joint Venture Company and are required to jointly execute and furnish an irrevocable Deed of Joint Undertaking and be jointly and severally liable to the Purchaser for ensuring manufacturing facilities of OPGW Cable in India (hereinafter called as the "Equipment") such that the Equipment to be supplied by the Supplier can be repaired and maintained without necessitating it to be taken outside the country and for supply at least 25% of OPGW Cable from such works of Subsidiary Company / Group Company / Joint Venture Company in India.

AND WHEREAS the Bidder has submitted its Bid to the Purchaser based on above stipulation and has agreed to furnish this Deed of Undertaking to be enforceable in the event of the award of the Contract by the Purchaser.

1.0 In consideration of the award of Contract by the Purchaser to the Bidder / Supplier (hereinafter referred to as the "Contract") we, the Bidder/Supplier and the Subsidiary Company/Joint Venture Company/ Group Company do hereby agree and undertake to provide requisite Manufacturing and testing facilities for the Equipment, after sales service and supply of spare parts as per the terms of the Contract.

2.0 Without in any way affecting the generality and total responsibility in terms of this Deed of Undertaking, the Bidder/Supplier hereby agrees to depute their technical experts from time to time to the Subsidiary Company/Joint Venture Company/ Group Company Works/ Purchaser's Project site as mutually considered necessary by the Purchaser, Bidder/Supplier and the Subsidiary Company/Joint Venture Company/ Group Company to ensure:

(i) A valid technology transfer agreement, including license to manufacture and supply from India, between the Bidder / Supplier, the technology provider and the Subsidiary Company/Joint Venture Company/ Group Company covering the type, size and rating of the OPGW Cable specified, valid minimum up to the end of the defect liability period of the contract. The technology transfer agreement necessarily covers transfer of technological know-how for OPGW Cable in the form of complete transfer of design dossier, design software's, drawings and documentation, quality system manuals and imparting relevant training by the Bidder / Supplier to the personnel of the Subsidiary Company / Group Company / Joint Venture Company.

(ii) Design of the Equipment's manufactured in India shall be identical to the design of equipment's to be manufactured and supplied by the Bidder/Supplier

(iii) Adequate up gradation of the testing facilities including quality systems at Indian works

(iv) Training to staff of the Subsidiary Company/Joint Venture Company/ Group Company and certification to its trained personnel for carry out each activity

(v) Involvement and supervision during all phases of manufacturing by expert of Bidder/Supplier for the OPGW Cable.

(vi) MQP of Subsidiary Company/Joint Venture Company/ Group Company shall be same as that of Bidder/Supplier

(vii) Source of raw material / major bought out components shall be same as that of Bidder/Supplier

(viii) Timely supply on FOR destination delivery at site basis.

(ix) Supervision of unloading at site, storage, erection, testing & commissioning and successful performance of the equipment in accordance with contract specifications

(x) If necessary the Bidder/Supplier shall advise the Subsidiary Company/Joint Venture Company/ Group Company, suitable modifications of designs and implement necessary corrective measures to discharge the obligations under the Contract.

(xi) Warranty obligations as per GCC clause 22.1of the biding documents for the entire quantity to be supplied from the Subsidiary Company/Joint Venture Company/ Group Company.

3.0 This Deed of Undertaking shall be construed and interpreted in accordance with the laws of India and the Courts in Delhi shall have exclusive jurisdiction in all matters arising under the Undertaking.

4.0 We, agree that this undertaking shall be irrevocable and shall form an integral part of the Contract.

5.0 We hereby confirm that the above undertaking has also been approved by our Board of Directors and the Resolution passed by our Board(s) is attached with this undertaking.

IN WITNESS WHEREOF the Supplier and Subsidiary Company/Group Company/Joint Venture Company have through their Authorised Representatives executed these presents and affixed Common seals of their respective Companies on the day, month and year first above mentioned.

WITNESS

Signature ……..

Name ……..

Office Address ……..

[For Bidder/Supplier]

(Signature of the authorized representative)

Name ……..

Common Seal of Company ……..

WITNESS

Signature ……..

Name ……..

Office Address ……..

[For Subsidiary Company/Group Company/Joint Venture Company]

(Signature of the authorized representative)

Name ……..

Common Seal of Company …..……..

Note:

1. For the purpose of executing the Deed of Undertaking, the non-judicial stamp papers of appropriate value shall be purchased in the name of executant.

2. The Undertaking shall be signed on all the pages by the authorized representative(s) of the Bidder and the Subsidiary Company/Group Company/Joint Venture Company and should invariably be witnessed.

3. The Resolution of the Board of Directors of the Bidder and the Subsidiary Company / Group Company / Joint Venture Company, as per the format, shall be attached with this Undertaking.

4. This Deed of Undertaking duly attested by Notary Public of the place(s) of the respective executant, shall be submitted along with the bid, in case where the Subsidiary Company/Group Company/Joint Venture Company is already incorporated under the Indian Companies Act, and shall be submitted during execution of contract if the Subsidiary Company/Group Company/Joint Venture Company is incorporated under the Indian Companies Act subsequent to award of contract.

PART-II

TECHNICAL SPECIFICATION

VOL-II, SEC-I

GENERAL TECHNICAL CONDITION

CONTENTS

Clause No.	Description
1.0	General Technical Conditions
2.0	Environment and Social Policy and its Implementation

SECTION-II

GENERAL TECHNICAL CONDITION

1.0 General Technical Conditions

1.1 General

The following provisions shall supplement all the detailed technical specifications and requirements brought out herein. The contractor's proposal shall be based on the use of materials complying fully with the requirements specified herein.

1.2 Engineering Data

1.2.1 The furnishing of engineering data by the Contractor shall be in accordance with the Schedule as specified in the Bidding Document. The review of these data by the Employer will cover only general conformance of the data to the specifications and not a thorough review of all dimensions, quantities and details of the materials, or items indicated or the accuracy of the information submitted. This review by the Employer's shall not be considered by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications.

1.2.2 All engineering data submitted by the Contractor after review by the Employer shall form part of the contract document.

1.3 Drawings

In addition to those stipulated in clause regarding drawings in GCC/SCC, the following also shall apply in respect of Contractor Drawings.

1.3.1 All drawings submitted by the Contractor including those submitted at the time of Bid shall be with sufficient detail to indicate the type, size, arrangement, dimensions, material description, Bill of Materials, weight of each component break-up for packing and shipment, fixing arrangement required, the dimensions required for installation and any other information specifically requested in these specifications.

1.3.2 Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, the specification title, the specification number and the name of the Project. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be to the scale and in S.I. units.

1.3.3 The drawings submitted by the Contractor shall be reviewed by the Employer as far as practicable within 15 days and shall be modified by the Contractor if any, modifications and/or corrections are required by the Employer . The Contractor shall incorporate such modifications and/or corrections and submit the final drawings for approval. Any delays arising out of failure by the Contractor to rectify the drawings in good time shall not alter the contract completion date.

1.3.4 The drawings submitted for approval to the Employer shall be in quadruplicate. One print of such drawings shall be returned to the Contractor by the Employer marked "approved/approved with corrections". The contractor shall there upon furnish the Employer additional prints as may be required along with one reproducible in original of the drawings after incorporating all corrections.

1.3.5 The work shall be performed by the Contractor strictly in accordance with these drawings and no deviation shall be permitted without the written approval of the Employer, if so required.

1.3.6 All manufacturing, fabrication and erection work under the scope of Contractor, prior to the approval of the drawings shall be at the Contractor's risk. The contractor may incorporate any changes in the design, which are necessary to conform to the provisions and intent of the contract, and such changes will again be subject to approval by the Employer.

1.3.7 The approval of the documents and drawings by the Employer shall mean that the Employer is satisfied that:

(a) The Contractor has completed the part of the Works covered by the subject document (i.e. confirmation of progress of work).

(b) The Works appear to comply with requirements of Specifications.

In no case the approval by the Employer of any document does imply compliance with all technical requirements nor the absence of errors in such documents.

If errors are discovered any time during the validity of the contract, then the Contractor shall be responsible for consequences.

1.3.8 All drawings shall be prepared using AutoCAD software version 2000 or later only. Drawings, which are not compatible to AutoCAD software version 2000 or later, shall not be accepted. After final approval all the drawings (structural drawings, BOMs, shop sketches and tower accessories drawings) shall be submitted to the Employer in **CDs.**

A copy of each drawing reviewed will be returned to the Contractor as stipulated herein.

1.3.9 Copies of drawings returned to the Contractor will be in the form of a print with the Employer's marking, or a print made from a microfilm of the marked up drawing.

1.3.10 The following is the general list of the documents and drawings that are to be approved by the Employer.

a) Work Schedule (Master Network) Plan.

b) Detailed survey report and profile drawings showing ground clearance and tower locations (as applicable).

c) Tower schedule and foundation classification for individual tower locations.

d) Tower Deign and Tower structural drawing and bill of materials.

e) Soil Investigation report.

f) Foundation Design and Foundation working drawings/excavation Plan.

g) Tower footing earthing drawing.

h) Stub and stub-setting template drawings.

i) Stringing procedure

j) Tower accessories drawings like danger plate, name plate etc.

k) Quality plans for fabrication and site activities including Quality System.

l) Sub-vendors approval, etc.

m) Line material drawings.

n) Type test report for line materials.

1.4 Design Improvements

1.4.1 The Employer or the Contractor may propose changes in the specification and if the parties agree upon any such changes and the cost implication, the specification shall be modified accordingly.

1.5 Design Co-ordination

Wherever, the design is in the scope of Contractor, the Contractor shall be responsible for the selection and design of appropriate material/item to provide the best coordinated performance of the entire system. The basic

design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

1.6 Design Review Meeting

The contractor will be called upon to attend design review meetings with the Employer, and the consultants of the Employer during the period of Contract. The contractor shall attend such meetings at his own cost at the Office of the Employer or at mutually agreed venue as and when required. Such review meeting will be held generally four times in a year.

1.7 Quality Assurance, Inspection & Testing

1.7.1 Quality Assurance

To ensure that the supply and services under the scope of this Contract whether manufactured or performed within the Contractor's works or at his Sub-Contractor's premises or at site or at any other place of work are in accordance with the specifications. The Contractor shall adopt suitable quality assurance programme to control such activities at all points necessary. Such programme shall be broadly outlined by the Contractor and shall be finalised after discussions before the award of Contract. The detailed programme shall be submitted by the contractor after the award of contract and finally accepted by the Employer after discussion. A quality assurance programme of the Contractor shall generally cover but not limited to the following :

(a) His organisation structure for the management and implementation of the proposed quality assurance programme.

(b) Documentation control System.

(c) Qualification data for Contractor's key personnel.

(d) The procedure for purchase of materials, parts components and selection of sub-Contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.

(e) System for shop manufacturing including process controls and fabrication and assembly controls.

(f) Control of non-conforming items and system for corrective action.

(g) Control of calibration and testing of measuring and testing equipment's.

(h) Inspection and test procedure for manufacture.

(i) System for indication and appraisal of inspection status.

(j) System for quality audits.

(k) System for authorising release of manufactured product to the Employer.

(l) System for maintenance of records.

(m) System for handling storage and delivery and

(n) A quality plan detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to critical and important items of supply.

The Quality plan shall be mutually discussed and approved by the Employer after incorporating necessary corrections by the Contractor as may be required.

1.7.1.1 **Quality Assurance Documents**

The Contractor shall be required to submit all the Quality Assurance Documents as stipulated in the Quality Plan at the time of Employer 's inspection of equipment/material.

1.7.1.2 The Employer or his duly authorised representatives reserves the right to carry out Quality Audit and quality surveillance of the systems and procedures of the Contractor's/his vendor's Quality Management and Control Activities.

1.7.2 **Employer's Supervision**

1.7.2.1 To eliminate delays and avoid disputes and litigation to the Contract, all matters and questions shall be resolved in accordance with the provisions of this document.

1.7.2.2 The manufacturing of the product shall be carried out in accordance with the specifications. The scope of the duties of the Employer, pursuant to the contract, will include but not be limited to the following.

a)Interpretation of all the terms and conditions of these Documents and Specifications.

b)Review and interpretation of all the Contractor's drawings, engineering data etc.

c)Witness or authorise his representative to witness tests at the manufacturer's works or at site, or at any place where work is performed under the contract.

d)Inspect, accept or reject any equipment, material and work under the Contract, in accordance with the Specifications.

e)Issue certificate of acceptance and/or progressive payment and final payment certificate.

f)Review and suggest modification and improvement in completion schedules from time to time, and

g)Supervise the Quality Assurance Programme implementation at all stages of the works.

1.8 Inspection and Tests

1.8.1 Inspection

1.8.1.1 The Employer, his duly authorized representative and/or outside inspection agency acting on behalf of the Employer shall have, at all reasonable times, access to the premises and /or works of the contractor and/or their sub-contractor(s)/sub-vendors and shall have the right, at all reasonable times, to inspect and examine the materials and workmanship of the product during its manufacture.

1.8.1.2 The Contractor shall give the Employer's Inspector fifteen (15) days written notice of any material being ready for testing. In case of turnkey contract, the turnkey contractor shall give the notice for inspection and shall associate in the inspection with Employee's inspector. All such inspections shall be to the Contractor's account except for the expenses of the Employer's inspector. The Employer's inspector, unless witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date of which the equipment is notified as being ready for test/inspection or on a mutually agreed date, failing which the Contractor may proceed with the test in accordance with the technical specification after informing the Employer in writing and he shall forthwith forward to the inspector duly certified copies of test reports / certificates in triplicate.

1.8.1.3 The Employer's Inspector shall, within fifteen (15) days from the date of inspection, give notice in writing to the Contractor, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and shall make the modifications that may be necessary to meet the said objections.

1.8.1.4 When the factory tests have been completed at the Contractor's or Sub-Contractor's works, the Employer's inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Employer's inspector, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test Certificate by the Employer's Inspector. The completion of these tests or the issue of the certificate shall not bind the Employer to accept the equipment should it, on further tests after erection, be found not to comply with the Contract.

1.8.1.5 In all cases where the Contract provides for test whether at the premises or works of, the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such item as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Employer's inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Employer's Inspector or to his authorised representative to accomplish testing.

1.8.1.6 The inspection by Employer and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the Contract.

1.8.1.7 a) The Contractor shall keep the Employer informed in advance about the time of starting and of the progress of manufacture and fabrication of various tower parts at various stages, so that arrangements could be made for inspection.

b)The acceptance of any part of items shall in no way relieve the Contractor of any part of his responsibility for meeting all the requirements of the Specification.

1.8.1.8 The Employer or his representative shall have free access at all reasonable times to those parts of the Contractor's works which are concerned with the fabrication of the *Employer's material for satisfying himself that the fabrication is being done in accordance with the provisions of the Specification.

1.8.1.9 Unless specified otherwise, inspection shall be made at the place of manufacture prior to dispatch and shall be concluded so as not to interfere unnecessarily with the operation of the work.

1.8.1.10 Should any member of the structure be found not to comply with the supplied design, it shall be liable to rejection. No member once rejected shall be resubmitted for inspection, except in cases where the Employer or his authorised representative considers that the defects can be rectified.

1.8.1.11 Defect which may appear during fabrication shall be made good with the consent of, and according to the procedure proposed by the Contractor and approved by the Employer.

1.8.1.12 All gauges and templates necessary to satisfy the Employer shall be supplied by the contractor.

1.8.1.13 The specified grade and quality of steel shall be used by the Contractor. To ascertain the quality of steel used, the inspector may at his discretion get the material tested at an approved laboratory.

1.8.2 **Tests**

1.8.2.1 The type, acceptance and routine tests and tests during manufacture shall be carried-out on the material and shall mean as follows:

1.8.2.2 **Type Tests** shall mean those tests which are to be carried out to prove the process of manufacture and general conformity of the material to this Specification. These tests shall be carried out on samples prior to commencement of commercial production against the order. The Bidder shall indicate his schedule for carrying out these tests.

1.8.2.3 **Acceptance Tests** shall mean those tests which are to be carried out on samples taken from each lot offered for pre-dispatch inspection, for the purposes of acceptance of that lot.

1.8.2.4 **Routine Tests** shall mean those tests, which are to be carried out on the material to check requirements which are likely to vary during production.

1.8.2.5 **Tests During Manufacture** shall mean those tests, which are to be carried out during the process of manufacture and end inspection by the Contractor to ensure the desired quality of the end product to be supplied by him.

1.8.2.6 The norms and procedure of sampling for these tests will be as per the Quality Assurance Programme to be mutually agreed to by the Contractor and the Employer.

1.8.2.7 The standards and norms to which these tests will be carried out are listed against them. Where a particular test is a specific requirement of this Specification, the norms and procedure of the test shall be as specified in Annexure-A or as mutually agreed to between the Contractor and the Employer in the Quality Assurance Programme.

1.8.2.8 For all type and acceptance tests, the acceptance values shall be the values specified in this Specification or guaranteed by the Bidder, as applicable.

1.9 **Guaranteed Technical Particulars**

1.9.1 The Guaranteed Technical Particulars of the various items shall be furnished by the Bidders in one original and specified number of copies in the prescribed schedules of the Specifications. The Bidder shall also furnish any other information as in their opinion is needed to give full description and details to judge the item(s) offered by them

1.9.2 The data furnished in the Guaranteed Technical Particulars should be the minimum or maximum value (whichever is ruling condition as per the requirement of the specification) required. A Bidder may guarantee a value more stringent than the specification requirement. However, for testing purpose or from performance point of view, the material shall be considered performed successfully if it achieves the minimum / maximum value required, whichever is ruling condition, as per the technical specification. No preference what so ever shall be given to the bidder offering better/more stringent values than those required as per specification except where stated otherwise.

1.10 **Packing**

1.10.1 All the materials shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing.

1.10.2 The Contractor shall include and provide for securely protecting and packing the materials so as to avoid loss or damage during transport by air, sea, rail and road.

1.10.3 All packing shall allow for easy removal and checking at site. Wherever necessary, proper arrangement for attaching slings for lifting shall be provided. All packages shall be clearly marked for with signs showing 'up' and 'down' on the sides of boxes, and handling and unpacking instructions as considered necessary. Special precaution shall be taken to prevent rusting of steel and iron parts during transit by sea.

1.10.4 The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols, i.e. fragile, handle with care, use no hook etc. wherever applicable.

1.10.5 Each package shall be legibly marked by the Contractor at his expenses showing the details such as description and quantity of contents, the name of the consignee and address, the gross and net weights of the package, the name of the Contractor etc.

1.10.6 Angle section shall be wire bundled.

1.10.7 Cleat angles, gusset plates, brackets, fillet plate, hanger and similar loose pieces shall be tested and bolted together in multiples or securely wired through holes.

1.10.8 Bolts, nuts washers and other attachments shall be packed in double gunny bags accurately tagged in accordance with the contents.

1.10.9 The packing shall be properly done to avoid losses & damages during transit. Each bundle or package shall be appropriately marked.

2.0 Environment and Social Policy and its Implementation

2.1 Development and growth of mankind through Industrialization and unwarranted use of natural resources has inflicted considerable impact on Environment and Society. As a result, Environmental and Social issues have emerged as the focal point of global debate.

Transmission activities by their inherent nature and flexibility have negligible impacts on environmental and social attributes. In order to address the rising expectations of a cleaner, safer and healthier environment, The following Environmental and Social Policy and Procedures (ESPP) are evolved:-

i) Avoidance of environmentally and socially sensitive areas while planning project activities.

ii) Minimisation of impacts when project activities occur in environmentally and socially sensitive areas.

iii) Mitigation of any unavoidable adverse impacts arising out of its projects.

2.2 Basic issues to be kept in mind while carrying out construction activities are to

i) Avoid socially sensitive areas with regard to human habitations and areas of cultural significance.

ii) Secure the interest of people affected by Employer's projects.

iii) Involve local people affected by transmission line projects as per requirement and suitability.

iv) Consult affected people in decisions having implication to them if considered necessary.

v) Apply, efficient and safe technology/practices.

vi) Keep abreast of all potential dangers to people's health, occupational-safety and safety of environment and the respective mitigatory measures.

vii) Establish preventive mechanisms to guarantee safety.

viii) Mitigation measures in case of accidents.

ix) Avoid unwarranted cutting of trees in forest area.

2.3 While constructing the lines through forest stretches the contractor will provide alternate fuel to its employee e.g. working labours/supervisors etc. in order to avoid cutting of forest woods.

2.4 Contractor will ensure safety to the wild life, during working/camping near to the National park.

2.5 Contractor during construction of lines in agricultural fields will ensure minimum damages to the crops, trees, bunds, irrigation etc. If the same is un-avoidable, the decision of Executive Engineer- in-charge shall be final.

2.6 The waste/excess material/debris should be removed from the construction site including agricultural field, forest stretches, river etc. immediately after construction work.

2.7 The Contractor will ensure least disturbance to the hill slope and natural drainage so as to avoid soil erosion. Natural drainage in plain area if disturbed is to be trained to the satisfaction of Engineer- in-charge.

2.8 As far as possible existing path/kutchha road/approach shall be used for the construction.

2.9 The Contractor will ensure supply of stone chips/sand from authorised/approved quarry areas.

2.10 Proper documentation of above, if any.

PART-II

TECHNICAL SPECIFICATION

VOL-II, SEC-III

SURVEY & SOIL INVESTIGATION (1st PART)

SECTION - III
SURVEY (1st part)

CONTENTS

Clause No.	Description
1.0	General information & Scope Of Work
2.0	Route Alignment
3.0	Detailed Survey
4.0	Geotechnical Investigations
5.0	Statutory Regulations and Standards
6.0	Field Quality Plan
7.0	Completion Period

1. General Information & Scope Of Work

1.1 The technical specifications covers detailed survey including route alignment, profiling, tower spotting, optimization of locations, check survey, contouring, and soil investigation for the transmission lines / part of the transmission lines covered under this specification as included in the BPS.

1.1.1 The scope of work inter-alia shall include the following:-

a. Detailed Survey using GPS, Total Work stations, long range scanners & Digital theodolites of reasonable accuracies inter-alia including :

i. Digitised profiling along the selected route along with plan details

ii. tower spotting & optimization

iii. Soil resistivity measurement along the route

b. Check survey including digitised contouring at undulated / hilly tower locations.

c. Soil Investigation

d. Preparation of Survey reports including estimation of Bill of Quantities, identification and explanation of route constraints (like Forest, Animal/Bird sanctuary, reserve coal belt areas, oil pipe line/underground inflammable pipe lines etc.), infrastructure details available enroute etc.

1.1.2 The Provisional quantities for the scope of work are indicated in relevant Price Schedules of BPS. The final quantities for route alignment & detailed survey (quantities in "kms" unit) shall be the route length along the approved route alignment. For contouring at undulated/hilly tower locations and soil investigations (quantities in "Locs." unit), the actual quantities to be executed shall be decided by Site Engineer-in-charge during execution stage and the final quantities shall be as approved by Site Engineer-in-charge. The route alignment, detailed survey, including profiling & tower spotting, contouring, soil investigation etc. shall be carried out by the Contractor as per the technical specifications stipulated herein.

1.1.3 The Contractor must note that the Employer shall not be responsible for loss or damage to properties, trees etc. due to contractor's work during survey. The Contractor shall indemnify the Employer for any loss or damage to properties, trees etc. during the survey work.

1.1.4 The Contractor should note that Employer will not furnish the NRSA satellite imageries or topographical maps prepared by survey of India but will make available assistance that may be required in obtaining these by providing letters of recommendation to the concerned authorities.

1.1.5 The bidder shall give along with their bid clause by clause commentary indicating their confirmation / comments/ observation in respect of all clauses of technical specification.

1.1.6 The work shall be carried out by the contractor using modern surveying techniques. The bidder shall indicate in his offer, the detailed description of the procedure to be deployed. The details of the equipment & facilities including soft wares for image processing, computer aided tower spotting etc. available with the bidder or his associates shall also be furnished with the bid.

1.1.7 The Contractor shall also engage services of a reputed geo-technical consultant or experts from independent educational/research institutions for examining stability aspects of the selected transmission line route/locations in hilly terrain wherever required.

1.1.8 After carrying out the detailed survey and soil investigations, the contractor shall estimate complete BOQ of the transmission lines and submit the same (as per the BOQ format enclosed with the Technical Specifications) to the Employer.

2.0 Route Alignment

2.1 Route alignment shall be carried out by the contractor using satellite imageries / topographical maps.

2.2 **Requirement of Transmission Line Routing** (for changes if any necessitated on account of site constrains etc.):

2.2.1 The Re-alignment, if any required, of the transmission line shall be most economical from the point of view of construction and maintenance. The contractor shall identify & examine alternative route alignments and suggest to the Employer the optimal route alignment.

2.2.2 Routing/Re-routing of transmission line through protected/reserved forest area should be avoided. In case it is not possible to avoid the forests or areas having large trees completely, then keeping in view of the overall economy, the route should be aligned in such a way that cutting of trees is minimum.

2.2.3 The route should have minimum crossings of Major River, Railway lines, National/State highways, overhead EHV power line and communication lines.

2.2.4 The number of angle points shall be kept to minimum.

2.2.5 The distance between the terminal points specified shall be kept shortest possible, consistent with the terrain that is encountered.

2.2.6 Marshy and low lying areas, river beds and earth slip zones shall be avoided to minimize risk to the foundations.

2.2.7 It would be preferable to utilize level ground for the alignment.

2.2.8 Crossing of power lines shall be minimum. Alignment will be kept at a minimum distance of 300 m from power lines to avoid induction problems on the lower voltage lines.

2.2.9 Crossing of communication line shall be minimized and it shall be preferably at right angle. Proximity and parallelism with telecom lines shall be eliminated to avoid danger of induction to them.

2.2.10 Areas subjected to flooding such as nallah shall be avoided.

2.2.11 Restricted areas such as civil and military airfield shall be avoided. Care shall also be taken to avoid aircraft landing approaches.

2.2.12 All alignment should be easily accessible both in dry and rainy seasons to enable maintenance throughout the year.

2.2.13 Certain areas such as quarry sites, tea, tobacco and saffron fields and rich plantations, gardens & nurseries which will present the Employer problems in acquisition of right of way and way leave clearance during construction and maintenance should be avoided.

2.2.14 Angle points should be selected such that shifting of the point within 100 m radius is possible at the time of construction of the line.

2.2.15 The line routing should avoid large habitations, densely populated areas, Forest, Animal/Bird sanctuary, reserve coal belt areas, oil pipe line/underground inflammable pipe lines etc. to the extent possible.

2.2.16 The areas requiring special foundations and those prone to flooding should be avoided.

2.2.17 For examination of the alternatives & identification of the most appropriate route, besides making use of information/data/details available/extracted through Survey of India Topographical maps and computer-aided processing of NRSA's satellite imagery, the contractor shall also carryout reconnaissance/preliminary survey as may be required for verification & collection of additional information /data /details.

2.2.18 The contractor shall submit his preliminary observations & suggestions along with various information/data /details collected and also processed satellite imagery data, scanned topographical map data marked with the alternative routes etc. The final evaluation of the alternative routes shall be conducted by the contractor in consultation with Employer's representatives and optimal route alignment shall be proposed by the contractor. Digital terrain modeling using contour data from topographical maps as well as processed satellite data shall be done by the contractor for the selected route. A fly through perspective using suitable software(s) shall be developed for further refinement of the selected route, if required. Site visit and field verification shall be conducted by the contractor jointly with the Employer's representative for the proposed route alignment.

2.2.19 Final digitized route alignment drawing with latest topographical and other details/features including all rivers, railway lines, canals, roads etc. up to 8 Km. on both sides of selected route alignment shall be submitted by the contractor for Employer's approval along with report containing other information/details as mentioned above.

2.2.20 Changes in the route alignment, if any, during detail survey, shall be incorporated in the final digitized route alignment drawings.

3.0 Detailed Survey

3.1.1 The detailed survey shall be carried out using GPS, Total stations, digital theodolites etc. along the approved route alignment.

3.1.2 Soil resistivity, along the route alignment shall be measured in dry weather by four electrode method keeping inter-electrode spacing of 50 mtrs. For calculating soil resistivity formula 2□ar (Where a=50 m and r= megger reading in ohms) shall be

adopted. Measurement shall be made at every 2 to 3 km along the length of the route. In case soil characteristics changes within 2 to 3 km, values shall have to be measured at intermediate locations also. Megger reading and soil characteristics should also be indicated in the soil resistivity results.

3.1.3 Route Marking

3.1.4 The route of the transmission line shall be recorded using GPS of positional accuracy less than 3m.

3.1.5 The co-ordinates of all the angle points as well as other important crossings, landmarks etc. shall be recorded using GPS for easy relocating.

3.1.6 At the starting point of the commencement of route survey the co-ordinates shall be recorded. The co-ordinates of the location of the survey instrument shall also be recorded. Further, the co-ordinates at prominent position at intervals of not more than 750 meter along the transmission line to be surveyed up to the next angle point shall also be recorded. Wherever the line alignment crosses the EHT line, Railway line, P&T line or roads, the contractor shall record co-ordinates on the points of crossing. Wherever line route alignment passes over permanent land marks such as rock, boulders, culverts etc. suitable white paint marks with directional and PDD,J&K markings shall be made and co-ordinates recorded.

3.1.7 Profiling

3.1.8 The complete profiling along the route shall be carried out using modern surveying equipment's viz. total stations, GPS, digital theodolite, long range scanners etc. Reference levels at every 20 metres along the route are to be recorded. R/Ls at other undulations along the route as well as in the route plan and other enroute details viz. crossings, building & structures, trees & other infrastructure etc. shall also be recorded. Areas along the route, which in the view of the contractor, are not suitable for tower spotting, shall also be marked.

3.1.9 The complete profiling details shall be digitized and the data shall be prepared & stored in the format compatible to computer-aided tower spotting software.

3.1.10 A printed/plotted output of the digitized profiling shall be submitted by the contractor to Employer's site-in-charge for review before taking up computer-aided tower spotting.

3.1.11 Optimisation of Tower Location / Tower Spotting

3.1.12 Optimisation of tower locations shall be done by the contractor using computer-aided tower spotting software - PLSCADD and shall furnish sample calculations and manual tower spotting drawings for some typical sections.

3.1.13 The sag-tension characteristics of the conductor as well as tower spotting data shall be furnished by the Contractor to the Employer during execution stage. Sag template curves, if any required for tower spotting, shall be prepared by the contractor.

3.1.14 General description of towers is indicated in Section – I of this specification for information of the Bidders.

3.1.15 Tower Spotting

While profiling & spotting the towers, the following shall be borne in mind:

a) Span

The number of consecutive spans between the section points shall not exceed 15 spans or 5 Km in plain terrain and 10 spans or 3km in hilly terrain. A section point shall comprise of tension point with B/DB type or C/DC type or D/DD type towers as applicable.

b) Extension/Truncation

An individual span shall be as near to the normal design span as possible. In case an individual span becomes too short with normal supports on account of undulations in ground profile, one or both the supports of the span may be extended by inserting standard body/leg extension. In case of locations where the ground clearance is available, truncated towers may be spotted.

c) Loading

There shall not be any upward force on suspension towers under normal working conditions and the suspension towers shall support at least the minimum weight span as provided in the designs. In case uplift is unavoidable, it shall be examined if the same can be overcome by adding standard body extensions to the towers failing which tension towers designed for the purpose shall be deployed at such positions.

d) Road Crossing

At all important road crossings, the tower shall be fitted with tension insulator strings but the ground clearance at the roads under maximum temperature and in still air shall be such that even with conductor broken in adjacent span, ground clearance of the conductor from the road surfaces will not be less than specified. At all national highways crossing span will not be more than 250 meters.

e) Railway Crossings

All the railway crossings coming-enroute the transmission line shall be identified by the Contractor. At the time of detailed survey, the railway crossings shall be finalised as per the regulation laid down by the Railway Authorities. The following are the important features of the prevailing regulations (revised in 1987)

i) The crossings shall be supported on D/DD type tower on either side depending on the merits of each case.

ii) The crossing shall normally be at right angle to the railway track.

iii) The minimum distance of the crossing tower shall be at least equal to the height of the tower plus 6 meters away measured from the centre of the nearest railway track.

iv) No crossing shall be located over a booster transformer, traction switching station, traction sub-station or a track cabin location in an electrified area.

v) Minimum ground clearance above rail level of the lowest portion of any conductor under condition of maximum sag shall be maintained at 15.40m for 220KV Transmission lines.

vi) The crossing span will be limited to 300 meters.

f) River Crossings

In case of major river crossing, towers shall be of suspension type along with anchor towers of D/DD type tower on either side of the main river crossing. Alternately on the basis of economics and / or site/ execution constraints crossing of rivers using extended angle towers also shall be considered. For navigable rivers, clearance required by navigation authority shall be provided. For non-navigable river, clearance shall be reckoned with respect to highest flood level (HFL).

g) Power line Crossings

Where the line is to cross over another line of the same voltage or lower voltage, A/DA type tower with suitable extensions shall be used. Provisions to prevent the possibility of its coming into contact with other overhead lines shall be made in accordance with the Indian Electricity Rules, 1956 as amended up-to-date. In order to reduce the height of the crossing towers, it may be advantageous to remove the ground-wire of the line to be crossed (if this is possible, and permitted by the Employer of the line to be crossed).

Minimum clearance in metres between lines when crossing each other:

Sl. No.	Nominal System Voltage	110-132KV	220KV	400KV	765KV
1.	110-132KV	3.05	4.58	5.49	7.94
2.	220KV	4.58	4.58	5.49	7.94
3.	400KV	5.49	5.49	5.49	7.94
4.	765KV	7.94	7.94	7.94	7.94

For power line crossings of voltage level of 132 kV and above, angle towers shall be provided adjacent to DA/A type tower on either side of the Power line crossing which can be used in temporary dead end condition with proper guying to facilitate stringing of the power line crossing sections separately on obtaining line shutdowns.

h) Telecommunication Line Crossings

The angle of crossing shall be as near to 90 degree as possible. However, deviation to the extent of 30 degree may be permitted under exceptionally difficult situations.

When the angle of crossing has to be below 60 degree, the matter will be referred to the authority in charge of the telecommunication System. On a request from the Contractor, the permission of the telecommunication authority may be obtained by the Employer.

Also, in the crossing span, power line support will be as near the telecommunication line as possible, to obtain increased vertical clearance between the wires.

i) Details Enroute

All topographical details, permanent features, such as trees, building etc. 17.5m for 220 KV on either side of the alignment shall be detailed on the profile plan.

3.2 Clearance from Ground, Building, Trees etc.

Clearance from ground, buildings, trees and telephone lines shall be provided in conformity with the Indian Electricity Rules, 1956 as amended up to date.

3.2.1 The Contractor shall count, mark and put proper numbers with suitable quality of paint at his own cost on all the trees that are to be cut by the Employer at the time of actual execution of the work as detailed below. Contractor may please note that Employer shall not pay any compensation for any loss or damage to the properties or for tree cutting due to Contractor's work.

3.2.2 To evaluate and tabulate the trees and bushes coming within 17.5m for 220 KV on either side of the central line alignment the trees will be numbered and marked with quality paint serially from angle point 1 (I) onwards and the corresponding number will be painted on the stem of trees at a height of 1 meter from ground level. The trees list should contain the following:

a) Girth (circumstances) measured at a height of 1 meter from ground level.

b) Approximate height of the tree with an accuracy of +2 meters.

c) Name of the type of the species/tree.

d) The bushy and under growth encountered within the 35m for 220 KV line should also be evaluated with its type, height, girth and area in square meters, clearly indicating the growth in the tree/bush statement.

3.2.3 The contractor shall also intimate the Employer, his assessment about the likely amount of tree & crop compensation etc. required to be paid by the Employer during execution stage. This assessment shall be done considering prevailing practices/guidelines, local regulations and other enquiries from local authorities.

3.2.4 The Contractor shall also identify the forest/non forest areas involved duly authenticated by concerned authorities.

a) A statement of forest areas with survey/compartment Nos.(all type of forest RF/PF/Acquired forest/Revenue forest/Private forest/Forest as per dictionary meaning of forest etc.)

b) A statement of non-forest areas with survey/compartment nos.

c) Tree cutting details(Girth wise & specie wise)

d) Marking of forest areas with category on topo sheets 1:2,50,000 showing complete line route, boundaries of various forest divisions and their areas involved.

e) Village forest maps of affected line and affected forest area and marking of the same.

f) Forest division map showing line and affected forest area.

3.6.5 The Contractor shall finalize the forest clearance proposal on the prescribed format duly completed in all respects for submission by the Employer to the Forest Department.

3.3 Preliminary Schedule

The profile sheets showing the locations of the towers together with preliminary schedules of quantities indicating tower types, wind & weight spans, angle of deviation, crossing & other details etc. shall be submitted by the contractor for review & approval by Employer's site-in-charge.

3.4 Check Survey of Tower Locations

3.4.1 The check survey shall be conducted to locate tower locations on ground conforming to the approved profile and tower schedule.

3.4.2 The co-ordinates of all the tower locations shall also be recorded using GPS of positional accuracy less than 3m for easy relocating. The position of all tower locations shall be marked in the final digitized route alignment drawing with relative distances from any permanent bench mark area.

3.4.3 The contractor shall also collect required data at each tower location in respect of soil strata, ground water level, history of water table in adjacent areas/surface water, distance from permanent bench mark (these details to be furnished in a tabulated form) and classify the suitable type of foundation at each tower location based on the data collected at each location and detailed soil investigations carried out at selected locations etc.

3.5 Contouring at hilly/undulated locations

3.5.1 The levels up or down of each pit centre with respect to centre of tower location shall be recorded at intervals of 2m using total stations/GPS/digital theodolite and digitized contour plans shall be made. Based on the digitized elevation plans, the quantities of benching & protection work vis-à-vis possible unequal leg extensions shall be optimized using suitable computer-aided techniques/softwares. Required tower and foundation details, cost data for comparative evaluation for benching & protection work vis-à-vis unequal leg extensions shall be provided by the Employer to the Contractor during execution stage.

3.6 The changes desired by the Employer in the preliminary tower schedule or as may be required based on detailed survey of tower locations & contouring by the contractor, shall be carried out by the contractor and the final tower schedule shall be submitted for approval of Employer. The tower schedule shall show position of all type of towers, span length, type of foundation for each tower, benching & revetment requirement, unequal leg extensions, deviation at all angles, crossings & other details etc.

3.7 Survey Methodology & Precision

3.7.1 All elevations shall be referenced to benchmarks established by the survey of India. Survey operations shall begin and end at benchmarks approved by the Employer.

3.7.2 During the leveling of the profile, check surveys will be affected at intervals not exceeding 50Km. with benchmarks of known elevations. The difference in elevations as surveyed by the contractor and as declared by Survey of India for these benchmarks shall not exceed the precision required for 3rd order surveys $e \leq 24k$ where k is the distance between benchmarks in km and e is the difference between elevations in mm.

3.7.3 In the absence of suitable benchmarks the leveling shall be done by two independent leveling parties working in opposite directions along the same line. The difference in

elevations between the two surveys shall not exceed the precision required for 3rd order surveys as stated above.

3.7.4 All important objects and features along the transmission line centerline (railways, highways, roads, canals, rivers, transmission lines, distribution lines, telephone lines etc.) shall be surveyed and located with a positional accuracy of 1:2000 between points of known horizontal position.

3.8 Survey Report

3.8.1 Complete BOQ of the transmission lines as per format enclosed with this technical specification at Annexure-A shall be furnished in the survey report.

3.8.2 Each angle point locations shall be shown with detailed sketches showing existing close by permanent land marks such as specific tree(s), cattle shed, homes, tube wells, temples, electric pole/tower, telephone pole, canal, roads, railway lines etc. The relative distance of land marks from the angle points and their bearings shall be indicated in the sketch. These details shall be included in the survey report.

3.8.3 Information w.r.t infrastructure details available enroute, identification and explanation of route constraints, etc. shall also be furnished in the Survey report and shall inter-alia include the following:

3.8.3.1 Information regarding infrastructural facilities available along the final route alignment like access to roads, railway stations, construction material sources (like quarry points for stone, sand and availability of construction water), labour, existing transport facilities, fuel availability etc. shall be furnished in the survey report.

3.8.3.2 All observations which the Contractor thinks would be useful to the construction of the transmission lines mentioned under scope of work are to be reported.

3.8.3.3 Suggestions regarding the number of convenient zones (line segments / portions) in which the entire alignment can be divided keeping in view the convenience of corporation are to be given.

3.8.3.4 Suggestions regarding location for setting up stores during line construction in consultation with Employer's representative shall also be provided by the contractor.

3.8.3.5 Working months available during various seasons along the final route alignment, with period, time of sowing & harvesting of different type of crops and the importance attached to the crops particularly in the context of way leave problems and compensation payable shall be stated by the Contractor.

3.8.3.6 Availability of labour of various categories and contractors of civil works shall also be reported.

3.8.3.7 Some portions of the line may require clearance from various authorities. The Contractor shall indicate the portion of the line so affected, the nature of clearance required and the name of concerned organizations such as local bodies, municipalities, P&T (name of circle), Inland navigation, Irrigation Department, Electricity Boards and Zonal railways, Divisional Forest Authorities etc.

3.8.4 All the requisite data for processing the case for statutory clearances such as PTCC, Forest and Railway shall be provided along with the report.

3.8.5 The contractor shall also collect & report (as per Formats enclosed at B) details pertaining to pollution levels envisaged along the transmission line.

3.8.6 Six copies of survey reports shall be furnished by the contractor to the Employer.

4.0 Geotechnical Investigations

4.1 General

4.1.1 Employer requires that a detailed Geotechnical investigation be carried out at various tower locations to provide the designer with sufficiently accurate information, both general and specific, about the substrata profile and relevant soil and rock parameters at site on the basis of which the foundation of transmission line towers can be classified and designed rationally.

4.1.2 These specifications provide general guidelines for geotechnical investigation of normal soils. Cases of marshy locations and locations affected by salt water or saltpeter shall be treated as special locations and the corresponding description in these specifications shall apply. Any other information required for such locations shall be obtained by Contractor and furnished to Employer.

4.2 Scope

4.2.1 The scope of work includes detail soil investigations and furnishing bore log data at various tower locations. The provisional quantities have been indicated in Bill of Quantities. However, during actual execution of work, the quantities shall be decided by the Engineer - in - Charge, depending upon the soil strata and terrain. Based on the bore log data / soil parameter /soil investigation results, the Contractor shall recommend the type of foundations suitable for each locations and the same shall be got approved by the Employer.

4.2.2 These specifications cover the technical requirements for a detailed Geotechnical investigation and submission of a detailed Geotechnical Report. The work shall include mobilization of all necessary tools and equipment, provision of necessary engineering supervision and technical personnel, skilled and unskilled labour, etc. as required to carry out the entire field investigation as well as laboratory tests, analysis and interpretation of data collected and preparation of the Geotechnical Report. Contractor shall also collect data regarding variation of subsoil water table along the proposed line route. The aforementioned work shall be supervised by a graduate in Civil Engineering having at least 5 years of site experience in geotechnical investigation work.

4.2.3 Contractor shall make his own arrangements to establish the co-ordinate system required to position boreholes, tests pits and other field test locations as per the drawings/sketches supplied by Employer. Contractor shall determine the reduced levels (R.L's) at these locations with respect to benchmarks used in the detailed survey. Two reference lines shall be established based on survey data/details. Contractor shall provide at site all required survey instruments to the satisfactions of the Employer so that the work can be carried out accurately according to specifications and drawings. Contractor shall arrange to collect the data regarding change of course of rivers, major natural streams and nallas, etc., encountered along the transmission line route from the best available sources and shall furnish complete hydrological details including maximum velocity discharge, highest flood level (H.F.L), scour depth etc. of the concerned rivers, major streams and nallas (canals).

4.2.4 The field and laboratory data shall be recorded on the proforma recommended in relevant Indian Standards. Contractor shall submit to Employer two copies of field bore logs (one copy each to Employer site and Divisional Office) and all the field records (countersigned by the Employer) soon after the completion of each boreholes/test.

4.2.5 Whenever Contractor is unable to extract undisturbed samples, he shall immediately inform the Employer. Payment for boring charges shall be subject to Employer being satisfied that adequate effort has been made to extract undisturbed samples. Special care shall be taken for locations where marshy soils are encountered and Contractor in such cases shall ensure that specified numbers of vane shear tests are performed and the results correlated with other soil parameters.

4.2.6 One copy of all field records and laboratory test results shall be sent to Employer on a weekly basis. Employer may observe, at the laboratory testing procedures.

4.2.7 The Contractor shall interact with the Employer to get acquainted with the different types of structures envisaged and in assessing the load intensities on the foundation for the various types of towers in order to enable him to make specific recommendation for the depth, founding strata, type of foundation and the allowable bearing pressure.

4.2.8 After reviewing Contractor's geotechnical investigation draft report, Employer will call for discussions, to be held normally within one week at Employers site Office, in order to comment on the report in the presence of Contractor's Geotechnical Engineer. Any expenditure associated with the redrafting and finalising the report, traveling etc. shall be deemed included in the rates quoted for the geotechnical investigations.

4.2.9 Contractor shall carry out all work expressed and implied in these specifications in accordance with requirements of the specification.

4.2.10 The contractor shall prepare and submit soil profile along the transmission line route (in digitized form, with digitized route alignment drawing as base) indicating salient soil characteristics / features, water table etc. based on detailed soil investigations and other details / information collected during detailed survey.

4.3 General Requirements

4.3.1 Wherever possible, Contractor shall research and review existing local knowledge, records of test pits, boreholes, etc., types of foundations adopted and the behaviour of existing structures, particularly those similar to the present project.

4.3.2 Contractor shall make use of information gathered from nearby quarries, unlined wells excavation etc. Study of the general topography of the surrounding areas will often help in the delineation of different soil types.

4.3.3 Contractor shall gather data regarding the removal of overburden in the project area either by performing test excavations, or by observing soil erosion or landslides in order to estimate reconsolidation of the soil strata. Similarly, data regarding recent landfills shall be studied to determine the characteristics of such landfills as well as the original soil strata.

4.3.4 The water level in neighboring streams and water courses shall be noted. Contractor shall make enquiries and shall verify whether there are abandoned underground

works e.g. worked out ballast pits, quarries, old brick fields, mines, mineral workings etc.

4.3.5 It is essential that equipment and instruments be properly calibrated at the commencement of the work. If the Employer so desires. Contractor shall arrange for having the instruments tested at an approved laboratory at its cost and shall submit the test reports to the Employer. If the Employer desires to witness such tests, Contractor shall arrange for the same.

4.4 Codes and Standards for Geotechnical Investigations

4.4.1 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. In case of conflict between the present specifications and those referred to herein, the former shall prevail. Internationally accepted standards which ensure equal or higher performance than those specified shall also be accepted.

4.4.2 All work shall be carried out in accordance with the following Indian Standards and Codes:

Indian Standards (IS)	**Title**	**International and Internationally Recognised Standard/Code**
IS:1080-1990	Codes of Practice for Design and Construction of Simple Spread Foundations.	
IS:1498-1992	Classification and Identification of Soils for General Engineering purposes.	ASTM D 2487 ASTM D2488
IS:1892-1992	Code of Practice for Subsurface Investigation for Foundation	
IS:1892-1992	Code of Practice for Subsurface Investigation for Foundation	
IS:1904-1986	Code of Practice for Design and Construction of foundation in Soils: General Requirements.	
IS:2131-1992	Method of Standard Penetration Test for Soils	ASTM D 1586
IS:2132-1992	Code of Practice for Thin Walled Tube Sampling of Soils	ASTM D 1587
IS:2720-1992	Method of Test for Soils(Relevant Parts)	ASTM D 420
IS:2809-1991	Glossary of Terms and symbols Relating to Soil Engineering	ASTM D 653
IS:2911-1980	Code of Practice for Design and construction of Pile Foundations	

Indian Standards (IS)	Title	International and Internationally Recognised Standard/Code
	(Relevant Parts).	
IS:3025	Methods of Sampling and Testing(Physical and Chemical) for water used in Industry	
IS:3043-1991	Code of Practice for Earthing	
IS:4078-1990	Code of Practice for Indexing and Storage of Drill Cores.	
IS:4091-1987	Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles.	
IS:4434-1992	Code of Practice for In-situ Vane Shear Test for Soils	ASTM D 2573 ASTM D 4648
IS:4453-1992	Code of Practice for Exploration by Pits, Trenches, Drifts and Shafts.	
IS:4464-1990	Code of Practice for Presentation of Drilling information and core description in Foundation investigation	
IS:4968(Part-II)1992	Method for Subsurface sounding for soils, dynamic method using cone and Bentonite slurry.	
IS:5313-1989	Guide for Core Drilling observations.	
IS:6403-1990	Code of Practice for Determination of Allowable Bearing Pressure on Shallow Foundation.	ASTM D 194
IS:6926-1990	Code of Practice for Diamond Core Drilling for Site Investigation for River Valley Projects.	
IS:6935-1989	Method of Determination of Water level in a Bore Hole.	
IS:7422-1990	Symbols and Abbreviations for use in Geological Maps Sections and subsurface Exploratory Logs (Relevant parts).	
IS:8009(Part-	Code of Practice for Calculation of Settlements of Foundations (Shallow Foundations subjected	

Indian Standards (IS)	Title	International and Internationally Recognised Standard/Code
I)-1993	to symmetrical Vertical Loads).	
IS:8764-1991	Method of Determination of Point Load Strength Index of Rocks.	
IS:9143-1991	Method of Determination of Unconfined Compressive Strength of Rock Materials.	ASTM D 2938
IS:9179-1991	Method of Preparation of Rock Specimen for Laboratory Testing.	ASTM D 4543
IS:9259-1992	Specification for Liquid Limit Apparatus.	ASTM D 4318
IS:9640-1992	Specification for Split Spoon Sampler.	ASTM D 1586
IS:10050-1991	Method of Determination of Slake Durability Index of Rocks.	ASTM D 4644
IS:11315(Part-II)-1991	Description of Discontinuities in Rock Mass-Core Recovery and Rock Quality.	

4.5 Field Investigation for Soils

Tentative numbers of detailed soil investigation to be done is given in BPS

4.5.1 Boring

Boreholes are required for detailed soil investigations.

4.5.1.1 General Requirements

a) Boreholes shall be made to obtain information about the subsoil profile, its nature and strength and to collect soil samples for strata identification and for conducting laboratory tests. The minimum diameter of the borehole shall be 150mm and boring shall be carried out in accordance with the provisions of IS:1892 and the present specification:

b) All boreholes shall be 10m deep for normal soil conditions. The depth of boreholes at river crossings and special locations shall be 40m. If a strata is encountered where the Standard Penetration Test Records N values greater than 100, with characteristics of rock, the borehole shall be advanced by coring atleast 3m further in normal locations and at least 7m further for the case of river crossing locations with prior approval of the *Employer*. When the boreholes are to be termination in soil strata an additional Standard Penetration Test shall be carried out at the termination depth. No extra payment shall be made for carrying out Standard Penetration Tests.

c) Casing pipe shall be used when collapse of a borehole wall is probable. The bottom of the casing pipe shall at all times be above the test of sampling level but not more than 15cm above the borehole bottom. In case of cohesion less soils, the advancement of the casing pipe shall be such that it does not disturb the soil to be tested or sampled. The casing shall preferably be advanced by slowly rotating the casing pipe and not by driving.

d) In-situ tests shall be conducted and undisturbed samples shall be obtained in the boreholes at intervals specified hereafter. Representative disturbed samples shall be preserved for conducting various identification tests in the laboratory. Water table in the bore hole shall be carefully recorded and reported following IS:6935. No water or drilling mud shall be used while boring above ground water table. For cohesion less soil below water table, the water level in the borehole shall at all times be maintained slightly above the water table.

e) The borehole shall be cleaned using suitable tools to the depth of testing or sampling, ensuring least or minimum disturbance of the soil at the bottom of the borehole. The process of getting through an open tube sampler shall not be permitted. In cohesive soils, the borehole may be cleaned by using a bailer with a flap valve. Gentle circulation of drilling fluid shall be done when rotary mud circulation boring is adopted.

f) On completion of the drilling, Contractor shall backfill all boreholes as directed by the *Employer*.

4.5.1.2 Auger Boring

Auger boring may be employed in soft to stiff cohesive soils above the water table. Augers shall be of helical or post hole type and the cuttings brought up by the auger shall be carefully examined in the field and the description of all strata shall be duly recorded in the field bore log as per IS:1498. No water shall be introduced from the top while conducting auger boring.

4.5.1.3 Shell and Auger Boring

4.5.1.3.1 Shell and auger boring may be used in all types of soil which are free from boulders. For cohesion less soil below ground water table, the water level in the borehole shall always be maintained at or above ground water level. The use of chisel bits shall be permitted in hard strata having SPT-N value greater than 100 Chisel bits may also be used to extend the bore hole through local obstructions such as old construction. Boulders rocky formations, etc. The requirements in Clause 4.5.1.2 shall apply for this type of boring also.

4.5.1.3.2 Rotary method may be used in all types of soil below water table. In this method the boring is carried out by rotating the bit fixed at the lower end of the drill rod. Proper care shall be taken to maintain firm contact between the bit and the bottom of the borehole. Bentonite or drilling mud shall be used as drilling fluid to stabilise and protect the inside surface of the

borehole. Use of percussion tools shall be permitted in hard clays and in dense sandy deposits.

4.5.2 Standard Penetration Test (SPT)

4.5.2.1 This test shall be conducted in all types of soil deposits encountered within a borehole, to find the variation in the soil stratification by correlating with the number of blows required for unit penetration of a standard penetrometer. Structure sensitive engineering properties of cohesive soils and sifts such as strength and compressibility shall not be inferred based on SPT values.

4.5.2.2 The test shall be conducted at depths as follows:

Location	**Depths (m)**
Normal Soils	2.0, 3.0, 5.0, 7.0, 10.0
River crossings and special Locations.	2.0, 3.0, 5.0, 7.0, 10.0 and thereafter at the rate of 3m intervals to 40m

4.5.2.3 The spacing between the levels of standard penetration test and next undisturbed sampling shall not be less than 1.0m. Equipment's, accessories and procedures for conducting the test and for the collection of the disturbed soil samples shall conform to IS:2131 and IS:9640 respectively. The test shall be conducted immediately after reaching to the test depth and cleaning of bore hole.

4.5.2.4 The test shall be carried out by driving a standard split spoon sampler in the bore hole by means of a 650N hammer having a free fall of 0.75 m. The sample shall be driven using the hammer for 450mm recording the bumper of blows for every 150mm. The number of blow for the last 300mm drive shall be reported as N value.

4.5.2.5 This test shall be discontinued when the blow count is equal to 100 or the penetration is less than 25 mm for 50 blows. At the level where the test is discontinued, the number of blows and the corresponding penetration shall be reported. Sufficient quantity of disturbed soil samples shall be collected from the split spoon sampler for identification and laboratory testing. The sample shall be visually classified and recorded at the site as well as properly preserved without loss of moisture content and labeled.

4.5.3 Sampling

4.5.3.1 General

a) Sufficient number of soil samples shall be collected. Disturbed soil samples shall be collected for soil identification and for conducting tests such as sieve analysis, index properties, specific gravity, chemical analysis etc. Undisturbed samples shall be collected to estimate the physical bearing capacity and settlement properties of the soil.

b) All accessories and sampling methods shall conform to IS:2132: all disturbed and undisturbed samples collected in the field shall be classified at site as per IS:1498

c) All samples shall be identified with date, borehole or test pit number, depth of sampling, etc. The top surface of the sample in-situ shall also be marked. Care shall be taken to keep the core and box samples vertical, with the mark directing

upwards. The tube samples shall be properly trimmed at one end and suitably capped and sealed with molten paraffin wax. The Contractor shall be responsible for packing, storing in a cool place and transporting all the samples from site to the laboratory within seven days after sampling with probe, protection against loss and damage.

4.5.3.2 Disturbed Samples

a) Disturbed soil samples shall be collected in boreholes at regular intervals. Jar samples weighing approximately 1 kg shall be collected at 0.5m intervals starting from a depth of 0.5m below ground level and at every identifiable change of strata to supplement the boring records. Samples shall be stored immediately in air tight jars which shall be filled to capacity as much as possible.

b) In designated borrow areas, bulk samples, from a depth of about 0.5m below ground level shall be collected to establish the required properties for use as a fill material. Disturbed samples weighing about 25kg (250N) shall be collected at shallow depths and immediately stored in polythene bags as per IS:1892. The bags shall be sealed properly to preserve the natural moisture content of the sample and placed in wooden boxes for transportation.

4.5.3.3 Undisturbed Samples

In each borehole undisturbed samples shall be collected at every change of strata and at depths as follows:

Location	Depths (m)
Normal Soils	1.0, 4.0, 6.0, 8.0
Special Locations	1.0, 4.0, 6.0, 8.0,11.0 and thereafter at the rate of 3 m intervals up to 33m

4.5.3.3.1 The spacing between the top levels of undisturbed sampling and standard penetration testing shall not be less than 1.0m. Undisturbed samples shall be of 100mm diameter and 450mm in length. Samples shall be collected in a manner to preserve the structure and moisture content of the soil Accessories and sampling procedures shall conform to IS:1892 and IS:2132

a) Undisturbed sampling in cohesive soil :

Undisturbed samples in soft to stiff cohesive soils shall be obtained using a thin walled sampler. In order to reduce the wall friction, suitable precautions, such as oiling the surfaces shall be taken. The sampling tube shall have a smooth finish on both surfaces and a minimum effective length of 450mm. The area ratio of sampling tubes shall be less than 12.5%. However, in case of very stiff soils area ratio up to 20% shall be permitted.

b) Undisturbed sampling in very loose, saturated, sandy and silty soils and very soft clays :

Samples shall be obtained using a piston sampler consisting of a cylinder and piston system. In soft clays and silty clays, with water standing in the casing pipe,

piston sampler shall be used to collect undisturbed samples in the presence of expert supervision.

Accurate measurements of the sampling depth, dimensions of sampler, stroke and length of sample recovery shall be recorded. After the sampler is pushed to the required depth, the cylinder and piston system shall be drawn up together, preventing disturbance and changes in moisture content of the sample;

c) Undisturbed sampling in cohesion less soils

Undisturbed samples in cohesion less soils shall be obtained in accordance with IS: 8763. Sampler operated by compressed air shall be used to sample cohesion less soils below ground water table.

4.5.4 Ground Water

4.5.4.1 One of the following methods shall be adopted for determining the elevation of ground water table in boreholes as per IS:6935 and the instructions of the Employer:

a) In permeable soils, the water level in the borehole shall be allowed to stabilize after depressing it adequately by bailing before recording its level. Stability of sides and bottom of the boreholes shall be ensured at all times.

b) For both permeable and impermeable soils, the following method shall be suitable. The borehole shall be filled with water and then bailed out to various depths. Observations on the rise or fall of water level shall be made at each depth. The level at which neither fall nor rise is observed shall be considered the water table elevation and confirmed by three successive readings of water level taken at two hours interval.

4.5.4.2 If any variation of the ground water level is observed in any specific boreholes, the water level in these boreholes shall be recorded during the course of the filed investigation. Levels in nearby wells, streams, etc., if any, shall also be noted in parallel.

4.5.4.3 Subsoil water samples

a) Subsoil water samples shall be collected for performing chemical analysis. Representative ground water samples shall be collected when first encountered in boreholes and before the addition of water to aid boring or drilling.

b) Chemical analysis of water samples shall include determination of pH value, turbidity, sulphate, carbonate, nitrate and chloride contents, presence of organic matter and suspended solids. Chemical preservatives may be added to the sample for cases as specified in the test methods or in applicable Indian Standards. This shall only be done if analysis cannot be conducted within an hour of collection and shall have the prior written permission and approval of the Employer.

4.5.5 Dynamic Cone Penetration Test (only at Special locations)

a) With bentonite slurry

Dynamic cone penetration test shall be conducted to predict stratification, density, beating capacity of granular soils, etc. The test shall be conducted to the specified depth or refusal, whichever comes first. Refusal shall be considered when the

blow count exceeds 100 for 300mm penetration. Equipment, accessories test procedures, field observations and reporting of results shall conform to IS: 4968, Part-II. The driving system shall comprise of a 650 N weight hammer having a free fall of 750mm. The cone shall be of 60^0 and of 65mm diameter provided with vents for continuous flow of bentonite slurry through the cone and rods in order to avoid friction between the rods and soil. On completion of the test the results shall be presented as a continuous record of the number of blows required for every 300mm penetration of the cone into the soil in a suitable chart supplemented by a graphical plot of blow count for 300mm penetration vs. depth. On completion of the test, the results shall be presented on the proforma approved by the Employer.

b) Without bentonite slurry

This test shall be conducted with 50mm diameter 60^0 cone fitted loosely to the driving rod through a cone adopter. The cone shall be driven in to the soil by allowing 650 N weight hammer top fall freely through a height of 750mm each time. The number of blows for every 75mm penetration shall be recorded. The process shall be repeated till the cone is driven to the required depth. The penetration depth shall be limited to 5m in cohesion less soil and 10m in mixed soil with some binding material. The cone driving rods, driving head, hoisting equipment shall conform to IS: 10589. The test report should be prepared as per guidelines of IS: 4968 (Part I).

4.5.6 Vane Shear Test. (required for boreholes where UDS is not possible) (Only at Special Locations)

Field vane shear test shall be performed inside the borehole to determine the shear strength and bearing capacity of cohesive soils, especially of soft and sensitive clays, which are highly susceptible to sampling disturbance. Equipment, accessories, test procedures, field observations shall correspond to IS: 4434. Tests may also be conducted by direct penetration from ground surface. If the cuttings at the test depth in the borehole show any presence of gravel, sand shells, decomposed wood, etc., which is likely to influence the test results substantially, the test at that particular depth may be omitted with the permission of the Employer. However, the test shall be conducted at a depth where these obstructions cease to occur. On completion of the test, the results shall be reported in an approved proforma as specified in IS: 4434, Appendix - A.

4.6 Field Investigation for Rock

4.6.1 Rock Drilling

4.6.1.1 If, during the investigations, large hard fragments or natural rock beds are encountered, work shall proceed with core drilling methods. The equipment and procedures for this operation shall conform to IS: 1892. The starting depth of drilling in rock shall be certified by the Employer. At the end of the investigation, the hole drilled in rock shall be backfilled with grout consisting of 1 part cement and 3 parts sand by weight.

4.6.1.2 Drilling shall be carried out with NX size tungsten carbide (TC) or diamond tipped drill bits, depending on the type of rock and according to IS:6926. Suitable type of drill bit (TC/Diamond) and core catchers shall be used to ensure continuous and good

core recovery. Core barrels and core catchers shall be used for breaking off the core and retaining it when the rods are withdrawn. Double tube core barrels shall be used to ensure better core recovery and to retrieve cores from layers of bedrock. Water shall be circulated continuously in the hollow rods and the sludge conveying the rock cuttings to the surface shall be collected. A very high core recovery ratio shall be aimed at in order to obtain a satisfactory undisturbed sample. Attempt shall be made to recover cores of 1.5m in length. Normally TC bit shall be used. Change over to a diamond bit shall require the specific written approval of the Employer, and his decision as to whether a TC or a diamond bit is to be used shall be final and binding on Contractor.

4.6.1.3 No drilling run shall exceed 1.5 m in depth. If the core recovery is less than 80% in any run, the length of the subsequent run shall be reduced to 0.75m. During drilling operations observations on return water, rate of penetration etc. shall be recorded as per IS: 5313.

a) The colour of return water at regular intervals, the depth at which any change of colour of return water is observed, the depth of occurrence and amount of flow of hot water, if encountered, shall be recorded.

b) The depth through which a uniform rate of penetration was maintained, the depth at which marked change in rate of penetration or sudden fail on drill rod occurs, the depth at which any blockage of drill bit causing core loss, if any, shall be recorded.

c) Any heavy vibration or torque noticed during the drilling should be recorded together with the depth of occurrence.

d) Special conditions like the depth at which grouting was done during, drilling, presence of artesian conditions, loss of drilling fluid, observations of gas discharge with return water, etc., shall also be observed and recorded.

e) All the observations and other details shall be recorded as per daily drill and reported in a proforma as given in IS: 5313, Appendix A.

4.6.2 Core Sampling

4.6.2.1 Core samples shall be extracted by the application of a continuous pressure at one end of the core with the barrel held horizontally without vibration. Friable cores shall be extracted from the barrel directly into a suitably sized half round plastic channel section. Care shall be taken to extrude the samples in the direction of coring to avoid stress reversal.

4.6.2.2 Immediately after withdrawal from the core barrel, the cores shall be placed in a tray and transferred to boxes specially prepared for this purpose. The boxes shall be made from seasoned timber or any other durably material and shall be indexed on top of the lid according to IS: 4078. The cores shall be numbered serially and arranged in the boxes in a sequential order. The description of the core samples shall be recorded as instructed in IS: 4464. Where no core is recovered, it shall be recorded as specified in the standard. Continuous records of core recovery and rock quality designation (RD/DD/QD) are to be mentioned in the bore log in accordance with IS: 11315 (Part-II).

4.7 Laboratory Testing

4.7.1 Essential Requirements

a) Depending on the types of substrata encountered, appropriate laboratory tests shall be conducted on soil and rock samples collected in the field. Laboratory tests shall be scheduled and performed by qualified and experienced personnel who are thoroughly conversant with the work. Tests indicated in the schedule of items shall be performed on soil, water and rock samples as per relevant IS codes. One copy of all laboratory test data records shall be submitted to Employer progressively every week. Laboratory tests shall be carried out concurrently with the field investigations as initial laboratory test results could be useful in planning the later stages of field work. A schedule of laboratory tests shall be established by Contractor to the satisfaction of the Employer within one week of completion of the first borehole;

b) Laboratory tests shall be conducted using approved apparatus complying with the requirements and specification of Indian Standards or other approved standards for this type of work. It shall be checked that the apparatus are in good working condition before starting the laboratory tests. Calibration of all the instruments and their accessories shall be done carefully and precisely at an approved laboratory.

c) All samples, whether undisturbed or disturbed shall be extracted, prepared and examined by competent personnel properly trained and experienced in soil sampling. examination, testing and in using the apparatus in conformance with the specified standards;

d) Undisturbed soil samples retained in liners or seamless tube samplers shall be removed, without causing any disturbance to the samples, using suitably designed extruders just prior to actual testing. If the extruder is horizontal, proper support shall be provided to prevent the sample from breaking. For screw tube extruders, the pushing head shall be free from the screw shaft so that no torque is applied to the soil sample in contact with the pushing head. For soft clay samples, the sample tube shall be cut by means of a high speed hacksaw to proper test length and placed over the mould before pushing the sample into it with a suitable piston;

e) While extracting a sample from a liner or tube, care shall be taken to assure that its direction of movement is the same as that during sampling to avoid stress reversal;

4.7.2 Tests

4.7.2.1 Tests as indicated in these specifications and as may be requested by the Employer, shall be conducted. These tests shall include but may not be limited to the following :

a) Tests of undisturbed and disturbed samples

- Visual and engineering classification;
- Sieve analysis and hydrometric analysis;
- Liquid, plastic and shrinkage limits;
- Specific gravity;
- Chemical analysis

- Swell pressure and free swell index determination
- Proctor compaction test.

b) Tests of undisturbed samples:

- Bulk density and moisture content;
- Relative density(for sand),
- Unconfined compression test;
- Box shear test (for sand);
- Triaxial shear tests (depending on the type of soil and field conditions on undisturbed or remoulded samples):
    i. Unconsolidated undrained;
    ii. Consolidated drained test;
- Consolidation.

c) Tests on rock samples

- Visual classification;
- Moisture content , porosity and density;
- Specific gravity;
- Hardness
- Stake durability
- Unconfined compression test (both saturated and at in-situ water content);
- Point load strength index;
- Deformability test (both saturated and dry samples).

d) Chemical analysis of sub soil water.

4.7.3 Salient Test Requirement

a) Triaxial shear tests shall be conducted on undisturbed soil samples, saturated by the application of back pressure. Only if the water table is at sufficient depth so that chances of its rising to the base of the footing are small or nil, the triaxial tests shall be performed on specimens at natural moisture content. Each test shall be carried out on a set of three test specimens from one sample at cell pressures equal to 100, 200 and 300 KPa respectively or as required depending on the soil conditions:

b) Direct shear test shall be conducted on undisturbed soil samples. The three normal vertical stresses for each test shall be 100, 200 and 300 KPa or as required for the soil conditions;

c) Consolidation test shall have loading stages of 10, 25, 50, 75, 100, 200, 400 and 800 KPa. Rebound curve shaft be recorded for all samples by unloading the specimen at its in-situ stress. Additional rebound curves shall also be recorded wherever desired by the Employer;

d) Chemical analysis of subsoil shaft includes determination of PH value, carbonate, sulphate (both SO_3 and SO_4). Chloride and nitrate contents, organic matter, salinity and any other chemicals which may be harmful to the foundation material. Their contents in the soil shall be indicated as percentage (%);

e) Chemical analysis of subsoil water samples shall include the determination of properties such as colour, odour, turbidity, PH value and specific conductivity, the last two chlorides, nitrates, organic matter and any other chemical harmful to the foundation material. The chemical contents shall be indicated as parts per million (PPM) based on weight.

4.8 Geotechnical Investigation Report

4.8.1 General

a) Contractor shall submit a formal report containing geological information of the region, procedures adopted for geotechnical investigation, field observations, summarised test data, conclusions and recommendations. The report shall also include detailed bore logs, subsoil sections, field test results, laboratory observations and test results both in tabular as well as graphical form, practical and theoretical considerations for the interpretation of test results, supporting calculations for the conclusions drawn, etc. Initially, Contractor shall submit three copies of the report in draft form for Employer's review;

b) Contractor's Geotechnical engineer shall visit Employer's Office for a detailed review based on Employer's comments in order to discuss the nature of modifications, if any, to be done in the draft report. Contractor shall incorporate in the report the agreed modifications and resubmit the revised draft report for approval. Ten copies of the detailed final approved report shall be submitted to Employer together with one set of reproducible of the graphs, tables etc.

c) The detailed final report based on field observations, in-situ and laboratory tests shall encompass theoretical as well as practical considerations for foundations for different types of structures.

4.8.2 Data to be furnished

4.8.2.1 The report shall also include the following

a) A plot plant/location plan showing the locations and reduced levels of all field test e.g. boreholes, trial pits, static cone penetration tests, dynamic cone penetration tests, etc., property drawn to scale and dimensioned with reference to the established grid lines;

b) A true cross section of all individual boreholes and test pits with reduced levels and co-ordinates showing the classification and thickness of individual stratum, position of ground water table, various in-situ tests conducted, samples collected at different depths and the rock stratum, if encountered;

c) Geological information of the area including geomorphology, geological structure, lithology, stratigraphy and tectonics, core recovery and rock quality designation (RD/DD/QD), etc.,

d) Observations and data regarding change of course of rivers, velocity, scour depths, slit factor, etc., and history of flood details for mid-stream and river bank locations;

e) Past observations and historical data, if available, for the area or for other areas with similar soil profile, or with similar structures in the surrounding areas;

f) Plot of Standard Penetration Test (uncorrected and corrected N values) with depth for each test site;

g) Results of all laboratory test summarised according to Table 4.0 (i) for each sample as well as (ii) for each layer, along with all the relevant charts, tables, graphs, figures, supporting calculations, conclusions and photographs of representative rock cores,

h) For all triaxial shear tests, stress vs. strain diagrams as well as Mohr's circle envelopes shall be furnished. If back pressure is applied for saturation, the magnitude of the same shall be indicated. The value of modulus of elasticity (E) shall be furnished for all tests along with relevant calculations;

i) For all consolidation tests, the following curves shall be furnished

   i. e vs. log p;

   ii. e vs. p;

   iii. Compression vs log t or vs √t

   depending upon the shape of the plot, for proper determination of coefficient of consolidation.

   The point showing the initial condition (e0, p0) of the soil shall be marked on the curves;

j) The procedure adopted for calculating the compression index from the field curve and settlement of soil strata shall be clearly specified. The time required for 50% and 90% primary consolidation along with secondary settlements, if significant, shall also be calculated.

Table 4.0

SUMMARY OF RESULTS OF LABORATORY TESTS ON SOIL

AND WATER SAMPLES

1. Bore hole test pit. no
2. Depth (m)
3. Type of sample
4. Density(kg/m3)
   a) Bulk
   b) Dry.

c) **Submerged**

5. Water content (%)
6. Particle Size (%)
   a) Gravel
   b) Sand
   c) Silt
   d) Clay
7. Consistency properties
   a) LL
   b) PL
   c) PI
   d) LI
8. Soil
   a) Classification -IS
   b) Description
   c) Specific gravity
9. Strength Test
   a) Type
   b) c (Cohesion)
   c) Ø (angle of internal friction)
   d) **Angle of repose**
10. Consolidation Test
    a) e0
    b) Pc
    c) Cc
    d) DP
    e) Mv
    f) Cv
11. Shrinkage limit (%)
12. Swell Test
    a) S.Pr
    b) FS
13. Relative Density (%)
14. Remarks

Notations:

I. For type of Sample:

DB - Disturbed bulk soil sample.

DP - Disturbed SPT soil sample

DS - Disturbed samples from cutting edge of undisturbed soil sample.

RM - Remoulded soil sample

UB - Undisturbed block soil sample

US - Undisturbed soil sample by sampler

W - Water sample

II. For Strength Test :

SCPT - Static Cone Penetration Test

UCC - Unconfined Compression Test

VST - Vane Shear Test

Tuu - Unconsolidated Undrained Triaxial Test

Note: Replace T by D for Direct Shear Test

Tod - Consolidation Drained Triaxial Test

III. For Others :

LL - Liquid Limit (%)

PL - Plastic Limit

PI - Plasticity Index

LI - Liquidity Index

C - Cohesion (kPa)

Ø - Angle of Internal Friction (degrees)

S-Pr. - Swelling Pressure (kPa)

e0 - Initial Void Ratio

Pc - Reconsolidation Pressure (kPa)

Cc - Compression Index

DP - Change in Pressure (kPa)

m_v - Coefficient of Volume Compressibility (m2/KN)

Cv - Coefficient of Consolidation (m2/hr)

IV. For Chemical Test

As per Specifications - Clause 4.8.4

4.8.3 Recommendations

4.8.3.1 Recommendations shall be provided for each tower location duly considering soil type and tower spotting data. The recommendations shall provide all design parameters and considerations required for proper selection, dimensioning and future performance of tower foundations and the following

a) The subsurface material must provide safe bearing capacity and uplift resistance by incorporating appropriate safety factors thereby avoiding rupture under ultimate loads;

b) Movement of the foundation, including short and long term components under transient and permanent loading, shall be strictly controlled with regard to settlement, uplift, lateral translation and rotation:

c) Co-efficient of permeability of various sub soil and rock strata based on in-situ permeability tests.

Core resistance, frictional resistance total resistance, relation between core resistance, Standard Penetration Test N value, and settlement analysis for different sizes of foundation as specified in para 4.1.8.3 (I) based on static cone penetration test.

d) For shallow foundation the following shall be indicated with comprehensive supporting calculations:

i. Net Safe allowable bearing pressure for isolated square footing of sizes 4.0, 5.0, 6.0 & 7.0 m at three different founding depths of 1, 2 and 3 & 3.5m below ground level considering both shear failure and settlement criteria giving reasons for type of shear failure adopted in the calculation.

ii. Net safe allowable bearing pressure for raft foundations of widths greater than 5m at 2.0, 3.0 and 4.0m below ground level considering both shear failure and settlement criteria.

iii. Rate and magnitude of settlement expected of the structure.

iv. Net safe bearing capacity for foundation sizes mentioned in para(i) above, modulus of sub grade reaction, modules of elasticity from plate load test results along with time settlement curves and load settlement curve in both natural and log graph, variation of Modulus of sub grade reaction with size, shape and depth of foundation.

e) The stable slopes for shallow and deep excavations, active and passive earth pressure at rest and angle of repose for sandy soils shall be furnished. The loading of the foundations shall not compromise the stability of the surrounding subsurface materials and the stability of the foundation shall be ensured against sliding or overturning:-

f) Depending on the subsurface material, water table level and tower type, either reinforced concrete isolated pad and chimney, cast-in-situ bored pile of special foundations shall be installed at a given location.

g) Net Safe allowable bearing pressure and uplift resistance shall be provided for the various sizes of isolated square footings founded at various depths below ground level considering both shear failure and movement criteria; rate and magnitude of movement expected of the structure (settlement, uplift, and rotation) shall also be given.

h) In cases where normal open cast/pile foundations appear to be impractical, special pile foundations shall be given due consideration along with the following:

i. Type of pile foundation and reasons for recommending the same duly considering the soil characteristics.

ii. Suitable founding strata for the pile:

iii. Estimated length of pile for 500, 750 and 1000 KN and 4500 KN capacities; end bearing and frictional resistance shall be indicated separately:

iv. Magnitude of negative skin friction or uplift forces due to soil swelling.

i) Where the subsoil water and soil properties are found to be chemically aggressive. Contractor shall take suitable precautions during construction including any protective coating to be applied on the foundations; susceptibility of soil to termite action and remedial measures for the same shall be dealt with;

j) Suitability of locally available soils at site for filling, backfilling and adequate compaction shall be investigated.

k) If expansive soil such as black cotton soil is encountered recommendation of removal or retainment of the same shall be given in the latter case, detailed specifications of special requirements shall also be given;

l) Susceptibility of subsoil strata to liquefaction in the event of earthquake and remedial measures, if required, shall be considered.

m) Any other information of special significance such as dewatering schemes, etc. which may have a bearing on the design and construction shall be provided.

n) Recommendations for additional soil investigations, beyond the scope of the present work, shall be given if Contractor considers such investigations necessary.

4.8.4 Hydrogeological Conditions

4.8.4.1 The maximum elevation of ground water table, amplitudes of its fluctuations and data on water aggressivity with regard to foundation structure materials shall be reported. While preparing ground water characteristics the following parameters should be specified for each acquifier:

a) bicarbonate alkalinity mg-eq/(deg),

b) pH value

c) content of aggressive carbon dioxide, mg/l;

d) content of magnesia salts. mg/l, recalculated in terms of ions Mg+2;

e) content of ammonia salts, mg/l, recalculated in terms of ions NH4+

f) content of caustic alkalis, mg/l, recalculated in terms of ions Na+ and K+

g) contents of chlorides, mg/l recalculated in terms of ions Cl-

h) contents of sulphates, mg/l, recalculated in terms of ions SO4-2

i) aggregate content of chlorides, sulphates, nitrates, carbonates and other salts. mg/l.

4.9 Rates and Measurements

4.9.1 Rates

The contractor's quoted rates shall be inclusive of making observations, establishing the ground level and co-ordinates at the location of each borehole, test pit etc. No extra payments shall be made for conducting Standard Penetration Test, collecting, packing, transporting of all samples and cores, recording and submittal of results on approved formats.

4.10 Specific Requirements for Geotechnical Investigation at River Crossings.

4.10.1 The entire soil investigation work at river crossing locations (if required) shall be carried out in accordance with the relevant parts of the specifications for geotechnical investigation modified to the extent given below.

4.10.2 Requirements

4.10.2.1 Boreholes shall be executed to specified depth of 40m (refer clause 4.5.1.1 b). If refusal strata is reached (i.e. SPT-N value is greater than 100 continuously for 5m depth) with characteristics of rock the borehole may be terminated at shallower depth i.e. at 5m in refusal strata, with prior approval of the *Employer*.

4.10.2.2 Laboratory testing shall be conducted on all soil samples to determine grain size distribution, liquid limit and plastic limit of the different soil strata encountered.

4.10.2.3 Geotechnical Report must furnish the following:

a) Geotechnical investigation scheme;

b) Bore-logs indicating soil stratification, with IS classification, sampling details and SPI 'N' values.

c) Soil cross-sections along various boreholes in two orthogonal directions indicating soil stratification based on field and laboratory tests;

d) Grain size distribution curves.

e) IS classification of soils.

f) Shear tests (UU) to be done on saturated soil samples;

g) Bearing capacity of soil at different levels;

h) Highest flood level (H.F.L.);

i) Maximum discharge, velocity etc. (from authenticated source such as CWC or appropriate State authorities)

j) Recommendations regarding type of foundation to be adopted at the location.

4.10.3 A check list for reporting results of river crossing locational details, detailed soil investigation and river values for river crossing locations is enclosed at Annexure-C.

4.11 Special Terms and conditions for Geotechnical Investigation in the River bed

4.11.1 Contractor is required to mobilise a suitable arrangement (floating pontoon, plant, equipment etc.) to carry out geotechnical investigation work in creek/river locations identified by the Employer.

4.11.2 In the event of storm or stoppage of work, etc., Contractor shall not be paid extra for mobilization / remobilisation of floating pontoon, plant, equipment, etc.

4.11.3 Contractor shall fully satisfy himself about the conditions of creek/river (depth of water, wave currents, wind conditions, etc.) prevailing in the area of proposed investigation and plan the necessary tools and plant to be deployed before quoting. Any claim resulting from lack of data collection in this respect shall not be entertained.

4.11.4 Contractor shall make his own arrangements for locating the coordinates and position of boreholes in creek/river with respect to two grid-lines indicated by Employer.

4.11.5 Boring in creek or river shall be payable only below the bed level and no payment shall be made for lowering the casing in water.

4.11.6 Contractor shall arrange for necessary transportation on water (e.g. motor boat) to facilitate the supervision of work by officials of Employer at its own cost.

4.11.7 Full details of the construction plant, proposed working method for boring and sampling in water shall be submitted along with the Tender.

4.11.8 The unit rate quoted for underwater boring shall include complete work required as per specification and no separate payment shall be made on any account.

5.0 STATUTORY REGULATIONS AND STANDARDS

5.1 Contractor is required to follow statutory regulations stipulated in Electricity (Supply) Act 1948, Indian Electricity Rules and other local rules & regulations.

5.2 The codes and standards referred to in these specifications shall govern. In case of a conflict between such codes/standards and these specifications, the provisions of the specifications shall prevail. Such codes, standards referred to shall mean latest revisions, amendments, changes adopted and published by relevant agencies.

5.3 Other Internationally acceptable standards which ensure equivalent or better performance than those specified shall also be acceptable.

6.0 FIELD QUALITY PLAN

A standard Field Quality Plan is annexed to this specifications at D. The bidders are requested to convey their acceptance to the same along with their offer.

7.0 COMPLETION PERIOD

The work as detailed in this specification shall be completed in all respects within the time schedule stipulated in letter of award (LOA).

PART-II

TECHNICAL SPECIFICATION

VOL-II, SEC-III

SURVEY & SOIL INVESTIGATION (2nd PART)

Annexure-A

BOQ FORMAT FOR TRANSMISSION LINE PACKAGE
(To be filled by the Contractor)

Name of line : **Voltage level:**
Package:

SL.NO.	DESCRIPTION	UNIT	QUANTITY
1	TOTAL LINE LENGTH	KMS	
	Plain terrain	KMS	
	Hilly terrain	KMS	
2	TOWER		
	a. Suspension	Nos.	
	b. Tension	Nos.	
	c. Special River Crossing Tower	Nos.	
3	DETAILED SURVEY INCLUDING PROFILIING & TOWER SPOTTING	KMS	
4	CHECK SURVEY	KMS	
5	SOIL INVESTIGATION		
	a. All kinds of soil except fissured rock & hard rock	LOC.	
	b. Fissured rock		
	c. Hard rock		
	d. River crossing		
6	BENCHING		
	a. All kinds of soil except fissured rock & hard rock	CUM	
	b. Fissured rock		
	c. Hard rock		
7.1	DESIGN FABRICATION AND SUPPLY OF TOWER AND TOWER EXTENSIONS WITH STUB, BOLTS AND NUTS, STEP BOLTS, PACK WASHERS HANGERS, D-SHACKLES ETC. AND ERECTION OF FOLLOWING TYPE OF TOWERS AND TOWER EXTN'S COMPLETE WITH ALL ABOVE MENTIONED FITTINGS INCLUDING TACK WELDING AND SUPPLY AND APPLICATION OF ZINC RICH PAINT.	NOS.	
	a. Tower Type A/DA	NOS.	
	(I) Standard Tower		
	(ii) A/DA/QA +3M Extn.		
	(iii) A/DA/QA +6M Extn.		
	(iv)A/DA/QA +9M Extn.		
	(v) A/DA/QA +18M Extn.		
	(vii) A/DA/QA +25M Extn.		
	b. Tower Type B/DB	NOS.	
	(I) Standard Tower		
	(ii) B/DB/QB +3M Extn.		
	(iii) B/DB/QB +6M Extn.		
	(iv) B/DB/QB+9M Extn.		

	c. Tower Type C/DC	NOS.	
	(I) Standard Tower		
	(ii) C/DC/QC +3M Extn.		
	(iii) C/DC/QC +6M Extn.		
	(iv)C/DC/QC+9M Extn.		
	d. Tower Type D/DD	NOS.	
	(I) Standard Tower		
	(ii) D/DD/QD +3M Extn.		
	(iii) D/DD/QD +6M Extn.		
	(iv) D/DD/QD +9M Extn.		
	(v) D/DD/QD +18M Extn.		
	(vii) D/DD/QD +25M Extn.		
8.1	DESIGN AND CONSTRUCTION OF TOWER FOUNDATION FOR FOLLOWING TOWERS INCLUDING EXCAVATION, STUB SETTING, CONCRETING & SUPPLY AND PLACEMENT OF REINFORCEMENT.		
	a. Tower Type A/DA STANDARD	NOS.	
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	b. Tower Type A/DA +3M Extn.	NOS.	
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	c. Tower A/DA +6M Extn.	NOS.	
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		

	ix. WBC		
	d. Tower Type A/DA +9M Extn.	NOS.	
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	e. Tower Type A/DA +18M Extn.	NOS.	
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	f. Tower Type A/DA +25M Extn.	NOS.	
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	g. Tower Type B/DB STANDARD	NOS.	
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	h. Tower Type B/DB +3M Extn.	NOS.	
	i. Dry		
	ii. Wet		
	iii. PS		

	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	i. Tower Type B/DB +6M Extn.		
	i. Dry		
	ii. Wet		
	iii. PS	NOS.	
	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	j. Tower Type B/DB +9M Extn.		
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged	NOS.	
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	k. Tower Type C/DC STANDARD		
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged	NOS.	
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	l. Tower Type C/DC +3M Extn.		
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged	NOS.	
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		

	m. Tower Type C/DC +6M Extn.		
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged	NOS.	
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	n. Tower Type C/DC +9M Extn.		
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged	NOS.	
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	O. Tower Type D/DD STANDARD		
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged	NOS.	
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	p. Tower Type D/DD +3M Extn.		
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged	NOS.	
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	q. Tower Type D/DD +6M Extn.		
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged	NOS.	
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		

	ix. WBC		
	r. Tower Type D/DD +9M Extn.	NOS.	
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	s. Tower Type D/DD +18M Extn.	NOS.	
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	t. Tower Type D/DD +25M Extn.	NOS.	
	i. Dry		
	ii. Wet		
	iii. PS		
	iv. Fully Submerged		
	v. Dry Fissured Rock		
	vi. Submerged Fissured Rock		
	vii. Hard Rock		
	viii. Sandy Soil		
	ix. WBC		
	i.		
		NOS.	
9	EARTHING OF TOWERS (SUPPLY AND INSTALLATION)		
	a. Pipe Type	Nos.	
	b. Counterpoise Type	Nos.	
	c. River crossing locations	Nos.	
10	PROTECTION OF TOWER FOOTING(SUPPLY AND INSTALLATION)		
	a. Random Rubble Stone Masonary Revetment in 1:5 Cement Mortar including Excacation.	CUM	
	b. Revetment of pack 6-inch and above stone/Boulders in heavily coated G.I. 4mm dia wire Performed mesh (mesh size 100 mmx100mm)	CUM	
	c. M 150 (1:2:4) mixed concrete for top seal cover of revetment.	CUM	
	d. Back filling/Levelling of volume enclosed by Revetment.	CUM	
11	SUPPLY AND INSTALLATION OF FOLLOWING TOWER ACCESSORIES		

	a. Danger Plate	Nos.	
	b. Number Plates	Nos.	
	c. Anti Climbing Device	Nos.	
	d. Phase Plate (set of 3)	Nos.	
	e. Circuit Plate (set of 2)	Nos.	
	f. Bird Guards	Sets.	
12	INSTALLATION OF INSULATOR STRING COMPLETE WITH ARCING HORNES AND NECESSARY HARDWARE, INSTALLING AND STRINGING OF CONDUCTOR INCLUDING FIXING OF CONDUCTOR ACCESSORIES INSTALLING AND STRINGING OF EARTH WIRE, INCLUDING FIXING OF EARTH WIRE ACCESSORIES FOR THE LINE COMPLETE STRINGING OF CONDUCTOR IS TO BE DONE USING TENSION STRINGING EQUIPPMENT.	KMS.	
13	AVIATION SIGNAL SUPPLY AND ERECTION		
	a. Painting of normal tower above 45m from ground level.	Nos.	
	b. Obstruction light on normal tower (to be provided as per IS 5613)		
	I) 1 medium + 2 low intensity	Sets.	
	ii) 1 medium + 4 low intensity	Sets.	
	c. Span Marker	Nos.	
14	Any other item		

Annexure-B

FORMAT FOR REPORTING DETAILS OF POLLUTED STRECHES OF TRANSMISSION LINES:

Project: Name Of Line: Voltage Leve (kV) Total Line Length (Kms.):

Sl no.	Section Details				Source of Pollution (Indicate S.no. of source)	Distance of source of Pollution from line section	Details Source of Distance Details of pollution measurement undertaken on dummy insulators viz						Details of existing lines in vicinity w.r.t insulator design, performance & pollution measurement			
	From	To	Length of Line Section	No. of Suspension Towers			Details of Dummy Insulators			Periodicity of Measurement	SDD (mg/cm^2)	NSDD (mg/cm^2)	Voltage Level	No. & Type of Insulators per Susp. String	Performance (Indicate Category)**	Remarks ***
							Dia (mm)	Spacing (mm)	Creepage (mm)							

* Source of pollution -(a): sea, (b): power stations, (c): cement factories, (d): Fertiliser plants, (e): oil refineries, (f): brick kilns, (g):Coal mines, (h): salt farms, (i) bird drops near butcheries/ . sanctuaries, (j): fertlisers, (k): soil with high salt content, (I): Any other (Please mention)

** Performance category -(I): Satisfactory, (2): Ocassional tripouts, (3): Frequent tripollts/ line drops

***Remarks – Indicate additional information like special maintenance practices followed, levels of pollution measurements if carried out etc. For further details please refer the following Format

QUESTIONNAIRE FOR COLLECTION OF POLLUTION DATA IN RESPECT OF TRANSMISSION LINES

1. Distance from sea-Coast (Route alignment indicating distances from sea coast may be enclosed) :
2. Details of industries along the proposed route (Power stations, Cement factories, Fertiliser plants, Oil refineries Brick-klins, Coal mines, Salt Forn1s etc.) :
    a. Type of Industry :
    b. Distance from the proposed route (please mark position of industries in the route map) :
    c. Nature of pollutants. :
    d. Details of stretches of lines (in kms) expected to be affected by above industries). :
3. Details of proposed industries along the Proposed route (Data may be collected From concerned authorities) :
4. Details of existing lines in the vicinity Of proposed route alignment :
    a. Name of line, voltage level, Utility :
    b. How long in service. :
    c. Type of insulators used (Standard! Antifog) :
    d. Details of insulator strings . (Nos. per string) :
    e. Has ever pollution measurement carried out by the utility. :
    f. Any specific steps being taken to counter pollution problems (Like hot line washing, insulator surface coating, cleaning of insulators etc.) :
    g. Performance of line (No. of ; tripouts/flashovers, failure of insulators etc. as collected from concerned utiluty) :
    h. Approx. distance between the Line and proposed route. :
    i. Any other information (Corrosion of insulator pin, towers, line drops etc.) :
5. Any butcheries / Bird sanctuaries along the route Alignment where bird drops may be anticipated (indicate position of the route map) :
6. Vicinity of highways :
    a. Distance from proposed route. :
    b. Length of parallelism :
7. Any specific area along the route alignment where soil may have salt content which may affect the insulator performance (Identify area on route maps) :

8. Details of cultivated fields where fertilisers are frequently used (Identify areas on the route maps) :

9. Details of natural rain :

    a. Duration of rainy season :

    b. Extent of rain. :

10. Details of thunderstorm conditions (Very frequent/frequent/less frequent) :

11. Details of Pollution measurement if any, carried out using dummy insulators/ existing lines nearby:- :

    i. Measurement conducted on insulator - Type, dia, spacing & creepage :

    ii. SDD , :

    iii. NSDD :

    iv. Type of pollutant :

    v. Periodicity of measurement: Values corresponding to :

        a. Quaterly :

        b. Half yearly :

        c. Yearly :

        d. Two yearly :

12. Any other information. :

Annexure-C

FORMAT FOR REPORTING RESULTS OF SURVEY OF RIVER CROSSING STRETCH OF TRANSMISSION LINE

Inputs:

River crossing profile, ground profile, GL, HFL, Tower type, Reference bench mark details:

- Base width
- Slope
- Loads
- Stub sections/ Leg sections

Soil Report (up to 40m. depth)

- N Value
- Cohesion © and friction angle (Ø)
- Dry Density & Submerged density of soil
- Soil composition including bore log data.
- Soil Strata distribution details depth wise
- R.L of ground (Soil investigation and foundation location)
- Mean grain size
- Silt factor calculations
- Scour depth calculations
- Special Recommendations, if any.
- River crossing profile showing the position of R.C towers and Anchor towers with span details.
- Any other details like bunds, roads, bridges etc. with their R.L.S.

River Values

- Max. discharge
- Max. velocity (Vmax.)
- HFL
- Clear water way
- River Meandering history.
- Navigable/ Non Navigable
- Location reference of above River values for crossing details.
- River bed level. (RL)

Annexure-D

FIELD QUALITY PLAN FOR TRANSMISSION LINES

S.No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref documents	Check/Testing		Counter Check/Test By PDD, J&K	Accepting authority in PDD, J&K
					Agency	**Extent**		
1.	Detailed Survey	a. Route alignment	Optimisation of route length	a. Preliminary survey. b. Topographical map c. Tower spotting data	Contractor - do - - do -	100% at Field - do - - do -	100% based on record docuements - do -	Executive Engineer incharge
		b. Route profiling & tower spotting	1. Ground clearance. 2. Cold Wt. Span 3. Hot Wt. Span 4. Sum of Adj span (wind span) 5. Angle of Devn.	a. Sag template b. Tower Spotting data c. Route alignment	Contractor - do - - do - - do - - do -	- do - - do - - do - - do - - do -	100% based on record documents - do - - do - - do -	Line incharge

2	Check Survey	Tower Location & Final Length	i. Alignment ii. Final Length	a. Route alignment b. Tower Schedule c. Profile	Contractor	100% at Field	i). All angle towers in plains and 50% in hilly terrains ii).Final length to be checked on 100% basis based on records/documents	Section Incharge
3.	Details Soil Investigation	a. Borelog	1. Depth of bore log. 2. SPT Test 3. Collection of samples	As per Specification	Contractor	100% at Field	To witness 20% at Field	Section incharge.
		b. Tests on samples	As per tech. Specs	- do -	Lab appd by PDD, J&K	100% by testing lab	Review of lab test results	Line incharge based on the report review by Engg.

PART-II

TECHNICAL SPECIFICATION

VOL-II, SEC-IV

TOWER, FOUNDATION, ERECTION,STRINGING AND COMMISSIONING OF LINE

SECTION IV

TOWER, FOUNDATION, ERECTION, STRINGING AND COMMISSIONING OF LINE

1.0 Transmission towers

1.1 General Description of the Tower

1.1.1 The transmission towers are of self-supporting hot dip galvanised lattice steel type designed to carry the line conductors with necessary insulators, OPGWs and all fittings under all loading conditions. Outline diagram of double circuit towers are enclosed with the Specification.

1.1.2 The tower shall be fully galvanised using mild steel or/and high tensile steel sections as specified in clause no. 1.6. Bolts and nuts with spring washer are to be used for connections.

1.1.3 The tower work in scope:

Double Circuit (DA, DB, DC & DD)

1.2 The towers for 220 kV Lines are classified as given below:

Type of Tower	Deviation Limit	Typical Use
A and DA	0 deg.	To be used as tangent tower.
B and DB	0 - 15 deg.	a) Angle towers with tension insulator string. b)Also to be used for uplift force resulting from an uplift span up to 200m under broken wire conditions. c) Also to be used for Anti Cascading Condition.
B and DB	0 deg.	To be used as Section Tower.
C and DC	15 - 30 deg.	a) Angle tower with tension insulator string. b) Also to be used for uplift forces resulting from an uplift span up to 200m under broken wire condition. c) Also to be used for anti-cascading condition.
C and DC	0 deg.	To be used for transposition of transmission lines.
D and DD	30 - 60 deg.	a) Angle tower with tension insulator string. b) Also to be used for uplift forces resulting from an uplift span up to 300m under broken wire condition. c) Dead end with 0 deg to 15 deg deviation both on line side and substation side (slack span)
DE and DDE wind	0 deg.	a) Complete dead end. b) For river crossing anchoring with longer span & 0 deg. deviation on crossing span side and 0 deg to 30 deg. deviation on other side.

Note:

i) All the above towers can also be used for longer span with smaller angle of deviations without infringing ground clearance.

ii) The above table provides indicative classification of Towers. Tower spotting data for various towers to be used in Transmission lines shall be given by contractor during execution stage

1.2.1 Extensions

1.2.1.1 The single and Double Circuit towers are to be designed so as to be suitable for adding 3M, 6M and 9M body extensions/leg extensions for maintaining adequate ground clearances without reducing the specified factor of safety in any manner.

1.2.1.2 The provision for addition of 18/25M body extension to tower types A/DA and D/DD is also to be kept by the Contractor. For Crossing or any other obstacle, tower types A/DA or D/DD can be used with 18/25 M extensions depending, upon the merit of the prevailing site condition. The maximum reduced spans for A/DA and D/DD type towers shall be mentioned in the tower spotting data. However this shall, in no case be less than 250 meters.

1.2.1.3 ~~*The towers have been designed for providing unequal leg extensions. The details of unequal leg extensions provided in the design shall be indicated to the contractor during execution stage, so that proper optimization of benching / revetment requirement can be done accordingly by the contractor. The towers are designed for unequal leg extensions of 3M, 6M and 9M generally with 3M maximum leg differential and in specific cases with 6m maximum leg differential. In exceptional situations where difference in leg differential does not suit the standard unequal leg extension provisions on the tower mentioned above, then suitable chimney extension shall be provided.~~

1.2.1.4 All above extension provisions to towers and foundations shall be treated as part of normal towers and foundations only.

1.2.1.5 The leg extensions, ~~unequal leg extensions~~, chimney extensions and / or a combination of these suitable for a tower location shall be selected on the basis of techno-economics.

1.3 Span and clearances

1.3.1 Normal Span

The normal ruling span of the line is 350m for 220KV lines.

1.3.2 Wind Span

The wind span is the sum of the two half spans adjacent to the support under consideration. For normal horizontal spans this equals to normal ruling span.

1.3.3 Weight span

The weight span is the horizontal distance between the lowest point of the conductors on the two spans adjacent to the tower. For spotting of structures, the span limits given in Table 3 for 220 kV lines shall prevail.

TABLE 3
(FOR 220 kV LINE)

TOWER TYPE	NORMAL CONDITION		BROKEN WIRE CONDITION	
	MAX. (m)	MIN. (m)	MAX. (m)	MIN. (m)
DA/A	500	200	300	100
DB/B, DC/C	500	0	300	-200
DD/D	500	0	300	-300

1.3.4 In case at certain locations where actual spotting spans exceed the design spans and cross-arms and certain members of towers are required to be modified/reinforced, in that case drawings for the modified/reinforced towers will be prepared by the Contractor for approval and without any additional financial implication to Employer for the design and drawing.

1.4 Electrical Clearances

1.4.1 Ground Clearance

The minimum ground clearance from the bottom conductor shall not be less than 7015 mm for 220KV lines at the maximum sag conditions and still air.

a) An allowance of 150mm shall be provided to account for errors in stringing.

b) Conductor creep shall be compensated by over tensioning the conductor at a temperature of 26°C, lower than the stringing temperature for ACSR "ZEBRA" for 220KV transmission lines.

1.4.2 **Live Metal Clearance**

The minimum live metal clearance to be provided between the live parts and steel work of superstructure shall be as given below:

i) Under Stationery Conditions

From Tower body: 2.13m

ii) Under Swing Conditions

Wind Pressure Condition	Minimum Electrical Clearance
a) Swing Angle (15^0)	1.98 mtrs
b) Swing Angle (30^0)	1.83 mtrs
c) Swing Angle (45^0)	1.675 mtrs

The pilot insulator strings are to be used for D/DD towers only.

1.4.3 **Angle of Shielding**

The angle of shielding is defined as angle formed by the line joining the centre lines of earthwire/OPGW and outer power conductor in still air at tower supports, to the

vertical line through the centre line of the earthwire. The angle of shielding shall be maximum 30^0 for 220kV. The drop of earthwire /OPGW clamp equal to 150mm should be considered while calculating the minimum angle of protection.

1.4.4 **Mid Span Clearance**

The minimum vertical mid span clearance between the earthwire and the nearest power conductor shall not be less than 8500mm for 220kV, which shall mean the vertical clearance between the earthwire and nearest conductor under all temperatures and still air condition in the normal ruling span. Further, the tension of the earthwire/OPGW and power conductor, shall be so co-ordinated that the sag of earthwire/OPGW shall be at least 10% less than that of power conductors under all temperature loading conditions

1.5 **Tower Loading Conditions:**

a) The design of towers shall be carried out by the Contractor as per IS 802 (Part 1/section-1) 2015* considering following wind zones except for drag coefficients which shall be as per IS 802 (Part 1/section-1) 1995.

b) Terrain category shall be considered as 2
c) Reliability level shall be considered as 1 for 220kV

* As per Clause 12.1.2.1 b) 2) of IS 802:2015, Under security condition for tension and dead end towers, the transverse loads due to line deviation shall be the component of 100 percent mechanical tension of conductor and ground wire/ OPGW corresponding to 100% of design wind pressure at everyday temperature or 36% design wind pressure at minimum temperature after accounting for drag coefficient and gust response factor.

1.5.1 **Design Temperatures**

The following temperature range for the conductors and ground wires shall be adopted for line design:

i)	Minimum Temperature	:	0 deg.C
ii)	Every day temperature of conductor	:	32 deg.C
iii)	Max. temperature of		
	a) Conductor (ACSR)	:	85 deg.C
	b) Earthwire exposed to sun	:	53 deg.C

1.5.2 **Phase Configuration**

For double circuit towers the three phases shall be in vertical formation. The phase to phase spacing for conductors shall be governed by the tower design as well as minimum live metal clearances under different insulator swing angles for 220kV

1.5.3 **BOLTS AND NUTS**

1.5.3.1 The minimum bolt spacing and rolled edge distance and sheared edge distance from the centers of bolt holes to be maintained are given below:-

Diameter of Bolt (mm)	Hole Diameter (mm)	Min. Bolt Spacing (mm)	Min. Rolled Distance (mm)	Min. Sheared Edge Distance (mm)
16	17.5	40	20	23
24	25.5	60	33	38

Bolts sizes mentioned above shall only be used. The minimum width of the flanges without bolt holes shall be 30 mm

1.5.3.2 For the purpose of calculating shearing stress and bearing stress for bolts clause 5.6 of IS: 802 (Part-1/Sec 2):1992 shall be referred.

1.6 **Design Calculation and Drawings**

1.6.1 The following design calculation and drawings are required to be furnished to the Employer:

A) Alongwith the bid:

i) Detailed design calculations and drawings for DA (as applicable) type tower of WZ – IV for package along with Proto Type Test reports

ii) Line diagram of all the tower types indicating live metal clearances, ground clearance , mid span clearance, shielding angle etc. as applicable in the package.

iii) Typical foundation sketches adopted for various types of soil. Bidder has to furnish along with the bid one sample calculation for one type of foundation for Towers at A i) above .

The above are for assessing the availability of tested tower design and foundation with the bidder as well as present design capability of the Bidder and should not be construed as review /approval of correctness of drawings/designs by the Employer. Subsequent to the award, successful Bidder shall have to comply to the technical specifications irrespective of the designs/ submitted at the bidding stage without any financial implication to the Employer.

B) After award of contract:

Approved copy of design /drawing of towers meeting all technical specification stipulations from utility along with proto type test report shall be submitted to purchaser for approval. .

In case of non-availability of tested design, the Contractor shall submit detailed design of tower & extension alongwith stress diagram / computer output together with sample calculations for few critical members etc., stub templates and loading / rigging arrangement of tower testing to enable the Employer to make a preliminary check regarding structural stability of tower (before) tests.

1.6.2 After successful testing of tower and subsequent approval of design, drawings and bill of materials, the Contractor shall furnish the following in ten (10) copies to the Employer for necessary distribution with in fifteen(15) days after approval of drawings:

a) Detailed design calculation and drawing for all towers & their extensions and foundations.

b) Detailed structural drawings indicating section size, length of members, sizes of plates along with hole to hole distance & joint details etc.

c) Bill of materials, indicating cutting and bending details against each member.

d) Shop drawings showing all details relevant to fabrication.

e) All the drawings for the tower accessories.

1.6.3 The Contractor is required to submit four copies of the drawings as mentioned in clause 2.6.2 for Employer's approval. While submitting the designs, structural drawings bill of materials and any other drawing pertaining to the subject transmission line, the Contractor shall clearly indicate on each drawing RECTPCL Specification No., Name of the transmission line and project , letter reference No. and date on which the submission are made. The same practice is also to be followed while submitting distribution copies.

1.6.4 The design and drawings as covered in clause 2.6.1 (B) above shall be approved / commented by the Employer as the case may be within twenty eight (28) days of receipt of design / drawings in Employer office. If the design / drawings are commented by the Employer, the Contractor shall submit revised designs / drawings with in fifteen (15) days of date of issue of comments.

1.6.5 The Contractor is required to furnish the progress of submissions and approvals of designs and drawings on twenty fifth day of every month till the completion of all the design activities.

The details shall include description of design / drawing, schedule date of submission, actual date of submission schedule date of approval ,actual date of approval, schedule date of submission of distribution copies, actual date of submission of distribution copies, schedule date of tower test, actual date of tower test and 'Remarks' column. Provision of six additional columns shall also be made in the above progress report to indicate date of comments issued by the Employer and details of submission of revised designs / drawings.

1.6.6 The tower accessories drawings like name plate, danger plate, phase plate, circuit plate, anticlimbing device, step bolt, D-shackle etc. shall also be prepared by the Contractor and shall be submitted to the Employer, in three copies, along with one reproducible, for record. These drawings shall be prepared in A4 size only.

1.6.7 All the drawings shall have a proper name plate clearly displaying the name of Employer on right hand bottom corner. The approval for exact format of the nameplate shall be obtained by the successful bidder from the Employer for adopting the same on all the drawings. Also all the drawings shall carry the following statement and shall be displayed conspicuously on the drawing:

WARNING: THIS IS PROPRIETORY ITEM AND DESIGN RIGHT IS STRICTLY RESERVED WITH EMPLOYER. UNDER NO CIRCUMSTANCES THIS DRAWING SHALL BE USED BY ANYBODY WITHOUT PRIOR PERMISSION FROM RECTPCL IN WRITING.

1.7 Joints shall be so designed so as to avoid eccentricity. The use of gusset plates for jointing tower member shall be avoided as far as possible. However, where connections are such that the elimination of the gusset plates would result in eccentric joints then gussets plates and spacer plates may be used in conformity

with modern practices. The thickness of the gusset plate, required to transmit stress, shall not be less than that of the thinnest of connected member but not less than 5 mm in any case.

1.8 Materials

1.8.1 Tower Steel Sections

1.8.1.1 IS Steel Sections of tested quality of conformity with IS: 2062 (Designated Yield Strength. 250 MPa) and/ or IS: 8500 grade 490 (Designated Yield Strength 350 MPa) are to be used in towers, extensions, stubs and stub setting templates. For snow zone towers, MS & HT Steel Sections shall conform to E250 Grade C & Grade E350 Grade C respectively The steel used for fabrication of towers shall be manufactured by Primary steel producers only.

1.8.1.2 Steel plates below 6mm size exclusively used for packing plates/packing washers produced as per IS: 1079 (Grade-0) are also acceptable. However, if below 6mm size plate are used as load bearing plates viz. gusset plates , joint splices etc. the same shall conform to IS : 2062 or equivalent standard meeting mechanical strength/metallurgical properties corresponding to grade E250 or above grade (designated yield strength not more than 355MPa), depending upon the type of grade incorporated into design. Flats of equivalent grade meeting mechanical strength/ metallurgical properties may also be used in place of plates for packing plates/ packing washers. The chequered plates shall conform to IS : 3502. SAILMA 350HI grade plate can also be accepted in place of HT plates (EN 10025 grade S355 JR/JO / IS 2062:2011 – grade E350, as applicable) provided SAILMA 350HI grade plate meet all the mechanical properties of plate as per EN 10025 grade S355 JR/JO (designated yield strength 355 MPa) / IS 2062: 2011 – grade E350.

1.8.1.3 For designing of towers, preferably rationalised steel sections may be used. During execution of the project, if any particular section is not available, the same shall be substituted by higher section. Any cost on account of the same shall be borne by the Contractor. However, design approval for such substitution shall be obtained from the Employer before any substitution and records of such substitutions shall be maintained by the Contractor.

1.8.2 Fasteners: Bolts, Nuts and Washers

1.8.2.1 All tower members shall be joined together with Bolts and nuts. The redundant members of first two (2) panels from ground level shall be connected with Anti-theft bolts and nuts along with spring washers whereas the balance joints shall be connected with hexagonal bolts and nuts. All hexagonal bolts and nuts shall conform to IS-12427. They shall have hexagonal head and nuts, the heads being forged out of the solid, truly concentric, and square with the shank, which must be perfectly straight.

All bolts and nuts shall be galvanised as per IS: 1367 (Part-13)/IS: 2629.

1.8.2.1 The bolt shall be of 16/24 mm diameter and of property class 5.6 as specified in IS: 1367 (Part-III) and matching nut of property class 5.0 as specified in IS:1367 (Part-VI).

1.8.2.2 Bolts up to M16 and having length up to 10 times the diameter of the bolt should be manufactured by cold forging and thread rolling process to obtain good and reliable mechanical properties and effective dimensional control. The shear strength of bolts for 5.6 grade should be 310 MPa minimum as per IS: 12427. Bolts should be provided with washer face in accordance with IS: 1363 (Part-I) to ensure proper bearing.

1.8.2.4 Nuts for hexagonal bolts should be double chamfered as per the requirement of IS: 1363 Part-III. It should be ensured by the manufacturer that nuts should not be over tapped beyond 0.4mm oversize on effective diameter for size up to M16.

1.8.2.5 Fully threaded bolts shall not be used. The length of bolts shall be such that the threaded portion will not extend into the place of contact of the members.

1.8.2.6 All bolts shall be threaded to take the full depth of the nuts and threaded for enough to permit firm gripping of the members, but not further. It shall be ensured that the threaded portion of each bolt protrudes not less than 3mm and not more than 8mm when fully tightened. All nuts shall fit tight to the point where the shank of the bolt connects to the head.

1.8.2.7 Flat and tapered washers shall be provided wherever necessary. Spring washers shall be provided for insertion under all nuts. These washers shall be steel electro-galvanized, positive lock type and 3.5mm in thickness for 16mm dia. bolt and 4.5mm for 24mm bolt.

1.8.2.8 To avoid bending stress in bolts or to reduce it to minimum, no bolt shall connect aggregate thickness of members more than three (3) times its diameter.

1.8.2.9 The bolt positions in assembled towers shall be as per structural drawing.

1.8.2.10 Bolts at the joints shall be so staggered that nuts shall be tightened with spanners without fouling.

1.8.2.11 To ensure effective in-process Quality control it is desirable that the manufacturer should have in house testing facility for all tests like weight of zinc coating, shear strength and other tests etc. The manufacturer should also have proper Quality Assurance System which should be in line with the requirement of this specification and IS: 14000 series Quality System Standard.

1.9 Tower Accessories

Arrangement shall be provided for fixing of all tower accessories to the tower at a height between 2.5 meters and 3.5 meters above the ground level.

1.9.1 Step Bolts & Ladders

Each tower shall be provided with step bolts conforming to IS: 10238 of not less than 16mm diameter and 175mm long spaced not more than 450mm apart and extending from 2.5 meters above the ground level to the top of the tower. However, the head diameter shall be 50mm as indicated in the enclosed drawing. For Single circuit tower the step bolt shall be fixed on one leg up to waist level and on two diagonally opposite legs above waist level up to top of the towers. For double circuit tower the step bolt shall be fixed on two diagonally opposite legs up to top of the towers. Each step bolt shall be provided with two nuts on one end to fasten the bolt

securely to the tower and button head at the other end to prevent the feet from slipping away. The step bolts shall be capable of withstanding a vertical load not less than 1.5 KN. For special towers, where the height of the super structure exceeds 50 meters, ladders along with protection rings as per the approved design shall be provided in continuation of the step bolts on one face of the tower from 30 meters above ground level to the top of the special structure. From 2.5m to 30m height of super structure step bolts shall be provided. Suitable platform using 6mm thick perforated chequered plates along with suitable railing for access from step bolts to the ladder and from the ladder to each cross-arm tip and the ground wire support shall also to be provided. The platform shall be fixed on tower by using counter-sunk bolts.

1.9.2 **Insulator Strings and E/W/OPGW Clamps Attachments**

a) For the attachment of suspension Insulator string, a suitable dimensioned swinging hanger on the tower shall be provided so as to obtain specified clearances under respective swinging condition of the strings. The hanger, extensions links, D-shackles etc. as required shall be of same rating/strength as that of corresponding rating/Ultimate Tensile Strength of Insulator String. The design and supply of hanger, D-shackles, strain plate, extension link etc. are also in the scope of Contractor.

b) At tension towers, strain plates of suitable dimensions under each cross-arm tip, shall be provided for taking the hooks or D-shackles of the tension insulator strings. Full details of the attachments shall be provided to the contractor. To achieve requisite clearances, if the design calls for providing extra D-shackles, link plate etc. before connecting the insulator string the same shall be supplied by the Contractor.

1.9.3 **E/W/OPGW Clamps Attachments**

a) Suspension Clamp

Wherever required, the Contractor shall supply U – bolts, D – Shackles etc. for attachment of Suspension clamp to the tower.

b) Tension Clamps

Peaks of tension towers shall be provided with suitable plates to accommodate the shackle of tension clamps.

1.9.4 **Anti Climbing Device**

Barbed wire type anti climbing device, as per enclosed drawing shall be provided and installed by contractor for all towers and installed by the Contractor for all towers. The barbed wire shall conform to IS-278 (size designation A1). The barbed wires shall be given chromating dip as per procedure laid down in IS:1340.

1.9.5 **Danger, Number, Circuit and Phase plate**

Danger Plates, Circuit plates, Phase Plates and Number plates shall be provided and installed by the Contractor. These Danger/Number/Phase/ circuit Plate shall be as per drawing enclosed in the section of drawing. The contractor shall submit distribution copies of the same endorsing the package details (i.e. line name, LOA No. etc.) and installed by the Contractor.

a) Each tower shall be fitted with a danger plate, number plate, circuit plate and a set of phase plates for single circuit tower and two sets of phase plates for double circuit tower. The transposition towers should have provision of fixing phase plates on both the transverse faces.

3 The letters, figures and the conventional skull and bones of danger plates shall conform to IS-2551 and shall be in a signal red on the front of the plate.

4 The corners of the danger, number and circuit plates shall be rounded off to remove sharp edges.

d) The letters of number and circuit plates shall be red enameled with white enameled background.

1.9.5.1 **Bird Guard**

To prevent birds perching immediately above the suspension insulator strings (I type) and fouling the same with dropping, suitable bird guards shall be provided at all suspension towers. In case of I string Bird Guard as per IS 5613 shall be provided at cross arm tips. The typical drawing of Bird Guard is attached at the drawing section of this specification. Suitable provision of cleat/plate to be provided on all suspension towers facilitating installation of bird guard after stringing.

1.9.6 Aviation Requirements

1.9.6.1 Aviation requirements conforming to IS: 5613 shall be in the scope of Contractor, wherever indicated in BPS.

1.9.6.2 Night Markers (Obstruction lights)

1.9.6.2.1 The scope of night markers covers the design, manufacture, testing at manufacturers works, if any, supply, delivery, erection, testing and commissioning of medium intensity, low intensity, lights along with storage battery & solar panel, control panel, cables, clamps other accessories etc. as per the provision of IS-5613 (Part-II/ section-I), 1989, amendment no. 1, July'94 regarding night & day visual aids for denoting transmission line structures as per the requirement of directorate of flight safety.

1.9.6.2.2 The detail of each component of medium intensity, low intensity lights & associated accessories to be provided on the towers shall be as per the technical specifications given in the preceding clauses and IS/ICAO, International Standards recommended practices.

1.9.6.2.3 One set of Aviation Lights shall consist of one medium intensity light & two/four (as applicable) low intensity lights along with all accessories such as solar panel, control panel, batteries, cables etc.

1.9.6.2.4 Medium Intensity Light

Medium Intensity light shall be provided on the top of each tower. The medium light should have night time intensity as per ICAO requirements in international Standards Recommended Practices. The light on top of the structure should flash at the rate of 20 sequences per minute. The effective intensity during night time for the medium flashing light shall be 1600 CD. The light shall conform to ICAO requirements/BS 3224a and shall have weather protection conforming to IP-55.

The above lights conforming to ICAO specifications flashing red lights shall be DC operated through a suitably sized battery bank at the operating voltage 12V/24V DC. The burning life of the lamps shall be maximum possible in view of the maintenance hazard of H.T. live but in no case it should be less than 15,000 burning hours. In case of failure of the lamp before 15,000 burning hours, the same shall have to be replaced by the Contractor free of cost. The light shall be equipped with radio suppression facility conforming to BS800 in order to avoid any interference with signals of PLCC etc.

1.9.6.2.5 Low Intensity Lights

Two/four (as applicable) nos. of low intensity lights are required to be put on each of the towers. Placement drawing for the same shall be submitted by the bidder Contractor.

The light shall be stationary lamp with minimum effective intensity of 10 CD. of red light. The lamps shall conform to the ICAO requirement/relevant BS and shall have weather protection of minimum IP-55 class.

Two/four nos. of L.I. lamp required for each tower shall be operated through a suitable size common battery bank solar panel as per the requirement of operating voltage and load current of the type of lamps being offered.

The burning life of the lamps shall be maximum possible in view of the maintenance hazard of H.T live line, but in no case it should be less than 15,000 burning hours. In case of failure of the lamp before 15,000 hrs., the same shall have to be replaced by the Contractor free of cost even if the pendency of contract expires. Performance certificate of the lamps to be offered shall be furnished by the Contractor.

The low intensity lamp shall not generate any R.F. which can interfere with the PLCC signals.

1.9.6.2.6 Storage Battery

Storage Battery required for the above purpose shall be sealed maintenance free, valve regulate lead acid and suitable for mounting on the top of the transmission line towers. Contractors shall offer the most optimum capacity of the Battery Bank at 120 hour discharge rate (considering 80 % percentage usage) matching with the load requirement of the type of lamps being offered including any power loss in the associated cables. The battery sizing shall conform to JISC 8707/relevant Indian Standard or any other internationally recognized standard. The battery shall be hermetically sealed explosion proof and self-resealing type and free from orientation constraints. The working temperature ranges shall be minimum 0 degree centigrade and maximum 50 degree centigrade. Performance certificate of the offered batteries shall be submitted by the Contractor.

1.9.6.2.7 Battery Box

The battery box suitable for mounting on 220/400kV power transmission tower shall be robust construction suitable to accommodate desired number of SOLAR BATTERIES WITH proper clearance between the batteries. The sides and the top of the battery box shall be made from MS sheets not less than 14 SWG thick duly mounted on MS angle frame. The bottom of the battery box shall have suitably designed MS structure to freely hold the total weight of the batteries. The batteries should be placed on insulated base with proper drainage holes. Lifting lugs shall be provided. Dust and vermin proof lockable doors shall be provided for safety and easy access to the batteries for the maintenance. The battery box should incorporate the design for proper ventilation system in order to prevent a gas concentration inside the box. The ventilation opening shall be protected against rain/splash water and dust. The inside of the battery box shall be lined with insulating polyurethane plating and the exterior painted with weather proof polyurethane paint. The cable entry into the battery box shall be through suitable cable glands.

1.9.6.2.8 Solar Modules

Solar module required for the system shall be suitable for mounting on the transmission line towers and shall be designed for high performance, maximum reliability and minimum maintenance and shall be installed below bottom cross arms levels. The solar modules shall be IP 55 grade protection class. These should be highly resistant to water, abrasion, nail, impact and other environmental factors.

These should be placed on the tower at a most optimum angle so as to harness the maximum solar energy and facilitate self cleaning and shall conform to relevant Indian/International Standards.

Module mounting frames shall be weather proof suitable for mounting on tall towers. Details of mounting frames shall be furnished by the Contractor.

Junction box shall be provided with weather proof hinged lid with provision for cable glands entry and protections grade of class IP-55.

The Contractor shall submit the basis of selecting the numbers of solar modules.

The provision for design, supply & erection of mounting arrangements for photovoltaic modules on the transmission towers in a suitable manner to harness maximum solar energy shall be in the scope of the Contractor.

Provision for design, supply & erection of resting platform for the erection of battery bank in a closed enclosure with safety arrangement on the transmission towers shall also be in the scope of the Contractor the design and load consideration for safety of towers due to additional plate form shall be kept in view while designing, selecting the above.

1.9.6.2.9 Control Panels

Control panels shall consist of solar charge controller, flasher unit, sensor, isolator, MCB, Voltmeter, Ammeter and other control gears. Panel enclosure shall be fabricated out of 14 SWG CRCA sheet and thoroughly treated and

painted. Suitable neoprene rubber gasket and pad locking device shall be provided and the protection class shall be of IP-55 class.

The Solar charge controller shall be most efficient and preferably fully solid state. It shall be provided with protection to load against increase in temperature, Surge, automatic low voltage and automatic disconnection and reconnection during high inrush current and normalcy respectively.

The flash regulator shall be provided for regulating light flashing. The same shall be completely solid state and provided with flash rate set points. The protection against overload current shall also be provided.

Necessary sensor/timer shall be provided in the system to "switch on" the light automatically in the evening and poor visibility period and switch off the same during day time and normal visibility period.

1.9.6.2.10 Cables, Cable Glands, Conduits and Accessories

The cable to be supplied and erected shall be of multi strands copper conductor, weather proof, PVC insulated PVC sheathed, armoured 1.1 KV grade. The same shall conform to IS: 1554.

All the cable accessories such as thimble, glands etc. shall be in the scope of supply and erection of the Contractor.

Supply and erection of all the PVC conduits and accessories shall be in the scope of the contract. All the conduit and accessories shall be as per the relevant ISS or ISI brand.

The inter-connection cable/conduit will be clamped in a secured manner with the tower members and any interconnection should be made only inside the environmentally protected junction box.

1.9.6.2.11 Earthing

All the installations on the tower shall be securely and properly earthed with the tower body by using flexible copper braided wire. Cost of earthing material shall deemed to be included in the total cost.

1.10 Tower Fabrication

The fabrication of towers shall be in conformity with the following:

1.10.1 Except where hereinafter modified, details of fabrication shall conform to IS: 802 (Part-II) or the relevant international standards.

1.10.2 The tower structures shall be accurately fabricated to connect together easily at site without any undue strain on the bolts.

1.10.3 No angle member shall have the two leg flanges brought together by closing the angle.

1.10.4 The diameter of the hole shall be equal to the diameter of bolt plus 1.5mm.

1.10.5 The structure shall be such that all parts are accessible for inspection and cleaning. Drain holes shall be provided at all points where pockets of depression are likely to hold water.

1.10.6 All steel sections before any work is done on them, shall be carefully leveled, straightened and made true to detailed drawings by methods which will not injure the materials so that when assembled, the adjacent matching surfaces are in close contact throughout. No rough edges shall be permitted in the entire structure.

1.10.7 Drilling and Punching

1.10.7.1 Before any cutting work is started, all steel sections shall be carefully straightened and trued by pressure and not by hammering. They shall again be trued after being punched and drilled.

1.10.7.2 Holes for bolts shall be drilled or punched with a jig but drilled holes shall be preferred. The punching may be adopted for thickness up to 16mm. Tolerances regarding punch holes are as follows:-

a) Holes must be perfectly circular and no tolerances in this respect are permissible.

b) The maximum allowable difference in diameter of the holes on the two sides of plates or angle is 0.8mm i.e. the allowable taper in a punched hole should not exceed 0.8mm on diameter.

c) Holes must be square with the plates or angles and have their walls parallel.

1.10.7.3 All burns left by drills or punch shall be removed completely. When the tower members are in position the holes shall be truly concentric / matching to each other. Drilling or reaming to enlarge holes shall not be permitted.

1.10.8 Erection mark

1.10.8.1 Each individual member shall have erection mark conforming to the component number given to it in the fabrication drawings. The mark numbers shall be marked with marking dies of 16mm size before galvanising and shall be legible after galvanising,

1.10.8.2 Erection Mark shall be A-BB-CC-DDD

A = *Employer's* code assigned to the Contractors - Alphabet

BB = Contractor's Mark-Numerical

CC = Tower Type Alphabet.

DDD = Number mark to be assigned by Contractor - Numerical.

Erection mark for high tensile steel members shall be prefixed by the letter "H"

2.0 Quantities and weights

2.1 The quantities of the following items have been envisaged in Metric Tonne (MT) in the relevant price Schedules for various types of towers:-

i) Basic Body.

ii) Body Extensions.

iii) Leg Extension.

iv) Stubs & Cleats

v) Bolts & Nuts including spring washers and step bolts etc.

During detail engineering, proto assembly of each of the above items shall be inspected and approved by RECTPCL and subsequently shall be released for fabrication and manufacturing as per the Technical Specification by the Contractor. The manufacturing of the above items shall be taken up in such a manner that the Equipment/Material offered for inspection to RECTPCL are on completed tower basis for each type of tower, completed Stubs & Cleats set basis so as to facilitate availability of erectable tower of each type and erectable stubs & cleats set for casting of foundation. After inspection of the offered Equipment/Material by RECTPCL representative(s), CIP shall be issued by RECTPCL for the material meeting the Technical Specification. However, MICC shall be issued only on Completed Tower Basis for each type of tower (comprising the required Basic Body, body extensions wherever required, four (4) equal or defined unequal Leg Extension, Bolts & Nuts along with Packing and Spring Washers) and on completed Stubs & Cleats set basis for each type of tower foundations (comprising a set of stubs & Cleats, required Bolts and Nuts along with Spring Washers).

Accordingly, the payment shall be released on completed Tower Basis for each type of tower (comprising the Basic Body, body extensions, wherever applicable, bolts & nuts along with spring washer and step bolts, unequal leg extensions wherever applicable for a completed tower) and on completed Stubs and Cleats set basis for each type of foundation (comprising a set of stubs & cleats, required Bolts and nuts along with Spring Washers) based on the weight of the tower parts as calculated and fasteners based on the unit rates incorporated in the contract.

2.2 The provisional quantities required are mentioned in the respective Schedules of BPS. Final quantities shall be determined after completion and approval of the detailed route survey. The final quantities of tower shall be confirmed by the Employer based on the requirement of quantities of various towers furnished by the Contractor after completion of detailed survey. Hence it will be responsibility of the Contractor to intimate the exact requirement of all towers and various line materials required for line immediately after the survey.

The Employer reserves the right to order the final quantities including reasonable quantities of spares for which the rates quoted in the Bid shall be valid. Regarding quantity variation the provisions of relevant clauses of SCC shall apply.

2.3 The estimated total weight of tower/tower parts as well as bolts & nuts along with spring washers and step bolts to be supplied by the Contractor under various packages have been envisaged in the relevant Price Schedule. Though fully galvanised tower parts are to be supplied, the weight of tower shall mean the weight of tower calculated by using the black sectional (i.e. ungalvanised) weight of steel members of the size indicated in the approved fabrication drawings and bill of materials, without taking into consideration the reduction in weights due to holes, notches and level cuts etc. but taking into consideration the weight of the D shackles, hangers, strain plates, pack plates, gusset plates and pack washers etc. The weight of stub and cleats also shall be calculated in similar manner. The weight of gusset plates shall mean the weight of its

circumscribing rectangle, without taking into considerations the reductions in weight due to holes, notches etc. For bolts and nuts along with spring washers and step bolts, the weight per tower shall be calculated from the bolt schedule applicable to each type of towers and body extensions as approved by the Employer. The rate quoted by the bidder for tower/tower parts supply, is deemed to be inclusive of galvanising charges including the cost of zinc.

2.4 The contractor is permitted to get inspected and supply up to 2.5% extra fasteners to take care of losses during erection. No payment shall be admissible for these extra supplies.

3.0 Galvanising

3.1 Fabricated Tower Parts & Stubs

The tower parts, stubs and pack washers shall be hot dip galvanized. The galvanization shall be done as per requirements of IS: 4759 after all fabrication work is completed. The contractor shall also take guidelines from the recommended practices for hot dip galvanizing laid down in IS: 2629 while deciding and implementing galvanizing procedure. The mandatory requirements however, are specified herein.

Unless otherwise specified the fabricated tower parts and stubs shall have a minimum overall Zinc coating of 610 gms per sq. m of surface except for plates below 5mm which shall have Zinc coating of 460 gms per sq. m of surface. The average zinc coating for sections 5mm & above shall be maintained as 87 microns and that for sections below 5mm shall be maintained as 65 microns.

The zinc coating shall be adherent, reasonably uniform, smooth, continuous and free from imperfections such as black / bare spots, ash rust strains, bulky white deposits / wet storage strains and blisters.

The surface preparation for fabricated tower parts and stubs for hot dip galvanizing shall be carried out as indicated herein below:

(i) Degreasing & Cleaning of Surface: Degreasing and cleaning of surface, wherever required, shall be carried out in accordance with clause 4.1 of IS 2629-1985. After degreasing the article shall be thoroughly rinsed. However, if acidic degreasers are used rinsing is not required.

(ii) Pickling: Pickling shall be done using either hydrochloric or sulphuric acid as recommended at clause 4.3 of IS 2629-1985. The actual concentration of the acids and the time duration of immersion shall be determined by the Contractor depending on the nature of material to be pickled. Suitable inhibitors also shall be used with the acids to avoid over pickling. The acid concentration, inhibitors used, and maximum allowable iron content shall form part of plant standard to be formulated and submitted to employer along with Quality Assurance Program.

(iii) Rinsing: After pickling, the material shall be rinsed, preferably in running water to remove acid traces, iron particles or any other impurities from the surface. Two rinse tanks are preferable, with water cascading from the second tank to the first to ensure thorough cleaning. Wherever single tank is employed, the water shall be periodically

changed to avoid acid contamination, and removal of other residue from the tank.

(iv) Fluxing: The rinsed article shall be dipped in a solution of Zinc ammonium chloride. The concentration and temperature of the flux solution shall be standardized by the contractor depending on the article to be galvanized and individual circumstances. These shall form part of plant standard to be formulated and submitted to employer along with Quality Assurance Program. The specific gravity of the flux solution shall be periodically monitored and controlled by adding required quantity of flux crystals to compensate for drag-out losses. Free acid content of the flux solution also shall be periodically checked and when it is more than two (2) grams of free acid per litre of the solution, it shall be neutralized. Alternatively, PH value should be monitored periodically and maintained between 5.0 to 5.5.

(v) Drying: When dry galvanizing is adopted the article shall be thoroughly dried after fluxing. For the purpose of drying, the contractor may use hot plate, air oven or any other proven method ensuring complete drying of the article after fluxing and prior to dipping in the molten zinc bath. The drying process shall be such that the article shall not attain a temperature at which the flux shall get decomposed. The article thus dried shall be galvanized before the flux coating picks up moisture from the atmosphere or the flux layer gets damaged or removed from the surface. The drying procedure, time duration, temperature limits, time lag between fluxing, drying, galvanizing etc. shall form part of plant standard to be formulated and submitted to employer along with Quality Assurance Program.

(vi) Quality of Zinc: Any one or combination of the grades of zinc specified in IS: 209 or IS: 13229 or other comparable international standard shall be used for galvanizing. The contractor shall declare the grade(s) of zinc proposed to be used by them for galvanizing. The molten metal in the zinc bath shall contain minimum 98.5 % zinc by mass. It shall be periodically measured and recorded. Zinc aluminum alloy shall be added as per IS: 2629.

(vii) Dipping Process: The temperature of the galvanizing bath shall be continuously monitored and controlled. The working temperature of the galvanizing bath shall be maintained at 450+/ - 10 degree C .The article should be immersed in the bath as rapidly as possible without compromising on safety aspects. The galvanizing bath temperature, immersion angle & time, time duration of immersion, rate of withdrawal etc. shall be monitored and controlled depending upon the size , shape, thickness and chemical composition of the article such that the mass of zinc coating and its uniformity meets the specified requirements and the galvanized surface is free from imperfections and galvanizing defects.

(viii) Post Treatment: The article shall be quenched in water. The quench water is to be changed / drained periodically to prevent corrosive salts from accumulating in it. If water quenching is not done then necessary cooling arrangements should be made. The galvanized articles shall be

dipped in chromating solution containing sodium dichromate and sulphuric acid or chromic acid base additive at a predetermined concentration and kept at room temperature to retard white rust attack. The temperature of the chromate solution shall not exceed 65 degree C. The articles shall not be stacked immediately after quenching and dichromating. It shall be ensured that the articles are dry before any further handling operation.

(ix) Storing, Packing and Handling: In order to prevent white rust formation sufficient care should be exercised while storing handling and transporting galvanized products. The articles shall be stored in an adequately ventilated area. The articles shall be stored with spacers in between them and kept at an inclination to facilitate easy drainage of any water collected on the articles. Similar care is to be taken while transporting and storing the articles at site.

The Contractor shall prepare a detailed galvanizing procedure including Flow Chart with control parameters and all plant standards as required above and submit to RECTPCL for approval as part of Quality Assurance Plan.

3.1.2. Fasteners.

For fasteners, the galvanizing shall conform to IS-1367(Part-13). The galvanizing shall be done with centrifuging arrangement after all mechanical operations are completed. The nuts, may however be tapped (threaded) or rerun after galvanizing and the threads oiled .The threads of bolts & nuts shall have a neat fit and shall be such that they can be turned with finger throughout the length of the threads of bolts and they shall be capable of developing full strength of bolts. Spring washers shall be electro galvanized as per Grade-IV of IS-1573.

4.0 Earthing

Each tower shall be earthed. The tower footing resistance shall not exceed 10 ohms. The Contractor shall measure the tower footing resistance (TFR) of each tower during dry weather after it has been erected and before the stringing of the OPGW. Pipe type earthing and counter poise type earthing shall be done as required in accordance with the following standards:

IS: 3043 Code of practice for Earthing

IS: 5613 Code of practice for Design, Installation and maintenance (Part-II/Section-2) of overhead power lines.

4.1 The drawings for pipe & counterpoise type earthing are enclosed with these specifications.

4.1.1 For counterpoise type earthing, the earthing will vary depending on soil resistivity. For soil resistivity less than 1500 ohms-meter, earthing shall be established by providing 4 lengths of 30m counterpoise wire. Otherwise, for soil resistivity greater than 1500 ohms meter earthing shall be established by providing 4 length of 70m counterpoise wire. The contractor shall also measure tower footing impedance using high frequency Tower footing impedance measurement kit, an addition to Tower footing resistance (TFR). The value of

Tower footing resistance as well as tower footing impedance shall not exceed 10 Ohms.

4.1.2 For pipe type earthing, length of flat indicated in the drawing is indicative only and actual length shall vary depending on site requirement (to avoid fouling of pipe type earthing with foundation base slab). The payment for the pipe type earthing shall be as per the unit rates in the Final BPS of the Contract Agreement irrespective of the length of flat

4.1.3 The provisional quantities for pipe type earthings and counterpoise earthing are indicated in the BPS. The bidders are required to quote unit rates for the same in appropriate schedule of BPS. The quoted price shall include fabrication, supply and installation of earthing material including supply of coke, salt etc. In case of counterpoise type earthing, the unit rates shall correspond to 120 meters of counterpoise wire per tower.

4.4 Earthing for River Crossing Towers / Pile foundation

Galvanised earthing strip of flat 50 x 6 mm is to be provided in two legs of tower for each location with proper arrangement of connecting these strips by 16mm bolts shall be provided in the stubs. For pile foundation, the strip has to be taken up to scour level along the concrete of pile foundations. Only bolted connections are allowed for connecting this strip to achieve desired length. Contractor shall submit the detailed drawing for approval of Owner before installations.

5.0 Inspection and Tests

5.1 General

All standard tests, including quality control tests, in accordance with appropriate Indian / International Standard, shall be carried out unless otherwise specified herein.

5.1.1 Inspection

In addition to the provision of this Specification, the following shall also apply:

5.1.1.1
a) The Contractor shall keep the Employer informed in advance about the time of starting and of the progress of manufacture and fabrication of various tower parts at various stages, so that arrangements could be made for inspection.
b) The acceptance of any part of items shall in no way relieve the Contractor of any part of his responsibility for meeting all the requirements of the Specification.

5.1.1.2 The Employer or his representative shall have free access at all reasonable times to those parts of the Contractor's works which are concerned with the fabrication of the Employer's material for satisfying himself that the fabrication is being done in accordance with the provisions of the Specification.

5.1.1.3 Unless specified otherwise, inspection shall be made at the place of manufacture prior to dispatch and shall be concluded so as not to interfere unnecessarily with the operation of the work.

5.1.1.4 Should any member of the structure be found not to comply with the supplied design, it shall be liable to rejection. No member once rejected shall be resubmitted for inspection, except in cases where the Purchaser or his authorised representative considers that the defects can be rectified.

5.1.1.5 Defect which may appear during fabrication shall be made good with the consent of, and according to the procedure proposed by the Contractor and approved by the Employer.

5.1.1.6 All gauges and templates necessary to satisfy the Purchaser shall be supplied by the Contractor.

5.1.1.7 The specified grade and quality of steel shall be used by the Contractor. To ascertain the quality of steel used, the inspector may at his discretion get the material tested at an approved laboratory.

6.0 Tower Load Tests

6.1 Testing of Tower

A Galvanized tower of each type complete with +9M extension for 220kV shall be subjected to design and destruction tests by first applying test loads applied in a manner approved by the Employer. The tower shall withstand these tests without showing any sign of failure or permanent distortion in any part. Thereafter the tower shall be subjected to destruction by increasing the loads further in an approved manner till it fails. The tower shall be tested for all the conditions considered for the design of tower. The Contractor shall submit to the Employer, for approval, the detailed programme and proposal for testing the towers showing the methods of carrying out the tests and manner of applying the loads. After the Employer has approved the test procedures and programmes the Contractors will intimate the Employer about carrying out the tests at least 30 days in advance of the scheduled date of tests during which the Employer will arrange to depute his representative to be present at the time of carrying out the tests. Six copies of the test reports shall be submitted. The Contractor shall submit one set of shop drawings alongwith the bill of materials at the time of prototype tower testing for checking the tower material. Further at the time of submitting test report, the contractor has to submit the final drawings of shop drawings and Bill of materials for Employer's reference and record. The type testing charges shall be released only after approval of test report, structural drawings, bill of material and shop drawings of tower.

6.1.1 In case of premature failure the tower shall be retested and steel already used in the earlier test shall not be used again. However, in case of minor failures, the contractor can replace the members with higher section and carry out the testing. The Contractor shall provide facilities to the Employer or their representatives for inspection of materials during manufacturing stage and also during testing of the same.

6.1.2 In case of any premature failure even during waiting period, the tower is to be retested with rectified members. However, if the failures are major in nature and considerable portion of tower is to be re-erected, in such cases all the tests which has been carried out earlier are required to be re-conducted again in compliance with Specification.

6.1.3 No part of any tower subject to test shall be allowed to be used on the line. The price for the tower tests will be quoted after allowing rebate for the scrap value of the tower material which will be retained by the Contractor.

6.1.4 The Contractor shall ensure that the specification of materials and workmanship of all towers actually supplied conform strictly to the towers which have successfully under gone the tests. In case any deviation is detected, the Contractor shall replace such defective towers free of cost to the Employer. All expenditure incurred in erection, to and fro transportation and any other expenditure or losses incurred by Employer on this account shall be full born by the Contractor. No extension in delivery time shall be allowed on this account.

6.1.5 Each type of tower to be tested shall be a full scale prototype galvanized tower and shall be erected vertically on rigid foundation of the stub protruding above ground level as provided in the design/drawing between ground level and concrete level. This portion of the stub shall be kept un-braced while testing. The tower erected on test bed shall not be out of plumb by more than 1 in 360.

6.1.6 All the measuring instruments shall be calibrated in systematic / approved manner with the help of standard weight / device. Calibration shall be done before commencing the test of each tower up to the maximum anticipated loads to be applied during testing.

6.1.7 The suspension tower is to be tested with an arrangement similar to 'I' string. The tension tower is to be tested with strain plate as per approved design / drawings.

6.1.8 The sequence of testing shall be decided by the Employer at the time of approving the rigging chart / test data sheet.

6.1.9 The Employer may decide to carry out the tensile test, bend test etc. as per the relevant IS on few members of the test tower after completion of the test or in case of any premature failure. The Contractor shall make suitable arrangement for the same without any extra cost to the Employer.

6.1.10 Prefix 'T' shall be marked on all members of test tower in addition to the Mark No. already provided.

6.2 **Method of Load Application**

6.2.1 Loads shall be applied according to the approved rigging arrangement through normal wire attachments angles on bent plates.

6.2.2 The various types of loads, transverse, vertical and longitudinal shall be applied in such a way that there is no impact loading on the tower due to jerks from the winches.

6.2.3 All the loads shall be measured through a suitable arrangement of strain devices or by using weights. Positioning of the strain devices shall be such that the effect of pulley friction is eliminated. In case the pulley friction cannot be avoided, the same will be measured by means of standards weights and accounted for in the test loads.

6.3 **Tower Testing Procedure**

The procedure for conducting the tower test shall be as follows:

6.3.1 **Bolt Slip Test**

In a bolt slip test the test loads shall be gradually applied up to the 50% of design loads under normal condition, kept constant for two (2) minutes at that loads and then released gradually.

For measurement of deflection the initial and final readings on the scales (in transverse & longitudinal directions) before application and after the release of Loads respectively shall be taken with the help of theodolite. The difference between readings gives the values of the bolt slip.

6.3.2 **Normal Broken Wire Load Tests**

All the loads, for a particular load-combination test, shall be applied gradually upto the full design loads in the following steps and shall also be released in the similar manner:

25 percent,

50 percent,

75 per cent,

90 percent,

95 percent and

100 percent

6.3.3 **Observation Periods**

Under normal and broken wire load tests, the tower shall be kept under observation for sign of any failure for two minutes (excluding the time of adjustment of loads) for all intermediate steps of loading up to and including 95 percent of full design loads.

For normal, as well as broken wire tests, the tower shall be kept under observation for five (5) minutes (excluding the time for adjustment of loads) after it is loaded up to 100 percent of full design loads.

While the loading operations are in progress, the tower shall be constantly watched, and if it shows any tendency of failure anywhere, the loading shall be immediately stopped, released and then entire tower shall be inspected. The reloading shall be started only after the corrective measures are taken.

The structure shall be considered to be satisfactory, if it is able to support the specified full design loads for five (5) minutes, with no visible local deformation after unloading (such as bowing, buckling etc.) and no breakage of elements or constitute parts.

Ovalization of holes and permanent deformation of bolts shall not be considered as failure.

6.3.4 Recording

The deflections of the tower in transverse and longitudinal directions shall be recorded at each intermediate and final stage of normal load and broken wire load tests by means of a theodolite and graduated scale. The scale shall be of about one meter long with marking up to 5 mm accuracy.

6.3.5 Destruction Test

The destruction test shall be carried out under normal condition or broken wire condition. Under which load condition the destruction test is to be carried out shall be intimated to the contractor at the time of approving rigging chart / test data sheet.

The procedure for application of load for normal/broken wire test shall also be applicable for destruction test. However, the load shall be increased in steps of five (5) per cent after the full design loads have been reached.

6.3.5.1 Type tests specified above shall not be required to be carried out if a valid test certificate is available for a similar design meeting all technical specification requirements. The tests certificate shall be considered valid if

Tests certificate issued thereof by the Test Agency to the contractor approved by the representative(s) of any utility.

In the event of any discrepancy in the test report (i.e., any test not applicable due to any design/manufacturing change including substitution of components or due to non-compliance with the requirement stipulated in the Technical Specifications), the tests shall be conducted by the contractor at no extra cost to the Employer.

6.3.5.2 Type test charges for type test indicated above are deemed to be included in fabrication charges quoted by bidder.

7.0 Packing

7.1 Angle section shall be wire bundled.

7.2 Cleat angles, gusset plates, brackets, fillet plate, hanger and similar loose pieces shall be tied and bolted together in multiples or securely wired through holes.

7.3 Bolts, nuts washers and other attachments shall be packed in double gunny bags accurately tagged in accordance with the contents.

7.4 The packing shall be properly done to avoid losses & damages during transit. Each bundle or package shall be appropriately marked.

8.0 Standards

8.1 The design, manufacturing, fabrication, galvanising, testing, erection procedure and materials used for manufacture and erection of towers, design and construction of foundations shall conform to the following Indian Standards (IS) / International Standards which shall mean latest revisions, with amendments / changes adopted and published, unless specifically stated otherwise in the Specification. In the event of supply of material conforming to Standards other than specified, the Bidder shall confirm in his bid that these Standards are equivalent to those specified. In case of award, salient features of comparison

between the Standards proposed by the Bidder and those specified in this document will be provided by the Contractor to establish their equivalence.

1.9.2 The material and services covered under these specifications shall be performed as per requirements of the relevant standard code referred hereinafter against each set of equipment and services. Other internationally acceptable standards which ensure equal or higher performance than those specified shall also be accepted.

Sl. No.	Indian Standards (IS)	Title	Internationally recognised Standards/Guides
1.	IS: 209-1992	Specification for Zinc	ISO/R/752 ASTM B6
2.	IS: 278-1991	Galvanised Steel Barbed wire	ASTM A131
3.	IS 800-1991	Code of Practice for General Building Construction in Steel	CSA 6.1
4.(a)	IS:802(Part1) Sec 1-1995 Sec 2-1992	Code of Practice for General Building Construction in Steel in Overhead Transmission Line Towers : Materials, loads and Permissible Stresses Section 1 Materials and loads Section 2 Permissible stresses.	ASCE 52 IEC 826 BS 8100
4.(b)	IS : 802-1990 (Part 2)	Code of practice for use of structural steel in over-head Transmission Line: Fabrication, Galvanising, Inspection and Packing	ASCE 52
4.(c)	IS:802-1990 (Part 3)	Code of practice for use of Structural Steel in over-load Transmission Line Towers Testing	ASCE 52 IEC 652
5.	IS:808-1991	Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections.	
6.	IS:875-1992	Code of Practice for Design Loads (other than Earthquakes) for Buildings and Structures.	
7.	IS:1363-1990	IS: 1363-1990 Hexagon Nuts (size range M5 to M36)	
8.	IS:1367-1992	Technical Supply Conditions for Threaded Steel/ Fasteners	
9.	IS:1477-1990	Code of practice for Painting of Ferrous Metals in Buildings: Part-I Pre-treatment: Part-II Painting.	

10.	IS:1573-1991	Electro-Plated Coatings of zinc on iron and Steel	
11.	IS:1852-1993	Rolling and Cutting Tolerances of Hot Rolled Steel Products	
12.	IS-1893-1991	Criteria for Earthquake Resistant Design of Structures	IEEE 693
13.	IS:2016-1992	Plain Washers ISO/R887	ANSIB18-22.1
14.	IS:2062-1992	Steel for general structural purposes	
15.	IS:2074-1992	Ready Mixed Paint. Air Drying, Red Oxide, Zinc Chrome, Priming Specification.	
16.	IS:2551-1990	Danger Notice Plates	
17.	IS:2629-1990	Recommended Practice for Hot Dip Galvanising of iron and steel.	
18.	IS:2633-1992	Method of Testing Uniformity of Coating of Zinc Coated Articles	ASTM A123 CSA G164
19.	IS:3043-1991	Code of Practice for Earthing	
20.	IS:3063-1994	Single coil Rectangular section Spring Washers for Bolts, Nuts Screws	DIN-127
21.	IS:3757-1992	High Strength Structural Bolts	
22.	IS:4759-1990	Specification for Hot zinc coatings on structural steel and other Allied products	
23.	IS:5369-1991	General Requirements for Plain Washers	
24.	IS:5613-1993	Code of Practice for Design installation and Maintenance of Overhead Power Lines Section 1 Design Part 2, Section 2 Installation and Maintenance	
25.	IS:6610-1991	Specification for Heavy Washers for Steel structures.	
26.	IS:6623-1992	High Strength Structural Nuts	
27.	IS:6639-1990	Hexagon Bolts for Steel Structure.	ASTM A394 CSA B334

28.	IS:6745-1990	Method for Determination of weight of Zinc coated iron and Steel Articles.	ASTM A90
29.	IS:8500-1992	Specification for Weldable Structural Steel (Medium & High Strength Qualities)	
30.	IS:10238-1989	Step Bolts for Steel Structures	
31.	IS:12427-1988	Bolts for Transmission Line Towers	
32.		Indian Electricity Rules.	
33.	Publication No. 19(N)/700	Regulation for Electrical Crossing of Railway Tracks	

2.0 Foundations

2.1 The foundation shall generally be of open cast type. Reinforced Cement concrete footing shall be used for all types of towers in conformity with the present day practices and the specification laid herein. Footings for all the four legs (without unequal chimney extension) of the tower and their extension shall be similar, irrespective of down thrust and uplift. The total depth of foundation, below ground level shall be 3.0 meters

2.2 Foundation includes supply of all labour, tools & machineries, materials such as cement, sand, coarse aggregates and reinforcement steel. Rates quoted for foundations in appropriate schedules shall include transportation of construction materials to site, excavation, stub setting, concreting, reinforcement, shoring, shuttering, dewatering, stock piling, dressing, curing, backfilling the foundation after concreting with excavated / borrowed earth (irrespective of leads), consolidation of earth and carriage of surplus earth to the suitable point of disposal as required by the Employer or any other activities related to completion of foundation works.

2.3 Classifications of Foundations:

Classification of foundation and design of foundation shall depend upon the type of soil, sub soil water level and the presence of surface water which have been classified as follows:

2.3.1 Normal dry

To be used for locations where normal dry cohesive or non-cohesive soils are met. Foundations in areas where surface water encountered from rain runoff or agricultural fields (except paddy fields) shall also be classified as normal dry.

2.3.2 Sandy Dry Soil

To be used for locations where cohesion less pure sand or sand with clay content less than 10% met in dry condition. If the clay content is more than 10 % met in dry condition, the foundation shall be classified as Normal Dry.

2.3.3 Wet

To be used for locations:

a) Where sub-soil water is met between 1.5 meters from the ground level and the depth of foundation below the ground level.

b) Which are in surface water for long period with water penetration not exceeding one meter below the ground level e.g. paddy fields.

2.3.4 Partially Submerged

To be used at locations where sub-soil water table is met between 0.75 meter and 1.5metre below the ground level.

2.3.5 Fully Submerged

To be used at locations where sub-soil water table is met at less than 0.75 meter below the ground level.

2.3.6 Submerged Black Cotton Soil

To be used at locations where soil is clayey type, not necessarily black in colour, which shrinks when dry and swells when wet, resulting in differential movement. For designing foundations, for such locations, the soil is considered submerged in nature.

2.3.7 **Dry Black Cotton Soil**

To be used at locations where soil is clayey type, not necessarily black in colour, which shrinks when dry and swells when wet, resulting in differential movement. For designing foundations, for such locations, where no sub-soil water is met upto the depth of foundation.

2.3.8 **Wet Black Cotton Soil**

To be used at locations where soil is clayey type, not necessarily black in colour, which shrinks when dry and swells when wet, resulting in differential movement. For designing foundations, for such locations, where sub-soil water is met between 1.5 meters and the depth of foundation below the ground level

2.3.9 **Fissured - Rock**

To be used at locations where decomposed or fissured rock, hard gravel, kankar, limestone, laterite or any other soil of similar nature is met. Under cut type foundation is to be used for fissured rock locations.

In case of fissured rock locations, where water table is met at 1.5M or more below ground level, wet fissured rock foundations shall be adopted. Where fissured rock is encountered with subsoil water table less than 1.5 meter below

ground level, submerged fissured rock foundations shall be adopted. In case of dry locations dry fissured rock foundations shall be adopted.

In case of fissured rock locations, where there is no sub-soil water within the foundation depth but which are in surface water for long period with water penetration not exceeding one meter below the ground level e.g. paddy fields/cultivated field, Paddy Fissured Rock foundation shall be adopted. However, if water penetration due to surface water is more than one meter below ground level, the adoption of suitable foundation shall be decided by site In-charge in consultation with engineering deptt.

2.3.10 **Hard Rock**

The locations where chiseling, drilling and blasting is required for excavation for monolithic rock for a particular leg/tower, Hard rock type foundations are to be used. For these locations rock anchoring is to be provided to resist uplift forces.

For quoting prices of Hard Rock foundations, Rock level shall be assumed at 1.5 meters below the ground level. Due to change in Rock level, no extra payment shall be payable on account of increase in concrete volume, excavation volume and weight of reinforcement, also no recovery shall be made if the actual volume of concrete, excavation and weight of reinforcement are less than that quoted in Schedule of prices. However, for design purpose, Rock level shall be considered at ground level and no over burden soil weight shall be considered for resisting the uplift.

2.3.11 The sub-soil water table is not constant and its level changes during different seasons due to various factors. In case during soil investigation/trial pit or during excavation, if wet soil / fissures rock is encountered within the foundation depth, it is to be considered that water table has been encountered (considering that water table had reached that level sometime in past) and accordingly type of foundation shall be classified.

2.3.11 Where soil is of composite in nature, classification of foundation shall be according to the type of soil predominant in the foundation pit**.**

2.3.12 The foundation classification at any particular location shall be based on the type of soil (clay / sandy / silt / fissured rock etc) and water table, presence of surface water, etc. at the location. However, in case of locations which are in vicinity of rivers, depending upon case to case, type of foundation is to be decided considering other aspects also e.g in case RL (reduced level) of a location in comparison to the HFL is lower and there is possibility of submergence at the time of floods due to absence of river bunds / protection etc., FS type foundation with suitable raised chimney is to be adopted. Further in case there is a possibility of change in river course, considering the nature and turbulence of probable water flow and subsequent scouring of soil, pile type or special foundation may be considered for these locations.

2.4 Design of Foundations

2.4.1 Loads on Foundations

2.4.1.1 The foundations shall be designed to withstand the specific loads of the superstructure and for the full footing reactions obtained from the structural stress analysis in conformity with the relevant factors of safety.

2.4.1.2 The reactions on the footings shall be composed of the following type of loads for which these shall be required to be checked:

a) Max. Tension or uplift along the leg slope.

b) Max. Compression or down-thrust along the leg slope.

c) Max. Horizontal shear or side thrust.

2.4.1.3 Overload Factor for Foundation Loads:

The overload factor for foundation loads shall be considered as 1.1 i.e. the reaction on the foundations shall be increased by 10 percent.

2.4.2 Stability Analysis

2.4.2.1 In addition to the strength design, stability analysis of the foundation shall be done to check the possibility of failure by over-turning, uprooting, sliding and tilting of the foundation.

2.4.2.2 The following primary types of soil resistance shall be assumed to act in resisting the loads imposed on the footing in earth:

A) Resistance Against Uplift

The uplift loads will be assumed to be resisted by the weight of earth in an inverted frustum of a conical pyramid of earth of this Section on the footing pad whose sides make an angle equal to the angle of repose of the earth with the vertical, in average soil. The weight of concrete embedded in earth and that above

the ground will also be considered for resisting the uplift. In case where the frustum of earth pyramids of two adjoining legs super-imposed each other, the earth frustum will be assumed truncated by a vertical plane passing through the centre line of the tower base.

B) Resistance Against Down Thrust

The down-thrust loads combined with the additional weight of concrete above earth will be resisted by bearing strength of the soil assumed to be acting on the total area of the bottom of the footings.

C) Resistance Against Side-Thrust

The lateral load capacity of a chimney foundation shall be based on chimney acting as a cantilever aided by passive earth resistance developed 500 mm below the ground level.

The chimney shaft shall be reinforced for the combined action of axial force, tension and compression and the associated maximum bending moment. In these

calculations, the tensile strength of concrete shall be ignored. The contribution of stub for chimney designed shall be considered as per latest CBIP Manual.

The increase in vertical toe pressure due to maximum bending moment at the bottom of the slab shall be taken into account and the base itself shall be designed for structural adequacy. In this case, the allowable vertical toe pressure may be increased by 25%. The unit weight of reinforced concrete is stipulated in Table 2-2.

2.5 Design Criteria

2.5.1 As per IS: 456-2002 Partial safety factor shall be considered 1.5 for concrete and 1.15 for steel.

2.5.2 The overload factors for open type foundations shall be as 1.1 i.e. all the reactions (compression, tension and side thrust) on foundations shall be increased by 10 percent for development of foundation design.

2.5.3 The physical properties of soil under various conditions are furnished in TABLE 2.3 to be considered for the design of foundations. These type of foundations correspond to list of foundations furnished in Schedule of prices VOL III.

2.5.4 The composite rate shall be paid to the contractor for above foundations irrespective of approved design volumes except for Gantry, Single circuit & Multi circuit towers for which payment shall be made on mutually agreed rates to be derived on the basis of rates available in the Contract during execution stage. Further, once the foundations are classified based on the preponderant soil, extra claim is not admissible for excavation in different kinds of soil encountered inside the pit.

However, it may be noted that the soil properties furnished in TABLE 2.3 are tentative in nature. After soil investigations, if it is found that the foundations listed in Schedule of Prices Vol. III cannot be used at that location; new foundation design shall be developed by the Contractor based on properties furnished in soil report.

Any such foundations required during execution of the project and authorised by the Employer, shall have to be carried out by the Contractor for which payment shall be made on mutually agreed rates to be derived on the basis of rates available in the Contract during execution stage.

2.5.5 The foundation shall be designed such as to satisfy the following conditions:

2.5.6 The thickness of concrete in the chimney portion of the tower footing would be such that it provides minimum cover of not less than100 mm from any part of the stub angle to the nearest outer surface of the concrete in respect of all dry locations limiting the minimum section of chimney to 300 mm square .In respect of all wet location, the chimney should have all around clearance of 150 mm from any part of stub angle limiting to 450 mm square minimum.

2.5.7 The chimney top or muffing must be at least 225 mm above ground level and also the coping shall be extended up to lower most joint level between the bottom lattices and the main corner legs of the tower. .

2.5.8 The centroidal axis of slab shall coincide with the axis of the chimney and pass through the center of foundation base. The design of the foundation (base slab and its reinforcement) shall take into account the additional stresses in the foundation resulting from the eccentricity introduced due to non-compliances of this requirement.

2.5.9 At least 100 mm thick pad of size equal to the base of slab with its sides vertical will be provided below the slab for R.C.C. type foundations.

2.5.10 In case of reinforced concrete slab, the slab thickness should not be less than 300 mm.

2.5.11 The minimum distance between the lowest edge of the stub angle and the bottom surface of concrete footing shall not be less than 100 mm or more than 150 mm in case of dry locations and not less than 150 mm or more than 200 mm in case of wet locations.

2.5.12 The total depth of open type foundations below the ground level shall not be less than 1.5 meters and more than 3.0 meters.

2.5.13 The portion of the stub in the slab shall be designed to take full down-thrust or uplift loads by the cleats combined with the bond between stub angles and slab concrete. The Contractor shall furnish the calculation for uprooting of stub along with the foundation design. Bolted cleat angles evenly spaced in sets of 4 along all sides of embedded portion of the stub shall be provided to act as shear connector with sufficient number of bolts.

2.5.14 In case of R.C.C. foundations are having steel reinforcement in base slab, at least 50 mm. thick pad of lean concrete corresponding to 1:3:6 nominal mixes shall be provided to avoid the possibility of reinforcement rod being exposed due to unevenness of the bottom of the excavated pit.

2.5.15 The base slab of the foundation shall be designed for additional moments developing due to eccentricity of the loads.

2.5.16 The additional weight of concrete in the footing below ground level over the earth weight and the full weight of concrete above the ground level in the footing and embedded steel parts will also be taken into account adding to the down thrust.

TABLE 2.3

PROPERTIES OF SOIL	**ULTIMATE BEARING CAPACITY KN/M2(Kg/M2)**	**ANGLE OF REPOSE DEGREE**
1. For Normal Soil		
(a) Normal Dry Soil	**268 (27350)**	**30~~25~~**
(b) Wet Soil Due to Presence of Subsoil/Surface Water	134 (13675)	15~~10~~

(c) Black cotton Soil Due to Presence of Subsoil/Surface Water and dry condition		134 (~~12500~~**13675)**	0
(d) Sandy Soil			

2.	**WEIGHT OF EARTH for Normal soil and black cotton soil**	**UNIT**	**VALUE**
	(a) Dry	KN/M3 (Kg/M3)	14.12 (1440)
	(b) In presence of Surface Water	KN/M3 (Kg/M3)	14.12 (1440)
	(c) In presence of Subsoil Water	KN/M3 (Kg/M3)	9.22 (940)
3.	**FISSURED ROCK**		
	(a) Ultimate Bearing Capacity (both for Dry & Wet Fissured Rock)	KN/M2 (Kg/M2)	613 (62500)
	(b) WEIGHT OF FISSURED ROCK		
	i) Dry	KN/M3 (Kg/M3)	14.12 (1440)
	ii) In presence of Subsoil Water	KN/M3 (Kg/M3)	9.22 (940)
	(c) ANGLE OF REPOSE		
	i) Fissured Rock in Dry Portion	Degrees	20
	ii) Fissured Rock in Presence of Water	Degrees	10
4.	**HARD ROCK**		
	a) Ultimate Bearing Capacity	KN/M2 (Kg/M2)	1225.83 (125000)
	b) Ultmate Bond between steel & Rock	KN/M2 (Kg/M2)	0.147 (15)

The above soil properties of the earth will be measured by the Contractor at the various locations in conformity with the standard method of testing and the foundation design will be revised suiting the site conditions from such tests.

2.6 Properties Of Concrete

The cement concrete used for the foundations shall generally be of grade M-20 having 1:1.5:3 nominal volumetric mix ratio with 20mm coarse aggregate for chimney portion and 20mm/40mm aggregates for pyramid or slab portion. All the properties of concrete regarding its strength under compression, tension, shear, punching and bending etc. as well as workmanship will conform to IS: 456.

All the properties of concrete regarding its strength under compression, tension, shear, punching and bending etc. as well as workmanship will conform to IS: 456.

2.6.1 The weight of concrete to be considered for design of foundations is given in TABLE 2-2.

TABLE 2.2

WEIGHT OF CONCRETE.

TYPE OF CONCRETE	WEIGHT OF DRY REGION KN / M3(Kg/m3)	WEIGHT IN PRESENCE OF SUB-SOIL WATER KN / M3(Kg/m3)
Plain Concrete	21.96 (2240)	12.16 (1240)
Reinforced Concrete	23.54 (2400)	13.73 (1400)

2.6.2 The Quantity of minimum cement to be used per unit quantity of consumption for different mix (nominal mix) of concrete should be as follows:

Sl.no.	Description	Unit	Quantity of Minimum cement to be used per Unit quantity of work (in kgs)
1.	1:1.5:3 nominal mix concrete	Cu.m.	400
2.	1:2:4 nominal mix concrete	Cu.m.	320
3.	1:3:6 nominal mix concrete	Cu.m.	220
4.	Random Rubble Masonry with 1:6 cement mortar	Cu.m.	83

In this regard utilisation record is to be maintained at site.

2.6.3 Alternatively, Ready Mix concrete from batching plant as per IS 4925 can also be used with no extra payment and without any recovery. However Cement content shall be as per IS 456. The ready mix concrete shall conform to IS: 4926. The selection and use of Materials for the ready mix concrete shall be in accordance with IS: 456. The concrete shall be of M20 grade design mix as per IS: 456. The transport of concrete and transportation time shall be as per IS: 4926.

2.6.4 a) Cement used shall be ordinary Portland Cement, unless mentioned otherwise, conforming to the latest Indian Standard Code IS: 269 or IS: 8112 or IS: 12269.

b) Alternatively, other varieties of cement other than ordinary Portland Cement such as Portland Pozzolana Cement conforming to IS; 1489 (latest edition) or Portland Slag Cement conforming to IS:455 (Latest edition) can also be used. The Contractor shall submit the manufacturer's certificate, for each consignment of cement procured, to the Employer. However Employer reserves the right to direct the Contractor to conduct tests for each batch/lot of cement used by the Contractor and Contractor will conduct those tests

free of cost at the laboratory so directed by the Employer. The Contractor shall also have no claim towards suspension of work due to time taken in conducting tests in the laboratory. Changing of brand or type of cement within the same structure shall not be permitted without the prior approval of the Employer. Sulphate Resistant Cement shall be used if sulphate content is more than the limits specified in IS: 456, as per Geotechnical investigation report.

The curing Time of cement shall be as per IS 456

2.6.5 Concrete aggregates shall conform to IS: 383-1970.

2.6.6 The water used for mixing concrete shall be fresh, clean and free from oil, acids and alkalies, organic materials or other deleterious substances.

2.6.7 Reinforcement shall conform to IS: 1786 for deformed and cold twisted bars **(Fe500)**. **If mentioned in BPS, epoxy coated reinforcement confirming to IS: 13620 shall be used**. **Thermo Mechanically Treated (TMT) bars (equivalent grade) in place of cold twisted bars are also accepted. Hard drawn steel wire shall conform to IS 432**. All reinforcement shall be clean and free from loose mill scales, dust, loose rust, and coats of paint, oil or other coatings, which may destroy or reduce bond. Contractor shall supply either prefabricated reinforcement or fabricate at site and place reinforcement to shapes and dimensions as indicated or as required to carry out the intent of approved foundation drawings and Specifications. **Spacers, chairs, stays, hangers, overlaps and annealed steel wire for binding etc. as may be necessary, should be used for proper completion of the foundation job as per requirement. Spacers or chairs should be placed at a maximum spacing of 1m and closer spacing shall be provided wherever necessary.**

2.7 Construction of Tower Foundation, Stub Setting and Earthing

2.7.1 Excavation

2.7.1.1 The excavation work for foundations shall be taken up by the contractor progressively stretch wise / section wise after obtaining approval from Employer for the proposed stretch wise / section wise tower schedule, profile etc. as per detailed survey along the approved route alignment.

2.7.1.2 Except as specifically otherwise provided, all excavation for footings shall be made to the lines and grades of the foundations. The excavation wall shall be vertical and the pit dimensions shall be based on an assumed clearance of 150mm on all sides of the foundation pad. For footings with undercut, care shall be taken to carry out excavation as per drawing without any side clearance. All excavation shall be protected so as to maintain a clean sub grade and provide worker safety until the footing is placed, using timbering, shoring, shuttering, dewatering etc. as approved by the Employer. Contractor shall especially avoid disturbing the bearing surface of the pad. Any sand, mud, silt or other undesirable materials which may accumulate in the excavated pit or borehole shall be removed by Contractor before placing concrete.

2.7.1.3 The soil to be excavated for tower foundations shall be classified as follows depending upon the physical state of the soil at the time of excavation irrespective of the type of foundation installed.

a) Dry Soil

Soil removable either manually, by means of a spade and shovel or mechanically by proclaims, excavators etc.

Excavation done in dry soil for wet, partially submerged, fully submerged and wet black cotton type of foundations shall also be covered under this

b) Wet Soil

Where the subsoil water table is encountered within the range of foundation depth or land where pumping or bailing out of water is required due to presence of surface water shall be treated as wet soil. The excavation done in wet soil in case of wet, partially submerged, fully submerged and wet black cotton type of foundation shall also be covered under this.

c) Dry Fissured Rock

Limestone, laterite, hard conglomerate or other soft or fissured rock in dry condition which can be quarried or split with crowbars, wedges, pickaxes etc. However, if required, light blasting may be resorted to for loosening the material but this will not in any way entitle the material to be classified as hard rock.

d) Wet Fissured Rock

Above fissured rock, when encountered with subsoil water within the range of foundation depth or land where pumping or bailing out of water is required, shall be treated as wet fissured rock.

e) Hard Rock

Any rock excavation, other than specified under fissured rock above, for which blasting, drilling, chiseling are required. The unit rate quoted for hard rock excavation shall be inclusive of all costs for such drilling (including drilling required for anchoring), chiseling and blasting, etc.

2.7.1.4 No extra payment shall be admitted for the removal of fallen earth into a pit or borehole once excavated.

2.7.1.5 Where rock is encountered, the holes for tower footings shall preferably be drilled. Blasting where resorted to as an economy measure, shall be done with utmost care to minimise fracturing rock and using extra concrete for filling the blasted area. All necessary precautions for handling and use of blasting materials shall be taken. In cases where unnecessarily large quantities are excavated / blasted, resulting in placement of large volumes of concrete, payment of concrete shall be limited to design volumes of excavation, concreting, reinforcement etc. In case where drilling is done, the stubs may be shortened suitably with the approval of the Employer.

2.7.1.6 The Contractor shall arrange & supply requisite blasting material, and be responsible for its storage and use without any extra cost to the Employer.

2.7.1.7 Indian Standard IS: 3764 shall be followed regarding safety of excavation work.

2.8 Unit Rates and Measurement for Foundation

2.8.1 The indicative shape of foundations is enclosed in this Specification. The bidder is required to quote the unit rates for different foundation activity namely, excavation for different types of soils, concreting, supply and placement of reinforcement steel and stub setting in the BPS.

2.8.2 The unit rates of excavation for each type of soil shall include excavation along with all associated activities like shoring, shuttering, dewatering till completion of foundation work stock piling, dressing, back filling of foundations after concreting with excavated/borrowed earth (irrespective of lead) and consolidation of earth, carriage of surplus earth to the suitable point of disposal as required by the Employer or any other activity required for to completion of foundation work in all respect.

The measurement for excavation shall be made on the basis of design excavation volume arrived at considering dimension of pit leaving 150mm gap around (except for undercut foundations) the base pad or actually excavated whichever is less and the unit rate of this item as indicated in Letter of Award. The payment for excavation shall be made as per actual type of soil encountered at the time of excavation, but the total payment for excavation portion shall not exceed the amount as payable for excavation considering the soil type same as that of foundation classification. The decision of the Employer shall be final and binding with respect to classification of soil and foundations.

2.8.3 Form boxes shall be used for casting of foundations. The unit rate of concreting shall include the cost of supply, fabrication and placement of form boxes, cement, water, coarse and fine aggregates mixing and placing of concrete, curing of concrete and any other activities related / required for completion of concreting works of foundation. The payment for this item shall be made as per the actual volumes of concreting completed but limited to design volume based on unit rates indicated in the letter of award.

2.8.4 The unit rate of 'Reinforcement Steel' shall include supply and placement of reinforcement steel, stirrups, wire for binding the reinforcement, chairs, bolsters and spacers etc. as required to complete the foundation work. The measurement of reinforcement steel for payments shall be made based on the calculated weight of reinforcement steel in tones corrected to third place of decimal as per relevant Indian Standard and as per working drawing or the quantity of reinforcement steel actually used, whichever is less. No allowance permitted towards wastage.

2.9 Setting of Stubs

2.9.1 The stubs shall be set correctly and precisely in accordance with approved method at the exact location, alignment and levels with the help of stub setting templates and leveling instruments. Stubs setting shall be done in the presence of Employer's representative available at site where required and for which adequate advance intimation shall be given to Employer by Contractor. Tolerances as per provisions of IS: 5613 shall be allowed for stub setting.

2.9.2 Setting of stub at each location shall be approved by Employer.

2.9.3 However, in hilly region for towers with unequal leg extensions and for river crossing towers, props may be used with complete accuracy and high skilled supervision, subject to prior approval from Employer.

2.9.4 For all towers the Contractor shall submit for approval the proposed method for setting of stubs.

2.9.5 Stub Setting Templates / Props

2.9.5.1 Stub setting templates shall be arranged by the Contractor at his own cost for all heights of towers. Stub templates shall be of adjustable type. The Contractor shall also arrange for props for setting of stubs at specific locations where use of prop is approved by the Employer. Stub templates / props should be painted.

2.9.5.2 The Contractor shall deploy sufficient number of templates / props for timely completion of the line without any extra cost to Employer.

2.9.5.3 However following minimum number of stub setting templates may be deployed by the Contractor for every 100km of line length subject to minimum of 5 templates for suspension tower:

	Templates for tower type	**Nos. to be deployed**
i)	A/DA	10
ii)	For each type of B/DB, C/DC and D/DD type	3
iii)	For A/DA +18/25 M	1
iv)	for D/DD+18/25 M	1

However, if more templates are required for timely completion of the lines, the Contractor shall deploy the same without any extra cost to Employer.

The number of sets of prop (if permitted) to be supplied, will depend as per actual site condition and completion schedule of line.

2.9.5.4 One set of each type of stub setting template / props (if used) shall be supplied to the Employer, on completion of the project, at no extra cost to Employer.

2.10 Mixing, Placing and Compacting of Concrete

2.10.1 The concrete shall be mixed in the mechanical mixer. However, in case of difficult terrain, hand mixing may be permitted at the discretion of the Employer. The water for mixing concrete shall be fresh, clean and free from oil, acids and alkalis. Saltish or blackish water shall not be used.

2.10.2 Mixing shall be continued until there is uniform distribution of material and mix is uniform in colour and consistency, but in no case the mixing be carried out for less than two minutes. Normal mixing shall be done close to the foundation but exceptionally, in difficult terrain**,** the concrete may be mixed at the nearest convenient place. The concrete shall be transported from the place of mixing to the place of final deposit as rapidly as practicable by methods which shall prevent the segregation or loss of any ingredient. The concrete shall be placed and compacted before setting commences.

2.10.3 To avoid the possibility of reinforcement rods being exposed due to unevenness of the bottom of the excavated pit, a pad of lean concrete 50mm thick and corresponding to a 1:3:6 nominal mix shall be provided at the bottom of the pad.

2.10.4 Form boxes shall be used for casting all types of foundations except at an undercut interface for which the adjoining subsurface material shall provide adequate support.

2.10.5 The concrete shall be laid down in 150mm layers and consolidated well, so that the cement cream works, up to the top and no honey-combing occurs in the concrete. A mechanical vibrator shall be employed for compacting the concrete. However, in case of difficult, terrain, manual compaction may be permitted at the discretion of the Employer. Monolithic casting of foundations must be carried out. However, in case of unavoidable circumstances, a key construction joint can be provided at the chimney-pad interface subject to approval of the Employer. However nothing extra shall be paid to the Contractor for providing such construction joints. After concreting the chimney portion to the required height, the top surface should be finished smooth with a slight slope towards the outer edge for draining rain water.

2.10.6 Wet locations shall be kept completely dewatered, both during and 24 hours after placing the concrete, without disturbance of the concrete.

2.10. 7 If minor defects in concrete surface is found after the form work has been removed, the damage shall be repaired with a rich cement sand mortar to the satisfaction of the Employer before the foundation is back filled.

2.11 Curing

The concrete shall be cured by maintaining the concrete wet for a period of at least 10 days after placing. Once the concrete has set for 24 hours the pit may be backfilled with selected moistened soil and well consolidated in layers not exceeding 200mm thickness and thereafter both the backfill earth and exposed chimney shall be kept wet for the remainder of the prescribed 10 days. The exposed concrete chimney shall also be kept wet by wrapping gunny bags around it and wetting the bags continuously during the critical 10 days period.

2.12 Backfilling and Removal of Stub Templates

2.12.1 After opening of formwork and removal of shoring, timbering, etc., backfilling shall be started after repairs, if any, to the foundation concrete. Backfilling shall normally be done with the excavated soil, unless it is a clay type or it consists of large boulders/stones, in which case the boulders shall be broken to a maximum size of 80-mm. At locations where borrowed earth is required for backfilling, Contractor shall bear the cost irrespective of leads & lift.

2.12.2 The backfilling materials shall be clean and free from organic or other foreign materials. A clay type soil with a grain size distribution of 50% or more passing the no. 200 sieve are unacceptable for backfilling. The earth shall be deposited in maximum 200mm layers, levelled, wetted if necessary and compacted properly before another layer is deposited. The moisture content for compaction shall be based on the Proctor compaction test results given in the Geo-technical Report, Clause 3.0 of section III. The density of the compacted backfill material may further be verified to the satisfaction of the Employer based on the sand-cone method described in the ASTM D1556-82 standard.

2.12.3 The backfilling and grading shall be carried to an elevation of about 75mm above the finished ground level to drain out water. After backfilling 50mm high, earthen embankment (band) will be made along the sides of excavation pits and sufficient water will be poured in the backfilling earth for at least 24

hours. After the pits have been backfilled to full depth the stub template can be removed.

2.13 Benching

When the line passes through hilly/undulated terrain, levelling the ground may be required for casting of tower footings. All such activities shall be termed benching and shall include cutting of excess earth and removing the same to a suitable point of disposal as required by Employer. Benching shall be resorted to only after approval from Employer. Volume of the earth to be cut shall be measured before cutting and approved by Employer for payment purposes. Further, to minimise benching, unequal leg extensions shall be considered and provided if found economical. The proposal shall be submitted by the Contractor with detailed justification to the Employer.

2.14 Protection of Tower and Tower Footing

2.14.1 Tower shall be spotted such that the quantity of revetment is optimum. For tower locations in undulated terrain such as hill / mountain slopes, options like use of unequal leg extensions for towers, unequal chimney extensions etc. shall be explored by the contractor for optimizing the need for revetment & benching.

2.14.2 The work shall include all necessary stone revetments, concreting and earth filling above ground level, the clearing from site of all surplus excavated soil, special measures for protection of foundation close to or in nallas, river bank / bed, undulated terrain, protection of uphill / downhill slopes required for protection of tower etc., including suitable revetment or galvanised wire netting and meshing packed with boulders. The top cover of stone revetment shall be sealed with M-15 concrete (1:2:4 mix). Contractor shall recommend protection at such locations wherever required. Details of protection of tower/tower footing are given in drawing enclosed with these specifications for reference purpose only.

2.14.3 Tower footings shall generally be backfilled using soil excavated at site unless unsuitable for backfilling. In the latter case, backfilling shall be done with borrowed earth of suitable quality irrespective of leads and lift. The unit rate for backfilling quoted in BPS shall include the required lead and consolidation and leveling of earth after backfilling.

2.14.4 The provisional quantities for protection work of foundations are furnished in BPS. The unit rates shall also be applicable for any quantity variations during execution. The same unit rates shall hold good for protection work carried out on down hills or up hills slopes applicable for the tower locations.

2.14.5 The unit rates for random rubble masonry revetment quoted in price schedule shall also include excavation & (1:6) random masonry and unit rate for top sealing with M-15 concrete. For payment purposes the volume of random rubble masonry revetment shall be measured from bottom to top sealing coat and paid at the unit rates indicated in the Letter of Award.

No extra payment shall be made for allied works such as excavation for revetment, packed stone at head of weep holes etc. However, no deduction shall be made for the volume enclosed by weep holes.

2.14.6 For some of the locations in nallas, river bed or undulated terrain etc., boulders of minimum. 150mm size bounded and packed in galvanised wire net/mesh of 8 SWG wire and 152 square (maxm.) mesh are to be provided. These stones shall be provided in crates size of 2.0mx2.0m or as deemed suitable for a particular location. Measurement shall be taken in cubic meters and 15% deduction will be made for void from cage/stack measurements.

3.0 Tower Erection, Stringing and Installation of Line Materials

3.1 General

3.1.1 The scope of erection work shall include the cost of all labour, tools and plant such as tension stringing equipment and all other incidental expenses in connection with erection and stringing work. The stringing equipment shall be of sufficient capacity to string the bundle conductors of specified size

3.1.2 The Contractor shall be responsible for transportation to site of all the materials to be supplied by the Contractor as well as proper storage and preservation of the same at his own cost, till such time the erected line is taken over by the Employer. Similarly, the Contractor shall be responsible for transportation, proper storage, safe custody, and loss or damage of all Employer's supplied items for incorporation in the lines and shall maintain and render proper account of all such materials at all times. The Contractor shall reimburse the cost of any of the materials lost or damaged during storage and erection.

3.1.3 Contractor shall set up required number of stores along the line and the exact location of such stores shall be discussed and agreed upon with the Employer. Employer supplied items shall be dispatched to the railway stations situated nearest to the stores set up by the Contractor. From the railway stations, receipt, unloading and transportation to the stores shall be the entire responsibility of the Contractor.

3.1.4 Payment for stringing shall be done on the basis of per kilometer and irrespective of number of tension/suspension towers. However, stringing for river crossing spans have been given separately in the BPS. The units of measurement for tower erection and other line materials, like, OPGW, Hard ware fittings and Accessories for conductor & OPGW are indicated in the BPS.

3.1.5 After installation of OPGW, the testing of each section shall be carried out by Contractor in presence of Employer representatives. In case of any damage/high loss in the fiber, the total length of that particular section/portion of OPGW shall be replaced by the contractor and in such case, the de-stringing & re-stringing shall be carried out by the contractor without any extra cost to Employer and cost of additional OPGW cable, hardware fittings and joint box, if any, for replacement of damaged OPGW etc. shall be recovered from the contractor. However introduction of additional joints in the links due to replacement of OPGW in damaged portion shall be allowed subject to meeting the optical link budget.

3.1.6 In case FO Cabling (OPGW, Approach cable etc.) installation is covered under the scope of package, Site Acceptance Testing (SAT) for FO Cabling shall be carried out by contractor as per Annexure-I.

3.2 Treatment of Minor Galvanisation Damage

Minor defects in hot-dip galvanised members shall be repaired by applying zinc rich primer and two coats of enamel paint to the satisfaction of the Employer before erection.

3.3 **Assembly of Tower**

The Contractor shall give complete details of the erection procedures he proposes to follow.

3.3.1 The method for the erection of towers shall ensure the following:

a) Straining of the members shall not be permitted for positioning. It may, however, be necessary to match hole positions at joints using tommy bars not more than 450mm in length;

b) Prior to erection of an upper section, the lower sections shall be completely braced, and all bolts provided tightened adequately in accordance with approved drawings to prevent any mishap during tower erection;

c) All plan diagonals, oblique bracings etc. for relevant section of tower shall be in place prior to assembly of an upper Section;

d) The bolt positions in assembled towers shall be as per IS-5613 (Part II/Section 2);

e) Tower shall be fitted with number, danger and phase plates as well as anti-climbing device, as described;

f) After complete erection of the tower, all blank holes, if any, are to be filled by bolts and nuts of correct size.

g) The towers shall not be out of vertical by more than 1 in 360 before stringing is carried out

3.4 Tightening of Bolts and Nuts

3.4.1 All nuts shall be tightened properly using correct size spanner and torque wrench. Before tightening, it will be verified that filler washers and plates are placed in relevant gap between members, bolts of proper size and length are inserted, and one spring washer is inserted under each nut. In case of step bolts, spring washers shall be placed under the outer nuts. The tightening shall progressively be carried out from the top downwards, care being taken that all bolts at every level are tightened simultaneously. The threads of bolts projecting outside the nuts shall be punched at their position on the diameter to ensure that the nuts are not loosened in course of time. If, during tightening, a nut is found to be slipping or running over the bolt threads, the bolt together with the nut shall be replaced.

3.4.2 The threads of all the bolts except for Anti-theft bolts projected outside the nuts shall be welded at two diametrically opposite places; the circular length of each welding shall be at least 10mm. The welding shall be provided from ground level to waist level for single circuit towers and to bottom cross arm for double circuit towers. However, for towers, with +18 meter, +25 meter extensions and river crossing towers, the welding shall be provided from ground level to 30m height from stub level. After welding zinc-rich primer having approximately 90% zinc content shall be applied. to the welded portion. At least two coats of

the paint shall be applied. The surface coated with zinc rich primer shall be further applied with two finish coats of high build enamel of the grade recommended by the manufacturer of the zinc rich primer. The cost of welding and paint including application of paint shall be deemed to be included in the erection price.

3.4.3 In addition to the tack welding of nuts with bolts, as described above, the Contractor can also propose some alternative arrangements, like use of epoxy resin adhesive which can serve the purpose of locking the nut permanently with the bolt and thus preventing pilferage of the tower members.

3.5 Insulator Hoisting

Suspension insulator strings shall be used on Suspension towers (A/DA) and tension insulator strings on angle and dead end towers. These shall be fixed on all the towers just prior to the stringing. Damaged insulators and strings, if any, shall not be employed in the assemblies. Prior to hoisting, all insulators shall be cleaned in a manner that will not spoil, injure or scratch the surface of the insulator, but in no case shall any oil be used for that purpose. For checking the soundness of insulators, IR measurement using 5 kV (DC) Meager shall be carried out on 100% insulators. Corona control rings/arcing horn shall be fitted in an approved manner. Torque wrench shall be used for fixing various line materials and components, such as suspension clamp for conductor and E/W, etc., whenever recommended by the manufacturer of the same.

3.6 Handling of Conductor and OPGW

3.6.1 Running Out of the Conductors

3.6.1.1 The conductors shall be run out of the drums form the top in order to avoid damage. The Contractor shall be entirely responsible for any damage to tower or conductors during stringing.

3.6.1.2 A suitable braking device shall be provided to avoid damaging, loose running out and kinking of the conductors. Care shall be taken that the conductors do not touch and rub against the ground or objects which could scratch or damage the strands.

3.6.1.3 The sequence of running out shall be from the top down i.e. the OPGW shall be run out first followed in succession by the conductors. Unbalanced loads on towers shall be avoided as far as possible. Inner phase of line conductors shall be strung before the stringing of the outer phases is taken up.

3.6.1.4 The Contractor shall take adequate steps to prevent clashing of sub conductors until installation of the spacers/spacer dampers. Care shall be taken that sub conductors of a bundle are from the same Contractor and preferably from the same batch so that creep behavior of sub conductors remains identical. During sagging, care shall be taken to eliminate differential sag in sub-conductors as far as possible. However, in no case shall sag mismatch be more than 25mm.

3.6.1.5 Towers not designed for one sided stringing shall be well guyed and steps taken by the Contractor to avoid damage. Guying proposal along with necessary calculations shall be submitted by the Contractor to Employer for approval. All expenditure related to this work is deemed to be included in the bid price and no extra payment shall be made for the same.

3.6.1.6 When the transmission lines runs parallel to existing energised power lines, the Contractor shall take adequate safety precautions to protect personnel; from the potentially dangerous voltage built up due to electromagnetic and electrostatic coupling in the pulling wire, conductors and OPGWs during stringing operations.

3.6.1.7 The Contractor shall also take adequate safety precautions to protect personnel from potentially dangerous voltage build up due to distant electrical storms.

3.6.2 Running Blocks

3.6.2.1 The groove of the running blocks shall be of such a design that the seat is semicircular and larger than the diameter of the conductor and it does not slip over or rub against the slides. The grooves shall be lined with hard rubber or neoprene to avoid damage to conductor and shall be mounted on properly lubricated bearings.

3.6.2.2 The running blocks shall be suspended in a manner to suit the design of the cross-arm. All running blocks, especially at the tensioning end will be fitted on the cross-arms with jute cloth wrapped over the steel work and under the slings to avoid damage to the slings as well as to the protective surface finish of the steel work.

3.6.3 Repairs to Conductors

3.6.3.1 The conductor shall be continuously observed for loose or broken strands or any other damage during the running out operations.

3.6.3.2 Repairs to conductor if accidentally damaged, shall be carried out with repair sleeve.

3.6.3.3 Repairing of the conductor surface shall be carried out only in case of minor damage, scuff marks, etc. The final conductor surface shall be clean, smooth and free from projections, sharp points, cuts, abrasions, etc.

3.6.3.4 The Contractor shall be entirely responsible for any damage to the towers during stringing.

3.6.4 Crossings

Derricks or other equivalent methods ensuring that normal services need not be interrupted nor damage caused to property shall be used during stringing operations where roads, channels, telecommunication lines, power lines and railway lines have to be crossed. However, shut down shall be obtained when working at crossings of overhead power lines. The Contractor shall be entirely responsible for the proper handling of the conductor, OPGW and accessories in the field.

3.7 Stringing of Conductor and OPGW

3.7.1 The stringing of the conductor for 765 kV / 400kV shall be done by the control tension method. The equipment shall be capable of maintaining a continuous tension per bundle such that the sag for each conductor is about twenty percent greater than the sags specified in the stringing sag table. The stringing of conductor for 220/132kV shall be done by standard stringing method.

3.7.2 The bidder shall give complete details of the stringing methods he proposes to follow. Prior to stringing, the Contractor shall submit the stringing charts for

the conductor and OPGW showing the initial and final sags and tension for various temperatures and spans alongwith equivalent spans in the lines for the approval of the Employer.

3.8 Jointing

3.8.1 When approaching the end of a drum length at least three coils shall be left in place when the stringing operations are stopped. These coils are to be removed carefully, and if another length is required to be run out, a joint shall be made as per the specifications.

3.8.2 Conductor splices shall not crack or otherwise be susceptible to damage in the stringing operation. The Contractor shall use only such equipment/methods during conductor stringing which ensures complete compliance in this regard.

3.8.3 All the joints on the conductor shall be of the compression type, in accordance with the recommendations of the manufacturer, for which all necessary tools and equipment like compressors, dies etc., shall be obtained by the Contractor. Each part of the joint shall be cleaned by wire brush till it is free of dust or dirt etc., and be properly greased with anti-corrosive compound. If required and as recommended by the manufacturer, before the final compression is carried out with the compressors.

3.8.4 All the joints of splices shall be made at least 30 meters away from the tower structures. No joints or splices shall be made in spans crossing over main roads, railways, power lines and small river spans up to 650m. Not more than one joint per sub conductor per span shall be allowed. The compression type fittings shall be of the self-centering type or care shall be taken to mark the conductors to indicate when the fitting is centered properly. During compression or splicing operation; the conductor shall be handled in such a manner as to prevent lateral or vertical bearing against the dies. After compressing the joint the aluminium sleeve shall have all corners rounded, burrs and sharp edges removed and smoothened.

3.8.5 During stringing of conductor to avoid any damage to the joint, the Contractor shall use a suitable protector for mid span compression joints in case they are to be passed over pulley blocks/aerial rollers. The pulley groove size shall be such that the joint alongwith protection can be passed over it smoothly.

3.9 Tensioning and Sagging Operations

3.9.1 The tensioning the sagging shall be done in accordance with the approved stringing charts or sag tables. The “initial” stringing chart shall be used for the conductor and final stringing chart for the OPGW. The conductors shall be pulled up to the desired sag and left in running blocks for at least one hour after which the sag shall be rechecked and adjusted, if necessary, before transferring the conductors from the running blocks to the suspension clamps. The conductor shall be clamped within 96 hours of sagging in.

3.9.2 The sag will be checked in the first and the last section span for sections up to eight spans, and in one additional intermediate span for sections with more than eight spans. The sag shall also be checked when the conductors have been drawn up and transferred from running blocks to the insulator clamps.

3.9.3 The running blocks, when suspended from the transmission structure for sagging, shall be so adjusted that the conductors on running blocks will be at the same height as the suspension clamp to which it is to be secured.

3.9.4 At sharp vertical angles, conductor and OPGW sags and tensions shall be checked for equality on both sides of the angle and running block. The suspension insulator assemblies will normally assume verticality when the conductor is clamped.

3.9.5 Tensioning and sagging operations shall be carried out in calm whether when rapid changes in temperature are not likely to occur.

3.10 Clipping In

3.10.1 Clipping of the conductors into position shall be done in accordance with the manufacturer's recommendations.

3.10.2 Jumpers at section and angle towers shall be formed to parabolic shape to ensure maximum clearance requirements. Pilot suspension insulator strings shall be used, if found necessary, to restrict jumper swing to design values.

3.10.3 Fasteners in all fittings and accessories shall be secured in position. The security clip shall be properly opened and sprung into position.

3.11 Fixing of Conductors and OPGW Accessories

Conductor and OPGW accessories including spacers, spacer dampers (for bundle conductor) and vibration dampers shall be installed by the Contractor as per the design requirements and manufacturer's instruction within 24 hours of the conductor/OPGW clamping. While installing the conductor and OPGW accessories, proper care shall be taken to ensure that the surfaces are clean and smooth and that no damage occurs to any part of the accessories or of the conductors. Torque wrench shall be used for fixing the Dampers/Spacer Dampers, Suspension Clamps etc. and torque recommended by the manufacturer of the same shall be applied.

3.12 Replacement

If any replacement is to be effected after stringing and tensioning or during maintenance, leg member and bracing shall not be removed without first reducing the tension on the tower by proper guying techniques or releasing of the conductor. For replacement of cross arms, the conductor shall be suitably tied to the tower at tension points or transferred to suitable roller pulleys at suspension points.

3.13 Permitted Extra Consumption of Line materials

3.13.1 The quantity of conductor and OPGW to be incorporated in the line shall be worked as per the following norms.

Quantify of Conductor = Line length* as per detailed survey x 3 phases x Nos. of conductor per bundle (for Single Circuit Line)

= Line Length* as per detailed survey x 3 phases x Nos. of conductor per bundle x 2 (for Double Circuit Line)

Quantity of OPGW = Line length* as per detailed survey x nos. of ground wires

* For calculation of conductor & OPGW requirement in hilly stretches, inclined distance between the towers may be considered instead of horizontal distance (considered for line length).

3.13.2 The Contractor shall make every effort to minimise breakage, losses and wastage of the line materials during erection. However, the Contractor shall be permitted and extra consumption of line materials up to the limits specified in Table 5.1 and shall be permitted to dispose of the scrap, if any at the end.

Table 5.1 : Permitted extra consumption of line materials

Item	**% of permitted extra consumption**
Conductor	1

3.13.3 In case of conductor, the permitted extra consumption limit of one percent is inclusive of sag, jumpering, damage, loss and wastage etc.

3.13.4 The Contractor shall not be required to return to the Employer empty conductor drums and shall dispose of the same at his cost.

3.13.5 Any conductor drum which has been opened by the Contractor shall not be taken back by Employer and the unused conductor in such drums may be treated as waste permissible within the overall limits specified in Table 5.1.

3.13.6 The Contractor shall return to the Employer all Employer supplied material not incorporated in the works, except those permitted by Employer as scrap in terms of Table 5.1. Otherwise, the Contractor shall pay in respect of such excess materials which he is unable to return at rates corresponding to the actual cost of procurement plus (i) 15% for OSM procured under domestically funded packages; and (ii) 26.5% for OSM procured against packages funded by multilateral funding agencies. The "cost of procurement" for the above purpose shall be F O R destination site cost of OSM as per LOA of the respective packages plus taxes & duties plus price variation (if positive) applicable as on the date of issuance of TOC for Tower Package. In case of contract in Foreign currency, Bills clearing (BC) Selling, Market Rate of Exchange (MRE) established by State Bank of India (SBI) as prevalent on date of TOC shall be applicable for converting into Indian Rupees.

3.13.7.1 For calculation of conductor consumption in hilly (mountainous) stretches inclined distance between towers may be considered, instead of horizontal distance between them.

3.13.7.2 The quantities of line materials to be supplied by the contractor (i.e. Conductor, OPGW, Disc Insulator, Hardware fittings & accessories) as indicated in the bill of quantities are provisional and the actual quantity shall depend upon detailed survey. Contractor shall be responsible for regulating the supplies of contractor supplied materials on the basis of actual requirements. The Employer shall have right, not to take any surplus contractor supplied line materials.

3.14 Final checking, Testing and Commissioning

After completion of the works, final checking of the line shall be carried out by the Contractor to ensure that all foundation works, tower erection and stringing have been done strictly according to the specifications and as approved by the Employer. All the works shall be thoroughly inspected in order to ensure that :

a) Sufficient backfilled earth covers each foundation pit and is adequately compacted;

b) Concrete chimneys and their copings are in good condition and finely shaped.

c) All tower members are used strictly according to final approved drawing and are free of any defect or damage whatsoever.

d) All bolts are properly tightened, punched, tack welded and painted with zinc rich paint;

e) The stringing of the conductors and OPGW has been done as per the approved sag and tension charts and desired clearances are clearly available;

f) All conductor and OPGW accessories are properly installed;

g) All other requirements for completion of works such as fixing of danger plate, phase plate, number plate, anti-climbing device, aviation signal have been fulfilled.

h) Wherever required, that proper revetment (erosion protection) is provided;

i) The original tracings of profile and route alignment as well as tower design, structural drawings, bill of material and shop drawings of all towers are submitted to the Employer for reference and record.

j) The insulation of the line as a whole is tested by the Supplier through provision of his own equipment, labour etc., to the satisfaction of the Employer.

k) All towers are properly grounded.

l) The line is tested satisfactorily for commissioning purpose.

3.14.1 The contractor should also fulfill the requirements of pre-commissioning procedure as given in Appendix – I to this Specification

4.0 Field Quality Plan

All field activity shall be carried out in accordance with Standard Field Quality plan as given in Appendix – II to this Specification.

APPENDIX-I

PRE-COMMISSIONING PROCEDURES FOR TRANSMISSION LINES

INTRODUCTION

Over all procedure, safety rules, Statutory Requirements, dispatch procedures, switching sequences, observations, passing criteria and documentation of test results have been documented in this report.

The detailed inspection and handing over documents are required to be checked for the entire length of transmission line before energization.

The detailed inspection/test procedure for each activity has been elaborated in separate section of this documentation. The contents of this report are as following:

1. Definition
2. Overall Procedures
3. Safety procedures
4. Inspection
5. Statutory Requirements
6. Handing over
7. Protective system
8. Dispatch procedures
9. Switching procedures
10. Testing
11. Energization
12. De-energization
13. Observations and duration
14. Passing criteria
15. Documentation

1.0 DEFINITION

"Main Transmission Lines" means all high pressure cables and overhead lines (not being an essential part of the distribution system of a licensee) transmitting electricity from a generating station to another generating station or a sub-station, together with any step-up and step-down transformers, switch-gear and other works necessary to and used for the control of such cables or overhead

lines, and such buildings or part thereof as may be required to accommodate such transformers, switch-gear and other works and the operating staff thereof;
"Power System" means a system under the control of the Government or any

Board of Generating Company or other agency and having one or more-

i) generating station; or

ii) main transmission lines and sub-stations; or

iii) generating stations and main transmission lines and substations;

"Regional Electricity Board" means any of the Boards as constituted immediately before the commencement of the Electricity Laws (Amendment) Act, 1991, by resolution of the Central Government for ensuring integrated operation of constituent system in the region;

"Regional Load Dispatch Centre" means the Centre so designated where the operation of each of the Regional Electricity Grids constituting the country's power system is coordinated;

"Sub-Station" means a station for transforming or converting electricity for the transmission or distribution thereof and includes transformers, convertors, switch-gear, capacitors, synchronous condensers, structures cables and other appurtenant equipment's and any buildings used for that purpose and the site thereof, a site intended to be used for any such purpose and any buildings used for housing the staff of the sub section;

"Tie-Line" means a line for the transfer of electricity between two power systems together with switchgear and other works necessary to, and used for the control of such line.

2.0 OVERALL PROCEDURE

First it is to be ascertained that the transmission line to be energized is ready for operation and has been properly handed over (released) in writing. This will include all safety aspects, Electrical inspector clearance, PTCC clearance, Statutory clearance, and final inspection, if any.

Instructions for the work and supervision is given by the test leader (Line in charge). However all switching and all operational activities will be executed by the regular operators.

Line charging instructions received from head office are clearly understood by the Line in charge and doubts, if any, are to be got clarified prior to the energisation of the line.

Once the line is handed over for charging no work shall be permitted without a valid WORK PERMIT.

When the whole system has been energized, including the AC line, it will be kept in this state for 8 hours or more for "soaking" with continuous inspection and monitoring. However, recommendations of the Head office may be checked. Otherwise it may be put into continuous operation.

3.0 SAFETY PROCEDURES

Energization implies an abrupt and serious change of the working conditions in the plant.

In order to avoid serious accidents, thorough information must be imparted to all personnel involved in the construction of transmission line. Incharge of the Transmission line (Divisional head) must ensure that due publicity has been made to the public in all the villages/areas along the line route cautioning them against climbing the towers etc. and that the line is proposed to be charged on so and so date. It is also to be confirmed that the AGENCIES involved in the construction activities shall not carry out any job on the said line without a valid WORK PERMIT.

It shall be ensured before charging that all men, material, Tools and plants and any temporary earthing on any part of the entire length of line are removed.

It must be ensured that any power supply / low voltage charging used as anti-theft measure must be disconnected and isolated to avoid accidental connection.

All equipment tests and pre-commissioning tests must have been completed, reterminated (in case cables were isolated for testing purpose) and documented.

The system must be formally declared ready for energization and handed over for operation in writing.

4.0 INSPECTION

Before the line is scheduled to be handed over for the pre-commissioning / energization the same shall be inspected by representatives of PDD, J&K and Construction Agency as follows :

Such an inspection shall include:

i) Right of way/way leave/electrical clearance

ii) Foundation and Revetments/Protection Work

iii) Tower and Tower accessories

iv) Hardware Fittings

v) Insulators

vi) Conductors and Earthwire/OPGW

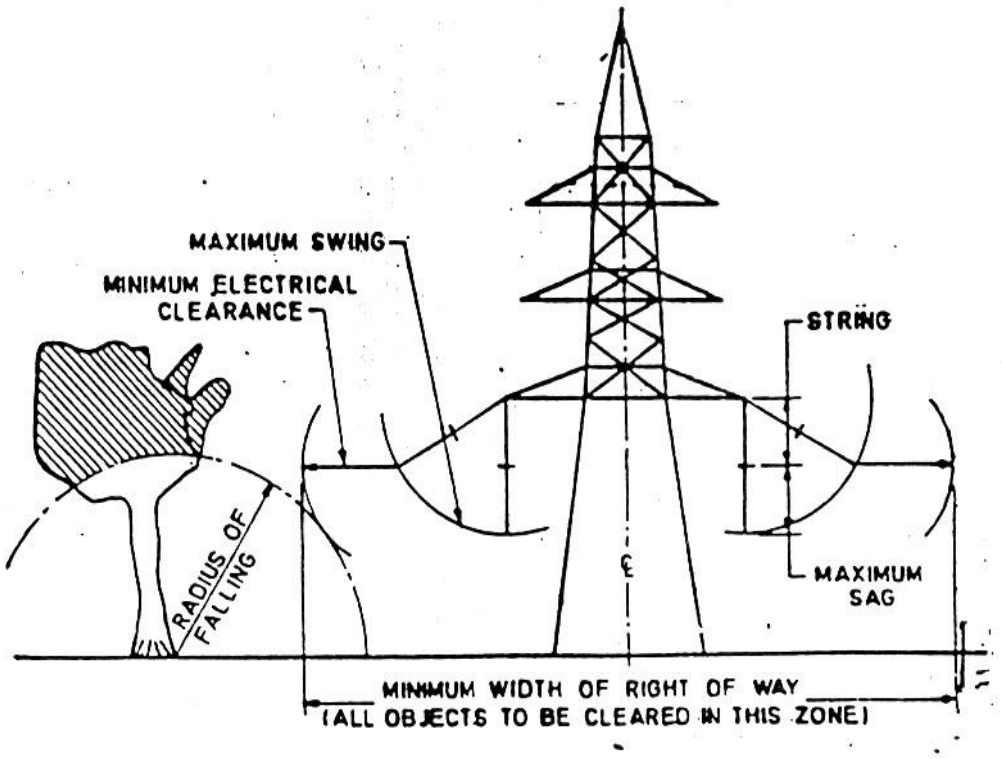
vii) Accessories for conductor and Earthwire/OPGW

viii) Aviation Warning Signals (Lights/globules/painting)

4.1 RIGHT OF WAY/WAY LEAVE/ELECTRICAL CLEARANCE

4.1.1 Right of way/Way leave clearance

Ensure that no tree/tree branches are falling within the zone of minimum clearance specified as per Fig. 1.



NOTE — Portion of tree falling within clearance zone to be lopped or trimmed.

FIG. 1 LINE CLEARANCE (RIGHT-OF-WAY) REQUIREMENTS

Guidelines of forest/environmental rules shall be followed to avoid excessive tree cutting i.e. all the trees should be cut from ROUTE level in the 3 meter corridor below each line Conductor/Earthwires/OPGW. In the balance corridor, Trees branches are only to be lopped to attain the specified clearance as per Table no 1.

TABLE NO. 1

CLEARANCE FOR RIGHT OF WAY

TRANSMISSION VOLTAGE (IN KV)	MINIMUM RIGHT OF WAY (IN MTRS)
110/132	22/27
220	35
400	52 (S/C)
400	46 (D/C)

4.1.2. Electrical Clearance

In case of line crossings, clearance between lowest conductor of line and top conductor of the other line shall be adequate as follows :

(Minimum clearances in mm between lines when crossing each other)

Sl. No.	Nominal System Voltage	132 kV	220 kV	400 kV
1.	132 KV	3050	4580	5490
2.	220 KV	4580	4580	5490
3.	400 KV	5490	5490	5490

Jumpers in the tension tower are properly intact with conductor and form a parabolic shape in order to achieve adequate clearance from super steel structure.

4.1.2.1. Ground clearance

Normally at the time of construction adequate clearance is provided between lowest conductor and ground, but due to delay in charging/commissioning there arc chances of dumping/heaping soil, earth and concrete etc. or staking bricks etc. which may cause reduction in ground clearance. In such cases the stored materials shall be removed.

Ensure that there is no temporary or permanent construction of houses or shades below the line. If the same has been constructed they shall be removed before charging.
The various clearances are given below as guidance however all the clearances indicated in Approved Drawings are to be referred.

The ground profile at the time of commissioning shall be checked with the profile approved at the time of check survey.

Ground clearance of lowest conductors at critical points/where ever the lowest conductor is touching the ground shall be checked in the field from any of the prevalent method and the values of ground clearance at these critical points shall be recorded in the prescribed format.

In case of hilly Terrain and for building clearance, the side clearance from conductors and jumpers at critical points shall also be checked and recorded for all phases of conductor/earthwire/OPGW towards hill/ building side.

The permissible minimum ground clearances for different voltages are as given below.

TRANSMISSION VOLTAGE (IN KV)	**GROUND CLEARANCE (MM)**
110/132	6100
220	7015
400	8840

4.1.2.2. Clearance for Telephone line crossings

The minimum clearances between the conductors of the power line and Telecommunication lines are specified as follows :

TRANSMISSION VOLTAGE (IN KV)	**CLEARANCE (MM)**
110/132	2745
220	3050
400	4880

The vertical clearances between conductors and between conductor and earth-wire shall be checked randomly say in any one span of all sections and 10 sections of hilly areas from single line diagram of the towers.

4.4. HARDWARE FITTINGS

Tightening of all bolts and nuts are to be checked up to specified torque.

Check the fixing of all security clips (W/R type clips).

Surface condition of corona control rings and distance/alignment between Tower side arcing horn (wherever applicable) and line side arcing horn/corona control ring to be checked as per approved drawings.

To restrict the swing of jumpers, the provision of Pilot strings in case of Tension Towers shall be verified from the approved drawings.

4.5 INSULATORS

All the damaged/broken insulators shall be replaced.

Unusual deflection in suspension strings if observed shall be rectified.

The insulators shall be cleaned before charging.

4.6. CONDUCTORS and EARTHWIRES/OPGW

Surface Condition

Surface of the conductors shall be free from scratches/rubs

Ensure that conductor strands are not cut and opened up. Wherever strands are found cut/damaged/scratched, they must be repaired with repair sleeves/repair protective rods in case the nos. of damaged strands are within specified limits (normally up to $1/6^{th}$ nos. of strands in the outer layer). ***

4.7. ACCESSORIES FOR CONDUCTOR

4.7.1. Joints

All joints on conductor shall be away from the tower at a distance of at least 30 metres or as provided in the Technical specification (TS).

Ensure that not more than one joint in a conductor is provided in one span or provided.

Ensure that no mid span joint is provided in major crossings for main roads, railway crossing and major rivers etc. or provided in TS.

Ensure that all mid span joints on conductors and repair sleeves of compression type are free from sharp edges, rust and dust. Wherever grease is specified the same shall be applied in the joints.

4.7.2. Clipping

Ensure that conductor is not over tightened in the suspension clamps.

4.7.3 Spacers, vibration dampers and copper bonds

Placement and no. of dampers on each phase shall be verified as per damper placement chart.

Spacing of Vibration dampers from the tower and spacing between damper to damper in case two Vibration Dampers (VD) were provided, shall be verified as per the damper placement chart. All loose/ displaced VD shall be properly tightened/relocated and missing VDs shall be provided.

To be ensured that no copper bond is loose/missing.

4.7.4 Jumpers

Verify Electrical clearance of jumpers to tower body as per design.

All the jumpers shall be checked properly. In case, jumpers (conductor/earthwire /OPGW) is found loose, it shall be tightened sufficiently.

4.7.5 Foreign material

Ensure that all foreign materials viz dead bird. fallen tree branches, bird nests etc. on conductors, earthwires/OPGW, Jumper, insulator string, cross arms are removed.

4.7.6. Others

It shall be ensured that all temporary/local earthing, guys, T &P (Tools and Plants), foreign material and other loose material which were used during stringing/tower erection have been removed.

In case there is any change in the ground profile before commissioning of line from the approved profile, the extra earth/obstruction /temporary sheds/any other construction shall be removed.

5.0 STATUTORY REQUIREMENT

5.1. The concerned authorities shall be informed before commissioning the lines and their approval obtained in accordance with Indian Electricity Act, 1910 and Indian Electricity Rule, 1956. and Electricity Act 2003.

5.2 Before charging of the line PTCC approval from P&T Dept. shall be obtained.

6.0 HANDING OVER

The transmission line shall be inspected prior to energization and a formal handing over document to be jointly signed by the representative of SUPPLIER (if available), ERECTION AGENCY, PDD, J&K ERECTION.

However all contractual taking over has to be resolved separately as per the terms and conditions of the contract. The Handing over shall be limited to the completion of Erection and ready for Energization.

Any outstanding points or remaining activities are to be listed jointly by PDD, J&K and ERECTION agency and signed jointly. This document is also to be retained at Office of Executive Engineer with a copy to Superintending Engineer office. The remaining activities/outstanding points are classified in the following category.

Details of the SECTIONS :

A. List of outstanding activities remaining in any part of the line

B. A list of temporary arrangements introduced.

C. Check list records properly documented, completed and signed.

D. Original tracing of Profile, Route Alignment, Tower Design, Structural Drawings, Bill of Materials, Shop Drawings, Stringing charts (initial and final as applicable) etc. of all towers/line submitted to PDD, J&K.

With the outstanding activities mentioned above are solved or with only minor points without influence on the charging remain (minor issues handing over of the transmission line shall be accepted by the pre-coinmissioning team. This handing over for energization with or without remaining activities shall be made by the Engineer in - Charge to the commissioning in charge in writing.

Shortcomings noticed during the inspection, "List of outstanding activities" shall be recorded and a copy of the format is to be given to the responsible parties like SUPPLIER(s) and ERECTION AGENCY etc. for corrective action to be taken on a time schedule.

7.0 PROTECTIVE SYSTEM

Before energization it must be ascertained that all protective systems for the unit to be energized are operative.

This includes confirmation that the protections have been properly tested and that the tests have been documented.

It also includes verification by inspection or otherwise, if necessary by repetition of trip test, that the protections are actually functionally enabled. This verification serves to prevent that energization takes place of a unit where a protection has been disabled for test or other reason.

8.0 DISPATCH PROCEDURES

All operational activities (switching etc.) must be coordinated and communicated with the system dispatcher i.e. IOCC / CPCC / RLDC.

In this respect the general procedures already established by PDD, J&K will be followed.

9.0 SWITCHING PROCEDURES

For each activity the instructions to the operators and the communications to the dispatchers will be made in writing or by confirmed telephone messages. The switching procedures first to be properly documented step by step and understood by everybody involved in the switching operation prior to the enerzisation. Any clarification required in the procedures must be resolved. The format established by PDD, J&K for switching orders and operational data logging shall be followed.

The implication of this is that each and every activity must be listed and described, so that complete information is available for detail investigation, if required in future.

10.0 TESTING AND MEASUREMENT PROCEDURES

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10.2.2 Conductor Continuity Test

10.2.2.1 The objective of this test is to verify that each conductor of the overhead line properly connected electrically (the value of electrical resistance of line does not vary abnormally from that of a continuous conductor of the same size and length). The electrical resistance of the conductor shall be measured with a Whetstone bridge or other suitable instrument, if available taking the safety aspects of Equipment as well as testing Engineer.

11.0 ENERGIZATION

Execution of the energization is simply the last event in the switching sequence, switching of the close control button for the relevant circuit breaker.

12.0 DE-ENERGIZATION

Instructions about de-energization will be given only if this is part of the test. Otherwise de-energization will be considered part of regular operation.

13.0 OBSERVATION AND DURATION

Visual and audible inspection (look and listen) of the relevant equipment and reading of permanent instrumentation will be made.

The system shall be charged at least for 8 hours. During this time continuous monitoring and inspection will be maintained in control room, auxiliary systems areas and switch yards.

This will include frequent, scheduled inspection of all equipment and reading of all permanent instruments and recorders, and surge arrester counters, especially system parameters as per standard procedures adopted by PDD, J&K.

14.0 PASSING CRITERIA

Neither insulation breakdown nor protective system actions must occur. No irregular equipment behavior noise, vibration, high temperature is permitted.

Corona discharges may not be "unreasonable". Local discharges that may be attributable to sharp points shall be carefully located and recorded. After termination of the energization the equipment shall be closely inspected and the points rounded or covered.

No unscheduled changes of system nor of equipment is permitted during the 8 hour energized condition.

15.0 DOCUMENTATION

Switching and operational activities will be recorded in regular manner in the operators log. Likewise all readings of permanent instruments. Copies of this log, notes on special observations from inspections and other measurements will constitute the test records.

END

STANDARDISED FIELD QUALITY PLAN

Appendix-II

ITEM: **Transmission Line**
Applicability
Date of Issue:
Validity

SFQP No.

S No	Description of Activity	Item to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check /Test by JKPDD	Accepting authority in JKPDD
					Agency	Extent		
1	Preliminary /Detailed Survey	a) Route alignment	Optimization of route length	a. Preliminary survey. b. Topographical map c. Tower spotting data given by Engineer.	Contractor	I00% at Field	I00% based on record documents	Project In-charge
		b) Route profiling &	1. Ground clearance. 2. Cold wt. Span 3. Hot wt. Span 4. Sum of Adj. Span (wind span) 5. Angle of Devn. 6. Suitability of Tower spotting in hilly area.	Sag template Tower Spotting data Route alignment	Contractor Or -do- -do- -do- -do- -do-	I00% al Field -do- -do- -do- -do- -do-	I00% based on record documents -do - -do- -do- Verification of 100% at Field	Site In-charge
2	Check Survey	Tower Location &Final Length	1.Alignment 2.Final Length 3.Angel of deviation & pit marking-	a. Route alignment b. Tower Schedule C. Profile	Contractor -do-	I00% at Fie ld -do-	a. All angle towers in plains and 50% in hilly terrains. b. Final length to be checked on I00% based on records/document 20% test check at site for physical verification	Site Engineer
3	Detail Soil Investigation	a) Bore Log	1. Depth of bore log. 2. STP Test 3. Collection of samples	As per JKPDD Specification	Contractor -do-	I00% at Field -do-	To witness 20% at Field	Site Engineer
		b) Tests on	As per tech. Specs.	As per JKPDD	Contractor	100% by	Review of lab test	Site In-charge

		samples		Specification	(Testing in JKPDD accepted Lab)	testing lab (Reports to be signed by Testing person &Checking person)	results(All soil reports to have signature of JKPDD executive reviewing the report)	
		c) Special foundations	As per tech. Specs	As per JKPDD Specification	Contractor (Testing of samples in JKPDD accepted Lab)	100% by testing lab (Reports to be signed by Testing person & Checking person)	Review of lab test results (All soil reports to have signature of JKPDD executive reviewing the report)	Site In-charge
4	Revetment	RR Masonry	a) Size of Stone	CPWD Spec.	Contractor	100% physical verification per source	Physical verification on random basis	Site Engineer
			b) Water absorption	-Do-	-Do- (Testing in JKPDD accepted Lab)	1 sample/ source	Review of Lab Test results	-Do-
			c) Cement :sand ratio in mortar	As per JKPDD Specification	Contractor	100%	Physical verification in random.	-Do-
5	Benching	Checking of Reduced level	Reduced level	As per Approved Drawing	Contractor	100%	100% by Site Engineer and 20%by Line In-charge	Site In-charge

6	Tower Foundation							
		A) Materials 1. Cement	1. Brand approval	Cement of approved brands according to the COV in JKPDD website may be procured.	Contractor	100%	Any new brand cement proposed by Contractor shall be assessed by FQA and approved by Chief Engineer.	FQA-PDD
			2. Physical tests	As per document at Annexure-I of this FQP	Contractor Samples to be taken jointly with JKPDD and tested at JKPDD approved lab	Review of 100% MTC's and one sample for every batch number of manufacturer.	100% review of lab test results and MTC. Test results shall be sent by the Lab. By E-mail directly to JKPDD; further, hard copy of test certificate shall also be sent by the Lab directly to JKPDD postal address.	Site In-charge
			3. Chemical Tests Chemical composition of Cement	-do-	Contractor	Review of all MTC's	100% review of MTC test results	Site In-charge

		2. a) Reinforcement Steel	1. Sources Approval	May be Procured either from main producers directly or through the authorised dealer who can produce MTC from main producers with traceability. Contact JKPDD for list of main producers of reinforcement steel.	Contractor	100%	Material shall be supplied from main Producers / authorized dealers.	Site-In-Charge
			2. Physical and Chemical analysis test	As per annexure-2 of this FQP	Contractor to submit MTC	100% MTC's One sample / 500MT/ Manufacturer shall be jointly sealed by JKPDD and Tested at JKPDD approved Lab **Note: All sizes of mm and above shall be taken for testing in every 500MT**	100% 1) Review sent by the Lab. by E-mail directly to JKPDD; further, hard copy of test certificate shall also be sent by the Lab. directly to JKPDD by postal Address. 2) Unit weight of three samples to be witnessed.##	Site In -Charge Site Engineer
Three samples of each size of Reinforcement steel all size of 10 mm and above out of 100 MT steel lot need to be physically weight at site in presence of JKPDD to ascertain their acceptance as per technical specification. The weighted samples at site may be kept under custody for three months for further examination by any auditing authority if required								
		2. b) Miscellaneous	Source Approval.	Source with material meeting JKPDD	contractor	As proposed by	To verify documents.	Site In -charge

		structural steel .		Specification		contractor		
		3. Coarse Aggregates	1. Source approval	Source with materials meeting JKPDD Specification	Contractor	Proposed by the Contractor, indicating the location of the quarry and based on the test results of Joint samples tested at JKPDD accepted Lab.	To review the proposal based on the documents	Site In-charge Once approved, the particular quarry shall be used for all under various packages.
			2. Physical tests	As per document at Annexure-3 of this FQP	Contractor	One sample per 500cum or part thereof per source for 400KV&below TL Samples to be tested by Contractor JKPDD approved lab.	100% review of lab test results. Out of these 100% samples, JKPDD shall witness at TPL, 5 samples selected at random, spread during the overall execution period of contract.	Site In-charge.

		4.Fine aggregate	1. Source approval	Source with materials meeting JKPDD Specification	Contractor	Proposed by the contractor indicating the location of the quarry and based on results of joint samples tested in JKPDD accepted lab.	To review the proposal based on the documents.	Site In-charge Once approved the particular quarry shall be used for all the running contracts under various packages.
			2. Physical test	As per Annexure-4 of this FQP	Contractor	One sample per 500 cum or part thereof per source for 400KV &below TL Samples to be tested by Contractor in JKPDD approved Lab.	100% review of lab test results . Out of these 100% samples, JKPDD shall witness at TPL, 5 samples selected at random, spread during the overall execution period of contract .	Site In charge.
		5. Water	1. Cleanliness (Water	As per JKPDD	Contractor	100% visual	Verification at	Site Engineer

			shall be fresh and clean)	Specification		check at Field.	random	
			2. PH Value	- do -	Contract or at site with calibrated PH meter or any other approved method	One sample per source	100% review of the test results - PH not less than 6	Site Engineer
		B) Foundation Classification	1. Visual observation of soil strata 2. Ground water level 3. History of water table in adj. Area/surface water 4. Soil Investigation wherever required	As per JKPDD Specification	Contractor	100% at Field	100% at Field	a. [other than b &c locations below) Recommendation by Site Engineer to be approved by Site in-charge after visiting at least 5% locations b. Incase of WBC/SFR/FS /ULE I Raised Chimney based recommendat

								ion by Site In-charge, to be approved Executive Engineer after visiting at least 5% locations. Superintending Engineer shall visit at least 2% locations for Test Check. C. For Spl. Fdns. (shallow depth, pile foundation, well foundation etc.) Acceptance CE/SE.
S No	**Description of Activity**	**Item to be Checked**	**Tests/Checks to be done**	**Ref. documents**	**Check/Testing**		**Counter Check /Test by JKPDD**	**Accepting authority in JKPDD**
					Agency	**Extent**		
	C)Concrete Works a)Before concreting							

		1. Bottom of excavated earth	Depth of foundation	Construction Drgs.	Contractor	100% at Field	100% check by JKPDD	Site Engineer
		2.P.C.C Grade, thickness &Size 3. Stub setting 4.Reinforcement steel	Completeness 1) Centre Line 2) Diagonals 3) Level of stubs Placement	IS:456 and JKPDD approved construction drawings & specification. Construction Drgs -do- -do- Bar bending schedule.	Joint Inspection by JKPDD and CONTRACTOR -do- -do- -do- -do-	For all locations -do- -do- -do- -do-	For all locations -do- -do- -do- -do-	Site Engineer *_* -do- *_* -do- *_* -do- •- * At least 5% locations shall be Cross verified by immediate Reporting Officer Site-In-charge, at random with respect to stub setting and reinforcement steel placement.
	b) During concrete Strength	1. Workability	Slump test	Range 25mm to 55mm refer document at Annexure-5 of this FQP	CONTRACTOR	Minimum One per day per location	Check at random	Site Engineer

		2. Concrete Strength	Cubes Comp Strength	As per annexure-5 of this FQP	CONTRACTOR Casting of Cube at site. Cube to be tested for days strength at JKPDD appd. Lab/JKPDD Lab/At site if testing machine installed by contractor is duly calibrated by NABL Lab. Cubes at 100% location are to be taken in presence of JKPDD officials	One sample of 3 cubes in each tower location if all the legs are cast continuously without interruption. If otherwise, additional 3 cubes to be taken for every sub sequent continuous casting case. Note: It is to be ensured that in every case 3 samples shall be selected in such a way that one each from start, middle and end of the casting process.	Normally testing shall be carried out at the cube Testing Facility installed by contractor at JKPDD premises, in the witness of JKPDD. Alternatively, samples shall be tested at JKPDD approved Labs/ JKPDD Lab. In this case, test results shall be sent by the Lab, by E- mail directly to JKPDD; further, hard copy of Test Certificate shall also be sent by the Lab directly to JKPDD by Postal Address. Further, JKPDD to witness testing on 20% samples and also to review 100% test results	Site Engineer. Out of testing on 10% samples to be witness at TPL by JKPDD Site Engineer and at least 5% samples at random, shall be witnessed by Site In-charge. In-case Site/JKPDD Lab, 100% witness by JKPDD Representative.
		3.Chimney	Top level of chimney	Appd. Drgs.	Contractor	100% at Field	100% check by	Site Engineer

		Concrete	concrete w.r.t GL				JKPDD	
	c) After Concreting	Back filling	Completeness	As per Specification	Contractor	100%	100%	Site Engineer
7	Pile Foundations	Refer FQP OF TRANSMISSION LINE PILE FOUNDATION						
8	Tower Erection	1. Materials ofTower member/bolts &nuts/washers/ accessories	Visual checking for 1.Stacking 2.Cleanliness 3. Galvanizing 4. Damages	Appd. Drgs./BOM	Contractor	100% at stores	100% verification of records	Site Engineer
		2. Erection of Super-structure	1. Sequence of erection	As per Appd. Drgs/JKPDD specification	Contractor	100% at field	Random	Site Engineer
			2. Check for completeness	As per Appd. Drgs. JKPDD specification	Contractor	100% at field	25% by Site Engg and random by Site Incharge.	Site In charge
			3. Tightening of nuts and bolts	-do-	-do-	-do-	-do-	-do-
			4. Check for verticality	-do-	-do-	-do-	-do-	-do-
			5. Tack welding for bolts &nuts	JKPDD Specification	Contractor	100% at Field	-do-	Site Engineer
		3. Tower footing resistance (TFR)	TFR at locations before and after earthing.	JKPDD Specification	Contractor	100% at Field	20% locations to be verified	Site In-charge
9	Earthling	Pipe Type	Salt &charcoal	As per approved drawings	Contractor	100%	Checking of record 100% and physical	Site Engineer

							verification in Random	
		Counterpoise Type	Length &Depth of earth electrode.	As per approved drawings	Contractor	100%	--- do---	Site Engineer
10	Stringing	1. Materials						
		a) Insulators	1. Visual check for cleanliness/glazing/ cracks/and white spots.	JKPDD Specification	Contractor	100% at Field	100% verification of records and to carry Physical verification random checks 10%	Site Engineer
			2. IR Value	Minimum acceptable value 2000 Mega ohm	-do-	Test shall be carried on 100% insulators using 5/10kV(DC) Megger	100 % by Contractor and record review by JKPDD and joint witnessing by JKPDD on 05% insulator	Site In-charge
			3. Traceability (Make/batch No./Locations where installed)	Packing list/CIP	Contractor	100% at field	100% Review of records	Site Engineer
		b) Conductor	On receipt, 1. Visual check of drum.	Packing list /CIP	Contractor	100% at stores	20% check	Site Engineer
			2. Check for seals and JKPDD signed sticker on outer end	-do-	-do-	-do-	-do-	-do-
			3. Check depth from top of flange to the top of the outer most layer	-do-	-do-	-do-	-do-	-do-
		c) Earth wire	Check for seals at both	Packing list/CIP	Contractor	100% at	20 % check	-do-

			ends			stores		
		2. Field activity						by
		a) Before Stringing	Readiness for stringing	Stringing procedures as per JKPDD specification	Contractor	Readiness certificate to be submitted by the Contractor	Review of Certificate	Sit e In-charge
		b) During stringing	(Conductor/Earth- wire)					
			1. Scratch/cut check (Visual)	Appd. Drawings/ JKPDD Specn.	Contractor	100% at Field	100% verification of record & 20% Field check	Site Engineer
			2. Repair sleeve	-do-	-do-	-do-	-do-	-do-
			3. Mid span Joints	-do-	-do-	-do-	-do-	-do-
			4. Guying (in case of towers not designed for one side stringing)	Appd. Guying arrangement/JKPDD Specn.	-do-	-do-	100%	Site Engineer
		c) After stringing	Check for,					
			1. Sag/Tension	Stringing Chart I tower Spotting data	-do-	-do-	100% verification of record & 20% field check	Site Engineer
			2. Electrical clearances	As per Appd. Drgs./JKPDD specifications	-do-	-do-	-do-	-do-
			i) Ground clearance	-do-	-do-	-do-	-do-	-do-
			ii) Live metal clearance etc.	-do-	-do-	-do-	-do-	-do-

			3. Jumpering	-do-	-do-	-do-	-do-	-do-
			4. Copper bond	As per Appd. Drgs/JKPDD Specification	Contractor	100% at Field		
			5a) Placement of Spacer/damper	As per Specn/Drgs/placement chart	-do-	-do-	-do-	-do-
		.	5b). Tightening of Bolts & nuts as per manufacturer recommendations	-do-	-do-		-do-	-do-
11.	Final Testing a) Pre-Commissioning of lines b)commissioning of lines	a) Readiness of lines for pre-commissioning Readiness of lines for commissioning	Completeness of Line Meggar test of line Digital Photograph of each tower to ascertain the completeness of tower	JKPDD latest Pre- commissioning Procedures a) JKPDD latest pre commissioning procedures b) Pre- commissioning Report c) CEA clearance	Joint inspection by JKPDD and Contractor	100%	100%	Site in – charge

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CEMENT

Annex-1 , sheet 01 of 03

ORDINARY PORTLAND CEMENT					
S.No.	**Name of the Test**	**Ordinary Portland Cement 33 grade as per IS 269**	**Ordinary Portland Cement 43 grade as per IS 8112**	**Ordinary Portland Cement 53 grade as per IS 12269**	**Remarks**

a)	Physical tests				To be conducted in apprd. Lab
(i)	Fineness	Specific surface area shall not be less than 225 sq. per Kg. or 2250 cm^2/gm.	Specific surface area shall not be less than 225 sq. m. per Kg or 2250cm^2/gm.	Specific surface area shall not be less than 225 sq. m. per Kg or 2250cm^2/gm.	Blaine's air permeability method as per IS 4031 (Part-2) / sieve analysis as per IS 4031 (part-3)
(ii)	Compressive strength	72 ± 1 hour; Not less than 16 Mpa (16N/mm^2) 678 ± 2 hour : Not less than 22 Mpa (22N/mm^2) 672 ± 4 hour : Not less than 33 Mpa (33N/mm^2)	72 ± 1 hour; Not less than 23 Mpa (23N/mm^2) 678 ± 2 hour : Not less than 33 Mpa (33N/mm^2) 672 ± 4 hour : Not less than 43 Mpa (43N/mm^2)	72 ± 1 hour; Not less than 27 Mpa (27N/mm^2) 678 ± 2 hour : Not less than 37 Mpa (37N/mm^2) 672 ± 4 hour : Not less than 53 Mpa (53N/mm^2)	As per IS 4031 (Part-6)
(iii)	Initial & Final setting time	Initial setting time : Not less than 30 minutes Final setting time :Not more than 600 minutes	Initial setting time : Not less than 30 minutes Final setting time :Not more than 600 minutes	Initial setting time : Not less than 30 minutes Final setting time :Not more than 600 minutes	As per ISO 4031 (Part-5) -do-
(iv)	Soundness	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test.	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test.	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test.	Le Chatlier and Autoclave test as per IS 4031 (Part -3)

Annex-1 , sheet 02 of 03

S. No.	**Name of the Test**	**Ordinary Portland Cement 33 grade as per IS 269**	**Ordinary Portland Cement 43 grade as per IS 8112**	**Ordinary Portland Cement 53 grade as per IS 12269**	**Remarks**

b)	**Chemical Composition tests**				Review of MTCC only
		a) Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02	a) Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02	a) Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02	
		b) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	b) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	b) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	
		c) Insoluble residue, percentage by mass max 4.00%	c) Insoluble residue, percentage by mass max 4.00%	c) Insoluble residue, percentage by mass max 4.00%	
		d) Magnesia percentage by mass max. 6%	d) Magnesia percentage by mass max. 6%	d) Magnesia percentage by mass max. 6%	
		e) Total sulphur content calculated as sulphuric anhydride (SO3), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percent by mass is 5or less and greater than 5 respectively.	e) Total sulphur content calculated as sulphuric anhydride (SO3), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percent by mass is 5or less and greater than 5 respectively.	e) Total sulphur content calculated as sulphuric anhydride (SO3), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percent by mass is 5or less and greater than 5 respectively.	
		f) Total loss on ignition shall not be more than 5 percent	**f) Total loss on ignition shall not be more than 5 percent**	**f) Total loss on ignition shall not be more than 5 percent**	

Annex-1 , sheet 03 of 03

S.No.	**Name of the test**				**Remarks**

2.	**PORTLAND POZZOLANA CEMENT AS PER IS 1489/2005**			
a)	Physical Tests	i) Fineness	Specific surface area shall not be less than 300sq.m. per Kg. or 3000cm²/gm.	To be conducted in JKPDD approved Lab
		ii) Compressive strength	a) 72 ± 1 hour : Not less than 16 Mpa (16N/mm²) b) 678 ± 2 hour : Not less than 22 Mpa (22N/mm²) c) 672 ± 4 hour : Not less than 33 Mpa (33N/mm²)	
		iii) Initial & Final setting time	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	
		iv) Soundness	Unaerated cement shall not have an expansion of more than 10mm Le chatlier test and 0.8% by Autoclave test as per IS 4031 (Part-3)	
b)	Chemical composition tests			
		a) Magnesia percentage by mass max. 6%		Review of MTCC only
		b) Insoluble material, percentage by mass X=4(100-X)/100 where X is the declared % of pozzolana in the PCC		-do-
		c) Total sulphur content calculated as sulphuric anhydride (SO3), percentage by mass not more than 3.0		-do-
		Total loss on ignition shall not be more than 5 percent		

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ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR REINFORCEMENT STEEL
AS PER IS 1786-1985 Edition – 4.3 (2004-12)

Annex-2

S.No.	Name of the Tests	Fe 415	Fe 500
i)	Chemical analysis test Carbon	0.30 Percent Maximum	0.33 Percent Maximum
	Sulphur	0.060 Percent Maximum	0.055 Percent Maximum
	Phosphorus	0.060 Percent Maximum	0.055 Percent Maximum
	Sulphur& Phosphorus	0.11 Percent Maximum	0.105 Percent Maximum
ii)	Physical Tests		
	a) Tensile Strength Minimum	10% more than actual 0.2% proof stress but not less than 485 N/sq.mm.	8% more than actual 0.2% proof stress but not less than 545 N/sq.mm
	b) 0.2% of proof stress/Yield stress Minimum, N/mm^2	415	500
	c) Elongation percent , Minimum	14.5	12
iii)	Bend & Rebend Tests	Pass	Pass

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR COARSE AGGREGATES AS PER IS 383

3.	**Coarse Aggregates**										
i)	**Physical Tests**										
	a) Determination of particles size	a. IS Sieve Designation	%age passing for Single- Sized Aggregate Of nominal size					Percentage Passing for graded Aggregate of nominal size			
			40mm	**20mm**	**16mm**	**12.5**	**10mm**	**40mm**	**20mm**	**16mm**	**12.5mm**
		63mm	**100**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		40mm	**85 to 100**	**100**	**-**	**-**	**-**	**95 to 100**	**100**	**-**	**-**
		20mm	**0 to 20**	**85 to 100**	**100**	**-**	**-**	**30 to 70**	**95 to 100**	**100**	**100**
		16mm	**-**	**-**	**85 to 100**	**100**	**-**	**-**	**-**	**90 to 100**	**-**
		12.5mm	**-**	**-**	**-**	**85 to 100**	**100**	**-**	**-**	**-**	**90 to 100**
		10 mm	**0 to 5**	**0 to 20**	**0 to 30**	**0 to 45**	**85 to 100**	**10 to35**	**25 to 55**	**30 to 70**	**40- 85**
		4.75mm	**-**	**0 to 5**	**0 to 5**	**0 to 10**	**0 to 20**	**0 to 5**	**0 to 10**	**0 to 10**	**0 to 10**
		2.36mm	**-**	**-**	**-**	**-**	**0 to 5**	**-**	**-**	**-**	**-**
	b) Flakiness index	**Not to exceed 25%**									
	c) Crushing Value	**Not to exceed 45%**									
	d) Presence of deleterious material	**Total presence of deleterious materials not to exceed 5%**									
	e) Hardness	**Abrasion value not more than 50% impact value not more than 45%**									
	f) Soundness test (for concrete work subject to frost action)	**Not to exceed 12% when tested with sodium sulphate and 18% when tested with magnesium sulphate**									

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR FINE AGGREGATES AS PER IS 383

4.	**Fine Aggregates**				
i)	**Physical Tests**	**IS Sieve Designation**	**Percentage Passing for**		
	a) Determination of particle size		F.A. Zone I	F.A. Zone II	F.A. Zone III
		10mm	100	100	100
		4.75mm	90-100	90-100	90-100
		2.36mm	60-95	75-100	85-100
		1.18mm	30-70	55-90	75-100
		600 microns	15-34	35-59	60-79
		300 microns	5 to 20	8 to 30	12 to 40
		150 microns	0-10	0-10	0-10
	b) Slit content		Not to exceed 8%	Not to exceed 8%	Not to exceed 8%
	c) Presence of deleterious material	Total presence of deleterious materials shall not exceed 5%			
	d) Soundness applicable to concrete work subject to frost action	12% when tested with sodium sulphate and 15% when tested with magnesium sulphate			

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CONCRETE WORK

1)	**Concrete**	**a) Workability**	**Slump shall be recorded by slump cone method and it shall between 25-55 mm**
		b) Compressive strength	**For nominal (volumetric) concrete mixes compressive strength for 1:1.5:3 (Cement : Fine aggregates : Coarse aggregates) concrete 28 days strength Shall be min 265Kg/cm² and for 1:2:4 (Cement: Fine Aggregate: Coarse Aggregates) nominal mix concrete 28 days strength shall be min 210 kg/cm².**

Notes:

1) ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTHS FOR NOMINAL MIXCONCRETE:

a) On the basis of mandatory lab test result, in case of actual average compressive strength being less than specified strength but up to 70% of specified strength, concrete may be accepted and the rate payable shall be in the same proportion as the actual average compressive strength bears to specified compressive strength.

However, in case cube strength of any one leg of any location is found to be between70% to 100% of specified value, all four leg of the respective location shall be analyzed. Root cause analysis has to be carried out with NDT method to verify the quality and strength of the foundations. If the results are not acceptable penalty such as re-doing of complete foundation/legs, cost towards supervision charges shall be levied from the contractor towards the sub-standard work, with the approval of Superintending/Executive Engineer.

b) If the actual average strength of accepted sample is less than 70% of specified strength, the Site -in-charge shall reject the defective portion of work represent by sample and nothing shall be paid for the rejected work. Remedial measures necessary to retain the structure shall be taken at the risk and cost of contractor. If, however, the Engineer-in-charge / Executive Engineer In-charge so desires, he may order additional tests to be carried out to ascertain if the structure can be retained/rectified. All the charges in connection with these additional tests shall be borne by the Contractor.

2) 53 Grade cement shall be used after obtaining specific approval of the Engineer in charge.

3) Portland slag cement conforming to IS: 455 may be used as per Technical Specification.

General Notes:

1) This standard Field Quality Plan is not to limit the supervisory checks which are otherwise required to be carried out during execution of work as per drawings/Technical specifications etc.

2) All materials under supply contract should have Cat-A CIP before they are erected.

3) Contractor shall be responsible for implementing/documenting the SFQP. Documents shall be handed over by the contractor to JKPDD after the completion of the work.

4) Executive Engineer in charge means over all in charge of work. Engineer-in-charge means in-charge of the line. Site engineer means in-charge of the section. Site Engineer's responsibility may be allocated to Site JE, with the approval of Superintending Engineer, only in such cases where, Site Engineer is not in position.

5) In case of deviation the approving authority will be one step above the officer designated for acceptance in this quality plan subject to minimum level of Line incharge.

6) Acceptance criteria and permissible limits for tests are indicated in the Annexures. However for further details/tests JKPDD specification and relevant Indian standards shall be referred.

7) Tests as mentioned in this FQP shall generally be followed. However E.I.C. reserves the right to order additional tests wherever required necessary at the cost of the agency.

8) All counter checks/tests by JKPDD shall be carried out by JKPDD's officials' at least at the level of Site Engineer-(Junior Engineer).

9) The authorized dealer means the dealer whose names are listed in the main producer's web site or certified by the main producers.

10) Accepting Authority for testing Laboratory shall be Superintending Engineer.

11) Mobile Testing Labs owned by the contractor may also be acceptable if their facilities meet the testing requirements and the testing equipment are properly calibrated at-Third Party Labs where testing/calibration is to be carried out should be accredited by NABL or an agency operating in line with ISO/IEC 17011 and having full membership &MRA of ILAC/APLAC, subject to approval of Executive Engineer in-charge.

12) READYMIX CONCRETE (RMC) IS ACCEPTABLE FOR USE. HOWEVER, SITE INCHARGE SHALL APPROVE THE SOURCE OF MATERIALS TO BE USED FOR RMC .The documentation to be maintained shall be as per IS 4926:2003 i.e

- **i.** Information to be supplied by the purchaser (clause 7)
- **ii.** Information to be supplied by the producer (clause8)

iii. Sampling for concrete strength should be one set of 3 nos. of cubes for every 50 cu.m or part thereof for each day of concreting and 28 days compressive strength shall be tested in linewith15:456.

13) Epoxy coating on reinforcement steel wherever required shall be done as per IS13620.

14) Cement is to be used in the order it is delivered (i.e. First in First Out). Cement bought to works shall not be more than 6 weeks old from the date of manufacture. In case the cement remains in storage for more than 3 months, the cement shall be retested before use and shall be rejected, if it fails to conform to any of the requirements given in the relevant Indian Standard. Cement shall be packed in bags and stored in accordance with the provisions in IS-4082.

15) If e-mail facility is not available in JKPDD approved Lab, report may be collected directly by JKPDD/ Speed Post/ Registered Post/ UPC.

16) In case any Laboratory refuses to allow JKPDD representative for witnessing the test, same shall be taken in writing and approval by Superintending Engineer

ENGINEERING GUIDE LINE FOR CHECKING / ACCEPTING SOIL INVESTIGATION REPORT:

Following are the guide line for checking and accepting the soil investigation report:

The soil investigation shall be carried out in line with the Technical Specification. The detailed soil investigation Report should be signed by the soil investigating agency, line Contractor and JKPDD's Site Engineer/Executive Engineer and following points should be checked in the soil investigation report :

1) *Normal Locations:*

a) Soil investigation report should contain the bore Log sheet indicating the variation of different soil strata.

b) The Bearing capacity, Bulk density (y) , Submerged Density (Y sub) , angle of repose (8) in dry as well as wet condition and Angle of internal friction(<l>) for different soil layers including at 3m depth shall be indicated in the Soil investigation report.

c) Present water table and history of variation of water table at the tower location shall be indicated in thesoil investigation report.

d) Classification of foundation should be indicated based on the water table, bearing capacity, Swelling Index, Soil type and the value of angle of repose (8)in line with parameters indicated in the standard foundation drawings.

2) River Crossing/Special Locations:

a) A sketch indicating profile of river crossing locations with bore hole positions shall be indicated in the soil investigation report.

b) Maximum discharge, Maximum velocity and Highest Flood Level (HFL) data (authenticated) of the river shall be enclosed in the Soil Investigation Report.

c) Comprehensive Bore log Sheet indicating the depth of different Strata, Soil type , SPT value & water table for each bore hole is to be indicated in the soil investing action report.

d) Natural Ground Level (GL) for all the locations are to be indicated. *Note that the GL &HFL should be with respect to* same *reference. For example if HFL is given in RL, the ground level should be in terms of RL only. Mixing of level with respect to MSL (Mean* Sea *level)* &*RL should be avoided.*

e) Whether the river is navigable or not is to be indicated in the soil investigation report.

f) Silt factor calculation based on the laboratory test results of weighted mean diameter (dm) of soil for different layer soft soil shall be furnished in the soil investigation report.

g) Bulk density(y), Submerged Density (Ysub), Value of Cohesion (C) and Angle of internal friction () for different soil layers based on laboratory test results shall be indicated in the soil investigation report.

h) If Rock is encountered prior to termination of bore hole (40m below existing Ground Level) ,core drilling should be done. The details of core recovery (Run wise) and calculation of Rock Quality Designation (RQO) together with the photograph of core sample properly placed in a core Box are to be enclosed in the soil investigation report.

i) If the refusal is not obtained or the type of soil encountered at 40m depth below existing ground level is very poor (like loose clay,

organic deposit etc.) further boring should be continued up to a depth of 50m below Ground Level or refusal whichever is earlier and all relevant data up to termination depth of bore holes shall be furnished in the Soil Investigation Report as detailed above.

PART-II
TECHNICAL SPECIFICATION
VOL-II, SEC-V
ACSR CONDUCTOR

TECHNICAL SPECIFICATIONS

SECTION-V

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TECHNICAL SPECIFICATIONS

SECTION-V

1. Technical Description of ACSR Conductor

1.1 **Details of Conductor**

1.1.1 The ACSR Conductor shall generally conform to IEC: 1089/ IS: 398 except where otherwise specified herein.

1.1.2 The salient parameters of the ACSR Conductor are indicated below.

		ACSR ZEBRA
a)	Stranding and wire diameter	54/3.18mmAl +7/3.18 mm steel
b)	Number of Strands	
	Steel core	1
	1st steel layer	6
	1st Aluminium layer	12
	2nd Aluminium layer	18
	3rd Aluminium layer	24
c)	Sectional area of Aluminium	428.90
d)	Total sectional area	484.5

1.1.3 Standard Technical Particulars

1.1.3.1 The Standard Technical Particulars (STP) of the ACSR conductor are enclosed at Annexure-B of this section. The values indicated in the STP are the minimum and/or maximum values required to be met by the Supplier.

1.2 Workmanship

1.2.1 All the Aluminium and steel strands shall be smooth, uniform and free from all imperfections, such as spills and splits, die marks, scratches, abrasions, etc., after drawing and also after stranding.

1.2.2 The finished conductor shall be smooth, compact, uniform and free from all imperfections including kinks (protusion of wires), wire cross over, over riding, looseness (wire being dislocated by finger/hand pressure and/or unusual bangle noise on tapping), material inclusions, white rust, powder formation or black spot (on account of reaction with trapped rain water etc.), dirt, grit etc.

1.2.3 The steel strands shall be hot dip galvanised and shall have a minimum zinc coating as indicated in the STP. The zinc coating shall be smooth, continuous,

of uniform thickness, free from imperfections and shall withstand number of dips in standard Preece test as indicated in STP. The steel wire rods shall be of such quality and purity that, when drawn to the size of the strands specified and coated with zinc, the finished strands and the individual wires shall be of uniform quality and have the same properties and characteristics as prescribed in IEC: 888.

1.2.4 The steel strands shall be preformed and post formed in order to prevent spreading of strands in the event of cutting of composite core wire. Care shall be taken to avoid, damages to galvanisation during pre-forming and post-forming operation.

1.3 Joints in Wires

1.3.1 Aluminium Wires

1.3.1.1 During stranding, no aluminium wire welds shall be made for the purpose of achieving the required conductor length.

1.3.1.2 No joints shall be permitted in the individual wires in the outer most layer of the finished conductor. However joints are permitted in the inner layer of the conductor unavoidably broken during stranding, provided such breaks are not associated with either inherently defective wire or with the use of short lengths of aluminium wires. Such joints shall not be more than four (4) per conductor length and shall not be closer than 15 meters from joint in the same wire or in any other aluminium wire of the completed conductor.

1.3.1.3 Joints shall be made by cold pressure butt welding and shall withstand a stress of not less than the breaking strength of individual strand guaranteed.

1.3.2 Steel Wires

There shall be no joint of any kind in the finished wire entering into the manufacture of the strand. There shall also be no strand joints or strand splices in any length of the completed stranded steel core of the conductor.

1.4 Tolerances

The manufacturing tolerances to the extent indicated in the STP shall be permitted in the diameter of individual aluminium and steel strands and lay-ratio of the conductor

1.5 Materials

1.5.1 Aluminium

The aluminium strands shall be hard drawn from electrolytic aluminium rods having purity not less than 99.5% and a copper content not exceeding 0.04%. They shall have the same properties and characteristics as prescribed in IEC: 889.

1.5.2 Steel

The steel wire strands shall be drawn from high carbon steel wire rods produced by either the acid or the basic open-hearth process, the electric furnace process, or the basic oxygen process and shall conform to the chemical composition indicated in the STP.

The Steel wire strands shall have the same properties and characteristics as prescribed for regular strength steel wire in IEC : 888.

1.5.3 Zinc

The zinc used for galvanizing shall be electrolytic High Grade Zinc of 99.95% purity as per IS209. It shall conform to and satisfy all the requirements of IS:209.

1.6 Standard Length

1.6.1 The standard length of the conductor shall be as indicated in the STP. All lengths outside this limit of tolerance shall be treated as random lengths. Not less than 90% of the total quantity of the conductor shall be supplied in standard lengths.

1.6.2 Random lengths will be accepted provided no length is less than 70% of the standard length and the total quantity of such random lengths shall not be more than 10% of the total quantity ordered. When one number random length has been manufactured at any time, five (5) more individual lengths each equivalent to the above random length with a tolerance of +/- 5% shall also be manufactured and all the above six random lengths shall be dispatched in the same shipment. At no point, the cumulative quantity supplied of such random lengths shall not be more than 12.5% of the total cumulative quantity supplied including such random lengths. However, the last 20% of the quantity ordered shall be supplied only in standard lengths as specified.

1.6.3 The Employer reserves the right to place orders for the lengths above the standard length on the same terms and conditions applicable for the standard lengths during the pendency of the Contract.

2.0 Tests and Standards

2.1 **Type Tests**

The following tests shall be conducted once on a sample/samples of conductor from each manufacturing facility:

a) DC resistance test on stranded conductor	As per Annexure-A
b)UTS test on stranded conductor	

2.1.1 **Type tests specified under Clause 2.1 shall not be required to be carried out if a valid test certificate is available for a similar design, i.e., tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO/IEC vide 25/17025 or EN 45001 by the National accreditation body of the country where laboratory is located) or witnessed by the representative(s) of PDD, J&K or Power utility. The test reports submitted shall be for the tests conducted within last 5 (five) years prior to date of bid opening.**

In case the test have been conducted earlier than the above stipulated period or in the event of any discrepancy in the test report (i.e., any test not applicable due to any design/manufacturing change including substitution of components or due to non-compliance with the requirement stipulated in the Technical Specifications), the tests shall be conducted by the Contractor at no extra cost to the Employer.

2.2 Acceptance Tests

a)	Visual and dimensional check on drum	As per Annexure-A
b)	Visual check for joints scratches etc. and length measurement of conductor by rewinding	
c)	Dimensional check on Steel and Aluminium strands	
d)	Check for lay-ratios of various layers	
e)	Galvanizing test on steel strands	
f)	Torsion and Elongation tests on steel strands	
g)	Breaking load test on steel and Aluminium strands	
h)	Wrap test on Steel & Aluminium strands	IEC : 888 & 889
i)	DC resistance test on Aluminium strands	IEC : 889
j)	Procedure qualification test on welded joint of Aluminium strands	Annexure-A
k)	Barrel Batten strength test	Annexure-A

Note : All the above tests except (j) shall be carried out on Aluminium and steel strands after stranding only.

2.3 Routine Test

a) Check to ensure that the joints are as per Specification

b) Check that there are no cuts, fins etc., on the strands.

c) Check that drums are as per Specification

d) All acceptance test as mentioned above to be carried out on each coil/ drum (as applicable)

2.4 Tests During Manufacture

a) Chemical analysis of zinc used for galvanizing b) Chemical analysis of Aluminium used for making Aluminium strands c) Chemical analysis of steel used for making steel strands	As per Annexure-A

2.5 Testing Expenses

2.5.1 As indicated in clause no. 2.1.1, no type test charges shall be payable.

2.5.2 In case testing is required due to non-availability of valid type test reports, bidder shall indicate the laboratories in which they propose to conduct the type tests. They shall ensure that adequate facilities are available in the laboratories and the tests can be completed in these laboratories within the time schedule guaranteed by them.

2.5.3 In case of failure in any type test the Supplier is either required to manufacture fresh sample lot and repeat all the test successfully once or repeat that particular type test three times successfully on the sample selected from the already manufactured lot at his own expenses. In case a fresh lot is manufactured for testing then the lot already manufactured shall be rejected.

2.5.4 The entire cost of testing for the acceptance and routine tests and Tests during manufacture specified herein shall be treated as included in the quoted unit price of conductor, except for the expenses of the inspector/Employer's representative.

2.5.5 In case of failure in any type test, if repeat type tests are required to be conducted, then all the expenses for deputation of Inspector/Employer's representative shall be deducted from the contract price. Also if on receipt of the Supplier's notice of testing, the Employer's representative does not find 'plant' to be ready for testing the expenses incurred by the Employer for re-deputation shall be deducted from contract price.

2.6 Additional Tests

2.6.1 The Employer reserves the right of having at his own expenses any other test(s) of reasonable nature carried out at Supplier’s premises, at site or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the materials comply with the Specifications.

2.6.2 The Employer also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Supplier's premises or at any other test centre. In case of evidence of non compliance, it shall be binding on the part of Supplier to prove the compliance of the items to the technical specifications by repeat tests, or correction of deficiencies, or replacement of defective items all without any extra cost to the Employer.

2.7 Sample Batch for Type Testing

2.7.1 The Supplier shall offer material for selection of samples for type testing only after getting Quality Assurance Plan approved from Employer's Quality Deptt. The sample shall be manufactured strictly in accordance with the Quality Assurance Plan approved by Employer.

2.7.2 The Supplier shall offer at least three drums for selection of sample required for conducting all type tests.

2.7.3 The Supplier is required to carry out all the acceptance tests successfully in presence of Employer's representative before sample selection.

2.8 Test Reports

2.8.1 Copies of type test reports shall be furnished in at least six copies along with one original. One copy will be returned duly certified by the Employer only after which the commercial production of the material shall start.

2.8.2 Record of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the Employer's representative.

2.8.3 Test Certificates of tests during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Employer.

2.9 Inspection

2.9.1 The Employer's representative shall at all times be entitled to have access to the works and all places of manufacture, where conductor shall be manufactured and representative shall have full facilities for unrestricted inspection of the Supplier's works, raw materials and process of manufacture for conducting necessary tests as detailed herein.

2.9.2 The Supplier shall keep the Employer informed in advance of the time of starting and of the progress of manufacture of conductor in its various stages so that arrangements can be made for inspection.

2.9.3 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested, unless the inspection is waived off by the Employer in writing. In the latter case also the conductor shall be dispatched only after satisfactory testing for all tests specified herein have been completed.

2.9.4 The acceptance of any quantity of material shall in no way relieve the Supplier of any of his responsibilities for meeting all requirements of the Specification, and shall not prevent subsequent rejection it such material is later found to be defective.

2.10 Test Facilities

2.10.1 The following additional test facilities shall be available at the Supplier's works:

a) Calibration of various testing and measuring equipment including tensile testing machine, resistance measurement facilities, burette, thermometer, barometer, digital ohm meter etc.

b) Standard resistance for calibration of resistance bridges.

c) Finished conductor shall be checked for length verification and surface finish on separate rewinding machine at reduced speed (variable from 8 to 16 meters per minute). The rewinding facilities shall have appropriate clutch system and free of vibrations, jerks etc. with traverse laying facilities.

2.11 Packing

2.11.1 The conductor shall be supplied in non-returnable, strong, wooden drums provided with lagging of adequate strength, constructed to protect the conductor against all damage and displacement during transit, storage and subsequent handling and stringing operations in the field. The Supplier shall be responsible for any loss or damage during transportation handling and storage due to improper packing. The drums shall generally conform to IS:1778, except as otherwise specified hereinafter.

2.11.2 The drums shall be suitable for wheel mounting and for letting off the conductor under a minimum controlled tension of the order of 5 KN.

2.11.3 The general outline of the drum for conductor shall be as in the annexed drawings. The Bidder should submit their proposed drum drawings along with the bid.

2.11.4 For conductor, one standard length shall be wound on each drum.

2.11.5 All wooden components shall be manufactured out of seasoned soft wood free from defects that may materially weaken the component parts of the drums. Preservative treatment shall be applied to the entire drum with preservatives of a quality which is not harmful to the conductor.

2.11.6 The flanges shall be of two ply construction with each ply at right angles to the adjacent ply and nailed together. The nails shall be driven from the inside face flange, punched and then clenched on the outer face. The thickness of each ply shall not vary by more than 3mm from that indicated in the figure. There shall be at least 3 nails per plank of ply with maximum nail spacing of 75mm. Where a slot is cut in the flange to receive the inner end of the conductor the entrance shall be in line with the periphery of the barrel.

2.11.7 The wooden battens used for making the barrel of the conductor shall be of segmental type. These shall be nailed to the barrel supports with at least two nails. The battens shall be closely butted and shall provide a round barrel with smooth external surface. The edges of the battens shall be rounded or chamfered to avoid damage to the conductor.

2.11.8 Barrel studs shall be used for the construction of drums. The flanges shall be holed and the barrel supports slotted to receive them. The barrel studs shall be threaded over a length on either end, sufficient to accommodate washers, spindle plates and nuts for fixing flanges at the required spacing.

2.11.9 Normally, the nuts on the studs shall stand protruded of the flanges. All the nails used on the inner surface of the flanges and the drum barrel shall be counter sunk. The ends of barrel shall generally be flushed with the top of the nuts.

2.11.10 The inner cheek of the flanges and drum barrel surface shall be painted with a bitumen based paint.

2.11.11 Before reeling, card board or double corrugated or thick bituminised water-proof bamboo paper shall be secured to the drum barrel and inside of flanges of the drum by means of a suitable commercial adhesive material. After reeling the conductor, the exposed surface of the outer layer of conductor shall be wrapped with water proof thick bituminised bamboo paper to preserve the conductor from dirt, grit and damage during transport and handling.

2.11.12 A minimum space of 75 mm for conductor shall be provided between the inner surface of the external protective tagging and outer layer of the conductor.

2.11.13 Each batten shall be securely nailed across grains as far as possible to the flange, edges with at least 2 nails per end. The length of the nails shall not be less than twice the thickness of the battens. The nails shall not protrude above

the general surface and shall not have exposed sharp, edges or allow the battens to be released due to corrosion.

2.11.14 The nuts on the barrel studs shall be tack welded on the one side in order to fully secure them. On the second end, a spring washer shall be used.

2.11.15 A steel collar shall be used to secure all barrel studs. This collar shall be located between the washers and the steal drum and secured to the central steel plate by welding.

2.11.16 Outside the protective lagging, there shall be minimum of two binder consisting of hoop iron /galvanised steel wire. Each protective lagging shall have two recesses to accommodate the binders.

2.11.17 The conductor ends shall be properly sealed and secured on the side of one of the flanges to avoid loosening of the conductor layers during transit and handling.

2.11.18 As an alternative to wooden drum Bidder may also supply the conductors in non-returnable painted steel drums. After preparation of steel surface according to IS:9954, synthetic enamel paint shall be applied after application of one coat of primer. Wooden/Steel drum will be treated at par for evaluation purpose and accordingly the Bidder should quote in the package.

2.12 Marking

Each drum shall have the following information stenciled on it in indelible ink along with other essential data:

(a) Contract/Award letter number.

(b) Name and address of consignee.

(c) Manufacturer's name and address.

(d) Drum number

(e) Size of conductor

(f) Length of conductor in meters

(g) Arrow marking for unwinding

(h) Position of the conductor ends

(i) Distance between outer-most Layer of conductor and the inner surface of lagging.

(k) Barrel diameter at three locations & an arrow marking at the location of the measurement.

(l) Number of turns in the outer most layer.

(m) Gross weight of drum after putting lagging.

(n) Tear weight of the drum without lagging.

(o) Net weight of the conductor in the drum.

(p) CIP/MICC No.

The above should be indicated in the packing list also.

2.13 Verification of Conductor Length

The Employer reserves the right to verity the length of conductor after unreeling. The quantity for verification shall be between a minimum of five percent (5%) to a maximum of ten percent (10%)of the drums in a lot offered for inspection. The actual quantity will be discussed and mutually agreed to by the Supplier & Employer in the Quality Assurance Programme.

2.14 **Standards**

2.14.1 The conductor shall conform to the following Indian/International Standards, which shall mean latest revisions, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification.

2.14.2 In the event of the supply of conductor conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent to those specified. In case of award, salient features of comparison between the standards proposed by the Supplier and those specified in this document will be provided by the Supplier to establish their equivalence.

Sl. No.	Indian Standard	Title	International Standard
1.	IS: 209-1992	Specification for zinc	BS:3436-1986
2.	IS: 398 Part-I - 1996	Specification for Aluminium Conductors for Overhead Transmission Purposes	IEC:1089-1991 BS:215-1970
3.	IS:398 Part-II - 1996	Aluminum Conductor Galvanised Steel Reinforced	BS;215-1970 IEC:1089-1991
4.	IS:398 Part-V - 1992	Aluminum Conductor Galvanised Steel- Reinforced For Extra High Voltage (400 KV) and above	IEC:1089-1991 BS:215-1970
5.	IS : 1778-1980	Reels and Drums for Bare Conductors	BS:1559-1949
6.	IS : 1521-1991	Method of Tensile Testing of Steel Wire	ISO 6892-1984
7.	IS : 2629-1990	Recommended Practice for Hot Dip Galvanising of Iron and Steel	
8.	IS : 2633-1992	Method of Testing Uniformity of Coating on Zinc Coated Articles	

9.	IS : 4826-1992	Galvanised Coating on Round Steel Wires	IEC : 888-1987 BS:443-1969
10.	IS : 6745-1990	Methods of Determination of Weight of Zinc Coating of Zinc Coated Iron and Steel Articles	BS:433-1969 ISO 1460 - 1973
11.	IS : 8263-1990	Method of Radio Interference Tests on High Voltage Insulators	IEC:437-1973 NEMA:107-1964 CISPR
12.		Zinc Coated steel wires for stranded Conductors	IEC : 888-1987
13.		Hard drawn Aluminium wire for overhead line conductors	IEC : 889-1987

The standards mentioned above are available from:

Reference Abbreviation	**Name and Address**
BS	British Standards, British Standards Institution 101, Pentonvile Road, N - 19-ND UK
IEC/CISPR	International Electro technical Commission, Bureau Central de la Commission, electro Technique international, 1 Rue de verembe, Geneva SWITZERLAND
BIS/IS	Beureau Of Indian Standards. Manak Bhavan, 9, Bahadur Shah Zafar Marg, New Delhi - 110001. INDIA
ISO	International Organisation for Standardization. Danish Board of Standardization Danish Standardizing Sraat, Aurehoegvej-12 DK-2900, Heeleprup, DENMARK.
NEMA	National Electric Manufacture Association, 155, East 44th Street. New York, NY 10017 U.S.A.

ANNEXURE-A

1. Tests on Conductor

1.1 UTS Test on Stranded Conductor

Circles perpendicular to the axis of the conductor shall be marked at two places on a sample of conductor of minimum 5 m length between fixing arrangement suitably fixed on a tensile testing machine. The load shall be increased at a steady rate up to 50% of minimum specified UTS and held for one minute. The circles drawn shall not be distorted due to relative movement of strands. Thereafter the load shall be increased at steady rate to 100% of the UTS of conductor and held for one minute. The Conductor sample shall not fail during this period. The applied load shall then be increased until the failing load is reached and this value shall be recorded.

1.2 Corona Extinction Voltage Test

The samples of conductor of 5 m length shall be strung at a height not exceeding 7.015 m above ground. The sample assembly when subjected to power frequency voltage shall have a corona extinction voltage of not less than 154 kV (rms) line to ground under dry condition. There shall be no evidence of corona on any part of the samples. The test should be conducted without corona control rings. However, small corona control rings may be used to prevent corona in the end fittings. The voltage should be corrected for standard atmospheric conditions.

1.3 Radio Interference Voltage Test

Under the conditions as specified under (1.2) above, the conductor samples shall have radio interference voltage level below 1000 microvolts at one MHz when subjected to 50 Hz AC voltage of 154 kV line to ground under dry conditions. This test may be carried out with corona control rings and arcing horns.

1.4 D.C. Resistance Test on Stranded Conductor

On a conductor sample of minimum 5m length two contact-clamps shall be fixed with a predetermined bolt torque. The resistance shall be measured by a Kelvin double bridge or digital ohm-metre of sufficient accuracy by placing the clamps initially zero metre and subsequently one metre apart. The test shall be repeated at least five times and the average value recorded. The value obtained shall be corrected to the value at 20_0C as per IS:398. The resistance corrected at 20_0C shall conform to the requirements indicated in the STP.

1.5 Chemical Analysis of Aluminium and Steel

Samples taken from the Aluminium and steel ingots/coils/strands shall be chemically/spectrographically analysed. The same shall be in conformity to the requirements stated in this Specification.

1.6 Visual and Dimensional Check on Drums

The drums shall be visually and dimensionally checked to ensure that they conform to the requirements of this Specification.

1.7 Visual Check for Joints, Scratches etc.

Conductor drums shall be rewound in the presence of the Employer. The Employer shall visually check for scratches, joints etc. and that the conductor generally conform to the requirements of this Specification. Five percent (5%) to ten percent (10%) drums from each lot shall be rewound in the presence of the Employer's representative. The actual quantity will be discussed and mutually agreed to by the Supplier & Employer in the Quality Assurance Programme.

1.8 Dimensional Check on Steel and Aluminium Strands

The individual strands shall be dimensionally checked to ensure that they conform to the requirement of this Specification.

1.9 Check for Lay-ratios of Various Layers

The lay-ratios of various layers shall be checked to ensure that they conform to the requirements of this Specification.

1.10 Procedure Qualification test on welded Aluminium strands.

Two Aluminium wire shall be welded as per the approved quality plan and shall be subjected to tensile load. The breaking strength of the welded joint of the wire shall not be less than the breaking strength of individual strands.

1.11 Chemical Analysis of Zinc

Samples taken from the zinc ingots shall be chemically/ spectrographically analyzed. The same shall be in conformity to the requirements stated in the Specification.

1.12 Galvanizing Test

The test procedure shall be as specified in IEC: 888. The material shall conform to the requirements of this Specification. The adherence of zinc shall be checked by wrapping around a mandrel four times the diameter of steel wire.

1.13 Torsion and Elongation Tests on Steel Strands

The test procedures shall be as per clause No. 10.3 of IEC: 888. In torsion test, the number of complete twists before fracture shall not be less than that indicated in the STP. In case test sample length is less or more than 100 times the stranded diameter of the strand, the minimum number of twists will be proportioned to the length and if number comes in the fraction then it will be rounded off to next higher whole number. In elongation test, the elongation of the strand shall not be less than 4% for a gauge length of 250 mm.

1.14 Check on Barrel Batten strength of Drums

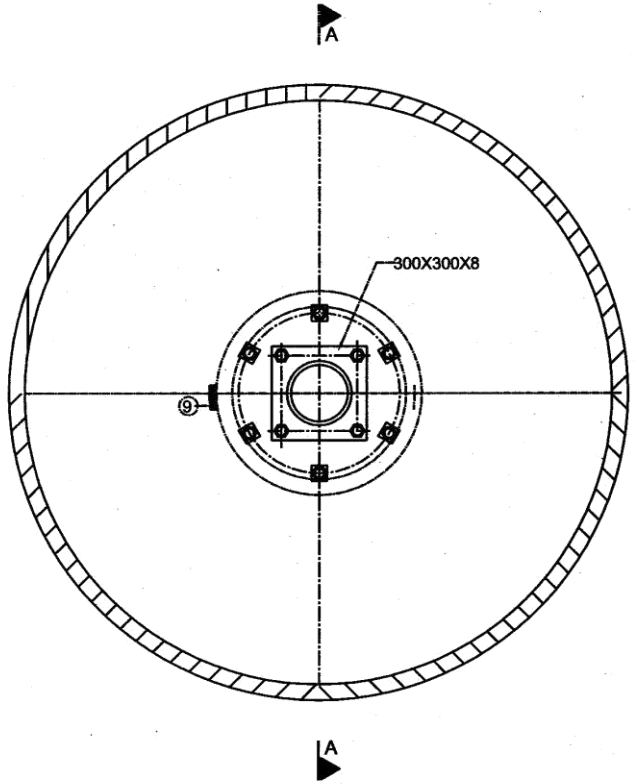
The details regarding barrel batten strength test will be discussed and mutually agreed to by the Supplier & Employer in the Quality Assurance Programme.

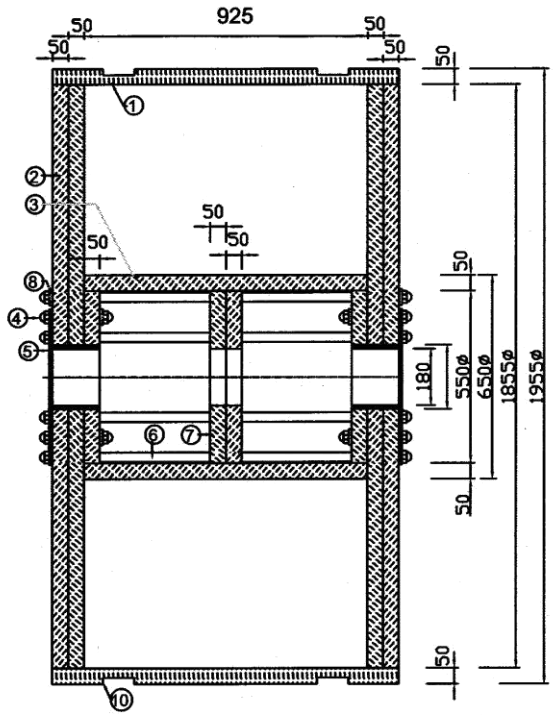
STANDARD TECHNICAL PARTICULARS OF ACSR ZEBRA CONDUCTOR

Sl.	Description	Unit	Guaranteed Values
1.0	**Raw Materials**		
1.1	**Steel Wire / Rods**		
1.1	**Aluminium**		
a)	Minimum purity of Aluminium	%	99.50
b)	Maximum copper content	%	0.04
1.2	**Steel wires/ rods**		
a)	Carbon	%	0.50 to 0.85
b)	Manganese	%	0.50 to 1.10
c)	Phosphorous	%	Not more than 0.035
d)	Sulphur	%	Not more than 0.045
e)	Silicon	%	0.10 to 0.35 (Max.)
1.3	**Zinc**		
a)	Minimum purity of Zinc	.%	99.95
2.0	**Aluminum strands after stranding**		
2.1	Diameter		
a)	Nominal	mm	3.18
b)	Maximum	mm	3.21
c)	Minimum	mm	3.15
2.2	Minimum breaking load of strand		
a)	Before stranding	KN	1.29
b)	After stranding	KN	1.23
2.3	Maximum resistance of 1 m length of strand at 20 deg. C	Ohm	0.003651
3.0	**Steel strand after stranding**		
2.1	Diameter		
a)	Nominal	mm	3.18
b)	Maximum	mm	3.24
c)	Minimum	mm	3.12
3.2	Minimum breaking load of strand		
a)	Before stranding	KN	10.43
b)	After stranding	KN	9.95

STANDARD TECHNICAL PARTICULARS OF ACSR ZEBRA CONDUCTOR

Sl.	Description	Unit	Guaranteed Values	
3.3	Galvanising			
a)	Minimum weight of zinc coating per sq.m.	gm	250	
b)	Minimum number of dips that the galvanised strand can withstand in the standard preece test	Nos.	2 dips of one minute & 1 dip of half minute	
c)	Min. No. of twists in guage length equal 100 times the dia. of wire which the strand can withstand in the torsion test (after stranding)	Nos	16	
4.	**Stranded Conductor**			
4.1	UTS of the conductor	kN	130.32 (Min.)	
4.2	Lay length of outer steel layer	mm	Max	Min
a)	Outer Steel layer	mm	18	13
b)	12 wire Aluminium layer	mm	17	10
c)	18 wire Aluminium layer	mm	16	10
d)	24 wire Aluminium layer	mm	14	10
4.3	DC resistance of the conductor at 20°C	ohm/km	0.06885	
4.4	Standard length of the conductor	m	1800	
4.5	Tolerance on Standard length	%	(+/-) 5	
4.6	Direction of lay of outer layer		Right Hand	
4.7	**Linear mass of the conductor**			
a)	Standard	kg/km	1621	
b)	Minimum	kg/km	1582	
c)	Maximum	kg/km	1652	





SECTION A-A

S.NO	DESCRIPTION
10	RECESS FOR BINDER
9	SLOT FOR INNER END OF CONDUCTOR
8	WASHER
7	BARREL SUPPORT
6	BARREL STUD TIE ROD.
5	MILD STEEL BUSH & PLATE
4	BARREL STUD
3	BARREL
2	FLANGE
1	PROTECTIVE EXETRNAL LAGAING

NOTES

1 : ALL DIM. ARE IN MM
2 : CLEARANCE FROM OUTER SURFACE OF OUTER LAYER OF CONDUCTOR TO INNER SURFACE OF PROTECTIVE LAGGING IS AT LEAST 75mm
3 : THICKNESS OF PROTECTIVE LAGGING SHOULD BE 50mm.
4 : TOLLERANCE ON DIMENSION OF WOOD ONLY IS EQUAL TO +3mm
5 : STANDARD LENGTH OF CONDUCTOR EQUAL TO 1800 MTS.
6 : TOLERANCE ON LENGTH CONDUCTOR IS EQUAL TO 5% OF STANDARD LENGTH

PROJECT	K.V. TRANSMISSION SYSTEM
TITLE	DRUM FOR ACSR / AACSR/ AAAC MOOSE CONDUCTOR
DRG. NO.	REV. 0

PART-II

TECHNICAL SPECIFICATION

VOL-II, SEC-VI

OPGW

Section – VI

Part-1

Introduction, General Information and General Requirement

Table of Content

Introduction, General Information and General Requirement

This part of the Tender Documents describes the technical specifications of OPGW and associated hardware & fittings including joint box etc. This specification describes the functional and performance requirements of the system.

This part of specification describes the functional and performance requirement of the Fibre Optic cable and its associated hardware & fittings.

1.1 Scope and General Requirements

The scope of OPGW requirement is described as follows:

The scope shall include planning, design, engineering, manufacturing, supply & testing of OPGW cable & associated items and documentation of:

(i.)24F OPGW cable/ 48F OPGW Cable

(ii.) All associated hardware, fittings and accessories (Tension assembly, Suspension assembly, Vibration dampers, Reinforcing rods, Earthing clamps, Downlead clamps etc.) required for installation of OPGW cable.

(iii) Joint box for above OPGW cable

(iv) Fibre Optic approach cable including associated installation material (as required if specified in BOQ).

(v) Fibre Optic Distribution Panels (FODP) (as required if specified in BOQ).

The various Parts of this specification define the design, performance, test and implementation requirements for OPGW Cable system.

1.2 General Requirements

The Contractor must conform to the requirements and provide any special equipment necessary to meet the requirements stated herein.

It should be noted that parameters for OPGW cable design has been specified in the tender. The Contractor shall offer the product meeting the design accordingly.

The Bidder's proposal shall address all functional and performance requirements within this specification and shall include sufficient information and supporting documentation in order to determine compliance with this specification without further necessity for inquiries.

The Bidder's proposal shall clearly identify all features described in the specifications or in any supporting reference material that will not be implemented; otherwise, those features shall become binding as part of the final contract.

The offered items shall be designed to operate in varying environments. Adequate measures shall be taken to provide protection against rodents, contaminants, pollutants, water & moisture, lightning & short circuit, vibration and electro-magnetic interference etc.

The Contractor shall demonstrate a specified level of performance of the offered items during well-structured factory tests and field testing wherever required.

Procedure for Type Test & FAT as per relevant international standards shall be provided during detailed engineering by the employer.

1.2.1 Organization of the Technical Specification Document

Part 3 through 4 and Appendices provide the project requirements of the fibre optic cabling system to be provided.

Part 2 contains specifications for OPGW cabling & associated hardware & fittings

Part 3 contains the requirement for Inspection & Testing requirement

Part 4 contains the Support Services & documentation

The following is a list of the Appendices:

Appendix A - Data Requirement Sheets (DRS)

Appendix B - Guide line for offline OPGW Installation

Appendix C - Guide line for liveline OPGW Installation as applicable

Appendix D - Splicing (Jointing) Manual

1.3 **Applicable Standards**

The following standards and codes shall be generally applicable to the equipment and works supplied under this Contract:

(1) American Society for Testing and Materials ASTM

ASTM-B415 Standard Specification for Hard-Drawn Aluminium-Clad Steel Wire

(2) Bell Communication Research

GR-20 Generic requirements for optical fibre and optical fibre cable

(3) **ITU-T/CCITT Recommendations**

G.650 Definitions and test methods for the relevant parameters of single-mode fibres

G.652 Characteristics of a single-mode optical fibre cable

(4) **IEEE**

IEEE-1138, 2009 IEEE Standard for Testing and Performance for Optic Ground Wire (OPGW) for Use on Electric Utility power Lines

(5) **Telecommunication Industry Association EIA/TIA**

EIA/TIA-455-3 Procedure to Measure Temperature Cycling Effects on Optical Fibres, Optical Cable, and Other Passive Fiber Optic Components

EIA/TIA-455-16 Salt Spray (Corrosion) Test for Fibre Optic Components

EIA/TIA-455-20	Measurement of Change in Optical Transmittance
EIA/TIA-455-25	Repeated Impact Testing of Fibre Optic Cables and Cable Assemblies
EIA/TIA-455-32	Fibre Optic Circuit Discontinuities
EIA/TIA-455-33	Fibre Optic Cable Tensile Loading and Bending Test
EIA/TIA-455-41	Compressive Loading Resistance of Fibre Optic Cables
EIA/TIA-455-59	Measurement of Fibre Point Defects Using an OTDR
EIA/TIA-455-62	Measurement of Optical Fibre Macrobend Attenuation
EIA/TIA-455-78	Spectral Attenuation Cutback Measurement for Single-Mode Optical Fibres
EIA/TIA-455-80	Measurement of Cut-Off Wavelength of Single-Mode Fibre by Transmitted Power
EIA/TIA-455-81	Compound Flow (Drip) Test for Filled Fibre Optic Cable
EIA/TIA-455-82	Fluid Penetration Test for Fluid-Blocked Fibre optic Cable
EIA/TIA-455-91	Fibre Optic Cable Twist-Bend Test
EIA/TIA-455-164	Single-Mode Fibre, Measurement of Mode Field Diameter by Far-Field Scanning
EIA/TIA-455-167	Mode Field Diameter Measurement, Variable Aperture Method in the Far-Field
EIA/TIA-455-168	Chromatic Dispersion Measurement of Multimode Graded Index and Single-Mode Optical Fibres by Spectral Group Delay Measurement in the Time Domain
EIA/TIA-455-169	Chromatic Dispersion Measurement of Single-Mode Optical Fibres by the Phase-Shift Method
EIA/TIA-455-170	Cable Cut-off Wavelength of Single-Mode Fibre by Transmitted Power
EIA/TIA-455-174	Mode Field Diameter Measurement
EIA/TIA-455-175	Chromatic Dispersion Measurement of Single-Mode Optical Fibres by the Differential Phase-Shift Method
EIA/TIA-455-176	Method of Measuring Optical Fibre Cross-Partal Geometry by Automated Grey-Scale Analysis
EIA/TIA-598	Optical Fibre Cable Colour Coding

(6) **International Electrotechnical Commission IEC standards**

IEC-60793-1 series	Optical fibres – Generic & product specifications, measurement methods & test procedures specification
IEC-60794-1-1	Optical fibre cables – Generic specification
IEC-60794-1-2	Optical fibre cables – Basic optical cable test procedure
IEC-60794-3	Optical fibre cables – Duct, buried and aerial cables – partal specification
IEC-60794-4	Optical fibre cables – Overhead cables
IEC-61089	Round wire concentric lay overhead electrical stranded conductors
IEC-61232	Aluminium-clad steel wires for electrical purposes
IEC-61284	Overhead lines-Requirements and tests for fittings
IEC-61395	Overhead electrical conductors – Creep test procedures for stranded conductors

Specifications and codes shall be the latest version, inclusive of revisions, which are in force at the date of the contract award. Where new specifications, codes, and revisions are issued during the period of the contract, the Contractor shall attempt to comply with such, provided that no additional expenses are charged to the Employer without Employer's written consent.

In the event the Contractor offers to supply material and/or equipment in compliance to any standard other than Standards listed herein, the Contractor shall include with their proposal, full salient characteristics of the new standard for comparison.

In case values indicated for certain parameters in the specifications are more stringent than those specified by the standards, the specification shall override the standards.

1.4 References

(1) CIGRE Guide for Planning of Power Utility Digital Communications Networks

(2) CIGRE Optical Fibre Planning Guide for Power Utilities

(3) CIGRE New Opportunities for Optical Fibre Technology in Electricity Utilities

(4) CIGRE guide to fittings for Optical Cables on Transmission Lines

……End of this part……

Part-02

Specification for OPGW cabling & associated hardware & fittings

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Section – VI

Part-02

Specification for OPGW cabling and associated hardware & fittings

This part of the technical specification describes the functional and technical specifications of OPGW cabling and associated hardware and fittings.

2.1 Fibre Optic Cabling

In this part of the technical specification, the functional & technical specifications of OPGW cable, associated hardware & fittings for the requirements for G.652D Dual-window Single mode (DWSM) telecommunications grade fibre optic cable is mentioned. Bidders shall furnish with their bids, detailed descriptions of the fibres & cable(s) proposed.

All optical fibre cabling including fibre itself and all associated installation hardware shall have a minimum guaranteed design life span of 25 years.

2.1.1 Required Optical Fibre Characteristics

The optical fibre to be provided should have following characteristics :

2.1.1.1 Physical Characteristic

Dual-Window Single mode (DWSM), G.652D optical fibres shall be provided in the fibre optic cables. DWSM optical fibres shall meet the requirements defined in Table 2-1(a) :

2.1.1.2 Attenuation

The attenuation coefficient for wavelengths between 1525 nm and 1575 nm shall not exceed the attenuation coefficient at 1550 nm by more than 0.05 dB/km. The attenuation coefficient between 1285 nm and 1330 nm shall not exceed the attenuation coefficient at 1310 nm by more than 0.05 dB/km. The attenuation of the fibre shall be distributed uniformly throughout its length such that there are no point discontinuities in excess of 0.10 dB. The fibre attenuation characteristics specified in table 2-1 (a) shall be "guaranteed" fibre attenuation of any & every fibre reel.

Table 2-1(a)
DWSM Optical Fibre Characteristics

Fibre Description:	Dual-Window Single-Mode
Mode Field Diameter @ 1310nm:	8.6 to 9.5 μm (± 0.6μm)
Cladding Diameter:	125.0 μm ± 1 μm
Mode field concentricity error	≤ 0.6μm
Cladding non-circularity	≤ 1%
Cable Cut-off Wavelength λ_{cc}	≤ 1260 nm
1550 nm loss performance	As per G.652 D
Proof Test Level	≥ 0.69 Gpa
Attenuation Coefficient:	@ 1310 nm ≤ 0.35 dB / km @ 1550 nm ≤ 0.21 dB / km
Chromatic Dispersion; Maximum: **Zero Dispersion Wavelength:** **Zero Dispersion Slope:**	18 ps/(nm x km) @ 1550 nm 3.5 ps/(nm x km) 1288-1339nm 5.3 ps/(nm x km) 1271-1360nm 1300 to 1324nm 0.092 ps/(nm^{2}xkm) maximum

Table 2-1(a)
DWSM Optical Fibre Characteristics

Polarization mode dispersion coefficient	≤ 0.2 ps/km^½
Temperature Dependence:	Induced attenuation ≤ 0.05 dB (-60°C to +85°C)
Bend Performance:	@ 1310 nm (75±2 mm dia Mandrel), 100 turns; Attenuation Rise ≤ 0.05 dB/km @ 1550 nm (75±2 mm dia Mandrel), 100 turns; Attenuation Rise ≤ 0.10 dB/km @ 1550 nm (32±0.5 mm dia Mandrel, 1 turn; Attenuation Rise ≤ 0.50 dB/km

2.1.2 Fibre Optic Cable Construction

The OPGW (Optical Ground Wire) cable is to be installed on the transmission lines in place of Earth wire for 765/400/220/132kV lines. The design of cable shall account for the varying operating and environmental conditions that the cable shall experience while in service. The OPGW cable to be supplied shall be designed to meet the overall requirements of the transmission line. To meet the overall requirements of the

transmission line(s), the contractor may offer more than one design without any additional cost to employer, in case single design is not meeting the requirement.

2.1.2.1 Optical Fibre Cable Lengths

The estimated optical fibre cable length for F.O. link(s) are provided in BPS considering 5% for plain and 7% for hilly areas over and above route length of the transmission line. The Contractor shall supply the OPGW cable in standard drum length mostly in 5 kms for plain terrain & 3 kms for hilly terrain. The OPGW BOQ shall be released by Project Manager for the purpose of supply. Adjustment if required shall be done by Project Manager in last lot of supply to optimise OPGW supply and avoid wastages.

Optical Fibre Identification

Individual optical fibres within a fibre unit and fibre units shall be identifiable in accordance with EIA/TIA 598 or IEC 60304 or Bellcore GR-20 colour-coding scheme.

Colouring utilized for colour coding optical fibres shall be integrated into the fibre coating and shall be homogenous. The colour shall not bleed from one fibre to another and shall not fade during fibre preparation for termination or splicing.

Each cable shall have traceability of each fibre back to the original fibre manufacturer's fibre number and parameters of the fibre. If more than the specified number of fibres is included in any cable, the spare fibres shall be tested by the cable manufacturer and any defective fibres shall be suitably bundled, tagged and identified at the factory by the vendor.

2.1.2.2 Optical Fibre Strain& Sag-Tension chart

The OPGW cable the optical fibres shall experience no strain under all loading conditions defined in IS 802. Zero fibre strain condition shall apply even after a 25 year cable creep.
For the purpose of this specification, the following definitions shall apply:

- *Maximum Working Tension (MWT)* is defined as the maximum cable tension at which there is *no fibre strain*.
- The *no fibre strain* condition is defined as fibre strain of less than or equal to 0.05%, as determined by direct measurements through IEC/ ETSI (FOTP) specified optical reflectometry

- The *Cable strain margin* is defined as the maximum cable strain at which there is no fibre strain.
- The cable *Maximum Allowable Tension (MAT)* is defined as the maximum tension experienced by the Cable under the worst case loading condition.
- The cable *max strain* is defined as the maximum strain experienced by the Cable under the worst case loading condition.
- The cable *Every Day Tension (EDT)* is defined as the maximum cable tension on any span under normal conditions.
- The *Ultimate Tensile Strength (UTS/* breaking strength) is defined as the maximum tensile load applied and held constant for one minute at which the specimen shall not break.

While preparing the Sag-tension charts for the OPGW cable the following conditions shall be met:

- The Max Allowable Tension (MAT) / max strain shall be less than or equal to the MWT/ Strain margin of the cable.
- The sag shall not exceed the earth wire sag in all conditions.
- The Max Allowable Tension shall also be less than or equal to 0.45 times the UTS.
- The 25 year creep at 25% of UTS (creep test as per IEEE 1138) shall be such that the 25 year creep plus the cable strain at Max Allowable Tension (MAT) is less than or equal to the cable strain margin.
- The everyday tension (EDT) shall not exceed 20% of the UTS for the OPGW cable.

The Sag-tension chart of OPGW cable indicating the maximum tension, cable strain and sag shall be calculated and submitted along with the bid as per tower design of the transmission line under various conditions mentioned below:

1. 53° C , no wind and no ice
2. 32° C, no wind and no ice
3. 0°C, no wind and no ice
4. 32° C, full wind and no ice
5. 32° C, 75% full wind and no ice
6. 0° C, 2/3rd / 36% of full wind (IS 802:1977 / 1995)

The above cases shall be considered for the spans from 100 m to 600 m or higher span length in the range of 50 m spans. Max. Vertical sag, max. tension and max sag at 0° C & no wind shall be considered in line with the design parameter of transmis-

sion line. The full wind load shall be considered as the design wind load for all the specified transmission lines as per relevant IS 802 version and the sag-tension chart shall be submitted considering the transmission lines. In case of any span higher than 600m, suitable OPGW cable meeting the sag tension requirement of the transmission line shall also be provided by contractor.

The size of OPGW shall be selected such that max. tension and sag at specified temperature and wind conditions remain within the limits of transmission line tower design.

2.1.2.3 Cable Materials

The materials used for optical fibre cable construction, shall meet the following requirements:

2.1.2.3.1 Filling Materials

The interstices of the fibre optic unit and cable shall be filled with a suitable compound to prohibit any moisture ingress or any water longitudinal migration within the fibre optic unit or along the fibre optic cable. The water tightness of the cable shall meet or exceed the test performance criteria as per IEC 60794-1-F-5.

The filling compound used shall be a non-toxic homogenous waterproofing compound that is free of dirt and foreign matter, nonhygroscopic, electrically nonconductive and non-nutritive to fungus. The compound shall also be fully compatible with all cable components it may come in contact with and shall inhibit the generation of hydrogen within the cable.

The waterproofing filling materials shall not affect fibre coating, colour coding, or encapsulant commonly used in splice enclosures, shall be dermatologically safe, non-staining and easily removable with a non-toxic cleaning solvent.

2.1.2.3.2 Metallic Members

When the fibre optic cable design incorporates metallic elements in its construction, all metallic elements shall be electrically continuous.

2.1.2.3.3 Marking, Packaging and Shipping

This part describes the requirements for marking, packaging and shipping the overhead fibre optic cable.

(a) Drum Markings: Each side of every reel of cable shall be permanently marked

in white lettering with the vendors' address, the Purchaser's destination address, cable part number and specification as to the type of cable, length, number of fibres, a unique drum number including the name of the transmission line & segment no., factory inspection stamp and date.

(b) Cable Drums: All optical fibre cabling shall be supplied on sturdy, corrosion resistant returnable steel drums (2% wastage due to transportation & handling is allowed) of adequate strength, constructed to protect against all damage and displacement during transit, re- transit, storage suitable for long periods , and subsequent handling and stringing operations in the field. The supplier shall be responsible for any loss or damage during transportation, handling and storage due to improper packing.

Both ends of the cable shall be sealed as to prevent the escape of filling compounds and dust & moisture ingress during shipment and handling. Spare cable caps shall be provided with each drum as required.

There shall be no factory splices allowed within a continuous length of cable. Only one continuous cable length shall be provided on each drum. The lengths of cable to be supplied on standard drum length.

2.1.3 Optical Ground Wire (OPGW) construction

OPGW cable construction shall comply with IEEE-1138, 2009. The cable provided shall meet both the construction and performance requirements such that the ground wire function, the optical fibre integrity and optical transmission characteristics are suitable for the intended purpose.

2.1.3.1 OPGW design

Buffer Tube

Loose tube construction shall be implemented. The individually coated optical fibre(s) shall be surrounded by a buffer for protection from physical damage during fabrication, installation and operation of the cable. The fibre coating and buffer shall be strippable for splicing and termination. Each fibre unit shall be individually identifiable utilizing colour coding. Buffer tubes shall be filled with a water-blocking gel. The individually coated optical fibre(s) shall be provided directly in stainless steel tube in case stainless steel tube design.

(a) Central Aluminium tube type

The composite fibre optic overhead ground wire shall be made up of multiple buffer tubes embedded in a water tight aluminium/aluminium alloy protective central fibre optic unit surrounded by concentric-lay stranded metallic wires in single or multiple layers. Each buffer tube shall have maximum 12 no. of fibres. All fibres in single buffer tube or directly in central fibre optic unit is not acceptable. The dual purpose of the composite cable is to provide the electrical and physical characteristics of conventional overhead ground wire while providing the optical transmission properties of optical fibre.

(b) Central Stainless Steel tube type

The composite fibre optic overhead ground wire shall consist of a central fibre optic unit made up of stainless steel with aluminium coating/tube surrounded by concentric-lay stranded metallic wires in single or multiple layers. The dual purpose of the composite cable is to provide the electrical and physical characteristics of conventional overhead ground wire while providing the optical transmission properties of optical fibre

2.1.3.1.1 Central Fibre Optic Unit

(a) Central Aluminium tube type

The central fibre optic unit shall be designed to house and protect multiple buffered optical fibre units from damage due to forces such as crushing, bending, twisting, tensile stress and moisture. The central fibre optic unit and the outer stranded metallic conductors shall serve together as an integral
unit to protect the optical fibres from degradation due to vibration and galloping, wind and ice loadings, wide temperature variations, lightning and fault current, as well as environmental effects which may produce hydrogen.

The OPGW design of dissimilar materials for stranded wires and tubes are not allowed. Central fibre optic unit may be of aluminium / aluminium alloy tube. There shall be no exposed areas of tubing that can make electrical contact either directly or indirectly

through moisture, contamination, protrusions, etc with the surrounding stranded wires. The tube may be fabricated as a seamless tube, seam welded, or a tube without a welded seam.

(b) Central Stainless Steel tube type

The central fibre optic unit shall be designed to house and protect optical fibres provided in single buffered tube of stainless steel tube from damage due to forces such as

crushing, bending, twisting, tensile stress and moisture. The central fibre optic unit and the outer stranded metallic conductors shall serve together as an integral unit to protect the optical fibres from degradation due to vibration and galloping, wind and ice loadings, wide temperature variations, lightning and fault current, as well as environmental effects which may produce hydrogen.

The OPGW design of dissimilar materials for stranded wires and tubes are not allowed. Central fibre optic unit shall be of stainless steel tube with aluminium protective coating or stainless steel tube with Al protecting outer tube. In case of aluminium protective coating, the coating must completely cover the tubes leaving no exposed areas of tubing that can make electrical contact either directly or indirectly through moisture, contamination, protrusions, etc with the surrounding stranded wires. The tube may be fabricated as a seamless tube, seam welded, or a tube without a welded seam.

2.1.3.1.2 Basic Construction

The OPGW cable construction shall conform to the applicable requirements of this specification, applicable clauses of IEC 61089 related to stranded conductors and Table 2.2(a) OPGW Mechanical and Electrical Characteristics. In addition, the basic construction shall include bare concentric-lay-stranded metallic wires with the outer layer having left hand lay. The wires may be of multiple layers with a combination of various metallic wires within each layer. The direction of lay for each successive layer shall be reversed. The finished wires shall contain no joints or splices unless otherwise agreed to by the Employer and shall conform to all applicable clauses of IEC 61089 as they pertain to stranded conductors.

The wires shall be so stranded that when the complete OPGW is cut, the individual wires can be readily regrouped and then held in place by one hand.

2.1.3.2 Breaking Strength

The rated breaking strength of the completed OPGW shall be taken as 90 percent of the sum of the rated breaking strengths of the individual wires, calculated from their nominal diameter and the specified minimum tensile strength.

The rated breaking strength shall not include the strength of the optical unit. The fibre optic unit shall not be considered a load bearing tension member when determining the total rated breaking strength of the composite conductor.

2.1.3.3 Electrical and Mechanical Requirements

Table 2-2(a) provides OPGW Electrical and Mechanical Requirements for the minimum performance characteristics.

Table 2.2(a)
OPGW Electrical and Mechanical Requirements

(1)	**Everyday Tension**	≤ 20% of UTS of OPGW
(2)	**D.C. Resistance at 20°C:**	< 1.0 ohm/Km
(3)	**Short Circuit Current**	≥ 6.32 kA for 1.0 second (for 220 kV & above lines) ≥ 5.6 kA for 1.0 second (for 132 KV & 66KV lines) Short Circuit shall be applicable as per the Voltage level of the lines

2.1.3.4 Operating conditions

Since OPGW shall be located at the top of the transmission line support structure, it will be subjected to Aeolian vibration, Galloping and Lightning strikes. It will also carry ground fault currents. Therefore, its electrical and mechanical properties shall be same or similar as those required of conventional ground conductors.

2.1.3.5 Installation Hardware

Installation Hardware includes all required fittings and hardware such as Tension assembly, Suspension assembly, Vibration dampers, Reinforcing rods, Earthing clamps, Downlead clamps, splice enclosure etc. The estimated quantity for hardware fittings

are provided in BPS. Initially 70% of total hardware shall be supplied based on quantities in BPS or as directed by Project Manager and balance 30% shall be supplied as directed by Project Manager.

The OPGW hardware fittings and accessories shall follow the general requirements regarding design, materials, dimensions & tolerances, protection against corrosion and markings as specified in clause 4.0 of EN 61284: 1997 (IEC 61284). The shear strength of all bolts shall be at least 1.5 times the maximum installation torque. The OPGW hardware & accessories drawing & Data Requirement Sheets (DRS) document shall consist of three parts: (1) A technical particulars sheet (2) An assem
bly drawing i.e. level 1 drawing and (3) Component level drawings i.e. level 2 & lower drawings. All component reference numbers, dimensions and tolerances, bolt tightening torques & shear strength and ratings such as UTS, slip strength etc shall be marked on the drawings.

The fittings and accessories described herein are indicative of installation hardware typically used for OPGW installations and shall not necessarily be limited to the following:

(a) Suspension Assemblies: Preformed armour grip suspension clamps and aluminium alloy armour rods/ reinforcing rods shall be used. The suspension clamps shall be designed to carry a vertical load of not less than 25 KN. The suspension clamps slippage shall occur between 12kN and 17 kN as measured. For river crossing and special transmission lines (where heavier earthwire used e.g. 7/4.5) OPGW installation hardware design slippage shall occur between 9% and 14% of UTS of OPGW.

The Contractor shall supply all the components of the suspension assembly including shackles, bolts, nuts, washers, split pins, etc. The total drop of the suspension assembly shall not exceed 150 mm (measured from the centre point of attachment to the centre point of the OPGW). The design of the assembly shall be such that the direction of run of the OPGW shall be the same as that of the conductor.

(b) Dead End Clamp Assemblies: All dead end clamp assemblies shall preferably be of performed armoured grip type and shall include all necessary hardware for attaching the assembly to the tower strain plates. Dead end clamps shall allow the OPGW to pass through continuously without cable cutting. The slip strength shall be rated not less than 95% of the Ultimate tensile strength of the OPGW.

(c) Clamp Assembly Earthing Wire: Earthing wire consisting of a 1500 mm length of aluminium or aluminium alloy conductor equivalent in size to the OPGW shall be used to earth suspension and dead end clamp assemblies to the tower structure. The earthing

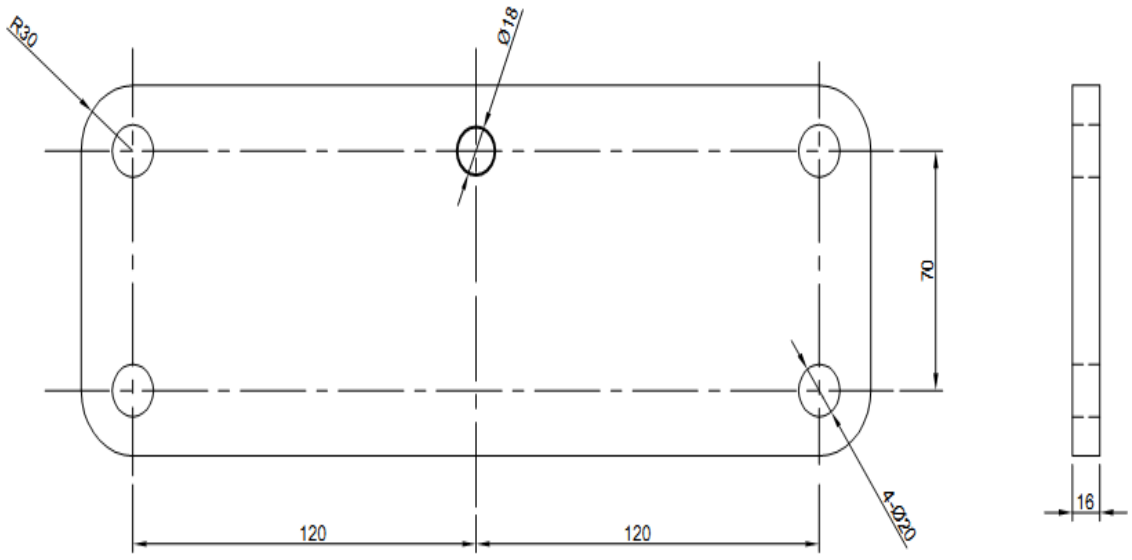
wire shall be permanently fitted with lugs at each end. The lugs shall be attached to the clamp assembly at one end and the tower structure at the other.

(d) Structure Attachment Clamp Assemblies: Clamp assemblies used to attach the OPGW to the structures, shall have two parallel grooves for the OPGW, one on either side of the connecting bolt. The clamps shall be such that clamping characteristics do not alter adversely when only one OPGW is installed. The tower attachment plates shall locate the OPGW on the inside of the tower and shall be attached directly to the tower legs/cross-members without drilling or any other structural modifications.

(e) Tension Fitting for Suspension Tower

The OPGW cable parts shall also be terminated & spliced on suspension towers as per requirement. For this, a special fitting namely Yoke plate alongwith tension fittings shall be provided for termination/jointing of OPGW on Suspension tower. Typical drawing of suspension fitting where cable may be terminated on suspension tower is given below:

Yoke Plate design for OPGW jointing on Suspension Tower (Typical)



(f) Vibration Dampers: Vibration dampers type 4R Stockbridge or equivalent, having four (4) different frequencies spread within the Aeolian frequency bandwidth corresponding to wind speed of 1m/s to 7 m/s, shall be used for suspension and tension points in each span. The Contractor shall determine the exact numbers and placement(s)

of vibration dampers through a detailed vibration analysis.

One damper minimum on each side per OPGW cable for suspension points and two dampers minimum on each side per OPGW cable for tension points shall be used for nominal design span of 400 meters. For all other ruling spans, the number of vibration damper shall be as per manufacturer recommendation and damper placement chart.

The clamp of the vibration damper shall be made of high strength aluminum alloy of type LM-6. It shall be capable of supporting the damper and prevent damage or chaffing of the conductor during erection or continued operation. The clamp shall have smooth and permanent grip to keep the damper in position on the OPGW cable without damaging the strands or causing premature fatigue failure of the OPGW cable under the clamp. The clamp groove shall be in uniform contact with the OPGW cable over the entire clamping surface except for the rounded edges. The groove of the clamp body and clamp cap shall be smooth, free from projections, grit or other materials which could cause damage to the OPGW cable when the clamp is installed. Clamping bolts shall be provided with self-locking nuts and designed to prevent corrosion of threads or loosening in service.

The messenger cable shall be made of high strength galvanised steel/stain less steel. It shall be of preformed and post formed quality in order to prevent subsequent droop of weight and to maintain consistent flexural stiffness of the cable in service. The messenger cable other than stainless steel shall be hot dip galvanised in accordance with the recommendations of IS: 4826 for heavily coated wires.

The damper mass shall be made of hot dip galvanised mild steel/cast iron or a permanent mould cast zinc alloy. All castings shall be free from defects such as cracks, shrinkage, inclusions and blow holes etc. The surface of the damper masses shall be smooth.

The damper clamp shall be casted over the messenger cable and offer sufficient and permanent grip on it. The messenger cable shall not slip out of the grip at a load less than the mass pull-off value of the damper. The damper masses made of material otherthan zinc alloy shall be fixed to the messenger cable in a suitable manner in order to avoid excessive stress concentration on the messenger cables which shall cause premature fatigue failure of the same. The messenger cable ends shall be suitably and effectively sealed to prevent corrosion. The damper mass made of zinc alloy shall be casted over the messenger cable and have sufficient and permanent grip on the messenger cable under all service conditions.

The contractor must indicate the clamp bolt tightening torque to ensure that the slip strength of the clamp is maintained between 2.5 kN and 5 kN. The clamp when installed on the OPGW cable shall not cause excessive stress concentration on the OPGW cable leading to permanent deformation of the OPGW strands and premature fatigue failure in operation.

The vibration analysis of the system, with and without damper and dynamic characteristics of the damper as detailed in Technical Specification, shall have to be submitted. The technical particulars for vibration analysis and damping design of the system are as follows:

Sl. No.	Description	Technical Particulars
1	Span Length in meters (i) Ruling design span: (ii) Maximum span: (iii) Minimum Span:	400 meters 1100 meters 100 meters
2	Configuration:	As per Specifications
3	Tensile load in each:	As per sag tension calculations
4	Armour rods used:	Standard preformed armour rods/AGS
5	Maximum permissible dynamic strain:	+/- 150 micro strains

The damper placement chart for spans ranging from 100m to 1100m shall be submitted by the Contractor. Placement charts should be duly supported with sample calculations and manufacturer recommendation.

The damper placement charts shall include the following

(1) Location of the dampers for various combinations of spans and line tensions clearly indicating the number of dampers to be installed per OPGW cable per span.

(2) Placement distances clearly identifying the extremities between which the distances are to be measured.

(3) Placement recommendation depending upon type of suspension clamps (viz.

Free center type/Armour grip type etc.)

2.1.4 Fibre Optic Splice Enclosures (Joint Box)

All splices shall be encased in Fibre Optic Splice Enclosures. Suitable splice enclosures shall be provided to encase the optical cable splices in protective, moisture and dust free environment. Splice enclosures shall comply with ingress protection class IP 66 or better. The splice enclosures shall be designed for the storage and protection of required number of optical fibre splices and equipped with sufficient number of splice trays for splicing all fibres in the cable. No more than 12 fibres shall be terminated in a single splice tray. They shall be filled with suitable encapsulate that is easily removable should re-entry be required into the enclosures.

Splice enclosures shall be suitable for outdoor use with each of the cable types provided under this contract. Splice enclosures shall be appropriate for mounting on transmission line towers above anti-climb guard levels at about 10 metres from top of the tower and shall accommodate pass-through splicing. The actual mounting height and location shall be finalised after Survey.

2.1.5 Fibre Optic Approach Cables (as required if specified in BoQ)

For purposes of this specification, a fibre optic approach cable is defined as the Armoured underground fibre optic cable required to connect Overhead Fibre Optic Cable (OPGW) between the final in line splice enclosure on the gantry / tower forming the termination of the fibre cable on the power line and the Fibre Optic Distribution Panel (FODP) installed within the building. The estimated fibre optic approach cabling length requirements are indicated in the BoQ. Actual supply to be done as per directives of Project Manager.

2.1.5.1 Basic Construction

The cable shall be suitable for direct burial, laying in trenches & PVC/Hume ducts, laying under false flooring and on indoor or outdoor cable raceways.

2.1.5.2 Jacket Construction & Material

The Approach Cable shall be a UV resistant, rodent proof, armoured cable with metallic type of armouring. The outer cable jacket for approach cable shall consist of carbon

black polyethylene resin to prevent damage from exposure to ultra-violet light, weathering and high levels of pollution. The jacket shall conform to ASTM D1248 for density.

2.1.5.3 Optical, Electrical and Mechanical Requirements

Approach cable shall contain fibres with identical optical/ physical characteristics as those in the OPGW cables. The cable core shall comprise of tensile strength member(s), fibre support/bedding structure, core wrap/bedding, and an overall impervious jacket.

2.1.6 Fibre Optic Distribution Panel (as required if specified in BOQ)

At each location requiring the termination of at least one fibre within a cable, all fibres within that cable shall be connectorized and terminated in Fibre Optic Distribution Panels in a manner consistent with the following:

(a) All fibre optic terminations shall be housed using FODPs provisioned with splice organizers and splice trays. All fibres within a cable shall be fusion spliced to preconnectorized pigtails and fitted to the "Back-side" of the provided fibre optic couplings.

(b) FODPs shall be suitable for use with each of the cable types provided as part of this contract. FODPs shall accommodate pass-through splicing and fibre terminations.

(c) FODPs shall be supplied in suitable cabinets/racks with locking arrangement. The dimension of FODP cabinet shall be minimum 2200mm x 600mm x 600mm (HxWxD) and shall meet or exceed ingress protection class IP41 specifications.

(d) All FODPs shall be of corrosion resistant, robust construction and shall allow both top or bottom entry for access to the splice trays. Ground lugs shall be provided on all FODPs and the Contractor shall ensure that all FODPs are properly grounded. The FODP shall meet or exceed ingress protection class IP55.

(e) Flexible protection shall be provided to the patch cord bunches going out from FODP to other equipment.

2.1.6.1 Optical Fibre Connectors

Optical fibres shall be connectorised with FC-PC type connectors preferably. Alternatively connector with matching patch cord shall also be acceptable. Fibre optic couplings supplied with FODPs shall be appropriate for the fibre connectors to be supported. There shall be no adapters.

…….……..…End of this Part……...

Section – VI

Part-3

Inspection and Testing

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Part 3

Inspection and Testing

All materials furnished and all work performed under this Contract shall be inspected and tested. Deliverables shall not be shipped until all required inspections and tests have been completed, and all deficiencies have been corrected to comply with this Specification and approved for shipment by the Employer.

Except where otherwise specified, the Contractor shall furnish all manpower and materials for tests, including testing facilities, power and instrumentation and replacement of damaged parts. The costs shall be borne by the Contractor and shall be deemed to be included in the contract price.

The entire cost of testing for factory acceptance, routine tests, production tests and other test during manufacture specified herein shall be treated as included in the quoted unit price of materials, except for the expenses of Inspector i.e. Employer's representative. Acceptance or waiver of tests will not relieve the Contractor from the responsibility to furnish material in accordance with the specifications.

All tests shall be witnessed by the Employer representative unless the Employer authorises testing to proceed without witness. The Employer representative shall sign the test form indicating approval of successful tests.

Should any inspections or tests indicate that specific item does not meet Specification requirements; the appropriate items shall be replaced, upgraded, or added by the Contractor as necessary to correct the noted deficiencies at no cost to the Employer. After correction of a deficiency, all necessary retests shall be performed to verify the effectiveness of the corrective action.

The Employer reserves the right to require the Contractor to perform, at the Employer's expense, any other reasonable test(s) at the Contractor's premises, on site, or elsewhere in addition to the specified Type, Acceptance, Routine, or Manufacturing tests to assure the Employer of specification compliance.

3.1 Inspection

Access to the Contractor's facilities during system manufacturing and testing and to any facility where systems/ equipment are being produced/ tested, shall be avail-

able to the Employer. At all times the Employer shall have full facilities for unrestricted inspection of such materials or equipment. To facilitate this, the Contractor shall submit for the Employer approval, a comprehensive Quality Assurance Plan using ISO 9000 as a general guideline. In addition, the Quality Assurance Plan shall satisfy the following:

(a) Sufficient office facilities, equipment, and documentation necessary to complete all inspections and to verify that the equipment is being fabricated and maintained in accordance with the Specification shall be provided by the Contractor to the Employer.

(b) Inspections to be performed by the Employer will include visual examination of hardware, cable dressings, and labelling. Contractor's documentation will also be examined to verify that it adequately identifies and describes all offered items and spare parts.

(c) Access to inspect the Contractor's standards, procedures, and records that are applicable to the supplied equipment shall be provided to the Employer. Documents will be inspected to verify that the Contractor has performed the required quality assurance activities.

(d) The inspection rights described above shall also apply to sub-Contractors who are responsible for supplying major components described in this Specification. These items shall be inspected and tested at the sub Contractor's factory by the Employer’s representatives prior to shipping this equipment to the Contractor's facility or directly to the Employer.

(e) The above inspection rights shall also apply to sub-Contractors supplying assemblies, subassemblies and components. However, such items will normally be inspected and tested by the Employer’s representatives at the Contractor's site before acceptance.

3.2 **Test Plans and Procedures**

Test plans and test procedures for both factory and site acceptance tests shall be provided by the Contractor. Test plans and test procedures shall ensure that each factory

and site test is comprehensive and verify all the features of the equipment to be tested. Test plans and test procedures shall be modular to allow individual test segments to be repeated upon request.

The Contractor shall submit a Test Schedule for the Employer's approval after the award of contract for Type Tests and all other tests one (1) month after the award of contract as project requirement overall schedule. The test schedule shall list the tests to be carried out, and the approximate test duration. The test periods shall also be indicated in the PERT chart or equivalent for the work.

The Contractor shall give the Employer twenty one (21) days written notice of any material being ready for testing. Fifteen days prior to the scheduled testing, the Employer shall provide written notice to the Contractor of any drawings, equipment, material, or workmanship which, in the Employer's opinion, is not compliant to the specification. The Contractor shall give due consideration to such objections, if valid, effecting the corrections as necessary or shall prove, in writing, that said modifications are unnecessary for contract compliance.

3.2.1 Test Plans

A test plan for all tests shall be submitted for the Employer approval, at least four (4) weeks before the start of testing. The test plan shall be a single overview document that defines the overall schedule and individual responsibilities associated with conducting the tests, documenting the test results, and successfully completing the test criteria. Test Plans shall include, at a minimum, the information contained in Table 3-1.

Table 3-1
Factory & field Test Plan Requirements

Item:	Description:
1.	Test schedule
2.	Record-keeping assignments, procedures and forms
3.	Procedures for monitoring, correcting and retesting variances
4.	Procedures for controlling and documenting all changes made to the communications equipment after the start of testing

3.2.2 Test Procedures

Test procedures for Type, Factory and other testing requirement shall be submitted for the Employer's approval at least four (4) weeks before each individual test. Testing shall not commence without approved test procedures. At a minimum, test procedures shall include the items listed in Table 3-2.

All test equipment and/or instruments shall bear calibration stickers indicating valid calibration on and beyond the testing date. The time lapsed since last calibration shall not exceed the test equipment/zig manufacturer recommended calibration interval or the interval recommended in the test lab's internal quality procedures.

The Contractor shall ensure that all testing will be performed by qualified testing personnel well experienced in performing such tests.

Table 3-2
Test Procedure Requirements

Item:	Description:
1.	Test Title and Revision Level, if applicable
2.	Function(s) / parameter(s) to be tested
3.	Purpose of each test segment
4.	List of required test equipment
5.	Description of any special test conditions or special actions required. This includes complete descriptions, listings and user interface procedures for all special hardware and software tools and/or display formats to be used during the test.
6.	Test set up including test configuration block diagrams and/or illustrations.
7.	Test procedures to be followed.
8.	Required inputs and expected outputs for each test segment
9.	Acceptance criteria for each test segment.
10.	List of test data to be supplied by the Contractor(s) and copies of any certified data to be used
11.	Format of test reports.

3.2.3 Test Records

Complete and indexed records of all tests results shall be maintained and provided to the Employer's by the Contractor in hardcopy. The records shall be keyed to the steps enumerated in the test procedures. The minimal items required in test records are described in Table 3-3.

Table 3-3
Test Record Requirements

Item:	Description:
1.	Test Title and Revision Level, if applicable; contract references
2.	Date and time for test start and test completed
3.	Test title and reference to the appropriate part of the test procedures
4.	Description of any special test conditions or special actions taken (Includes test-case data).
5.	Test results for each test segment including an indication of Passed, Conditional Pass, Incomplete or Failed.
6.	Test procedure modifications made during testing.
7.	Variance Report(s) tracking information and copies (if variance(s) was detected).
8.	Contractor's test engineer(s) identification, signature and remarks
9.	Employer's test witness identification, signature and remarks
10.	List of all attachments
11.	Attachments (including system logs, printouts, variances, hard copies of visual test result displays, etc.)

All principle test records, test certificates and performance curves shall be supplied for all tests carried out as proof of compliance with the specifications and/or each and every specified test. These test certificates, records and performance curves shall be supplied for all tests, whether or not they have been witnessed by the Employer's within 30 calendar days of completion of test. Information given on such test certificates and curves shall be sufficient to identify the material or equipment to which the certificates refer, and shall also bear the Contractor's reference and heading.

3.2.4 Rejection of Elements

Any item or component which fails to comply with the requirements of this Specification in any respect, at any stage of manufacture, test, erection or on completion at site may be rejected by the Employer's either in whole or part as considered necessary.

Material or components with defects of such a nature that do not meet the requirements of the Specification by adjustment or modification shall be replaced by the Contractor at his own expense. After adjustment or modification, the Contractor shall submit the items to the Employer for further inspection and/or tests.

3.3 Type Testing

"Type Tests" shall be defined as those tests which are to be carried out to prove the design, process of manufacture and general conformity of the materials to this Specification. Type Testing shall comply with the following:

(a) All equipment being supplied shall conform to type tests as per technical specification.

(b) The test reports submitted shall be of the tests conducted within last seven (7) years for OPGW cable prior to the date of bid opening. In case the test reports are older than seven (7) years for OPGW cable on the date of bid opening, the Contractor shall repeat these tests at no extra cost to the Employer.

(c) The Contractor shall submit, within 30 days of Contract Award, copies of test reports for all of the Type Tests that are specified in the specifications and that have previously (before Contract award) been performed. These reports may be accepted by the Employer only if they apply to materials and equipment that are essentially identical to those due to be delivered under the Contract and only if test procedures and parameter values are identical to those specified in this specifications carried out at accredited labs and witnessed by third party / customer's representatives.

In the event of any discrepancy in the test reports or any type tests not carried out, same shall be carried out by Contractor without any additional cost implication to the Employer.

(d) Type Tests shall be certified or performed by reputed laboratories using material and equipment data sheets and test procedures that have been approved by the Employer. The test procedures shall be formatted as defined in the technical specifications and shall include a complete list of the applicable reference standards and submitted for Employer approval at least four (4) weeks before commencement of test(s). The Contractor shall provide the Employer at least 30 days written notice of the planned commencement of each type test.

(e) The Contractor shall provide a detailed schedule for performing all specified type tests. These tests shall be performed in the presence of a representative of the Employer.

(f) The Contractor shall ensure that all type tests can be completed within the time schedule offered in his Technical Proposal.

(g) In case of failure during any type test, the Supplier is either required to manufacture a fresh sample lot and repeat all type tests successfully or repeat that particular type test(s) at least three times successfully on the samples selected from the already manufactured lot at his own expenses. In case a fresh lot is manufactured for testing then the lot already manufactured shall be rejected.

3.3.1 Type Test Samples

The Contractor shall supply equipment/material for sample selection only after the Quality Assurance Plan has been approved by the Employer. The sample material shall be manufactured strictly in accordance with the approved Quality As

surance Plan. The Contractor shall submit for Employer approval, the type test sample selection procedure. The selection process for conducting the type tests shall ensure that samples are selected at random. For optical fibres/ Fibre Optic cables, at least three reels/ drums of each type of fibre/cable proposed shall be offered for selection. For FO cable installation hardware & fittings at least ten (10) samples shall be offered for selection. For Splice enclosures at least three samples shall be offered for selection.

3.3.2 List of Type Tests

The list of required Type tests for FO cabling system as given below:

3.3.2.1 Type Tests for Optical Fibres

The type tests listed below in table 3-4 shall be conducted on DWSM fibres. The tests specific to the cable type are listed in subsequent parts.

Table 3-4
Type Tests For Optical Fibres

S. No.	Test Name	Acceptance Criteria	Test procedure
1	Attenuation	As per Part-02 of TS	IEC 60793-1-40 Or EIA/TIA 455-78A
2	Attenuation Variation with Wavelength	As per Part-02 of TS	IEC 60793-1-40 Or EIA/TIA 455-78A
3	Attenuation at Water Peak	As per Part-02 of TS	IEC 60793-1-40 Or EIA/TIA 455-78A
4	Temp. Cycling (Temp dependence of Attenuation)		IEC 60793-1-52 Or EIA/TIA 455-3A, 2 cycles
5	Attenuation With Bending (Bend Performance)		IEC 60793-1-47 Or EIA/TIA 455-62A
6	Mode Field dia.		IEC 60793-1-45 Or EIA/TIA 455-164A/167A/174
7	Chromatic Dispersion		IEC 60793-1-42 Or EIA/TIA 455-168A/169A/175A
8	Cladding Diameter		IEC 60793-1-20 Or EIA/TIA 455-176
9	Point Discontinuities of attenuation		IEC 60793-1-40 Or EIA/TIA 455-59
10	Core -Clad concen-tricity error		IEC 60793-1-20 Or EIA/TIA 455-176
11	Fibre Tensile Proof Testing		IEC 60793-1-31 Or EIA/TIA 455-31B
-End Of table-			

3.3.2.2 Type Tests for OPGW Cables

The type tests to be conducted on the OPGW cable are listed in table 3-5: Type Tests for OPGW Cables. Unless specified otherwise in the technical specifications or the referenced standards, the optical attenuation of the specimen, measured during or after the test as applicable, shall not increase by more than 0.05 dB/Km.

Table 3-5
Type tests for OPGW Cable

S. No.	Test Name	Test Description	Test Procedure
1	Water Ingress Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.3.5
2	Seepage of filling compound	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.3.6
3	Short Circuit Test	IEEE 1138 -2009	IEEE 1138-2009 Method 6.4.3.3
4	Aeolian Vibration Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.3.1
5	Galloping test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.3.2
6	Cable Bend Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.2.3
7	Sheave Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.2.1
8	Crush Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.2.2
9	Twist Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.2.4
10	Creep Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.1.1

Table 3-5
Type tests for OPGW Cable

S. No.	Test Name	Test Description	Test Procedure
11	Strain Margin Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.1.3
12	Stress strain Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.1.2
13	Temperature Cy-cling Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.3.7
14	Corrosion (Salt Spray) Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.3.8
15	Ultimate Tensile Strength Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.1.4
16	Lightning Arc Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.3.4
17	DC Resistance Test	IEEE 1138-2009	IEEE 1138-2009 Method 6.4.1.5
-End Of Table-			

3.3.2.3 Type Test on OPGW Cable Fittings

The type tests to be conducted on the OPGW Cable fittings and accessories are listed below:

(i) Mechanical Strength Test for Suspension/Tension Assembly

Applicable Standards: IEC 61284, 1997.

Suspension Assembly

The armour rods /reinforcement rods are assembled on to the similar OPGW using the Installation Instructions to check that the assembly is correctly fitted and is the

same that will be carried out during installations.

Part 1:

The suspension assembly shall be increased at a constant rate up to a load equal to 50% of the specified minimum Failure Load increased and held for one minute for the test rig to stabilise. The load shall then be increased at a steady rate to 67% of the minimum Failure Load and held for five minutes. The angle between the cable, the Suspension Assembly and the horizontal shall not exceed 16°. This load shall then be removed in a controlled manner and the Protection Splice disassembled. Examination of all the components shall be made and any evidence of visual deformation shall be documented.

Part 2:

The Suspension clamp shall then be placed in the testing machine. The tensile load shall gradually be increased up shall gradually be increased up to 50% of the specified Minimum Failure Load of the Suspension Assembly and held for one minute for the Test Rig to stabilise and the load shall be further increased at a steady rate until the specified minimum Failure Load is reached and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value shall be documented.

Tension Assembly

The Tension Assembly is correctly fitted and is the same that will be carried out during installations.

Part 1:

The tension assembly (excluding tension clamp) shall be increased at a constant rate up to a load equal to 50% of the specified minimum Failure Load increased at a constant rate and held for one minute for the test rig to stabilise. The load shall then be increased at a steady rate to 67% of the minimum Failure Load and held for five minutes. This load shall then remove in a controlled manner and the Tension Assembly disassembled. Examination of the Tension Dead-End and associated components shall be made and any evidence of visual deformation shall be documented.

Part 2:

The Tension Dead-End and associated components shall then be reassembled and

bolts tightened as before. The tensile load shall gradually be increased up shall gradually be increased up to 50% of the specified Minimum Failure Load of the

Tension Assembly and held for one minute for the Test Rig to stabilise and the load shall be further increased at a steady rate until the specified minimum Failure Load is reached and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value shall be documented.

Acceptance Criteria for Tension/Suspension Assembly:

- No evidence of binding of the Nuts or Deformation of components at end of Part 1 of Test.
- No evidence of Fracture at the end of one minute at the minimum failure load during Part 2 of the Test.

Any result outside these parameters shall constitute a failure.

(ii) Clamp Slip Strength Test for Suspension Assembly

The suspension assembly shall be vertically suspended by means of a flexible attachment. A suitable length fibre optical cable shall be fixed in the clamps. Once the Suspension Clamp has been assembled, the test rig is tensioned to 1 kN and the position scale on the recorder 'zeroed'. The test rig is then tensioned to 2.5 kN and the relative positions of the Reinforcing Rods, Armour Rods and Suspension Clamp shall be marked by a suitable means to confirm any slippage after the test has been completed. The relative positions of the helical Armour Rods and associated Reinforcing Rods at each end shall be marked and also 2 mm relative position between clamp body and Armour Rods shall be marked on one side. The load shall be increased to Minimum Slip load at a loading rate of 3 kN/min and held for one minute. At the end of this one minute period, the relative displacement between clamp body and the armour rods shall be observed. If the slippage is 2 mm or above, the test shall be terminated. Otherwise, at the end of one minute the position of the clamp body and 2 mm. relative positions between clamp body and armour rods shall be marked on the other side. After the one minute pause, the load shall be further increased at a loading rate of 3 kN/min, and recording of load and displacement shall continue until either the relative Position displacement between clamp body and armour rods reaches more than 2 mm or the load reaches the maximum slip load. On reaching either of the above values the test is terminated. Visual examination of all paint marks shall be recorded, and a measurement of any displacement recorded

in the Table of Results.

Acceptance Criteria:

The Suspension Clamp has passed the Slip Test if the following conditions are met:

- No slippage* shall occur at or below the specified minimum slip load.

* Definition of no slippage in accordance with IEC 61284, 1997:- Any relative movement less than 2 mm is accepted. The possible couplings or elongations produced by the cable as a result of the test itself are not regarded as slippage.

- Slippage shall occur between the specified maximum and minimum slip load.
- There shall be no slippage of the Reinforcing Rods over the cable, and no slippage of the Armour Rods over the Reinforcing Rods.
- The relative movement (i.e. more than 2 mm between Armour Rods & Clamp body) between minimum and maximum slip, shall be considered as slip.
- The Armour Rods shall not be displaced from their original lay or damaged**.

** Definition of no damage in accordance with convention expressed in IEC 61284: 1997 no damage, other than surface flattening of the strands shall occur.

Any result outside these parameters is a failure.

(iii) Slip Strength Test of Tension Clamp

Tension clamps shall be fitted on a 8 m length of fibre optic cable on both ends. The assembly shall be mounted on a tensile testing machine and anchored in a manner similar to the arrangement to be used in service. A tensile load shall gradually be applied up to 20 % of the UTS of OPGW. Displacement transducers shall be installed to measure the relative movement between the OPGW relative to the Reinforcing Rods and Tension Dead -End relative to Reinforcing Rods. In addition, suitable marking shall be

made on the OPGW and Dead-End to confirm grip. The load shall be gradually increased at a constant rate up to 50 % of the UTS and the position scale of the recorder is zeroed. The load shall then gradually increased up to 95 % of the UTS and maintained for one minute. After one minute pause, the load shall be slowly released to zero and the marking examined and measured for any relative movement.

Acceptance Criteria:

- No movement* shall occur between the OPGW and the Reinforcing Rods, or between the Reinforcing Rods and the Dead-End assembly.
- No failure or damage or disturbance to the lay of the Tension Dead-End, Reinforcing Rods or OPGW.

* Definition of no movement as defined in IEC 61284: Any relative movement less than 2 mm is accepted. The possible couplings or elongations produced by the conductor as a result of the test itself are not regarded as slippage.
Any result outside these parameters shall constitute a failure.

(iv) Grounding Clamp and Structure Mounting Clamp Fit Test

For structure mounting clamp, one series of tests shall be conducted with two fibre optic cables installed, one series of tests with one fibre optic cable installed in one groove, and one series of tests with one fibre optic cable in the other groove. Each clamp shall be installed including clamping compound as required on the fibre optic cable. The nut shall be tightened on to the bolt by using torque wrench with a torque of 5.5 kgm or supplier's recommended torque and the tightened clamp shall be held for 10 minutes. After the test remove the fibre optic cable and examine all its components for distortion, crushing or breaking. Also the fibre optic cable shall be checked to ensure free movement within the core using dial callipers to measure the diameter of the core tube. The material shall be defined as failed if any visible distortion, crushing, cracking or breaking of the core tube is observed or the fibre optic cable within the core tube is not free to move, or when the diameter of the core tube as measured at any location in the clamped area is more than 0.5 mm larger or smaller of the core diameter as measured outside the clamped area.

(v) Structure Mounting Clamp Strength Test

The clamp and mounting assembly shall be assembled on a vertical 200 mm x 200 mm angle and a short length of fibre optic cable installed. A vertical load of 200 kg shall be applied at the end of the mounting clamp and held for 5 minutes. Subsequently, the load shall be increased to 400 kg and held for 30 seconds. Any visible distortion, slipping or breaking of any component of the mounting clamp or assembly shall constitute failure.

3.3.2.4 Type Test on Vibration Damper

The testing standard of vibration damper for OPGW shall be as per applicable international standard i.e. IEC 61897.

(a) Dynamic Characteristic Test

The damper shall be mounted with its clamp tightened with torque recommended by the manufacturer on shaker table capable of simulating sinusoidal vibrations for Critical Aeolian Vibration frequency band ranging from 0.18/d to 1.4/d – where d is the

OPGW cable diameter in meters. The damper assembly shall be vibrated vertically with a ±1 mm amplitude from 5 to 15 Hz frequency and beyond 15 Hz at 0.5 mm to determine following characteristics with the help of suitable recording instruments.

(i) Force Vs frequency

(ii) Phase angle Vs frequency

(iii) Power dissipation Vs frequency

The Force Vs frequency curve shall not show steep peaks at resonance frequencies and deep troughs between the resonance frequencies. The resonance frequencies shall be suitably spread within the Aeolian vibration frequency-band between the lower and upper dangerous frequency limits determined by the vibration analysis of fibre optic cable without dampers.

Acceptance criteria for vibration damper:

(i) The above dynamic characteristics test on five damper shall be conducted.

(ii) The mean reactance and phase angle Vs frequency curves shall be drawn with the criteria of best fit method.

(iii) The above mean reactance response curve should lie within the following limits:

V.D for OPGW: 0.060f to 0.357f kgf/mm*

Where f is frequency in Hz

(iv) The above mean phase angle response curve shall be between 25° to 130° within the frequency range of interest.

(v) If the above curve lies within the envelope, the damper design shall be considered to have successfully met the requirement.

(vi) Visual resonance frequencies of each mass of damper is to be recorded and to be compared with the guaranteed values.

(b) Vibration Analysis

The vibration analysis of the fibre optic cable shall be done with and without damper installed on the span. The vibration analysis shall be done on a digital computer using energy balance approach. The following parameters shall be taken into account for the purpose of analysis.

(i) The analysis shall be done for single fibre optic cable without armour rods. The tension shall be taken as max Permissible Every Day Tension (20% of UTS), for a span ranging from 100 m to 1100 m.

(ii) The self-damping factor and flexural stiffness (EI) for fibre optic cable shall be

calculated on the basis of experimental results. The details to experimental analysis with these data shall be furnished.

(iii) The power dissipation curve obtained from Damper Characteristics Test shall be used for analysis with damper.

(iv) Examine the Aeolian Vibration level of the fibre optic cable with and without vibration damper installed at the recommended location or wind velocity ranging from 0 to 30 Km per hour, predicting amplitude, frequency and vibration energy input.

(v) From vibration analysis of fibre optic cable without damper, antinode vibration amplitude and dynamic strain levels at clamped span extremities as well as antinodes shall be examined and thus lower and upper dangerous frequency limits between which the Aeolian vibration levels exceed the specified limits shall be determined.

(vi) From vibration analysis of fibre optic cable with damper(s) installed at the recommended location, the dynamic strain level at the clamped span extremities, damper attachment point and the antinodes on the fibre optic cable shall be determined. In addition to above damper clamp vibration amplitude and antinodes vibration amplitudes shall also be examined.

The dynamic strain levels at damper attachment point, clamped span extremities and antinodes shall not exceed the specified limits. The damper clamp vibration amplitude shall not be more than that of the specified fatigue limits.

(c) Fatigue Tests

(i) Test Set Up

The fatigue tests shall be conducted on a laboratory set up with a minimum effective

span length of 30m. The fibre optic cable shall be tensioned at 25% of UTS of fibre optic cable and shall not be equipped with protective armour rods at any point.

Constant tension shall be maintained within the span by means of lever arm arrangement. After the fibre optic cable has been tensioned, clamps shall be installed to support the fibre optic cable at both ends and thus influence of connecting hardware fittings are eliminated from the free span. The clamps shall not be used for holding the tension on the fibre optic cable. There shall be no loose parts, such as suspension clamps, U bolts, on the test span supported between clamps mentioned above. The span shall be equipped with vibration inducing equipment suitable for producing steady standing vibration. The inducing equipment shall have facilities for step less speed control as well as step less amplitude arrangement. Equipment shall be available for measuring the frequency, cumulative number of cycles and amplitude of vibration at any point along the span.

(ii) Fatigue Test

The vibration damper shall be installed on the test span with the manufacturer's specified tightening torque. It shall be ensured that the damper shall be kept minimum three loops away from the shaker to eliminate stray signals influencing damper movement.

The damper shall then be vibrated at the highest resonant frequency of each damper mass. For dampers involving torsional resonant frequencies, tests shall be done at torsional modes also in addition to the highest resonant frequencies at vertical modes. The resonance frequency shall be identified as the frequency at which each damper mass vibrates with the maximum amplitude on itself. The amplitude of vibration of the damper clamp shall be maintained not less than ±25/f mm where f is the frequency in Hz.

The test shall be conducted for minimum ten million cycles at each resonant frequency mentioned above. During the test, if resonance shift is observed, the test frequency shall be tuned to the new resonant frequency.

The clamp slip test as mentioned herein above shall be repeated after fatigue tests without retorquing or adjusting the damper clamp, and the clamp shall withstand a minimum load equal to 80% of the slip strength for a minimum duration of one minute.

After the above tests, the damper shall be removed from fibre optic cable and subjected to dynamic characteristics test. There shall not be any major deterioration in the

characteristics of the damper. The damper then shall be cut open and inspected. There shall not be any broken, loose, or damaged part. There shall not be significant deterioration or wear of the damper. The fibre optic cable under clamp shall also be free from any damage.

For purposes of acceptance, the following criteria shall be applied:

(i) There shall not be any resonant frequency shift before and after the test by more than ±20%.

(ii) The power dissipation of the damper before and after test at the individual resonant frequencies do not differ by more than ±20%.

Beside above tests, the type tests listed below in the table shall also be conducted on Vibration Damper:

Sl. No.	Test Name	Test Procedure
1	Visual examination & Dimensional and material verification	IEC 61897 Clause 7.1 & 7.2
2	Clamp Slip Test	IEC 61897 Clause 7.5
3	Clamp bolt tightening test	IEC 61897 Clause 7.7
4	Attachment of weights to messenger cable	IEC 61897 Clause 7.8
5	Attachment of clamps to messenger cable	IEC 61897 Clause 7.8
6	Damper effectiveness evaluation	IEC 61897 Clause 7.11.3.2

3.3.2.5 Type Tests for Splice Enclosures (Joint Box)

Following Type tests shall be demonstrated on the Splice Enclosure(s) (Splice Enclosure/Box) . For certain tests, lengths of the fibre optic cable shall be installed in the splice box, and the fibres must be spliced and looped in order to simulate conditions of use. The attenuation of the fibres shall be measured, during certain tests, by relevant Fibre Optic Test Procedures (EIA/TIA 455 or IEC 60794-1 procedures).

(i) Temperature Cycling Test

FO cable is installed in the splice enclosure and optical fibres spliced and looped. The

box must be subjected to 5 cycles of temperature variations of -40°C to +65°C with a dwell time of at least 2 hours on each extreme.
Fibre loop attenuation shall be measured in accordance with EIA 455-20 / IEC 60794-1-C10. The variation in attenuation shall be less than ±0.05dB. The final humidity level, inside the box, shall not exceed the initial level, at the closing of the box.

(ii) Humid Heat test

The sealed splice enclosure, with fibres spliced and looped inside, must be subjected to a temperature of +55°C ±2°C with a relative humidity rate of between 90% and 95% for 5 days. The attenuation variation of the fibres during the duration of the test shall be less than ±0.05dB, and the internal humidity rate measured, less than 2% .

(iii) Water Immersion test

The splice enclosure with optical fibres cable installed and fibres spliced fixed, shall be immersed in water for 24 hours. No water seepage or moisture shall be detected in the splice enclosure. The attenuation variation of the fibres after the test shall be less than ±0.05dB.

(iv) Vibration Test

The splice enclosure, with fibres united inside, shall be subjected to vibrations on two axes with a frequency scanning of 5 to 50 Hz. The amplitude of the vibrations shall be constant at 0.450mm, peak to peak, for 2 hours, for each of the vibrations' axes. The variation in attenuation, of the fibres, shall be less than ±0.05dB. The splice enclosure shall be examined for any defects or deformation. There shall be no loosening or visible damage of the FO cable at the entry point.

(v) Bending and Torsion test

The splice enclosure, with fibres spliced inside, shall be firmly held in place and be subjected to the following sequence of mechanical stresses on the cable:

a) 3 torsion cycles of ±180° shall be exercised on the cable. Each cycle shall be less than one minute.

b) 3 flexure cycles of the cable, of ±180° with one cycle less than one minute.

The variation in the attenuation, of the fibres, shall be less than ±0.05dB. The cables connection ring shall remain securely fixed to the box with the connection maintained firmly. No defects/fissures shall be noted on the joint ring or on the splice enclosure

(vi) Tensile test

The splice enclosure with cable fixed to the boxes shall be subjected to a minimum tension of 448 N for a period of two minutes. No fissure shall be noted in the con

nections or on the box.

(vii) Drop Test

With 2 lengths of 11 metres of cable fixed to the box, it shall be dropped five times from a height of 10 metres. There shall be no fissure, at all, of the box, and the connections shall remain tight. The test surface shall be carried out in accordance with IEC 60068-2-32.

3.3.2.6 Type Tests for Fibre Optic Approach Cable

The type tests to be conducted on the Fibre Optic Approach cable are listed in table 3-6: Type Tests for Fibre Optic Approach Cable. Unless specified otherwise in the technical specifications or the referenced standards, the optical attenuation of the specimen, measured during or after the test as applicable, shall not increase by more than 0.05 dB/Km.

Table 3-6:
Type Tests Fibre Optic Approach Cable

S.NO.	Test Name	Test Procedure
1	Water Ingress Test	(IEC 60794-1-F5 / EIA 455-82B) Test duration : 24 hours
2	Seepage of filling compound	(EIA 455-81A) Preconditioning : 72 hours, Test duration : 24 hours.
3	Crush Test	(IEC 60794-1-E3/ EIA 455-41)
4	Impact Test	(IEC-60794-1-E4/ EIA 455-25A)

Table 3-6:
Type Tests Fibre Optic Approach Cable

S.NO.	Test Name	Test Procedure
5	Stress strain Test	(EIA 455-33A)
6	Cable Cut-off wave-length Test	(EIA 455-170)
7	Temperature Cycling Test	(IEC60794-1-F1/EIA-455-3A) – 2 cycles
-End Of Table-		

3.3.2.6.1 Impact Test

The Impact test shall be carried out in accordance with IEC:60794-1-E4. Five separate impacts of 2.0 kg shall be applied at different locations. The radius of the intermediate piece shall be the reel drum radius ± 10%. A permanent or temporary increase in optical attenuation value greater than 0.05 dB/km shall constitute failure.

3.4 Factory Acceptance Tests

Factory acceptance tests shall be conducted on randomly selected Fibre Optic cable & associated accessories to be supplied. Factory acceptance testing shall be carried out

on OPGW cable, hardware & fittings, Approach cable, Joint box, FODP etc.

Material shall not be shipped to the Employer until required factory tests are completed satisfactorily, all variances are resolved, full test documentation has been delivered to the Employer, and the Employer has issued Clearance Certificate. Successful completion of the factory tests and the Employer approval to ship shall in no way constitute final acceptance of the system or any portion thereof. These tests shall be carried

out in the presence of the Employer's authorised representatives unless waival for witnessing by Employer's representatives is intimated to the contractor.

Factory acceptance tests shall not proceed without the prior delivery to and approval of all test documentation by the Employer.

The factory acceptance test for the supplied items shall be proposed by the contractor in accordance with technical specifications and Contractor's (including Sub-Contractor's/supplier's) standard FAT testing program. In general the FAT for other items shall include at least: Physical verification, demonstration of technical characteristics, various operational modes, functional interfaces etc.

3.4.1 Sampling for FAT

From each batch of material presented by the Contractor for Factory acceptance testing, the
Employer shall select random sample(s) to be tested for acceptance. Unless otherwise agreed, all required FAT tests in the approved FAT procedures, shall be performed on all samples. The Sampling rate for the Factory acceptance tests shall be 10% of the batch size (minimum 1). The Physical verification shall be carried out on 100% of the offered quantities as per approved procedure. In case any of the selected samples fail, the failed sample is rejected and additional 20% samples shall be selected randomly and tested. In case any sample from the additional 20% also fails the entire batch may be rejected.

For the FO cable hardware fittings & accessories, the minimum sampling rate, and batch acceptance criteria shall be as defined in IS 2486.

The Sampling rate for the Factory acceptance tests shall be 10% of the batch size (minimum 2) for FO cable drums, FODPs & Joint box.

Since FAT testing provides a measure of assurance that the Quality Control objectives are being met during all phases of production, the Employer reserves the right to require the Contractor to investigate and report on the cause of FAT failures and to suspend further testing/approvals until such a report is made and remedial actions taken, as applicable.

3.4.2 Production Testing

Production testing shall mean those tests which are to be carried out during the process of production by the Contractor to ensure the desired quality of end product to be supplied by him. The production tests to be carried out at each stage of production
shall be based on the Contractor's standard quality assurance procedures. The production tests to be carried out shall be listed in the Manufacturing Quality Plan (MQP), along with information such as sampling frequency, applicable standards, acceptance criteria etc.

The production tests would normally not be witnessed by the Employer. However, the Employer reserves the right to do so or inspect the production testing records in accordance with Inspection rights specified for this contract.

3.4.3 Factory Acceptance Tests on Optical Fibre

The factory acceptance tests listed in table 3-7 below are applicable for the Optical fibres to be supplied. The listed tests follow testing requirements set forth in IEEE standard 1138/IEC 60794. The referenced parts specify the detailed test description. The acceptance norm shall be as specified in the above mentioned IEEE standards unless specified otherwise in the technical specifications.

Table 3-7
Factory Acceptance Tests for Optical Fibres: Optical Tests

S. No.	Test Name	Acceptance Criteria	Test procedure
1	Attenuation Coefficient	TS Vol II ,Table 2-1(a)	EIA/TIA 455- 78A
2	Point Discontinuities of attenuation	TS Vol II, Part 2.1.1.2	EIA/TIA 455-59
3	Attenuation at Water Peak	TS Vol II ,Table 2-1(a)	EIA/TIA 455- 78A
4	Chromatic Dispersion		EIA/TIA 455-168A/169A/175A
5	Core – Clad Concentricity Error		EIA/TIA 455-/176
6	Cladding diameter		EIA/TIA 455-176
7	Fibre Tensile Proof Testing		EIA/TIA 455-31B
-End of table-			

The test report for the above tests for the fibres carried out by the Fibre Manufacturer and used in the OPGW cables shall be shown to the inspector during OPGW cable FAT and shall be submitted along with the OPGW cable FAT report.

3.4.4 Factory Acceptance Test on OPGW Cable

The factory acceptance tests for OPGW cable specified below in Table 3-8 follow the requirements set forth in IEEE standard 1138 / IEC 60794. The FAT shall be carried out on 10% of offered drums in each lot as specified in technical specifications and the optical tests shall be carried out in all fibres of the selected sample drums. The Rated Tensile Strength test shall be carried out on one sample in each lot.

Table 3-8
Factory Acceptance Tests On OPGW
Applicable standard: IEEE 1138 / IEC 60794

S. No.	Factory Acceptance Test on Manufactured OPGW
1	Attenuation Co-efficient at 1310 nm and 1550 nm
2	Point discontinuities of attenuation
3	Visual Material verification and dimensional checks as per approved DRS/Drawings
4	Rated Tensile Strength
5	Lay Length Measurements

Factory Acceptance Test on OPGW Fittings

The factory acceptance tests for OPGW Fittings as specified below in Table 3-9. The sampling plan shall be as per relevant standard:

Table 3-9

Factory Acceptance Tests On OPGW Fittings

S. No.	Factory Acceptance Test
Suspension Assembly	
1	UTS/Mechanical Strength of the assembly
2	Clamp Slip Test
3	Visual Material verification and dimensional checks as per approved DRS/Drawings
4	Mechanical strength of each component
5	Galvanising test
Tension Assembly	
6	Clamp Slip Strength test
7	Visual Material verification and dimensional checks as per approved DRS/Drawings
8	Mechanical strength of each component
9	Galvanising test
Vibration Damper	
10	Galvanising test on damper, masses and messenger wires
11	Damper response (resonant frequencies)
12	Clamp Slip test
13	Strength of messenger wires
14	Attachments of weights to the messenger cable
15	Attachments of weights to the messenger cable
16	Clamp bolt tightening test

Table 3-9

Factory Acceptance Tests On OPGW Fittings

S. No.	Factory Acceptance Test
17	Clamp bolt torque test
18	Dynamic characteristic test.
19	Visual Material verification and dimensional checks as per approved DRS/Drawings
Structure Mounting Clamp	
20	Clamp fit test
21	Clamp Strength test
22	Visual Material verification and dimensional checks as per approved DRS/Drawings
End of Table	

3.4.5 Factory Acceptance Test on Approach Cable

The factory acceptance tests for Approach Cable specified below in Table 3-10:

Table 3-10
Factory Acceptance Tests On Approach Cable

S. No.	Factory Acceptance Test
1	Attenuation Co-efficient at 1310 nm and 1550 nm
2	Point discontinuities of attenuation
3	Visual Material verification and dimensional checks as per approved DRS/Drawings

3.4.6 Factory Acceptance Test on Splice Enclosure (Joint Box) /FODP

The factory acceptance tests for Splice Enclosures as specified below in Table 3-11:

Table 3-11
Factory Acceptance Tests on Splice Enclosures (Joint Box)/FODP

S. No.	Factory Acceptance Test
1	Visual check of Quantities and Specific Component Number for each component of Splice Enclosure/FODP and dimensional checks against the approved drawings.

---------- **End of Part-3** ----------

Section-4
Support Services & Documentation

TABLE OF CONTENTS

Section – VI, Part- 4
Support Services & Documentation

This section describes the requirements for Contractor-supplied support services and list of documents of the fibre optic cable system. The intent of the support program is to ensure for operation, maintenance and expansion of the system.

4.1 Support Services

Throughout design, implementation, factory testing, and site testing, the Contractor shall supply consulting assistance, as required by the Employer.

4.1.1 Technical Support

Consultation with Contractor's technical support personnel shall be readily available on a short-term/long-term basis to assist the Employer personnel in maintaining OPGW cable & associated items upon expiration of the warranty period. The Contractor shall include in their offer(s), a proposal for ensuring continued technical support as stated above.

4.2 Spare Parts

The spare parts and test equipment shall be provided for each subsystem as described below.

4.2.1 Mandatory Spare

. The mandatory spare BOQ represents the minimum spares the Contractor shall be required to supply.

4.2.2 Recommended Spare Parts List

The bidder shall propose a comprehensive spare parts strategy. The intent of the spare parts strategy is to ensure a readiness against unforeseen cabling system breakdowns, and to carry out replacement maintenance of susceptible or failed components. Consistent with the proposed spare parts strategy, the bidder shall provide a list of "Recommended Spare Parts", which may be required over and above the spares listed in Mandatory Spare parts list to support the fibre optic cabling system during a one-year period. This list of spares shall be called the "Recommended Spare Parts List".

The Recommended spare parts list shall not be considered for evaluation and shall be included in the final scope of supply. The Bid shall include the following minimum information for the recommended spare parts:

Original manufacturer and part number

Name and Description

Number of units in each set

Total number of sets to be provided

The unit as well as set prices shall be provided in the appropriate Bid Price Schedule.

4.2.3 **Test Equipment** (as required if specified in BOQ)

Mandatory test equipment requirements has been specified in the BOQ. The parameters / features of the mandatory equipment's are enumerated in Table 4.1 below:

Table 4.1

S.No.	Test equipment	Parameter
A.	**Test Equipments for OPGW cable**	
1	OTDR (Optical Time Domain Reflectometer) for 1310/1550 nm with laser source.	Equivalent to Anritsu MW9076B1 or better.
2	Optical Attenuators (variable 1310/1550nm).	Equivalent to JDSU OLA55 or better.
3	Optical Power meter (1310/1550nm)	Equivalent to JDSU OLP55 or better
4	Laser Light Source (1310/1550nm)	Equivalent to EXFO FLS300-23BL or better.
5	Optical Talk set.	Equivalent to JDSU OTS55 or better.
6	Optical Fibre Fusion Splicer incl. Fibre cleaver	Equivalent to Sumitomo T-39-SE or better.
7	Calibrated Fibre	
8	Connectorization kit	FIS–FI-0053-FC-INST or equivalent
8	Splice kit	FIS – FI-0053-FF or equivalent
9	Optical test accessory kit including all necessary connectors, adaptors, cables, terminations and other items required for testing	FIS – FI-0053-TS-ST or equivalent

In case the offered make/model of test equipment has multiple options for the parameters, the option of higher range shall be acceptable. The supplied test equipment shall be suitable for use in the high EMI/EMC environment. The Contractor shall submit performance certificate for offered test equipment from at least one customer. The Contractor shall offer only reputed make test equipment such as Acterna (JDSU)/Anritsu/Sumitomo/Agilent/EXFO etc.

4.3 Miscellaneous Supplies

The Contractor shall provide all required consumable and non-consumable supplies necessary to support all installation and test activities through final operational acceptance. However, if there are any problems in the SAT and additional consumables are required, the same shall also be supplied by the Contractor free of cost.

---------- **End of Section-4** ----------

Appendix-A

Data Requirement Sheets

Part-A : To be submitted along with Bid.

Part-B : to be submitted during detailed Engineering stage

Appendix-A

(Part-A)

Data Requirement Sheets

The following sets of Data Requirement Sheets are required to be filled up by the bidders to aid in the evaluation process. The response shall be brief and to the point and shall be supported by the printed product description and other literature. The DRS duly filled and the relevant drawings shall also be submitted during the detailed engineering along with the relevant technical brochures.

DRS Form 1(a)

DATA REQUIREMENTS SHEETS for OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW) – 24/48 Fibre:

Manufacturer: _____

Part #: _____

Configuration: _____

CABLE CONSTRUCTION			
Seq	**Parameter:**	**As per Technical Specification**	**As per Bidder Offering**
1.	No. of Fibres Dual Window Single-Mode:	24/48	
2.	Buffer Type:	Loose Tube	
3.	Buffer Tube material	As applicable	
4.	No. of Buffer Tubes:	As applicable	
5.	No. of Fibers per buffer-Tube:	As applicable	
6.	Expected Cable Life:	25 Year	
7.	**Parameters of OPGW**		
(i)	UTS	In Kgf	
(ii)	Effective area	In mm^2	
(iii)	Weight	In kg/m	
(iv)	Diameter	In mm	
(v)	Modulus of elasticity	In kg/ mm^2	
(vi)	Coeff. Of linear expansion	In /℃	
(vii)	Central tube design	Al or Steel	

DATA REQUIREMENTS SHEETS for OPTICAL FIBRE

DUAL-WINDOW SINGLE MODE (DW-SM)

OPTICAL PARAMETERS			
Seq	**Parameter:**	**As per Technical Specification**	**As per Bidder offering**
1.	Fiber manufacturer(s)/Type:		
2.	Attenuation Coefficient @ 1310 nm: @ 1550 nm:	≤ 0.35 dB/km ≤ 0.21 dB/km	
3.	Point discontinuity @ 1310nm: @ 1550nm:	≤ 0.05 dB ≤ 0.05 dB	
4.	Nominal Mode Field Diameter @ 1310 nm:	8.6 to 9.5 µm (± 0.6 µm)	
5.	Chromatic Dispersion Coefficient @ 1310 (1288-1339) nm: @ 1310 (1271-1360) nm: @ 1550 nm:	 3.5 ps/(nmxkm) 5.3 ps/(nmxkm) 18 ps/(nmxkm)	
6.	Zero dispersion wavelength:	1300 to 1324 nm	
7.	Cutoff wavelength:	≤ 1260 nm	
Physical and Mechanical Properties			
8.	Bend Performance: (37.5 mm radius, 100 turns) @1310 nm (30 mm radius, 100 turn) @1550 nm (16mm radius, 1 turn) @ 1550nm	≤ 0.05 dB ≤ 0.05 dB ≤ 0.50 dB	
9.	Cladding Diameter (nominal ± deviation):	125.0 µm ± 1 µm	
10.	Polarisation mode dispersion coefficient	≤ 0.2 ps/km$^{1/2}$	
11.	Proof test level	≥ 0.69 Gpa	

----------End of the Appendix----------

Appendix-A

Data Requirement Sheets

(Part-B)

The DRS forms have been included for the major items; however, the DRS for each item along with sufficient details shall be submitted during detailed engineering stage.

DRS Form 1

DATA REQUIREMENTS SHEETS for OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

Manufacturer: _____
Part #:_____

CABLE CONSTRUCTION			
Seq	**Parameter:**	**Unit:**	**Particulars:**
1	Fibre Manufacturer Dual Window Single-Mode:		
2	No. of Fibres Dual Window Single-Mode:	each	
3	Buffer Type:		
4	Buffer Tube Diameter:	mm	
5	Buffer Tube material		
6	No. of Buffer Tubes:	each	
7	No. of Fibers per Tube:	each	
8	Identification/numbering of individual tubes:		
9	No. of empty tubes (If any):	each	
10	Filling material:		
11	Filling material compliant with technical specifications?	Yes/No	
12.	Strength member(s):		
13.	Binding yarn/ tape:		
14	Describe Central Core Design:		

DRS Form 1 (Continued)

DATA REQUIREMENTS SHEETS for OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

Seq	**Parameter:**	**Unit:**	**Particulars:**
14.	Aluminum Clad steel wire Diameter: Number:	 mm each	
15.	Aluminum alloy wires Diameter: Number:	 mm each	
16.	Aluminum tube inner diameter:	mm	

DRS Form 1

DATA REQUIREMENTS SHEETS for OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

Manufacturer: _____
Part #:_____

	CABLE CONSTRUCTION		
17.	Aluminum tube outside diameter:	mm	
18.	Cable Diameter: (nominal ± deviation)	mm	
19.	Cable cross-section area (Nominal):	mm^2	
20.	Cable cross-section area (Effective):	mm^2	
21.	Fully Compliant with IEEE 1138:	Yes/No	

Mechanical Properties of Cable

22.	Max. breaking load/ Ultimate Tensile Strength (UTS)/Rated Tensile Strength:	kN	
23.	Fibre strain margin:	%	
24.	Zero fibre strain up to load	kN	
25.	Weight:	kg/km	
26.	Crush strength:	kg/mm	
27.	Equivalent Modulus of elasticity:	KN/mm^2	

- Continued -

DRS Form 1 (Continued)

DATA REQUIREMENTS SHEETS for OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

Seq	**Parameter:**	**Unit:**	**Particulars:**
28.	Minimum Bending Radius without microbending:	mm	
29.	Maximum Bending Radius: Short Term: Long Term (Continuous):	mm	
30.	Tensile proof test (Screening) level:	KN/mm^2	
31.	Maximum permissible tensile stress:	KN/mm^2	
32.	Permissible CTS. tensile stress:	KN/mm^2	
33.	Maximum sag at maximum temperature and design span with no wind:	mm	
34.	Everyday tension at 32ºC, no wind:		

DRS Form 1

DATA REQUIREMENTS SHEETS for OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

Manufacturer: _____
Part #:_____

CABLE CONSTRUCTION			
		% of UTS	
35.	Maximum tension at Every day condition with full wind pressure	Kg	

Thermal Properties of Cable

36.	Coefficient of linear expansion:	per °C	
37.	Coefficient of expansion Cladding: Core:	 per °C per °C	
38.	Nominal operating temperature range:	°C	
39.	SC current transient peak temperature:	°C	
40.	Maximum allowable temperature for lightning strike:	°C	

- Continued -

DRS Form 1 (Continued)

DATA REQUIREMENTS SHEETS for OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

CABLE SPOOL and DRUM			
Seq	**Parameter:**	**Unit:**	**Particulars:**
41.	Available length per spool Maximum: Nominal:	m	
42.	Size of drum:	m	
43.	Weight of empty drum:	kg	
44.	Weight of drum with cable: spooled	kg	
45.		Yes/No	

DRS Form 1 (Continued)

DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

CABLE SPOOL and DRUM			
Seq	**Parameter:**	**Unit:**	**Particulars:**
	Will drum length scheduling be practiced to match transmission line span lengths?		

46. Describe Drum materials:

47. Describe cable end capping and protection against abrasion etc.:

DRS Form 1 (continued)

DATA REQUIREMENTS SHEETS for OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

INSTALLATION			
Seq	**Parameter:**	**Unit:**	**Particulars:**
48.	Splice Loss: Maximum: Average:	 dB dB	
49.	Operating Temperature Range:	°C	
50.	Rated Isoceraunic No.		
51.	Expected Cable Life:	Years	
52.	Installation rate per team:	km/day	
53.	No. of persons per team:	no.	
54.	Max. possible span for specified operating conditions:	M	
55.	Midspan sag at 0°C with no wind loading:	Mm	
56.	Midspan sag at max temp. with no wind loading:	Mm	
57.	Midspan sag at max temp. and wind loading	Mm	
58.	Cable swing angles: Worst Case: Everyday:		
59	Describe Installation method(s):		

Sag tension chart parameters like sag and tension at various spans and applicable wind and ice load conditions shall be submitted along with the DRS. The cable parameters like coefficient of liner expansion, modulus of elasticity shall also be indicated.

DRS Form 2

DATA REQUIREMENTS SHEETS for OPTICAL FIBRE

DUAL-WINDOW SINGLE MODE (DW-SM)

OPTICAL PARAMETERS			
Seq	**Parameter:**	**Unit:**	**Particulars:**
1.	Fiber manufacturer(s)/Type:		
2.	Fiber production method:		
3.	Attenuation Coefficient @ 1310 nm: @ 1550 nm:	dB/km dB/km	
4.	Attenuation Variation with Wavelength (±25 nm):	dB/km	
5.	Attenuation at water peak:	dB/km	
6.	Point discontinuity @ 1310nm: @ 1550nm:	dB dB	
7.	Temperature dependence (induced attenuation):	dB	
8.	Nominal Mode Field Diameter @ 1310 nm: @ 1550 nm:	μm	
9.	Mode Field Diameter Deviation @ 1310 nm: @ 1550 nm:	μm	
10.	Mode field non-circularity:	%	
11.	Chromatic Dispersion Coefficient @ 1310 (1288-1339) nm: @ 1310 (1271-1360) nm: @ 1550 nm:	Ps/nm.km	
12.	Zero dispersion wavelength:	nm	
13.	Zero dispersion Slope:	$ps/nm^2.km$	
14.	Cutoff wavelength:	nm	
15.	Refractive Index:		
16.	Refractive Index profile:		
17.	Cladding Design:		
18.	Numerical aperture:		

DRS Form 2 (Continued)

DATA REQUIREMENTS SHEETS for OPTICAL FIBRE

DUAL-WINDOW SINGLE MODE (DW-SM)

PHYSICAL and MECHANICAL PROPERTIES			
Seq	**Parameter:**	**Unit:**	**Particulars:**
19.	Bend Performance: (37.5 mm radius, 100 turns) @1310 nm (30 mm radius, 100 turn) @1550 nm (16mm radius, 1 turn) @ 1550nm	dB dB	
20.	Core Diameter (nominal± deviation):	μm	
21.	Core non-circularity:	%	
22.	Cladding Diameter (nominal ± deviation):	μm	
23.	Core- Clad concentricity Error:	μm	
24.	Cladding noncircularity:	%	
25.	Fibre cut-off wavelength	μm	
26.	Protective Coating type & material DROP & INSERT: Secondary:		
27.	Protective Coating Diameter (nominal ± deviation):	μm	
28.	Protective Coating removal method:		
29.	Coating Concentricity	μm	
30.	Polarisation mode dispersion coefficient	ps/km^1/2	
31.	Proof test level	kpsi	
32.	Colour coding scheme compliant with EIA/TIA 598 or IEC 60304 or Bellore GR-20.	Yes/No	
33.	Colouring material compliant with technical specs?	Yes/No	

DRS Form 3-A

DATA REQUIREMENTS SHEETS for
HARDWARE AND ACCESSORIES

Suspension Clamp Assembly:

Manufacturer: _____
Part #: _____

ITEM	DESCRIPTION	UNIT	PARTICULARS
1.	Minimum vertical Strength	kN	
2.	Maximum Slip Strength	kN	
3.	Minimum Slip Strength	kN	
4.	Length (nominal)	mm	
5.	Weight (nominal)	kg	
6.	Total Drop (maximum) including shackles	mm	
7.	Tightening torque (nominal)	Nm	
8.	Details of Armour Rod Set		
	a) No. of rods per clamp		
	b) Direction of Lay		
	c) Overall length	mm	
	d) Diameter of each Rod	mm	
	e) Tolerances (i) Diameter of each rod (ii) Length of each rod	 ±% ±%	
	f) Material of manufacture		
	g) UTS of each Rod	kN	
	h) Weight	kg	
9.	Details of Protection Splice Set (Reinforcing Rods)		
	i) No. of rods per clamp		
	j) Direction of Lay		
	k) Overall length	mm	
	l) Diameter of each Rod	mm	
	m) Tolerances		

	(i) Diameter of each rod (ii) Length of each	 ±% ±%	
	n) Material of manufacture		
	o) UTS of each Rod	kN	
	p) Weight	kg	

DRS Form 3-B

DATA REQUIREMENTS SHEETS for HARDWARE AND ACCESSORIES

Dead End Clamp Assembly:

Manufacturer: _____
Part #: _____

ITEM	DESCRIPTION	UNIT	PARTICULARS
1.	Minimum Slip Load	kN	
2.	Length (nominal)		
	a) Reinforcing Rods	mm	
	b) Dead end	mm	
3.	Weight (nominal)		
	a) Reinforcing Rods	kg	
	b) Dead end	kg	
4.	Breaking strength (minimum)	kN	
5.	Wire Size		
	a) Reinforcing Rods	mm	
	b) Dead end	mm	

DRS Form 3-C

DATA REQUIREMENTS SHEETS for HARDWARE AND ACCESSORIES

Vibration Damper:

Manufacturer: _____

Part #: _____

ITEM	DESCRIPTION	UNIT	PARTICULARS
16560102	Total Weight	Kg	
10.	Weight of each Damper	Kg	
11.	Material of Damper Weight		
12.	Clamp Material		
13.	Clamp bolt tightening torque	Nm	
14.	Clamp bolt material		
15.	Messenger Cable Material		
16.	No. of Strands in Messenger Cable		
17.	Breaking Strength of Messenger Cable	kN	
18.	Resonance Frequencies		
	a) First Frequency	Hz	
	b) Second Frequency	Hz	
	c) Third Frequency	Hz	
	d) Forth Frequency	Hz	
19.	Minimum Slip Strength of Damper Clamp		
	a) Before Fatigue Test	kN	
	b) After fatigue Test	kN	

DRS Form 3-D

DATA REQUIREMENTS SHEETS for
OPGW HARDWARES and ACCESSORIES

Down Lead Clamp /Fastening Clamp

Manufacturer: _____
Part #: _____

ITEM	DESCRIPTION	Unit:	Particulars:
1.	Material:		
2.	Suitable for OPGW (range):	mm	
3.	Tightening torques	Nm	
4.	Vertical load	kN	
5.	Filler details:		
(a)	Material		
(b)	diameter:	mm	
6.	Tower attachment arrangement		

DRS Form 4-A
DATA REQUIREMENTS SHEETS for
Splice Enclosures(Joint Box) for Overhead FO cable

Manufacturer: _____
Model # _____

Seq	Parameter:	Unit:	Particulars:
1.	Dimensions H * W * D:	cm	
2.	Weight:	Kg	
3.	Colour and Finish:		
4.	Cable Glanding & Fixing:		
5.	Construction materials & Gauge:		
6.	Locking arrangements:		
7.	Installation Clearances: Front Access: Rear Access: Top * Bottom * Sides:	cm	
8.	IP Protection	Class	
9.	Total number of optical couplings:	ea	
10.	Provision of pass through splicing:	Yes/No	

DRS Form 4-A

DATA REQUIREMENTS SHEETS for
Splice Enclosures(Joint Box) for Overhead FO cable

Manufacturer: _____
Model # _____

11.	Whether filled with suitable encapsulant	Yes/No	
12.	Method(s) for mounting with the tower:		

Optical Fibre Cable Accommodations

13.	Cable Glanding:		
14.	Maximum number of cables that can be accommodated:	each	
15.	Diameter(s) of cables that can be accommodated:		

16. Describe Cable entries :

DATA REQUIREMENTS SHEETS for
Splice Enclosures(Joint Box) for Overhead FO cable

Seq	Parameter:	Unit:	Particulars:
Cable Termination Splice Accomodations:			
17.	Details of Splice Trays:		
	Dimension:		
	Material/Gauge:		
	Weight:	kg	
	Colour & Finish:		
	Method of mounting:		
18.	Maximum number of splice trays:	ea	
19.	Number of splices per tray:	ea	
20.	Provision of Splice organisors:		
21.	Do splice trays require a separate enclosure? If so:	Yes/No	
	Manufacturer:		
	Dimensions H * W * D:	cm	
	Weight:	Kg	
	Colour and Finish:		
	Method(s) of Mounting:		
	Construction materials & Gauge:		
	Locking arrangements:		
	Installation Clearances Front Access: Rear Access: Top * Bottom * Sides:	m	
22.	Excess length of fibre service loops		

DRS Form 5

DATA REQUIREMENTS SHEETS for
Fibre Optic Distribution Panels (FODPs)

Manufacturer: _____
Model # _____

Seq	Parameter:	Unit:	Particulars:
1.	Dimensions H * W * D:	cm	
2.	Weight:	Kg	
3.	Colour and Finish:		
4.	Cable Glanding & Fixing:		
5.	Construction materials & Gauge:		
6.	Locking arrangements:		
7.	Installation Clearances: Front Access: Rear Access: Top * Bottom * Sides:	cm	
8.	IP Protection	Class	
9.	Total number of optical couplings:	ea	
10.	Provision of pass through splicing:	Yes/No	
11.	Whether filled with suitable encapsulant	Yes/No	
12.	Method(s) for mounting		

Optical Fibre Cable Accommodations

13.	Cable Glanding:		
14.	Maximum number of cables that can be accommodated:	each	
15.	Diameter(s) of cables that can be accommodated:		

16. Describe Cable entries:

DATA REQUIREMENTS SHEETS for
Fibre Optic Distribution Panels (FODPs)

Manufacturer: _____
Model # _____

Seq	Parameter:	Unit:	Particulars:
Cable Termination Splice Accomodations:			
17.	Details of Splice Trays:		
	Dimension:		
	Material/Gauge:		
	Weight:	kg	
	Colour & Finish:		
	Method of mounting:		
18.	Maximum number of splice trays:	each	
19.	Number of splices per tray:	each	
20.	Provision of Splice organisors:		
21.	Do splice trays require a separate enclosure? If so:	Yes/No	
	Manufacturer:		
	Dimensions H * W * D:	cm	
	Weight:	Kg	
	Colour and Finish:		
	Method(s) of Mounting:		
	Construction materials & Gauge:		
	Locking arrangements:		
	Installation Clearances Front Access: Rear Access: Top * Bottom * Sides:	m	
22.	Excess length of fibre service loops		

DRS Form 6

DATA REQUIREMENTS SHEETS for
APPROACH CABLE

Manufacturer: _____
Part #:_____

CABLE CONSTRUCTION			
Seq	**Parameter:**	**Unit:**	**Particulars:**
1.	Fibre Manufacturer Dual Window Single-Mode:		
2.	No. of Fibres Dual Window Single-Mode:	each	
3.	Buffer Type:		
4.	Buffer Tube Diameter:	mm	
5.	Buffer Tube material		
6.	No. of Buffer Tubes:	each	
7.	No. of Fibers per Tube:	each	
8.	Identification/numbering of individual tubes:		
9.	No. of empty tubes (If any):	each	
10.	Filling material:		
11.	Filling material compliant with technical specifications?	Yes/No	
12.	Strength member(s):		
13.	Binding yarn/ tape:		
14.	Describe Central Core Design:		

DRS Form 6 (Continued)

DATA REQUIREMENTS SHEETS for APPROACH CABLE

Manufacturer: _____

Part #:_____

Seq	Parameter:	Unit:	Particulars:
15.	Outside Jacket coating (if any)		
16.	Jacket thickness	mm	
17.	Jacket non-circularity	%	
18.	Cable Diameter:(nominal □ deviation)	mm	
19.	Cable cross-section area:	mm^2	
20.	Rip-cord provided?	Yes/No	
21.	Fully Compliant with IEC 60974-3:	Yes/No	

Mechanical Properties of Cable

22.	Max. breaking load/ Ultimate Tensile Strength (UTS):	kN	
23.	Fibre strain margin:	%	
24.	Zero fibre strain up to load	kN	
25.	Weight:	kg/km	
26.	Crush strength:	kg/mm	
27.	Equivalent Modulus of elasticity:	KN/mm^2	
28.	Minimum Bending Radius without microbending:	mm	
29.	Maximum Bending Radius: Short Term: Long Term (Continuous):	mm	
30.	Tensile proof test (Screening) level:	KN/mm^2	
31.	Maximum permissible tensile stress:	KN/mm^2	
32.	Permissible CTS. tensile stress:	KN/mm^2	

- Continued -

DATA REQUIREMENTS SHEETS for APPROACH CABLE

Seq	Parameter:	Unit:	Particulars:
33.	Every day tensile stress	N	
34.	Torsion	twist/m	

Thermal Properties of Cable

35.	Coefficient of linear expansion:	per °C	
36.	Coefficient of expansion Cladding: Core:	 per °C per °C	
37.	Nominal operating temperature range:	°C	

CABLE SPOOL and DRUM

Seq	Parameter:	Unit:	Particulars:
38.	Available length per spool Maximum: Nominal:	m	
39.	Size of drum:	m	
40.	Weight of empty drum:	kg	
41.	Weight of drum with cable: spooled	kg	
42.	Will drum length scheduling be practiced to match transmission line span lengths?	Yes/No	

43. Describe Drum materials:

44. Describe cable end capping and protection against abrasion etc.:

DATA REQUIREMENTS SHEETS for APPROACH CABLE

INSTALLATION			
Seq	**Parameter:**	**Unit:**	**Particulars:**
45.	Splice Loss: Maximum: Average:	 dB dB	
46.	Operating Temperature Range:	°C	
47.	Expected Cable Life:	Years	

48. Describe Installation method(s) and the cable duct parameters for installation of approach cable:

DATA REQUIREMENTS SHEETS for
Test Equipment and Other Items/Materials being supplied under the Package and not covered in DRS Forms

The following items shall be described as a minimum:

1. Name of item:
2. Make & Model Number:
3. All Major Parameters:
4. Different options available and the specific option proposed to be supplied:
5. Operation Temperature range:

However, the technical brochure from the Manufacturer must be submitted along with the above DRSs in support of the various parameters. The DRS shall also include the list of suppliers for all bought out items.

----------End of the Appendix----------

Appendix-B

GUIDELINES FOR OPGW CABLE OFF-LINE INSTALLATION

1. General

Installation procedure for OPGW is basically similar to that for conventional overhead ground wires in overhead transmission line construction, however particular care required to be taken for protection of optical fibers in OPGW cable from damage by handling the same properly during transportation , unloading and installation at site. Off line installation to be carried out using power operated winch machines and pulley blocks on each tower using experienced installation team comprising of minimum 25 persons. The installation team shall have one team leader/crew in-charge along with 15 skilled and 10 unskilled persons minimum in one installation crew.

List of Tools and Plants to be used are as per enclosed Annexure.

Following aspects are to be kept in mind before taking up live-line installation:

a) Tools and Plant suitability
b) Working conditions, specially following:
    - Strong winds more than 7 m/sec
    - Rain or snow
    - Foggy
    - Lightening

2. Safety measures

All site workers must follow the Electricity Rules and Employer specified safety procedures. They must use safety belts, safety shoe, safety helmet and other safety items required.

Assign foremen/Crew In-charge for each erection crew for enforcing installation guidelines. It may be ensured that only authorized person is climbing the tower during live-line installation of OPGW. Fix the warning red flag on the tower, in order to keep the workers from encroaching into unsafe zones.

2.1 **Permission to Work (PTW) :**

Permit to work to be obtained by the representative of installation agency from concerned sub-station staff in coordination with employer project manager prior to commencement of installation in case of power line crossings and the same is to be returned after completion of the work in all respect within the specified time duly following the PTW conditions.

2.2 Preparedness to tackle untoward incidents:

a) Safety Engineer has to make sure the availability of First Aid Box with each team.

b) Maintain a record of the details of list of all nearby hospitals/clinics in each area,

with contact details and Emergency contact nos. of Ambulances.

c) In case of any untoward situation, Safety engineer/crew incharge must act fast and provide the necessary first aid to the affected person(s). Ambulance to be arranged immediately from the nearby area and coordinate with hospital for immediate medical assistance as required.

3. Off-line Installation Process

3.1 **Installation plan:**

Following measures are to be taken in advance for smooth completion of the installation.

- Coordination with employer project manager
- Erection crew mobilization along with T&Ps
- Safety aspects
- Field quality aspects
- Transportation arrangement

3.2 **Materials handling:**

Check the material with respect to the approved documentation. All materials shall be visually examined for any physical damage. Any material, which is not as per documentation or is damaged, shall not be used.

OPGW Drums checks:

- Packing condition
- Packing list (Object, Type, Length, OPGW Weight, Drum No. etc)
- Attenuation results of OPGW

Hardware Fittings Checks:

- Bolts, Nuts Pitch
- Type & Quantity

Handling of OPGW:

OPGW contains optical fibers which are very delicate and to be handled with due care. For the safety of optical fibers, it is very important to avoid the bending at sharp angle. Manufacturer guidelines are to be followed strictly while handling the same.

In order to avoid undue tension on OPGW, it is not recommended to pay off OPGW together with phase conductors or other wires tied in parallel. The tension during stringing works should be well managed within permissible limits.

Adequate length of OPGW shall be ensured as loop at each joint location after stringing so that it is possible to bring OPGW up to the ground level for carrying out jointing work.

4. OPGW Stringing

- Hang the pulley blocks on one of the earth wire peaks for the whole section (Section is a consecutive group of towers needed to support the installation of scheduled length of OPGW Drum)

- Carry out paying of pilot wire for entire section and connect the same with OPGW on drum side and winch machine on other side suitably.
- Pull the Pilot Wire with the use of winch machine to pay out the OPGW.
- Maintain proper tension while pulling OPGW so as to avoid damage to fibers inside the OPGW. In no case pulling tension should exceed 15 % of UTS of OPGW.

- **Set the Come-along and Lever Block to the OPGW.**With this OPGW paying fora section gets completed.

5. OPGW sagging

- Use the pre-calculated Sag & Tension Table as sag reference.
- Avoid fixing the sag if the wind is strong.

5.1 Sagging:

1) Methods and procedures for sagging of OPGW are the same as those of normal overhead ground wire.

After stringing the OPGW shall be sagged using information furnished on the sag and tension chart. The sag of the OPGW should not exceed the existing ground-wire sag.

3) Sagging thermometers shall be used to determine accurate temperature and OPGW sag of each sag section. Sagging thermometer shall be used sufficiently prior to the actual sagging operation to represent the temperature of the OPGW.

5) At the time of sagging OPGW, the sag should be within 6 inches of the theoretical value for existing temperature condition.

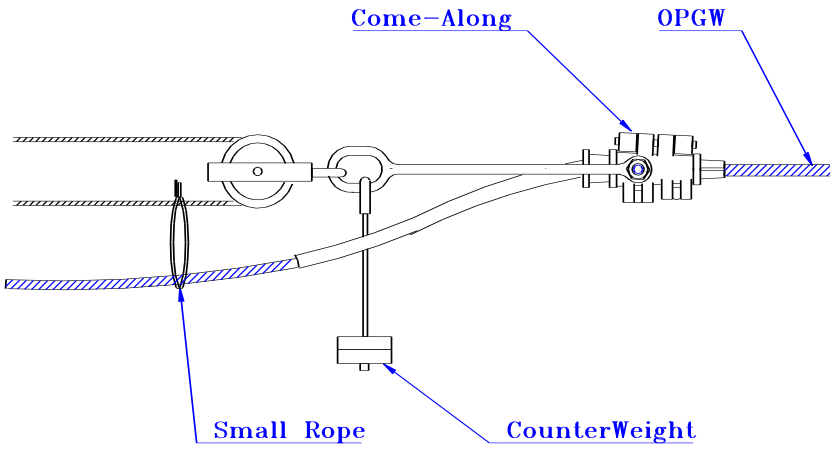
7) OPGW tension between each sag section shall be equalized and this shall be

determined by the vertical position of the suspension clamps on the last clipped structure of the preceding sag section.

8) For pulling the OPGW with tension, the device of come-along is to be recommended.

9) Personnel should be specifically deployed for keeping watch on sag at a different section of the line during stringing.

10) Waterproof caps shall be fixed at both ends of the OPGW cable after installation.

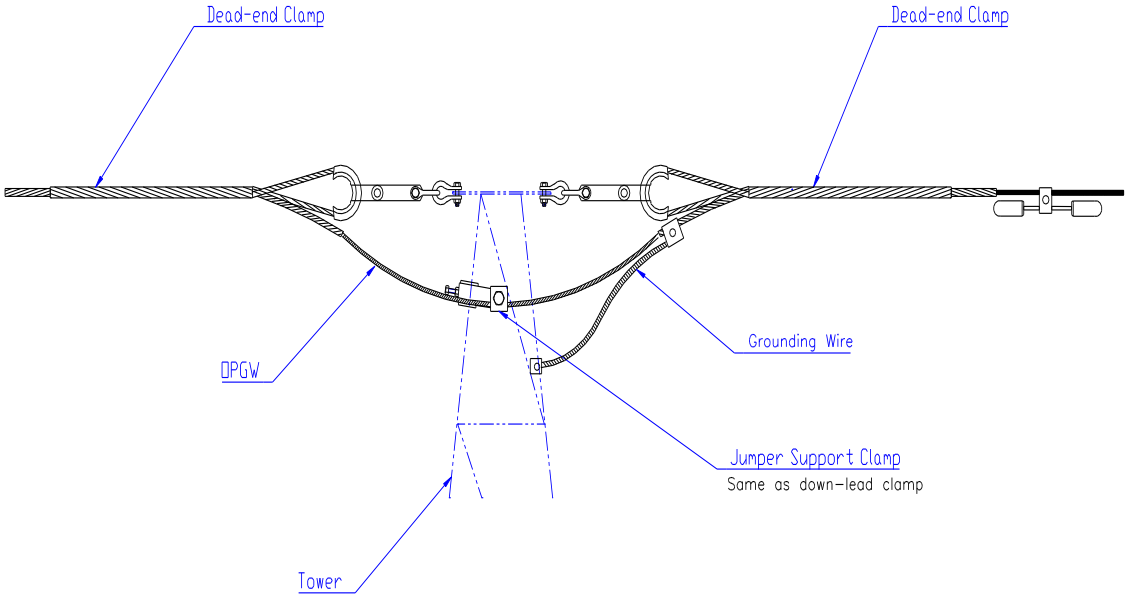


6. OPGW Clamping

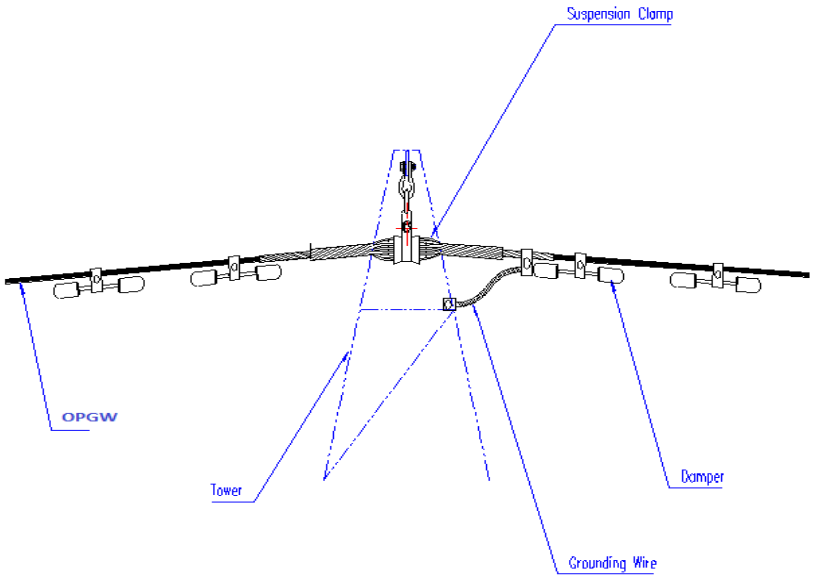
6.1 Make sure to install and tighten the bolt of clamp properly.

6.2 Tightening must be made sequentially from the support point.

TENSION TOWER



SUSPENSION TOWER



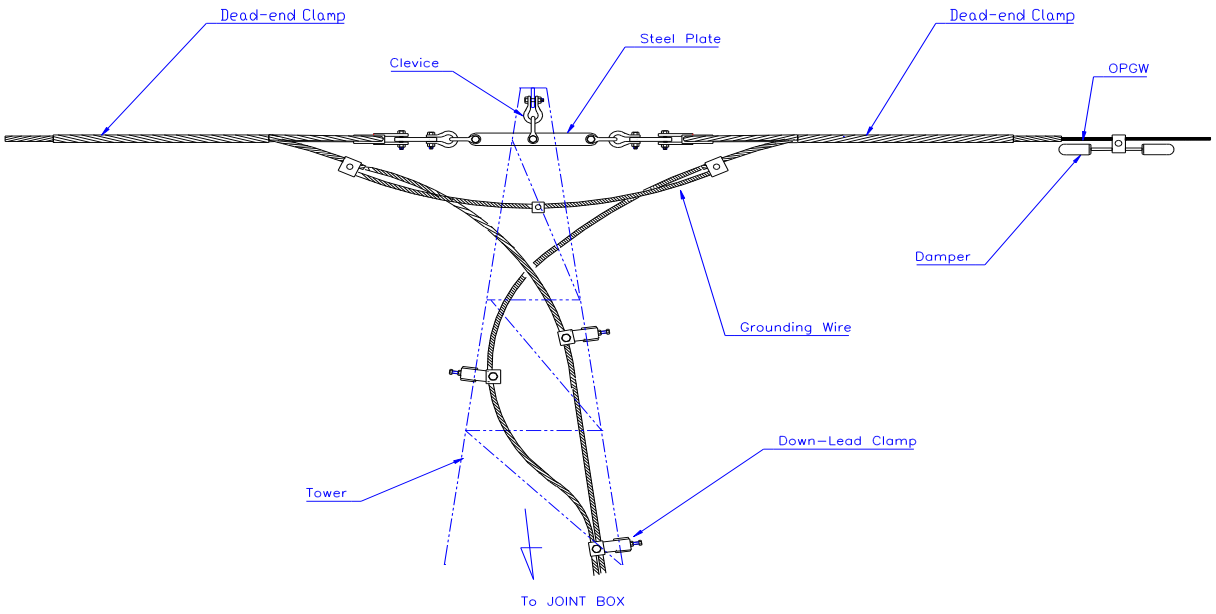
7. OPGW down Leading

7.1 Make sure to clip the OPGW with down lead clamp to the tower in a careful manner.

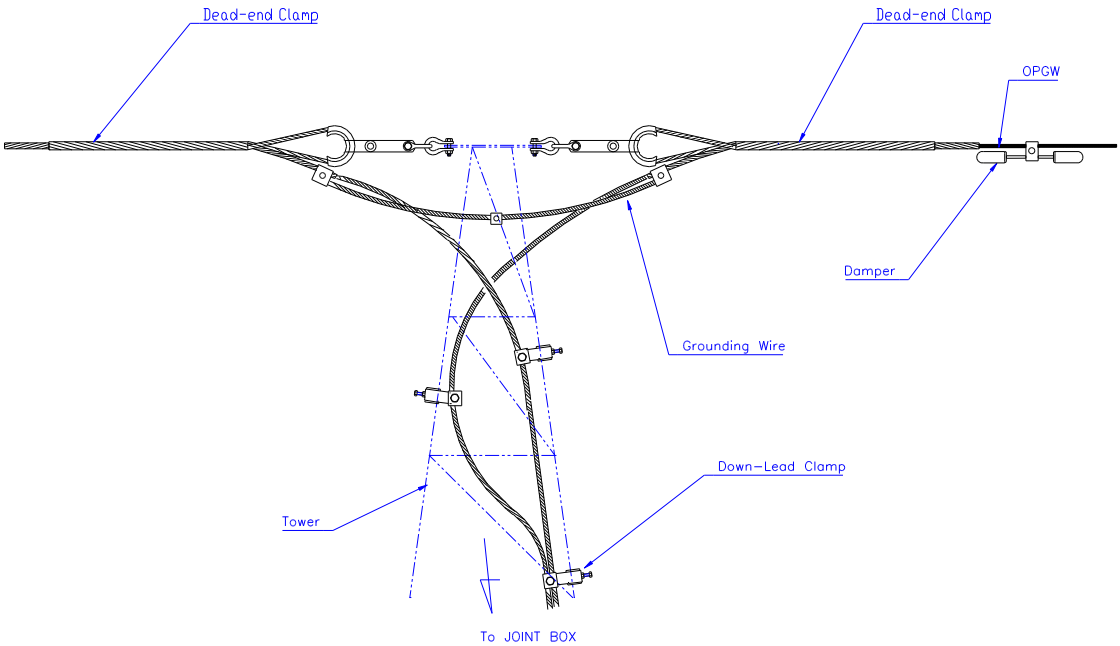
7.2 Make sure to tighten the bolt of down-lead clamp properly.

7.3 Install the down-lead clamp at appropriate interval .

SUSPENSION TOWER FOR JOINTING TOWER



TENSION TOWER OF JOINTING TOWER



Annexure-1

List of Tools:

S. No	Description	Specifications
01	Pulley block(Aluminum roller) 300 mm	20 Nos
02	Pulley block(Aluminum roller) 450 mm	20 Nos
03	Pulley block(Aluminum roller) 600 mm	6 Nos
04	Pilot Wire (14 mm)	1000 M
05	Pilot Wire (16 mm)	7000 M
06	Pilot Rope 12 mm Nylon Rope	600 M
07	Earthing roller	3-way roller
08	Winch machine (3 Tons)	2 Nos
09	Drum stand	2 sets
10	Reel winder	6 Nos
11	Come along clamp	8 Nos
12	Torque Wrench (1 Ton)	2 Nos
13	Running Board (20 Kg)	4 Nos
14	D-shackle	30 Nos
15	Snatch Block (1 way 2 ton)	8 Nos
16	Snatch Block (2 way 2 ton)	4 Nos
17	Chain Block (3 Ton)	4 Nos
18	Wire Connector	20 Nos
19	Braid Clamp	6 Nos
20	Wire Clamp	20 Nos
21	Swivel (3 ton)	10 Nos

Appendix - C

GUIDELINES FOR OPGW CABLE LIVE-LINE INSTALLATION

2. General

Installation procedure for OPGW is basically similar to that for conventional overhead ground wires in overhead transmission line construction, however particular care required to be taken for protection of optical fibers in OPGW cable from damage by handling the same properly during transportation , unloading and installation at site. Live line installation to be carried out using traction machines and support rollers using experienced installation team comprising of minimum 30-35 persons. The installation team shall have one team leader/crew in-charge along with 15 skilled and 14 unskilled persons minimum in one installation crew.

List of Tools and Plants to be used are as per enclosed Annexure.

Following aspects are to be kept in mind before taking up live-line installation:

c) Condition of existing ground wire for its suitability for live-line OPGW installation
d) Tools and Plant suitability
e) Working conditions, specially following:
    - Strong winds more than 7 m/sec
    - Rain or snow
    - Foggy
    - Lightening

2. Safety measures

All site workers must follow the Electricity Rules and Employer specified safety procedures. They must use safety belts, safety shoe, safety helmet and other safety items required.

Assign foremen/Crew In-charge for each erection crew for enforcing installation guidelines. It may be ensured that only authorized person is climbing the tower during live-line installation of OPGW. Fix the warning red flag on the tower, in

order to keep the workers from encroaching into unsafe zones.

2.1 **Permission to Work (PTW) :**

Permit to work to be obtained by the representative of installation agency from concerned sub-station staff in coordination with employer project manager prior to commencement of installation and the same is to be returned after completion of the work in all respect within the specified time duly following the PTW conditions.

2.2 Preparedness to tackle untoward incidents:

a) Safety Engineer has to make sure the availability of First Aid Box with each team.

b) Maintain a record of the details of list of all nearby hospitals/clinics in each area,

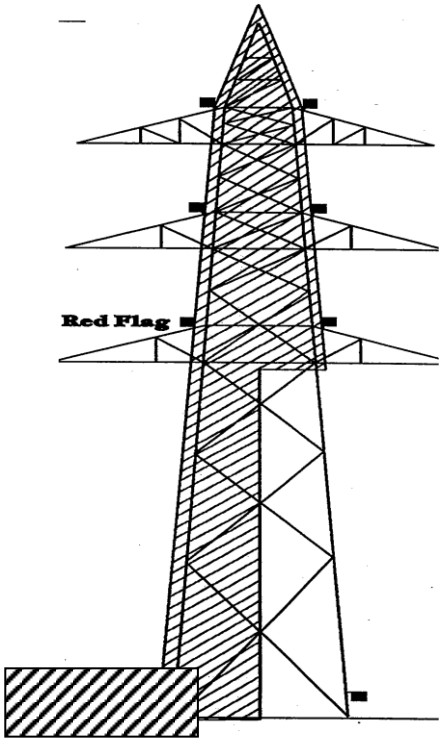
with contact details and Emergency contact nos. of Ambulances.

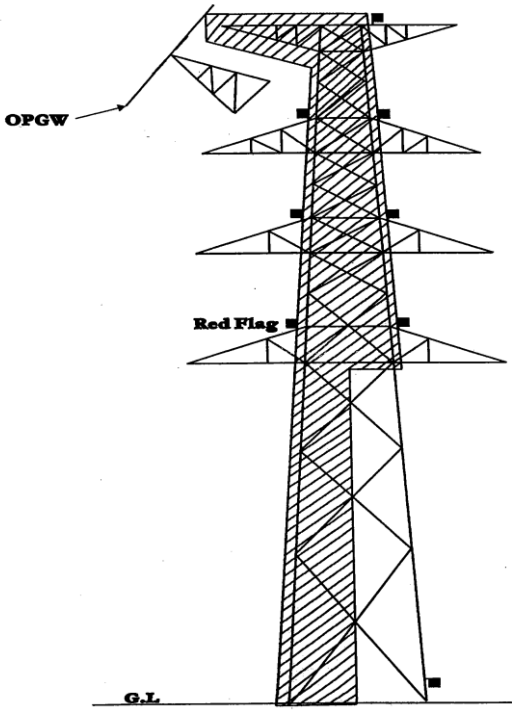
c) In case of any untoward situation, Safety engineer/crew incharge must act fast and provide the necessary first aid to the affected person(s). Ambulance to be arranged immediately from the nearby area and coordinate with hospital for immediate medical assistance as required.

2.3 Marking of Zones during OPGW Stringing:

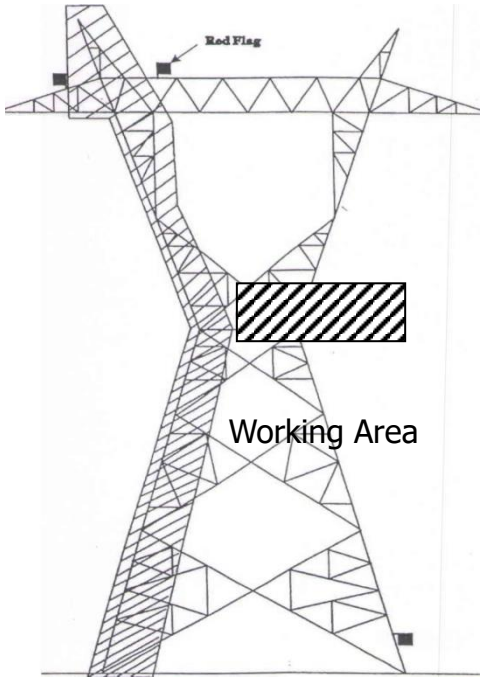
It is very essential for the installation agency to be aware of safe zones of the Tower while carrying out live-line installation. Generally crew members identified for preparation work on the ground, will not work on the tower and will remain within hazard-free zone.

The pictorial view of the working zone and limitation of the restricted zone are shown below for your convenience.





Working Area

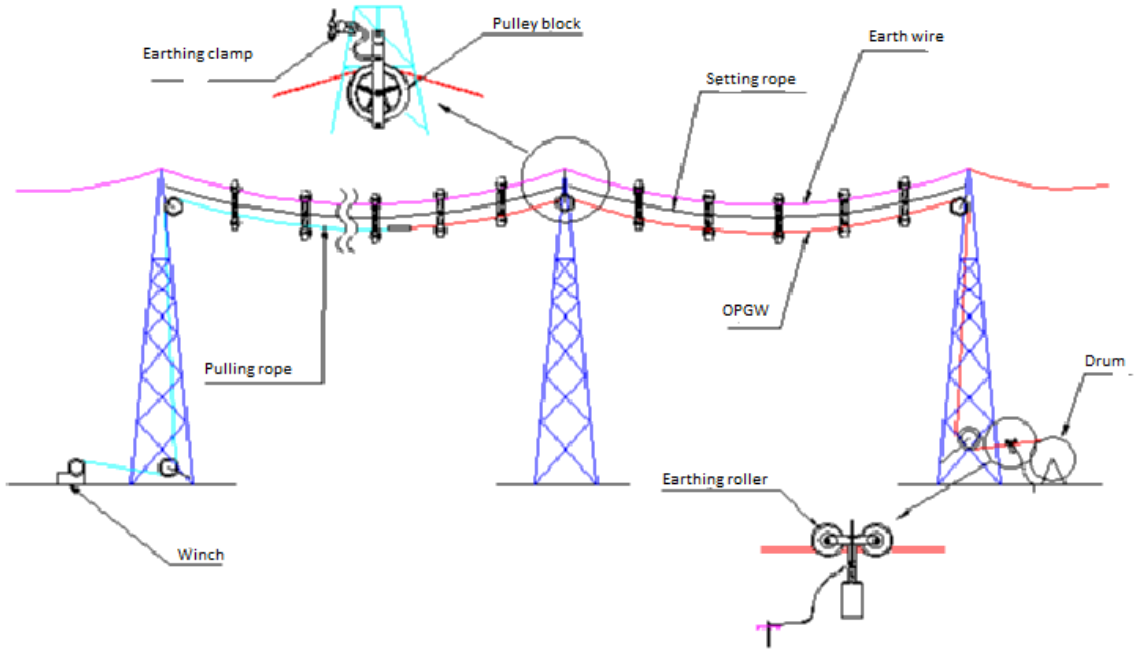


3. Grounding

Grounding of the following before starting work at site is required to be ensured. Grounding devices include the following:

3.1 **Equipment Grounding:**

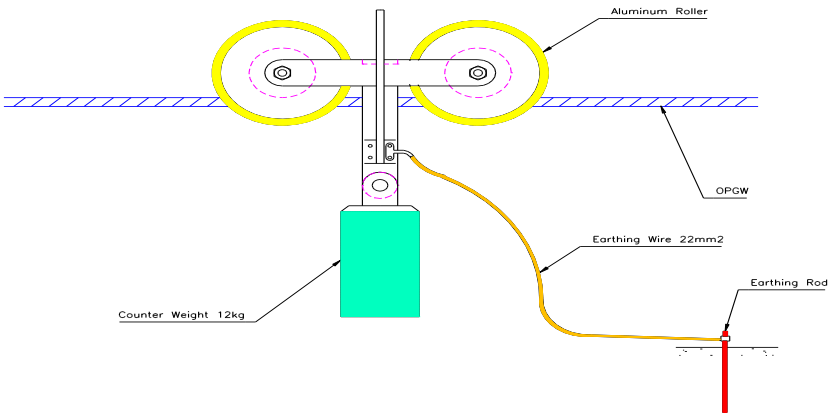
Equipment like OPGW and Existing Ground wire (GW), Pulley Blocks are connected with individual copper cable attached to the tower (with copper rod installed on the ground) or to the main grid if grounding system exists. Grounding



clamp shall be cleaned well and ensure proper contact.

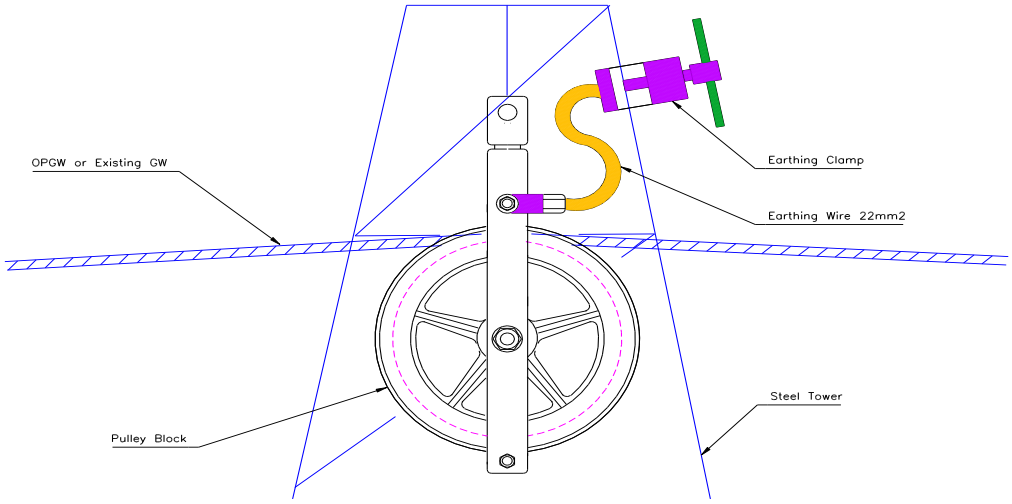
3.2 **Running Ground:**

Running ground shall be installed on the OPGW at drum side during OPGW stringing time and at the Winch side on the existing GW during dismantling time for the whole stringing operation to avoid any electrical charges of induction from the line.



3.3 Pulley Block Grounding:

For each tower grounding type pulley block must be used.



Grounding cable must be connected to the ground source first then to the object that needed to be grounded.

When removing grounds, the ground must be removed from the grounded objects first and then remove the grounding clamp from the ground source.

In case of any problems during the installation work, the person in charge of the section will immediately contact sub-station in charge of the line and employer Project Manager immediately for required support.

4. Live-line Installation Process

4.1 Installation plan:

Following measures are to be taken in advance for smooth completion of the installation.

- PTW availability and coordination with employer project manager
- Erection crew mobilization along with T&Ps
- Safety aspects
- Field quality aspects
- Transportation arrangement

4.2 **Materials handling:**

Check the material with respect to the approved documentation. All materials shall be visually examined for any physical damage. Any material, which is not as per documentation or is damaged, shall not be used.

OPGW Drums checks:

- Packing condition
- Packing list (Object, Type, Length, OPGW Weight, Drum No. etc)
- Attenuation results of OPGW

Hardware Fittings Checks:

- Bolts, Nuts Pitch
- Type & Quantity

Handling of OPGW:

OPGW contains optical fibers which are very delicate and to be handled with due care. For the safety of optical fibers, it is very important to avoid the bending at sharp angle. Manufacturer guidelines are to be followed strictly while handling the same.

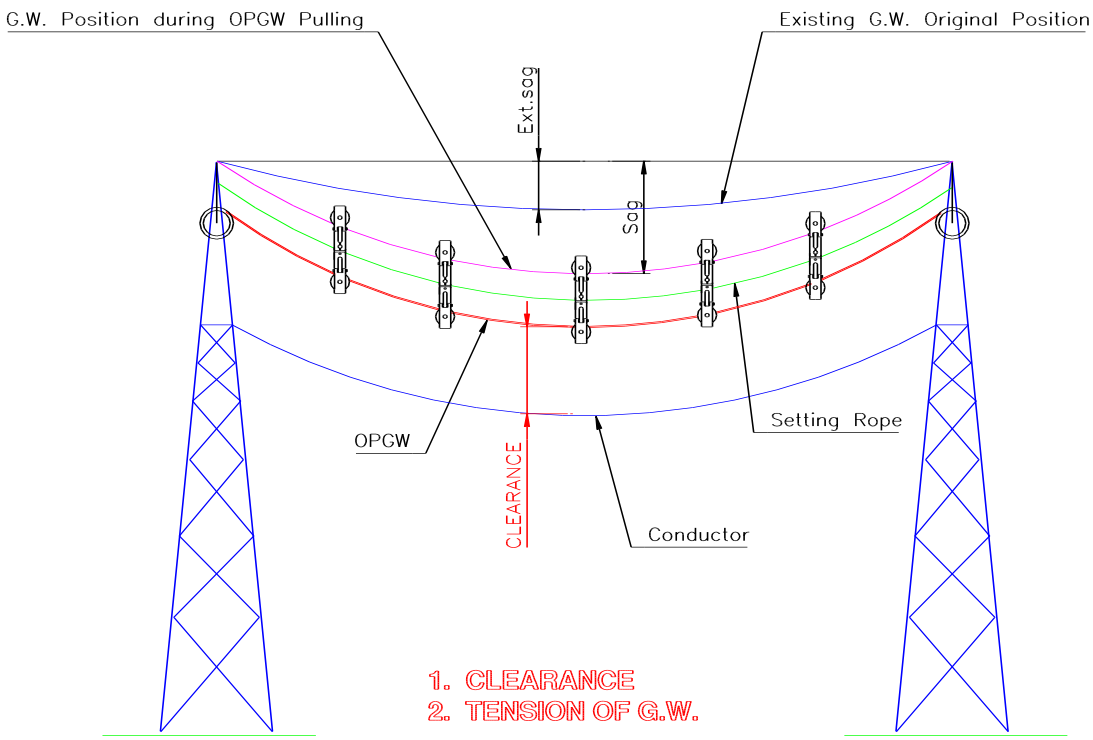
In order to avoid undue tension on OPGW, it is not recommended to pay off OPGW together with phase conductors or other wires tied in parallel. The tension during stringing works should be well managed within permissible limits.

Adequate length of OPGW shall be ensured as loop at each joint location after stringing so that it is possible to bring OPGW up to the ground level for carrying out jointing work.

5. Clearance Checking

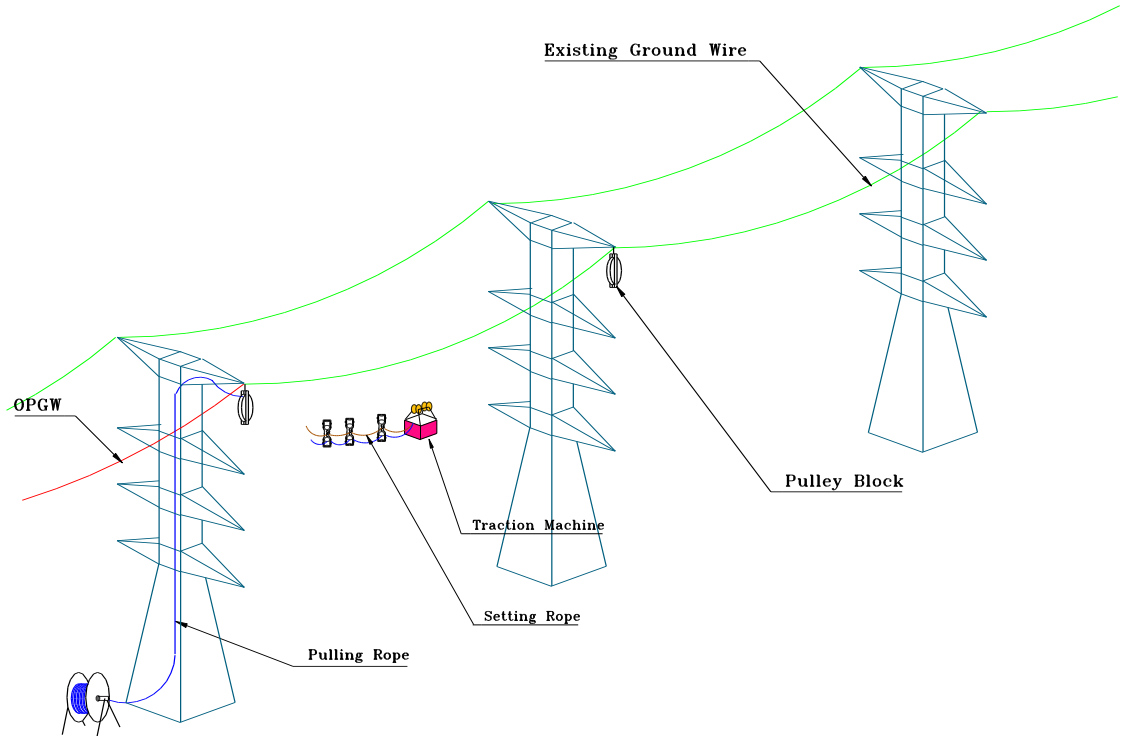
5.1 Check the clearance between existing ground-wire and live conductor before

Stringing. Check the clearance between OPGW and live conductor.



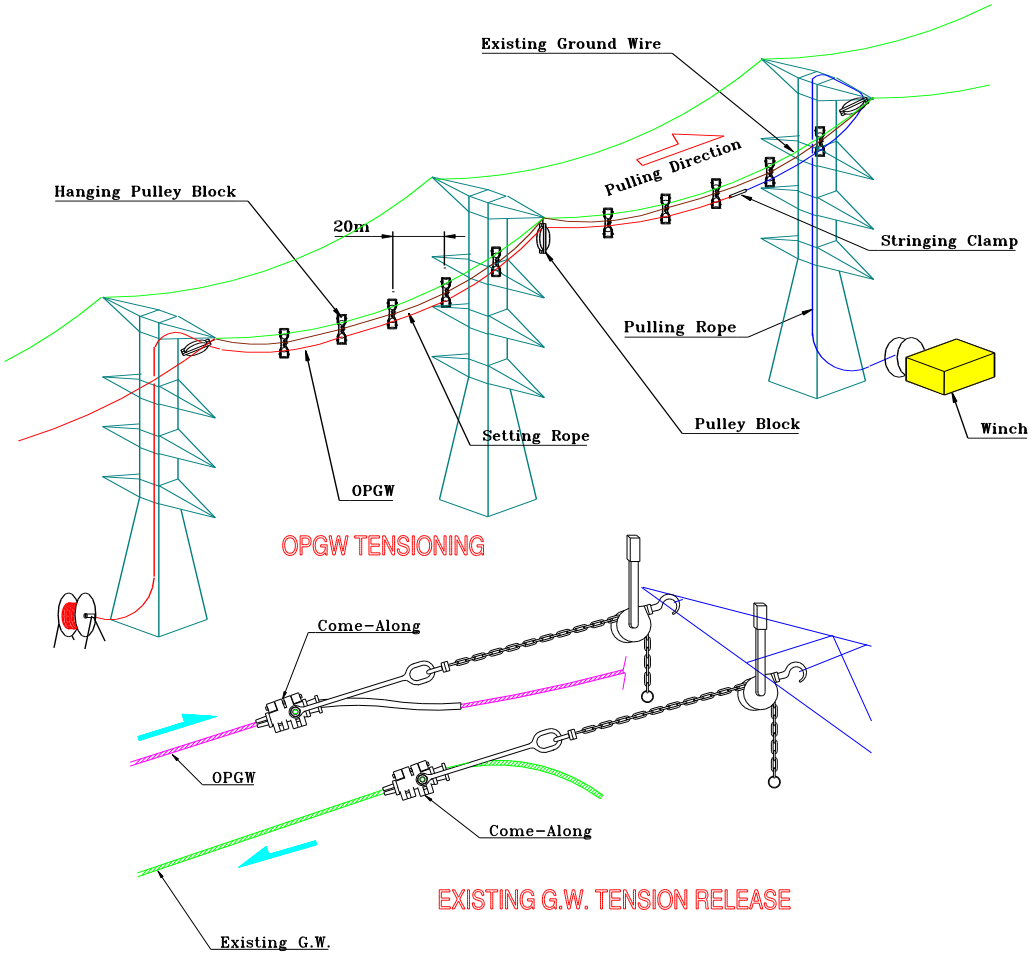
6. OPGW Stringing

- Hang the pulley blocks on one of the earth wire peaks for the whole section (Section is a consecutive group of towers needed to support the in-



stallation of scheduled length of OPGW Drum)

- Set the Traction machine on the existing ground wire.
- Set the support rollers on the existing ground wire where the OPGW is to be installed.
- Connect the Setting Rope and Pulling Rope to the Traction Machine.
- Pull the support rollers, Setting Rope and Pulling Rope with the use of Traction Machine. Support rollers should be hanged at an interval of 20 meters. (A mark with 20m interval marked on setting rope.
- Connect the OPGW to the Pulling Rope with Stringing Clamp.
- Pull the Pulling Rope with the use of winch machine to pay out the OPGW.
- Set the Come-along and Lever Block to the existing ground wire.
- Release the tension of existing ground wire. At the same time, with a fixed come-along and Lever Block, give more tension to the OPGW.



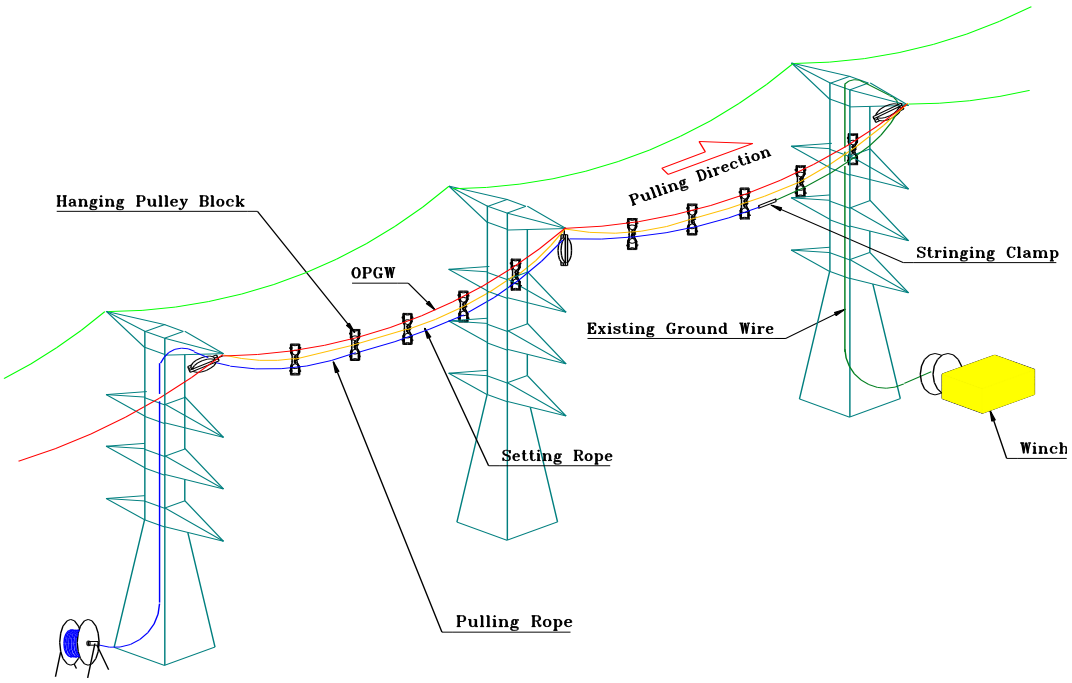
- Position of OPGW and existing ground wire will interchange with above action. The OPGW will be in upper position and existing ground wire in lower position in support rollers.
- With this OPGW paying for a section gets completed.

7. Dismantling process

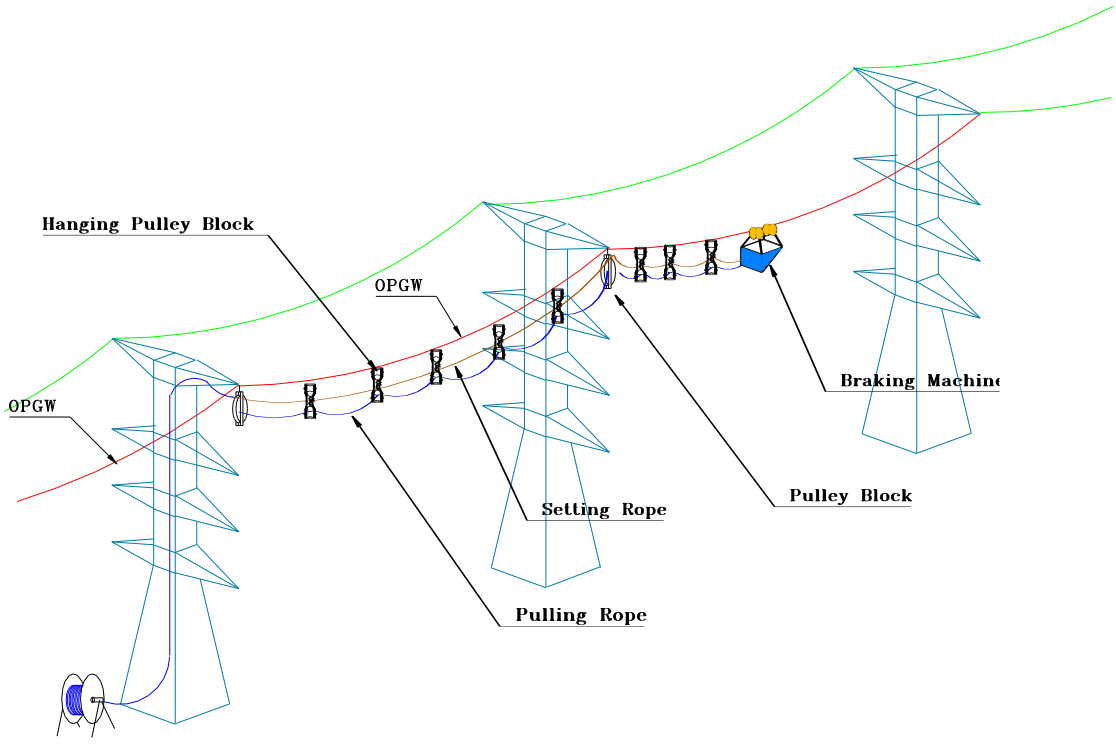
7.1 Existing ground wire:

- Connect the existing ground wire with the Pulling Rope.

- Pull the Pulling Rope with winch to dismantle the ground wire.



7.2 Hanging Pulley Block, Setting Rope and Pulling Rope:



- Set the Breaking Machine on the OPGW of the span required for dismantling.
- Connect the Pulling Rope and Setting Rope to the Braking Machine.

- Pull the Setting Rope and Pulling Rope to dismantle.
- Collect and dismantle the hanging pulley blocks upon reaching the succeeding tower.

8. OPGW sagging

- Use the pre-calculated Sag & Tension Table as sag reference.
- Avoid fixing the sag if the wind is strong.

8.1 *Sagging:*

1) Methods and procedures for sagging of OPGW are the same as those of normal overhead ground wire.

2) After stringing the OPGW shall be sagged using information furnished on the sag and tension chart. The sag of the OPGW should not exceed the existing ground-wire sag.

3) Sagging thermometers shall be used to determine accurate temperature and OPGW sag of each sag section. Sagging thermometer shall be used sufficiently prior to the actual sagging operation to represent the temperature of the OPGW.

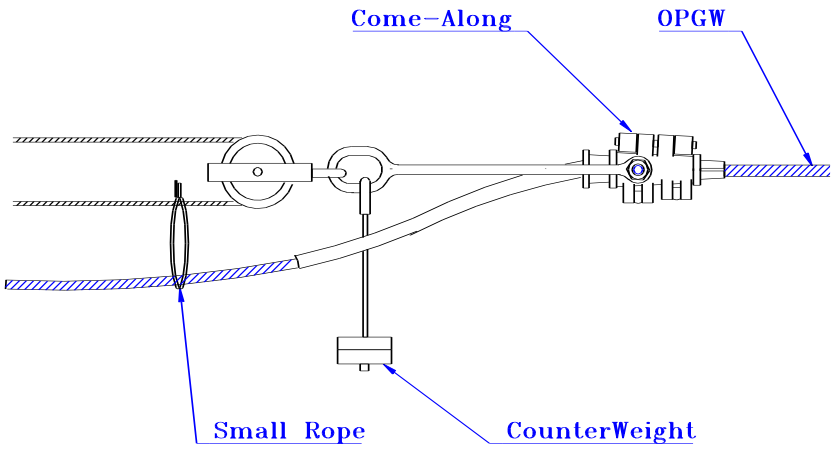
5) At the time of sagging OPGW, the sag should be within 6 inches of the theoretical value for existing temperature condition.

7) OPGW tension between each sag section shall be equalized and this shall be
determined by the vertical position of the suspension clamps on the last clipped structure of the preceding sag section.

8) For pulling the OPGW with tension, the device of come-along is to be recommended.

9) Personnel should be specifically deployed for keeping watch on sag at a different section of the line during live line stringing.

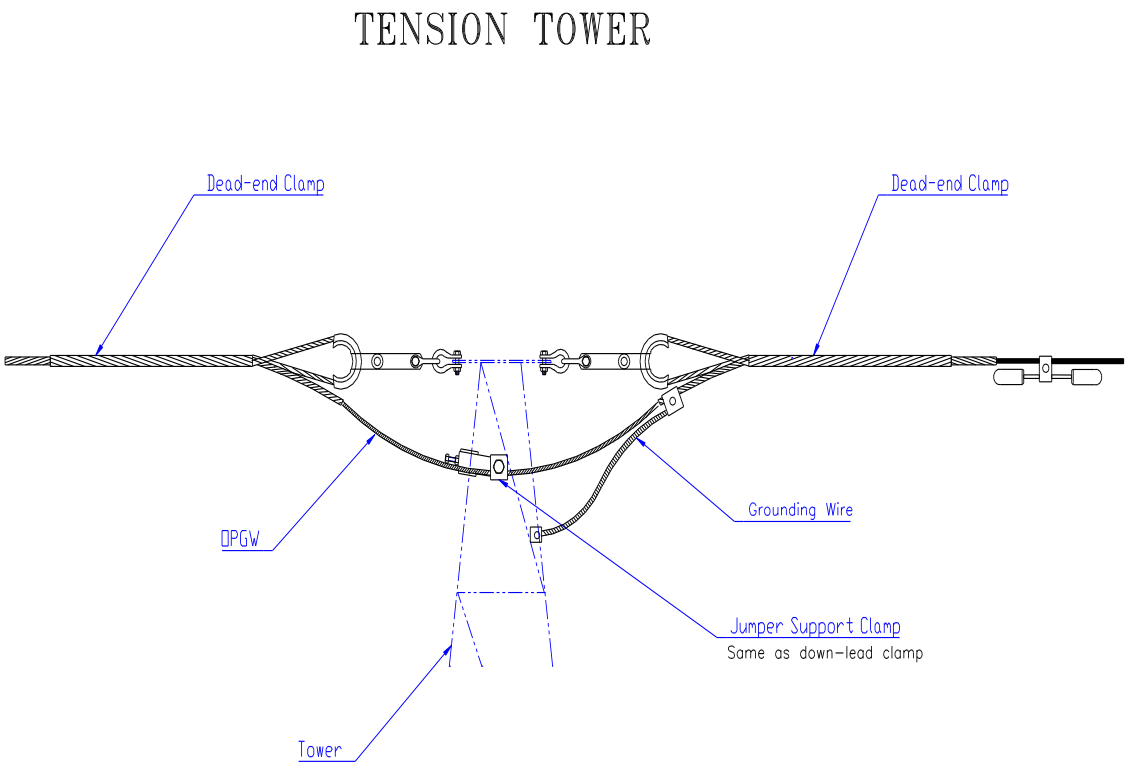
10) Waterproof caps shall be fixed at both ends of the OPGW cable after installation.



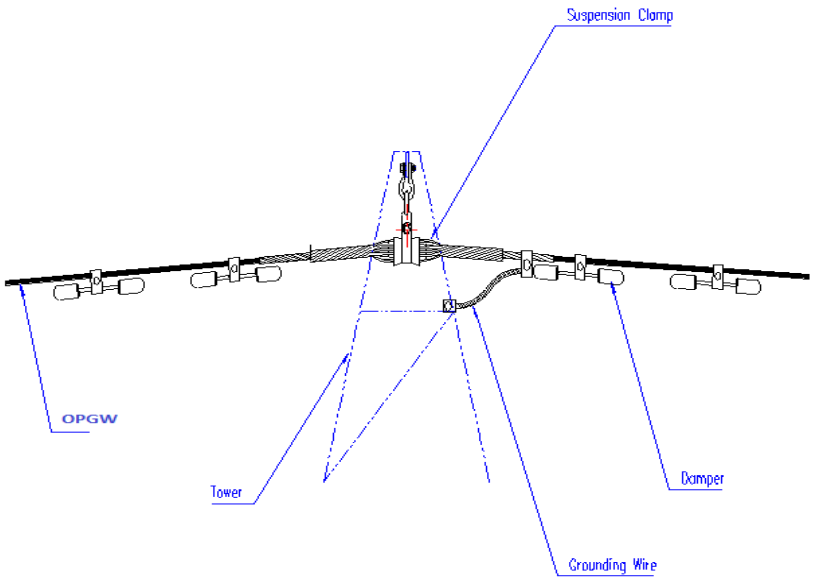
9. OPGW Clamping

9.1 Make sure to install and tighten the bolt of clamp properly.

9.2 Tightening must be made sequentially from the support point.



SUSPENSION TOWER



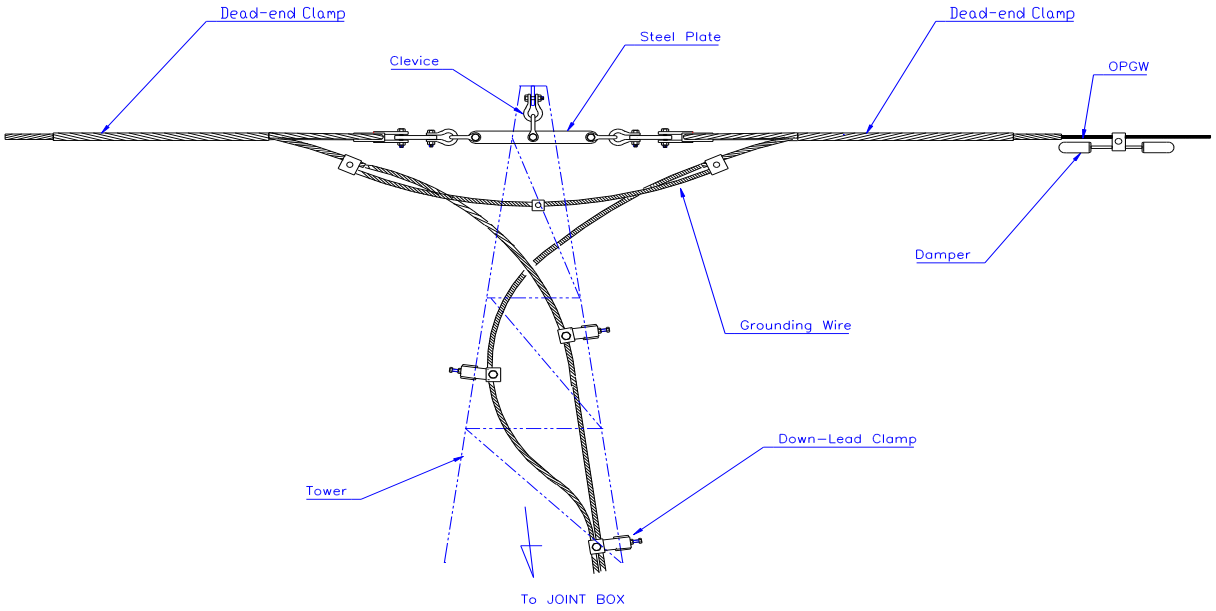
10. OPGW down Leading

10.1 Make sure to clip the OPGW with down lead clamp to the tower in a careful manner.

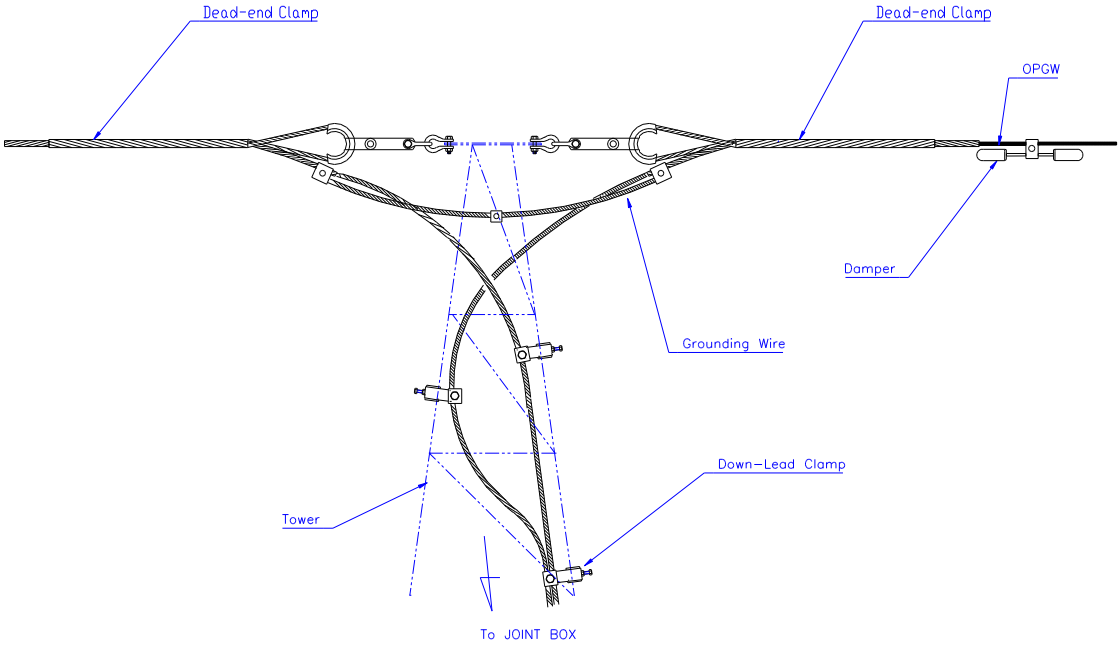
10.2 Make sure to tighten the bolt of down-lead clamp properly.

10.3 Install the down-lead clamp at appropriate interval .

SUSPENSION TOWER FOR JOINTING TOWER



TENSION TOWER OF JOINTING TOWER



Annexure-1

List of Tools:

S. No	Description	Specifications
01	Pulley block(Aluminum roller)	300 mm

02	Pulley block(Aluminum roller)	450 mm
03	Pulley block(Aluminum roller)	600 mm
04		
05		
06	Pilot Rope	12 mm Nylon Rope
07	Supporting Rope	16 mm Kevlar Rope
08	Messenger Rope	10 mm Nylon Rope
09	Setting rope	10 mm Nylon Rope
10	Pulling Rope	14 mm Nylon Rope
11	Earthing roller	3-way roller
12	Traction machine	35 kgf
13	Winch machine	3 tons
14	Drum stand	
15	Wheel winder	
16	Come along clamp	
17	Pulley block	
18	Kitto clamp	
19	D-shackle	
20	Sag-scope	
21	Support Rollers	

Appendix - D

Guidelines for Splicing of Fibre Optic Cable

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3. **Flowchart of jointing procedure** 4
4. **Jointing works**
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   b) **Cutting and treatment of OPGW ends** 5
   c) **Fixing OPGW in the pass cable** 6
   d) **Application of thermo-shrinkable tube** 7
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8. **Installation of a joint box** 18

1. General

OPGW based Fibre Optic network being established by Power Utilities for catering data & vo ice communication requirements. OPGW is being supplied in number of drums for a link and required splicing for completing of a fibre optic link. Generally fusion method is being used fo r splicing of fibres in cable. For carrying out splicing work, experienced personnel is essential for handling splicing kit and necessary instruments such as OTDR etc.

a) Jointing of OPGW is usually carried out on the ground. For ease of jointing w ith accuracy, adequate space (with tent) to be ensured on the ground for joi nter and equipment. This floor space should be protected against the heavy

wind, strong sunshine, high temperature, rain and dusty atmosphere.

b) Attention must be paid so as not to damage OPGW including its optical components during handling, cutting, un-stranding of component wires and jointing.

c) Attenuation of optical fibers to be measured just before splicing and after splicing.

d) Typical organization chart for jointing work is given below:

A. Jointing In charge -1

A.1For Testing :

(i) Lineman – 1
(ii) Jointer & Tester – 1
(iii) Unskilled labor -1

A.2 For Jointing :

(i) Lineman- 1
(ii) Jointer & Tester – 1
(iii) Unskilled labor -1

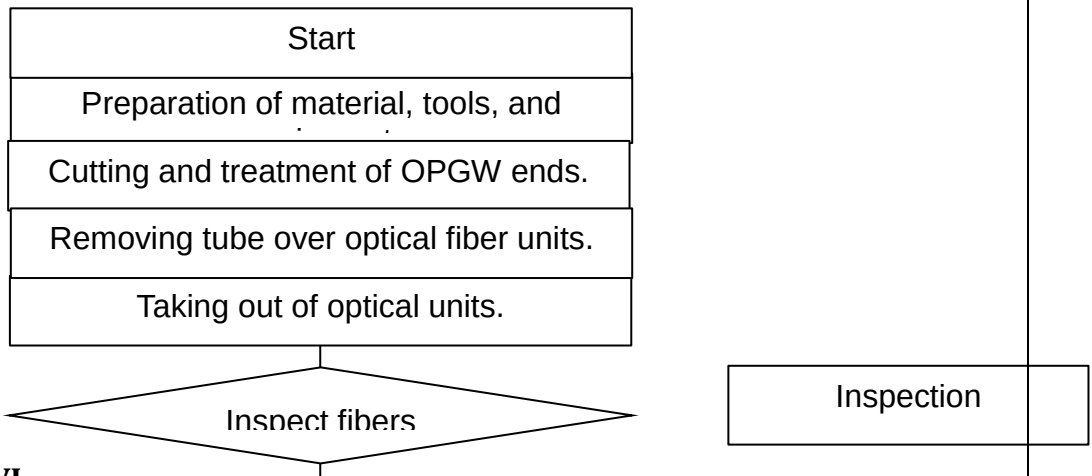
2. Jointing of optical fibre

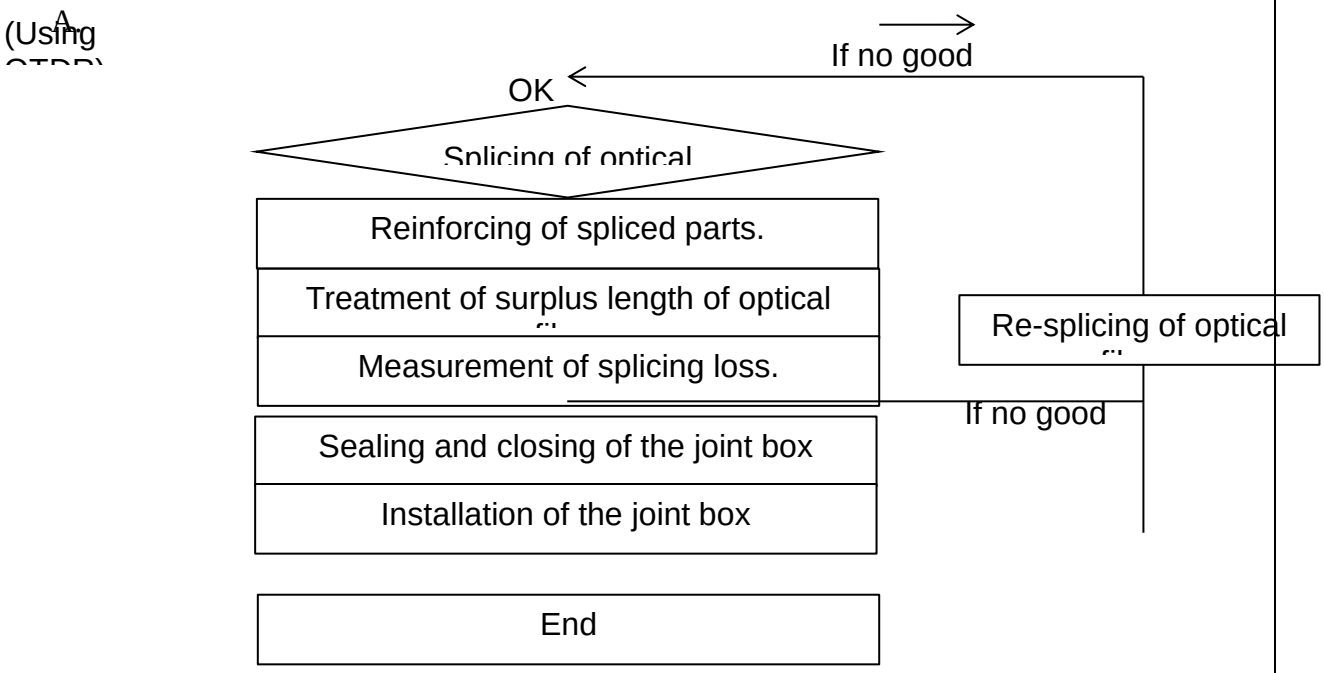
Optical fibre are joined by using Fusion splicing. It is the process of fusing or welding two fibers together usually by an electric arc. Fusion splicing is the most widely used method of splicing as it provides for the lowest loss and least reflectance, as well as providing the strongest and most reliable joint between two fibers.



3. Flowchart of jointing procedure.

Process flow chart of OPGW jointing works is summarized briefly, as below:




A
(Using
If no good
OK
Splicing of optical
Reinforcing of spliced parts.
Treatment of surplus length of optical
Re-splicing of optical
Measurement of splicing loss.
If no good
Sealing and closing of the joint box
Installation of the joint box
End

4. **Jointing works**

a) Preparation of materials, tools and equipment

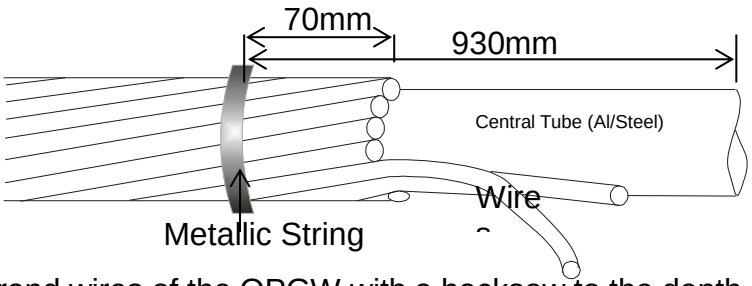
It may be ensured that all the materials, tools and equipment listed in the Ta ble-1 are available. The Table-1 shows tentative list of required tools & mate rial.

b) **Cutting and treatment of OPGW ends**

Description	Qt'y	Purpose
Stabilized light source	1	Measure loss
Optical power meter	1	Measure loss
Dummy fiber	1	Measure loss
Fusion splicer	1	Splicing fiber
Fiber cutter	2	Cutting fiber
Jacket stripper	2	Remove fiber jacket
Washing agent	2	Cleaning fiber
Ethyl alcohol	2	Cleaning fiber
Gauze	1 Set	Cleaning fiber
Dust remove	1	Cleaning splicer
Cable cutter	1	Cutting OPGW
Hacksaw	1	Cutting AW wire
Pipe cutter	1	Cutting al tube
Knife	1	
Screw driver set(+,-)	1	
Pliers	2	
Light stand	1	Lighting
Hexagon wrench	1	
Portable telephone set	2	
Engine generator(If need)	1	Power supply
OTDR	1	

Electric reel	1	
Optical telephone set	2	
Electric cord	1	

- Coiled OPGW to be brought down and cut-off unnecessary lengths of the OPGW with a cable cutter.
- Put marks on OPGW at positions where OPGW is to be fixed to the gland s of the joint box. Carryout mounting of OPGW at a position about 70mm below the cutting mark with a metallic string to prevent the stranded wires from becoming loose after cutting off the OPGW.



- Notch the Strand wires of the OPGW with a hacksaw to the depth of 1/3 o r 1/2 of the Strand wire diameter. In this case, take care not to damage th e inside Central Tube (AL/Steel) of the OPGW.
- Loose the Strand wires from the OPGW ends one by one and snap them off at the notched position.
- Cut the Central Tube (AL/Steel).

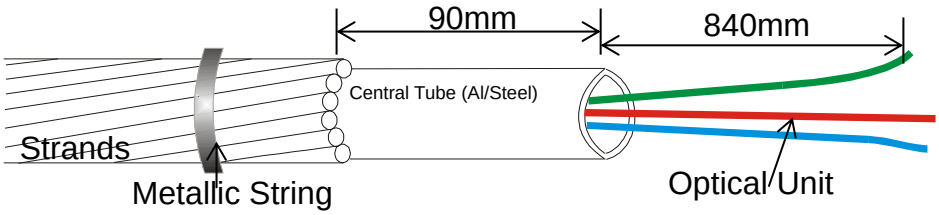


Table-1: Tools & Material

c) **Fixing OPGW in the Passcable** (see the Figure 4. for main assembling pa rticulars)

- Insert OPGW in the passcable until OPGW touch the internal clamping or until the Central Tube (AL/Steel) is outside from the passcable of about 9 0 mm.
- Lock the moving clamping with torque force of 12 NM, like a Figure 5.

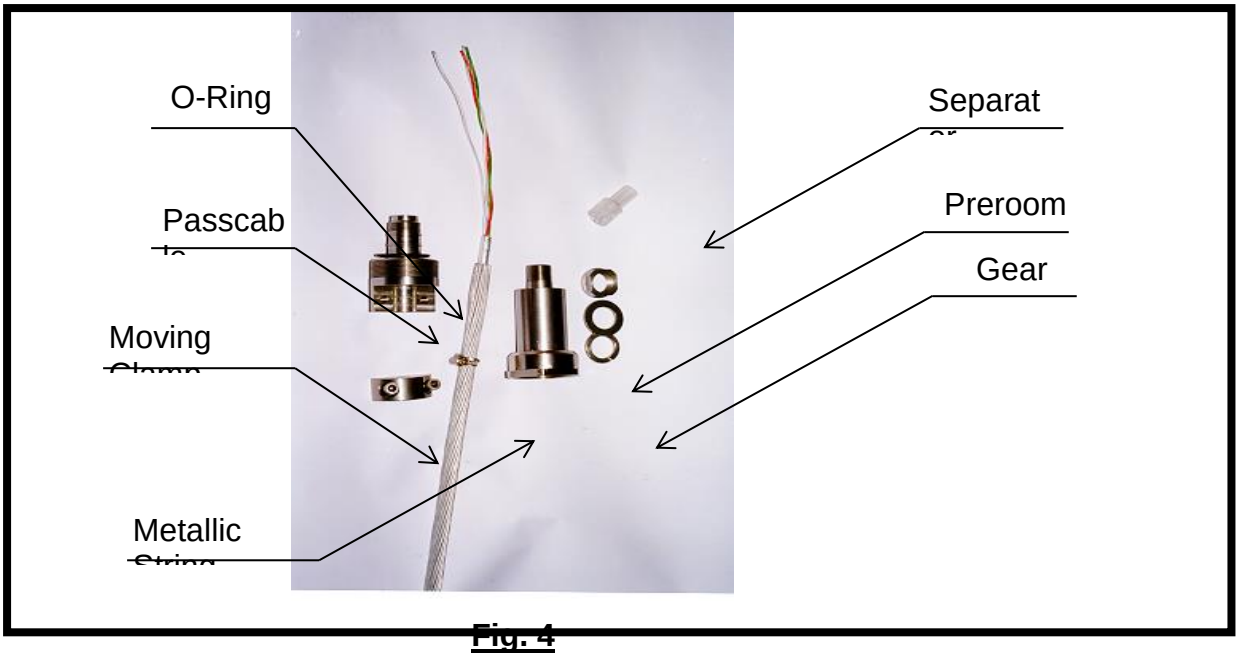


Fig. 4

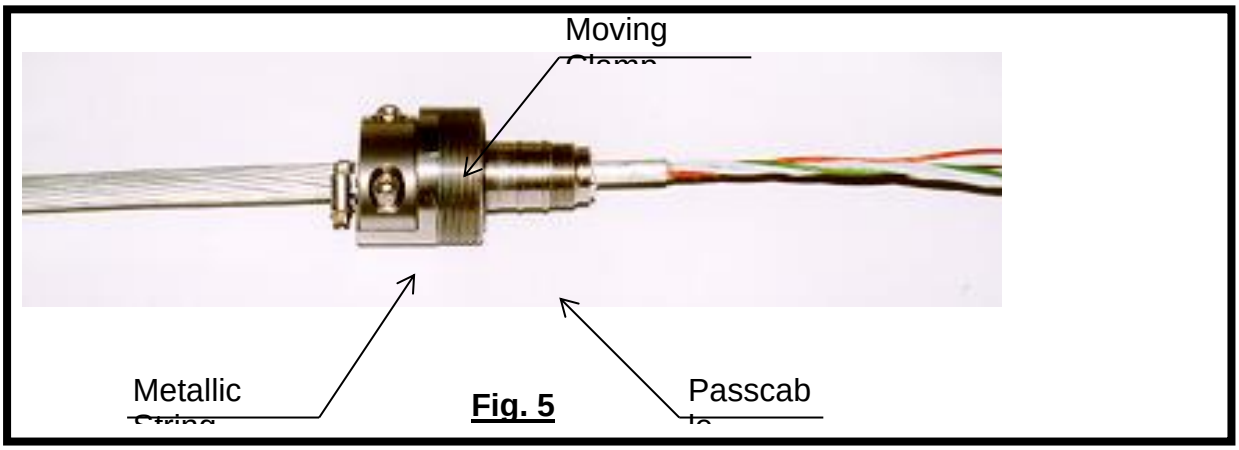


Fig. 5

d) Application of thermo-shrinkable tube

- Cover the Central Tube (AL/Steel) with aluminium sheet and put the ther mo-shrinkable tube with heating gun or lamp, like a Figure 6.

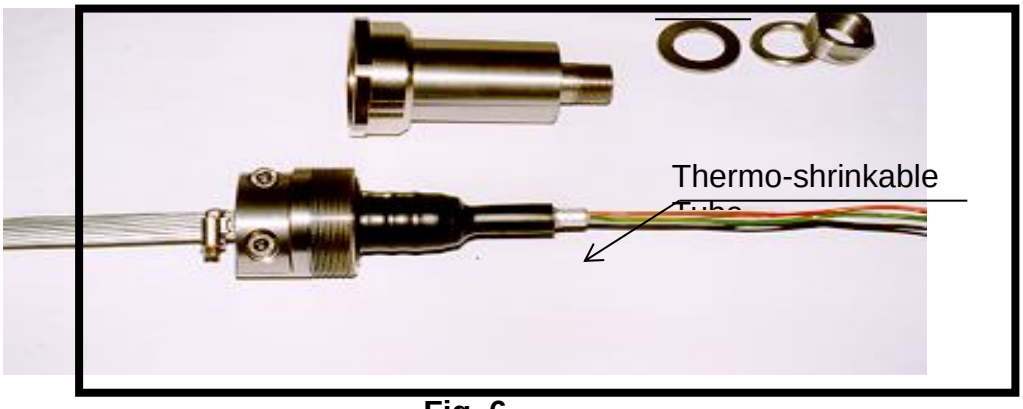


Fig. 6

e) Application of the preroom

- Lock the passcable to the preroom.
- Screw down the preroom to the passcable.

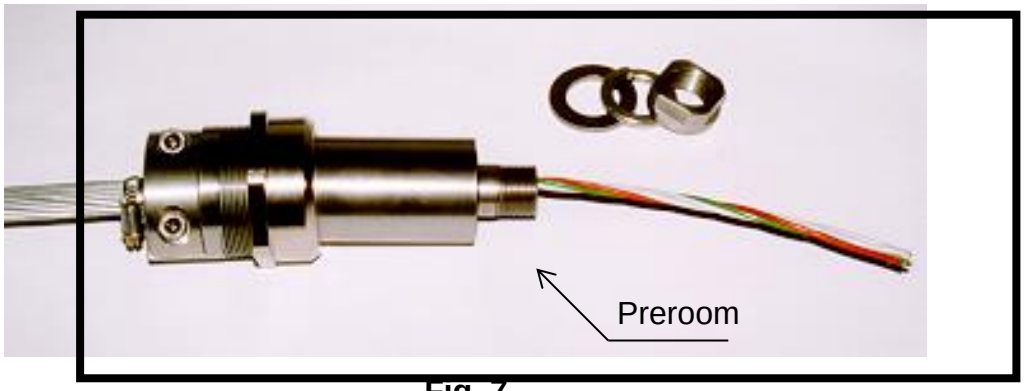


Fig. 7

f) Fixing of the preroom

- Put the preroom in the hole of the splice enclosure base.
- Give attention that the O-ring is in the right position and fix with the torque force of 50 NM

g) Taking out of optical units

- Remove the PBT tube of optical units leaving a suitable distance (around 1m) from the edge of the AL tube.
- Make each optical unit into loops of about 5 to 10 cm diameter, and stick these optical unit loops at a suitable position on the joint box with plastic adhesive tape in order to ensure that the optical unit is not damaged during splicing work.

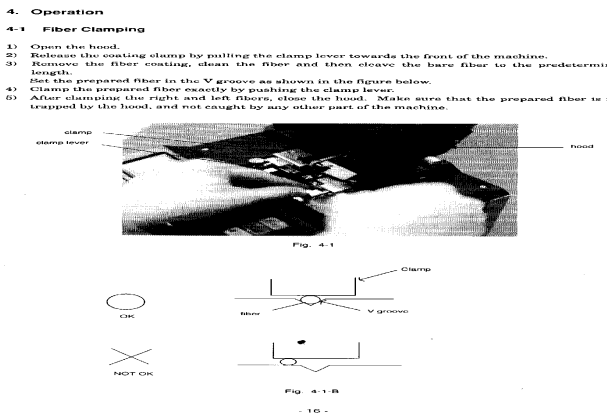
h) Splicing of optical fibers.

- Cleave length

Bare fiber length should be 16mm ±5 after cleaving.



- Remove the fiber coating. Clean the fiber and then cleave the bare fiber to the predetermined length. Slip a protection sleeve over one of the two fibers for reinforcement after splicing. Set the prepared fiber in the v grooves as shown in the figure below.



4. Operation

4-1 Fiber Clamping

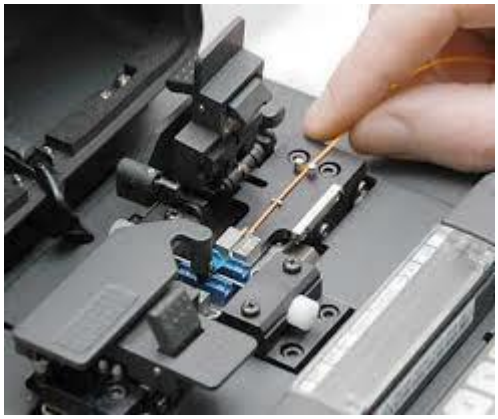
1) Open the hood.
2) Release the coating clamp by pulling the clamp lever towards the front of the machine.
3) Remove the fiber coating, clean the fiber and then cleave the bare fiber to the predetermined length.
Set the prepared fiber in the V groove as shown in the figure below.
4) Clamp the prepared fiber exactly by pushing the clamp lever.
5) After clamping the right and left fibers, close the hood. Make sure that the prepared fiber is not trapped by the hood, and not caught by any other part of the machine.

Fig. 4-1

Fig. 4-1-B

- 16 -

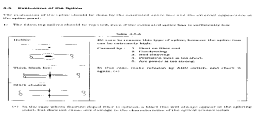
- Clamp the prepared fiber exactly by pushing the clamp lever. After clampi ng the right and left fibers, close the hood. Make sure that the prepared fi ber is not trapped by the hood, and not caught by any other part of the m achine.



- Evaluate the splice.

The evaluation of the splicing should be done by the splicing loss and the external appearance at the splice point.

(1) Splicing having the following appearance shall be rejected.

Bubble 	Be sure to remove this type of splice, bec ause the splice loss can be extremely hig h. Caused by 1. Dust on fiber end 2. Condensing 3. Bad cleaving 4. Pre-fusion time is too short. 5. Arc power is too strong.

Thick black line 	In this case, make re-fusion by ARC Switch, and check it again.(*)
Black shadow 	

(*) In the case where fluorine doped fiber is splicer, a black line will always appear at the splicing point, but does not cause any damage to the characteristics of the optical transmission.

(2) The following splices are acceptable, even if the external appearance at the splice point does not look good.

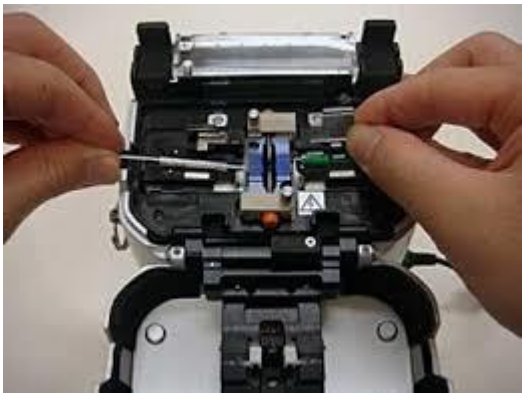
White line 	It is all right if the estimated splice loss is within the specified value. This is due to optical causes upon observation, and there is no effect on the splice characteristics.
Blurred thin line 	Same as above
	Because of core alignment, this is possible for fiber with large core eccentricity.
	This appearance is due to differences in fiber diameter.

When the spliced portion is required to be observed in detail, “FIELD CHANGE” and “FOCUS UP” and “FOCUS DOWN” SW on top mounted console panel are useful.

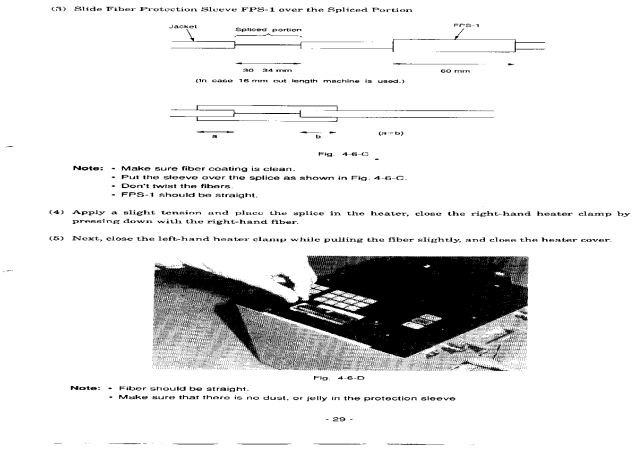
i) Reinforcing of spliced parts.

(I) Open the heater cover, the left fiber clamp and right fiber clamp

(II) Open the hood, take out the spliced portion, close the hood, and pr ess the “RESET” SW.



(III) Slide fiber protection sleeve over the spliced portion.


(3) Slide Fiber Protection Sleeve FPS-1 over the Spliced Portion

Jacket Spliced portion FPS-1

30 34 mm 60 mm

(In case 16 mm cut length machine is used.)

a b (a − b)

Fig. 4-6-C

Note: - Make sure fiber coating is clean.
- Put the sleeve over the splice as shown in Fig. 4-6-C.
- Don't twist the fibers.
- FPS-1 should be straight.

(4) Apply a slight tension and place the splice in the heater, close the right-hand heater clamp by pressing down with the right-hand fiber.

(5) Next, close the left-hand heater clamp while pulling the fiber slightly, and close the heater cover.

Fig. 4-6-D

Note: - Fiber should be straight.
- Make sure that there is no dust, or jelly in the protection sleeve

- 29 -

Fig. 5

Note

- Make sure fiber coating is clean.
- Put the sleeve over the splice as shown in Fig. 5.
- Don’t twist the fiber.
- Protection sleeve should be straight.

(IV) Apply a slight tension and place the splice in the heater, close the right h and heater clamp by pressing down with the right hand fiber.

(V) Next, close the left hand heater clamp while pulling the fiber slightly, and close the heater cover.

Note

- Fiber should be straight.
- Make sure that there is no dust, or jelly in the protection sleeve.

(VI) Press the “HEATER SET” SW, and the “working” indicator will light

up.



Fig. 5

(VII) After the tensile proof test (a few seconds), it will take a few minutes until the fiber protection sleeve is shrunk. A buzzer will indicate the finishing of shrinking the sleeve.
If the fiber breaks, or the fiber is loosely clamped or slips during the tensile proof test, the buzzer will beep intermittently. Correct the condition before proceeding.

Note 1

- Both the splicer and heater can be operated simultaneously.

Note 2

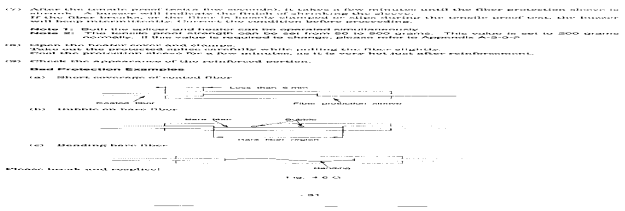
- The tensile proof strength can be set from 50 to 500 grams. This value is set to 200 grams normally.

(VIII) Open the heater cover and clamps.
Take out the protected splice carefully while pulling the fiber slightly.
Cool the protection sleeve for a few minutes, as it is very hot just after reinforcement.

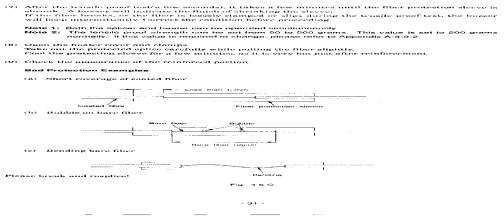
(IX) Check the appearance of the reinforced portion.

Bad protection examples

- Short coverage of coated fiber.



- Bubble on bare fiber.



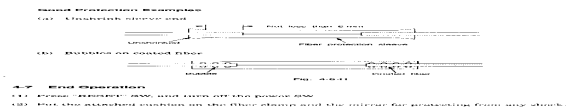
- Bending bare fiber



bendin
g

Good protection examples

- Unshrink sleeve end



- Bubble on coated fiber



5. Treatment of surplus length optical fibers.

- Arrangement of loose tube

  The loose tube should be dressed up while closing joint box so that it is prote cted against impact, corrosion and bend.
  The loop diameter of loose tube is more than 50mm.

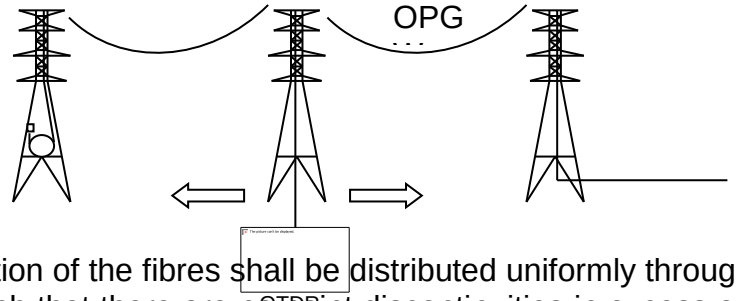
- Arrangement of optical fiber

  The spliced portion of optical fiber should be put in regular order in the fusion splice protector, and the extra length of optical fiber should be put on the spli ce tray.
  The loop diameter of optical fiber is more than 50mm.

6. Measurement of splice loss: Splice loss shall be measured by using OTDR.

A. Test (Before splicing)

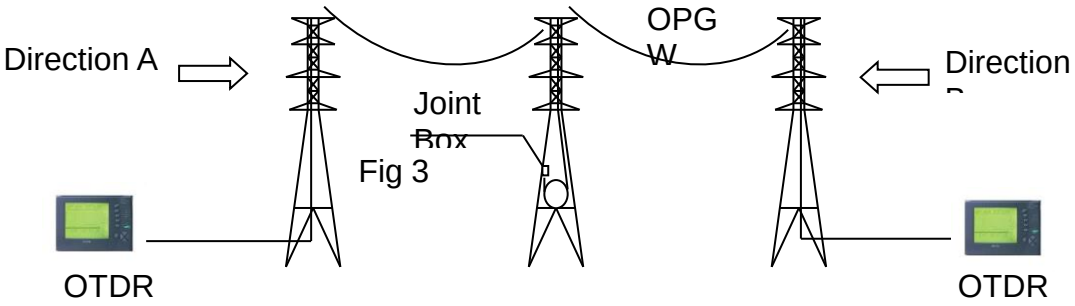
- After successfully completion of the installation, check for optical atte nuation and discontinuity at every splicing points (Joint Box Locations).



- The attenuation of the fibres shall be distributed uniformly throughout its length such that there are no point discontinuities in excess of 0.1 dB. The overall optical fibres attenuation should be less than 0.21dB /km at 1550nm and 0.35dB/km at 1310nm.

B. Splicing Test (After splicing)

- Before closing the splice enclosure, splice loss shall be measured for che cking the splicing condition.



- Before closing the in-line splice enclosure, the splice test shall be execute d at both sides (direction A & direction B) of jointing point.

- The average of bi-directional attenuation of fusion splices shall not be mo re than 0.05 dB and no single splice loss shall exceed 0.1 dB at 1550 nm .

- Appearance of splice enclosure shall have no defect,

- Splice enclosure shall have good sealing condition to prevent moisture an d dust free environment, and render it waterproof.

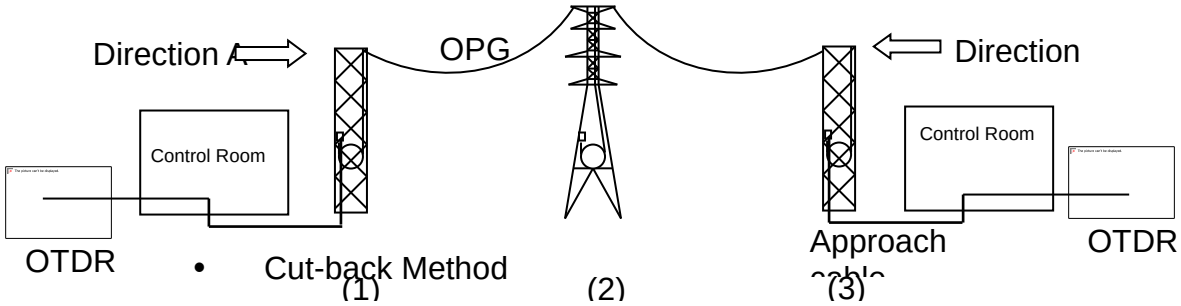
*No point discontinuities in excess of 0.1dB

- Every effort shall be taken to minimize the splice loss during splicing s o that every splice loss in the link shall lies within o.o5 dB. Maximum s

plice loss at any splice joint may be permitted up to 0.1 dB. However, such events shall be avoided to minimize the splice loss an d total loss in the link.

C. Measurement of splicing loss.

Measure the of splice loss by OTDR

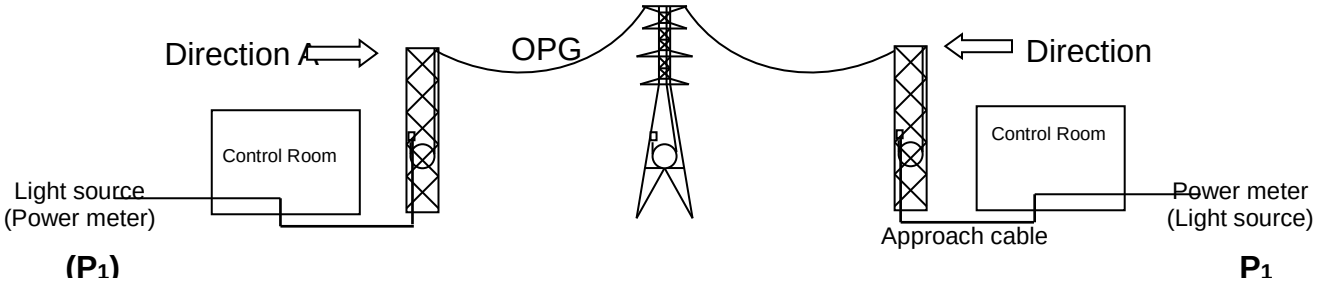


- Cut-back Method

Transmission Loss (dB) = $P_2 – P_1$

P_1 : Power measured when light source is connected to power meter with the OPGW fibre in between.

P_2 : Power measured when light source and power meter are connected to one anoth er with reference fibre in between.



7. Fixing the joint box lid

- Fix the cover to the joint box after having confirmed that nothing is left in th e joint box such as tools and dusts.
- Lock the lid with the torque force of 10 NM.

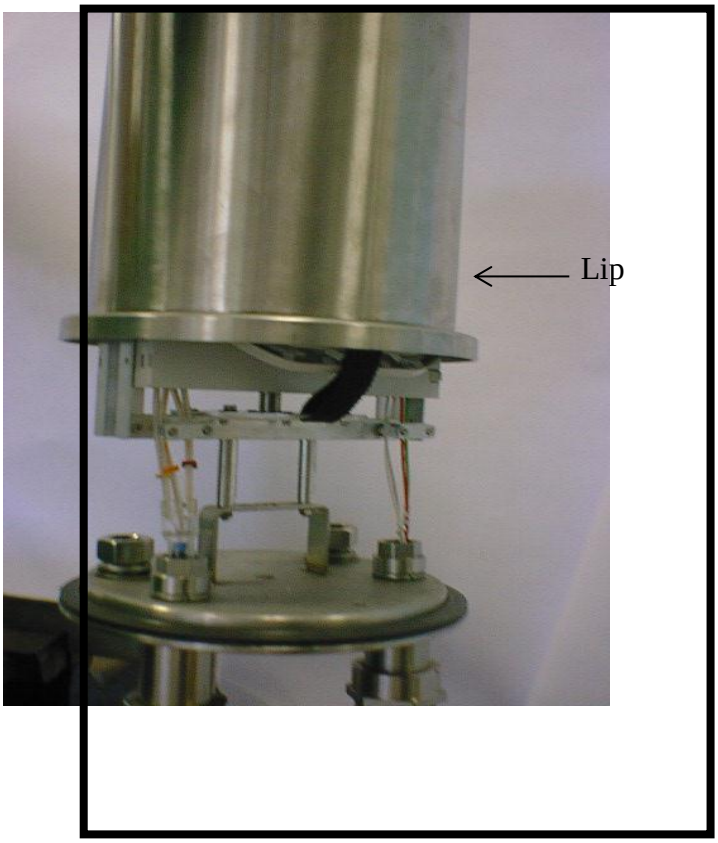
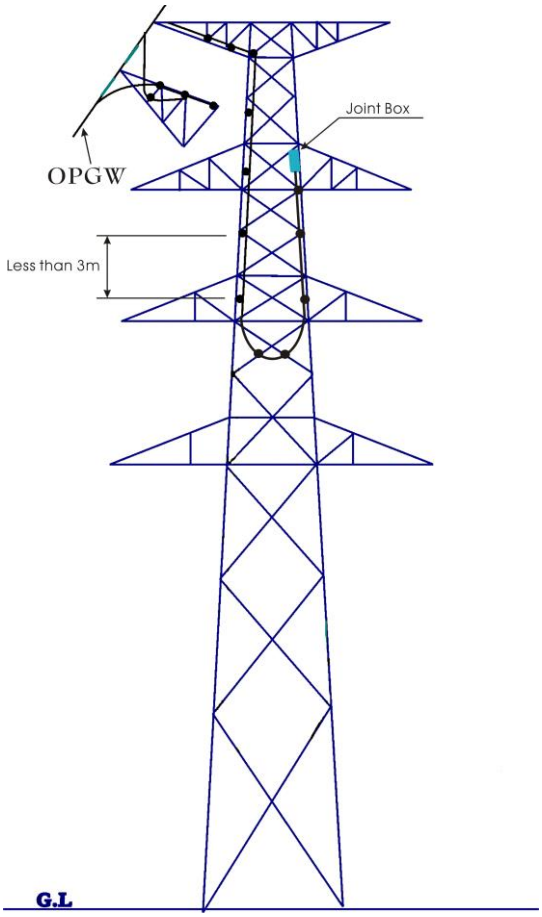


Fig. 6

8. Installation of a joint box.

SPLICING TOWER

The balanced length of OPGW should be coiled around a circle having a diameter of more than 1.5 meters after completion of jointing and



The position of the joint box should be near the top cross-arm of the tower as shown in the figure.

Check Point

- Check the status of water proof.
- Fusion splice working is protection it against dirt, grit and moisture.
- Lift the joint box using the eye bolt of lid.
- Fixing condition of joint box on the tower.
- Coiling condition of sur-plus(balanced) length of OPGW

PART-II

TECHNICAL SPECIFICATION

VOL-II, SEC-VII

COMPOSITE LONG ROD INSULATORS

SECTION - VII
COMPOSITE LONG ROD INSULATOR

CONTENTS

Clause No.	Description
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2.0	Equipment Marking
3.0	Bid Drawings
4.0	Tests and Standards
5.0	Annexure-A

TECHNICAL SPECIFICATIONS FOR COMPOSITE LONG ROD INSULATORS

1.0 Technical Description of Composite Long Rod Insulators

1.1 Details of Composite Long Rod Insulators

1.1.1 The insulators of the strings shall consist of composite long rod insulators for a three phase, 50 Hz, effectively earthed 220kV–transmission system application in a very heavily polluted environment. Couplings shall be ball and socket type.

1.1.2 Bidder shall quote such composite insulators which have proven use under foggy/humid operational conditions in polluted industrial environment combined with smoke and dust particles. The Bidder shall furnish evidence in the form of certification from the power utilities that the similar type of product supplied to them had been performing satisfactory. The Bidder shall also submit certified test report for an accelerated ageing test of 5000 hours such as that described in Appendix-C of IEC-61109 or in 62217.

1.1.3 Insulators shall have sheds of the "open aerodynamic profile without any under ribs" with good self-cleaning properties. Insulator shed profile, spacing projection etc. shall be strictly in accordance with the recommendation of IEC-60815.

1.1.4 The size of long rod insulator, minimum creepage distance, the number to be used in different type of strings, their electromechanical strength and mechanical strength of insulator string alongwith hardware fittings shall be as follows:

S.No	Type of String	*Size of Composite Insulator (Core dia x Nominal length)(mm)	Minimum Creepage Distance (mm) per unit	No. of individual Units per String (Nos.)	Electro-Mechanical Strength of Insulator Unit (kN)	Mechanical Strength of Insulator String along with Hardware Fittings (kN)
For 220 kV AC Transmission lines with single Zebra conductor						
1	Single 'I' Suspension	20x2030	7595	1×1	70	70
2	Single Tension	20x2175	7595	1x1	120	120
3	Single 'I' Suspension Pilot	20x2030	7595	1×1	70	70
4	Double Tension	20x2175	7595	2×1	120	2x120

Note: **The core dia of composite insulators mentioned at column No.3 is for indicative purpose. The bidder shall offer composite long rod insulators of suitable core dia to meet specified E&M and torsion strength requirements. For offered core dia, less than indicated in table above, the bidder shall submit documentary evidence of past supplies & satisfactory operation of the same for minimum period of three years. However, the overall string length shall be within the limits specified in the drawing.*

1.2 Ball and Socket Designation

The dimensions of the Ball and Socket shall be of 16 mm AltB designation for 70 kN insulators, 20 mm designation for 120 kN Insulators in accordance with the standard dimensions stated in IEC:60120/IS:2486 (Part-II).

1.3 Dimensional Tolerance of Composite Insulators

The tolerances on all dimensions e.g. diameter, length shall be allowed as follows:

± (0.04d+1.5) mm when d≤300 mm.

± (0.025d+6) mm when d>300 mm.

Where, d being the dimensions in millimeters for diameter, length as the case may be.

The tolerance in creepage distance shall be based on design dimensions and their tolerances. However, no negative tolerance shall be applicable to creepage distance specified in clause 1.1.4.

1.4 Interchangeability

The composite long rod insulators inclusive of the ball & socket connection shall be standard design suitable for use with the hardware fittings of any make conforming to relevant IEC standards.

1.5 Corona and RI Performance

All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part shall be subjected to excessive localized pressure. The insulator and metal parts shall be so designed and manufactured that it shall avoid local corona formation and shall not generate any radio interference beyond specified limit under the operating conditions.

1.6 Maintenance

1.6.1 The long rod insulators offered shall be suitable for employment of hot line maintenance technique so that usual hot line operation can be carried out with ease, speed and safety.

1.6.2 All insulators shall be designed to facilitate cleaning and insulators shall have the minimum practical number of sheds and grooves. All grooves shall be so proportioned that any dust deposit can be removed without difficulty either by wiping with a cloth or by remote washing under live line condition.

1.7 Materials

1.7.1 Core

It shall be a glass-fiber reinforced (FRP rod) epoxy resin rod of high strength. The rod shall be resistant to hydrolysis. Glass fibers and resin shall be optimized. The rod shall be electrical grade corrosion resistant (ECR), boron free glass and shall exhibit both high electrical integrity and high resistance to acid corrosion.

1.7.2 Housing & Weather sheds

The FRP rod shall be covered by a sheath of a silicone rubber compound of a thickness of minimum 3mm. The housing & weather sheds should have silicon content of minimum 30% by weight. It should protect the FRP rod against environmental influences, external pollution and humidity. It shall be extruded or directly molded on the core. The interface between the housing and the core must be uniform and without voids. The strength of the bond shall be greater than the tearing strength of the polymer. The manufacturer shall follow non-destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core. The

technique to be followed with detailed procedure and sampling shall be furnished by the Supplier and finalized during finalization of MQP.

The weather sheds of the insulators shall be of alternate shed profile. The weather sheds shall be vulcanized to the sheath (extrusion process) or molded as part of the sheath (injection molding process) and free from imperfections. The vulcanization for extrusion process shall be at high temperature and for injection molding shall be at high temperature & high pressure. Any seams / burrs protruding axially along the insulator, resulting from the injection molding process shall be removed completely without causing any damage to the housing. The track resistance of housing and shed material shall be class 1A4.5 according to IEC60587**.** The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The composite insulator shall be capable of high pressure washing.

1.7.3 End Fittings

End fittings transmit the mechanical load to the core. They shall be made of malleable cast iron spheroidal graphite or forged steel. They shall be connected to the rod by means of a controlled compression technique. The manufacturer shall have in-process Acoustic emission arrangement or some other arrangement to ensure that there is no damage to the core during crimping. This verification shall be in-process and done on each insulator. The system of attachment of end fitting to the rod shall provide superior sealing performance between housing and metal connection. The gap between fitting and sheath shall be sealed by a flexible silicone rubber compound. The sealing shall stick to both housing and metal end fitting. The sealing must be humidity proof and durable with time.

End fittings shall have suitable provisions for fixing grading rings at the correct position as per design requirements.

1.7.4 Grading Rings

Grading rings shall be used at both ends of each composite insulator unit for reducing the voltage gradient on and within the insulator and to reduce radio and TV noise to acceptable levels. The size and placement of the metallic grading rings shall be designed to eliminate dry band arcing/corona cutting/ exceeding of permissible electrical stress of material. The insulator supplier shall furnish design calculations using appropriate electric field software showing electric field at surface of housing, inside housing & core and at the interface of housing and metal fittings with the proposed placement and design of corona. Grading rings shall be capable of installation and removal with hot line tools without disassembling any other part of the insulator assembly. They shall have simple locking mechanism to ensure they are installed at the correct position.

The design &supply of grading rings shall be in the scope of the composite insulator supplier.

1.8 Workmanship

1.8.1 All the materials shall be of latest design and conform to the best modern practices adopted in the extra high voltage field. Bidders shall offer only such insulators as are guaranteed by him to be satisfactory and suitable for transmission lines specified and will give continued good service.

1.8.2 The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners to limit corona and radio interference.

1.8.3 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.

1.8.4 The core shall be sound and free of cracks, impurities and voids that may adversely affect the insulators.

1.8.5 Weather sheds/ Housing shall be uniform in quality. It shall be free from voids and impurities. Weather sheds/Housing shall be clean, sound, smooth and free from gross defects and excessive flashing at parting lines.

1.8.6 End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively, sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.

1.8.7 All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 600 gm/sq.m. and shall be in accordance with the requirement of ISO:1461 (E) and shall satisfy the tests mentioned in ISO:1460 (E). The zinc used for galvanizing shall be of purity of 99.95%. The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least six successive dips each lasting for one (1) minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

1.8.8 The supplier shall guarantee that there shall not be any failure/ decapping / breaking of insulators on line under normal operating condition. In the event of any failure/ decapping /breaking of insulators during the first ten years of service, Supplier shall supply to the owner free of cost spare insulators equal to 10 times the failed insulator quantity. Further, in case of decapping / Breaking and subsequent line drop, during the first ten years of service, the supplier shall also have to pay Rs 1,00,000/- (Rs one lakh only) per dropped string towards expenditure to be incurred by RECPDCL/JKPTCL for this line repair

2.0 Equipment Marking

2.1 Each composite long rod unit shall be legibly and indelibly marked with the trade mark of the manufacturer, name of RECPDCL/JKPTCL and month & year of manufacture. The guaranteed combined mechanical and electrical strength shall be indicated in kilo Newton followed by the word 'kN' to facilitate easy identification and to ensure proper use.

2.2 One 10 mm thick ring or 20 mm thick spot of suitable quality of paint shall be marked on the cap/end fitting of each composite long rod of particular strength for easy identification of the type of insulator. The paint shall not have any deteriorating effect on the insulator performance. Following codes shall be used as identification mark:

For 70 kN long rod unit : Black

For 120 kN long rod unit : Yellow

3.0 Bid Drawings

3.1 The Bidder shall furnish full description and illustration of the material offered.

3.2 The Bidder shall furnish along with the bid the outline drawing of each insulator unit along with grading rings including a cross sectional view of the long rod insulator unit. The drawing shall include but not limited to the following information:

(a) Major Dimensions with manufacturing tolerances

(b) Minimum Creepage distance with positive tolerance

(c) Protected creepage distance

(d) Unit mechanical and electrical characteristics

(e) Size and weight of ball and socket parts

(f) Weight of composite long rod units

(g) Materials

3.3 After placement of award, the Supplier shall submit full dimensioned insulator drawings containing all the details as given in Clause No. 3.2 above, in four (4) copies to Owner for approval. After getting approval from Owner, the Supplier shall submit 10 more copies of the same drawing along with a soft copy to the Owner for further distribution and field use at Owner's end.

3.4 After placement of award the Supplier shall also submit fully dimensioned insulator crate drawing for different type of insulators.

4.0 Tests and Standards

4.1 Type Tests

The required type tests on composite longrod units, components, materials and complete strings are stipulated hereunder.

The specified type tests under the following clause shall not be required to be carried out if a valid test certificate is available for a similar design. The tests certificate shall be considered valid if:

i. Tests conducted earlier is either conducted in accredited laboratory (accredited based on ISO/IEC vide 25/17025 or EN 45001 by the National accreditation body of the country where laboratory is located) or witnessed by the representative(s) of RECPDCL/JKPTCL or utility and

ii. Tests have been conducted not prior to 5 (five) years from the date of bid opening.

In case the test have been conducted earlier than the above stipulated period or in the event of any discrepancy in the test report (i.e., any test not applicable due to any design/manufacturing change including substitution of components or due to non-compliance with the requirement stipulated in the Technical Specifications), the tests shall be conducted by the Supplier at no extra cost to the Purchaser.

4.1.1 On the complete composite Long Rod Insulator String with Hardware Fittings

	Test	**Ref**	**Strings on which test to be conducted**
			220 kV
(a)	Power frequency / DC voltage withstand test with corona control	IEC:383-1993/	All Strings

	rings/grading ring and arcing horns under wet condition	IEC:60-1	
(b)	Impulse voltage withstand test under dry condition	IEC:383-1993	All Strings
(c)	Mechanical Strength test	IEC:383-1993	All Strings
(d)	Vibration test	Anex-A	Single I & Single Tension
(e)	AC : Salt-fog pollution withstand test / DC Pollution withstand test	Anex-A	

4.1.2 On Composite Insulator Units

(a)	Tests on interfaces and connections of metal fittings	IEC: 61109-2008
(b)	Assembled core load time test	IEC: 61109-2008
(c)	Damage limit proof test and test of tightness of interface between end fittings and insulator housing.	IEC: 61109-2008
(d)	High Pressure washing test	Annexure-A
(e)	Brittle fracture resistance test	Annexure-A
(f)	Dye penetration test	IEC: 61109-2008
(g)	Water diffusion test	IEC: 61109-2008
(h)	Tracking and erosion test	IEC: 61109-2008
(i)	Hardness test	IEC: 61109-2008
(j)	Accelerated weathering test	IEC: 61109-2008
(k)	Flammability test	IEC: 61109-2008
(l)	Silicone content test	Annexure-A
(m	Recovery of Hydrophobicity test	Annexure-A
(n)	Torsion test	Annexure-A

Hardness test, Accelerated weathering test & Flammability test specified under Clause No.4.1.2 above shall be conducted on housing/ weather shed of either 70kN or 120kN composite long rod for the same type of material.

4.2 **Acceptance Tests:**

4.2.2 For Composite Long Rod Insulators

a)	Verification of dimensions	IEC : 61109-2008
b)	Galvanising test	IEC : 60383
c)	Verification of end fittings	IEC: 61109 -2008

d)	Recovery of Hydrophobicity	Annexure-A
e)	Verification of tightness of interface between end fittings and insulator housing and of specified mechanical load	IEC : 61109-2008
f)	Tests on interfaces and connections of metal fittings	IEC: 61109-2008
g)	Silicone content test	Annexure-A
h)	Brittle Fracture Resistance Test	Annexure-A
i)	Dye Penetration Test	IEC :61109-2008
j)	Water Diffusion Test	IEC : 61109-2008

The test 4.2.1.(f) to (j) shall be carried out as acceptance test on any one lot.

In the event of failure of the sample to satisfy the acceptance test(s) specified in 4.2 above, the retest procedure shall be as per IEC 61109.

4.3 Routine Tests

4.3.2 **For Composite Long Rod Insulator Units**

a)	Visual Examination	As per IEC:61109-2008
b)	Mechanical routine test	As per IEC:61109 -2008

4.4 Tests During Manufacture

On all components as applicable

a)	Chemical analysis of zinc used for galvanising	As per Annexure-A
b)	Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.	As per Annexure-A
c)	Chemical analysis hardness tests and magnetic particle inspection for forgings	As per Annexure-A
d)	Tracking and erosion test on insulating material	IEC 60587

4.5 Testing Expenses

4.5.2 As mentioned under clause 4.1 above, no type test charges shall be payable to the supplier.

4.5.3 For Type Tests which involves the tests on the complete insulator string with hardware fitting, standard hardware fittings similar to existing insulator strings shall be arranged and used by the insulator supplier at his own cost.

4.5.4 In case of failure in any type test the supplier is either required to modify the design of the material & successfully carryout all the type tests as has been detailed out in Clause 4.1 of this specifications or to repeat that particular type test at least three times successfully at his own expenses.

4.5.5 Bidder shall indicate the laboratories in which they propose to conduct the type tests. They shall ensure that adequate facilities are available in the laboratory and the tests can be completed in these laboratories within the time schedule guaranteed by them in the appropriate schedule.

4.5.6 The entire cost of testing for acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted Ex-works/CIF Price.

4.5.7 In case of failure in any type test, if repeat type tests are required to be conducted, then all the expenses for deputation of Inspector/ Owner's representative shall be deducted from the contract price. Also if on receipt of the Supplier's notice of testing, the Owner's representative does not find the material or test setup / equipment's to be ready for testing, the expenses incurred by the Owner for re-deputation shall be deducted from contract price.

4.5.8 The Supplier shall intimate the Owner about carrying out of the type tests alongwith detailed testing programme at least 3 weeks in advance (in case of testing in India) and at least 6 weeks advance (in case of testing abroad) of the scheduled date of testing during which the Owner will arrange to depute his representative to be present at the time of carrying out the tests.

4.6 Sample Batch for Type Testing

4.6.2 The Supplier shall offer material for sample selection for type testing only after getting Quality Assurance Programme approved by the Owner. The Supplier shall offer at least three times the quantity of materials required for conducting all the type tests for sample selection. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Programme approved by the Owner.

4.6.3 Before sample selection for type testing, the Supplier shall be required to conduct all the acceptance tests successfully in presence of Owner's representative.

4.7 Schedule of Testing

4.7.2 The Bidder has to indicate the schedule of following activities in their bids :

a) Submission of drawing for approval.

b) Submission of Quality Assurance Programme for approval.

c) Offering of material for sample selection for type tests.

d) Type testing.

4.8 Additional Tests

4.8.2 The Owner reserves the right of having at his own expenses any other test(s) of reasonable nature carried out at Supplier's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the Specifications.

4.8.3 The Owner also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Supplier's premises or at any other test centre. In case of evidence of non-compliance, it shall be binding on the part of the Supplier to prove the compliance of the items to the technical specifications by repeat tests or correction of deficiencies or replacement of defective items, all without any extra cost to the Owner.

4.9 Guarantee

The Supplier of insulators shall guarantee overall satisfactory performance of the insulators.

4.10 Test Reports

4.10.2 Copies of type test reports shall be furnished in at least six (6) copies alongwith one original. One copy shall be returned duly certified by the Owner only after which the commercial production of the concerned material shall start.

4.10.3 Copies of acceptance test reports shall be furnished in at least six (6) copies. One copy shall be returned duly certified by the Owner, only after which the material shall be dispatched.

4.10.4 Record of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the Owner's representative.

4.10.5 Test certificates of test during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Owner.

4.11 **Inspection**

4.11.2 The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where insulator, and its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Supplier's and sub-Supplier's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.

4.11.3 The material for final inspection shall be offered by the Supplier only under packed condition as detailed in clause No.4.12 of the specification. The Owner shall select samples at random from the packed lot for carrying out acceptance tests. The lot should be homogeneous and should contain insulators manufactured in 3-4 consecutive weeks.

4.11.4 The Supplier shall keep the Owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.

4.11.5 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the Owner in writing. In the latter case also the material shall be dispatched only after satisfactory testing for all tests specified herein have been completed.

4.11.6 The acceptance of any quantity of material shall be no way relieve the Supplier of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such material are later found to be defective.

4.12 Packing and Marking

4.12.2 All insulators shall be packed in suitable PVC/ plastic tubes/any other suitable packing. The packing shall provide protection against rodent. The Supplier shall furnish detailed design of the packing. For marine transportation, crates shall be palleted.

4.12.3 The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.

4.12.4 Suitable cushioning, protective padding, or dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.

4.12.5 All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each case/crate shall have all the markings stenciled on it in indelible ink.

4.12.6 The Supplier shall guarantee the adequacy of the packing and shall be responsible for any loss or damage during transportation, handling, storage and installation due to improper packing.

4.13 **Standards**

The insulator strings and its components shall conform to the following Indian/International Standards which shall mean latest revision, with

amendments/changes adopted and published, unless specifically stated otherwise in the Specification.

4.13.2 In the event of supply of insulators conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent or better to those specified. In case of award, salient features of comparison between the standards proposed by the Bidder and those specified in this document will be provided by the Supplier to establish equivalence.

Sl. No.	Indian Standard	Title	International Standard
1.	IS:209-1992	Specification for zinc	BS:3436
2.	IS:406-1991	Method of Chemical Analysis of Slab Zinc	BS:3436
3.	IS:731-1991	Porcelain insulators for overhead Power lines with a nominal voltage greater than 1000 V	BS:137- (I&II) IEC:60383
4.	IS:2071 Part (I) – 1993 (Part(II)-1991 Part(III)-1991	Methods of High Voltage Testing	IEC:60060-1
5.	IS:2486 Part- I-1993 Part- II-1989 Part-III-1991	Specification for Insulator fittings for Overhead Power Lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements Locking Devices	 BS:3288 IEC:60120 IEC:60372
6.	IS:2629-1990	Recommended Practice for Hot, Dip Galvanisation for iron and steel	ISO-1461 (E)
7.	IS:2633-1992	Testing of Uniformity of Coating of zinc coated articles	
8.	IS:6745-1990	Determination of Weight of Zinc Coating on Zinc coated iron and steel articles	BS:433-1969 ISO:1460-1973
9.	IS:8263-1990	Methods of RI Test of HV insulators	IEC:60437 NEMAPubli- cation No.07/ 1964/ CISPR
10.	IS:8269-1990	Methods for Switching Impulse test on HV insulators	IEC:60506
11.		Thermal Mechanical Performance test and mechanical performance test on string insulator units	IEC: 60575
12.		Salt Fog Pollution Voltage Withstand Test	IEC:60507
13.		Composite insulators for A.C. Overhead lines with nominal voltage greater than	IEC 61109

Sl. No.	Indian Standard	Title	International Standard
		1000V – Definitions, test methods and acceptance criteria	
14.		Selection and dimensioning of high voltage insulators intended for use in polluted conditions: Polymer Insulators for AC systems	IEC:60815-**3**
15.		Tests on insulators of Ceramic material or glass or glass for overhead lines with a nominal voltage greater than 1000V	IEC:60383
16.		Composite string insulator units for overhead lines with a nominal voltage above 1000V : Standard strength classes and end fittings	IEC 61466-1
17.		Composite string insulator units for overhead lines with a nominal voltage above 1000V : Dimensional and electrical characteristics	IEC 61466-2
18		Electrical Insulating materials used under severe ambient conditions –Test methods for evaluating resistance to tracking and erosion	IEC 60587
19		Polymeric insulators for indoor and outdoor use with nominal voltage greater than 1000V- General definitions, tests, methods and acceptance criteria.	IEC 62217

The standards mentioned above are available from:

Reference Abbreviation	Name and Address
BS	British Standards, British Standards Institution 101, Pentonvile Road, N - 19-ND, UK
IEC/CISPR	International Electro technical Commission, Bureau Central de la Commission, electro Technique international, 1 Rue de verembe, Geneva, SWITZERLAND
BIS/IS	Beureau Of Indian Standards. ManakBhavan, 9, Bahadur Shah ZafarMarg, New Delhi - 110001.INDIA
ISO	International Organisation for Standardization. Danish Board of Standardization Danish Standardizing Sraat, Aurehoegvej-12 DK-2900, Heeleprup, DENMARK
NEMA	National Electric Manufacture Association, 155, East 44th Street.

	New York, NY 10017U.S.A.
ASTM	American Society for Testing and Materials, 1916 Race St. Philadelphia, PA19103 USA

ANNEXURE-A

1.0 Tests on Complete Strings with Hardware Fittings

1.1 Mechanical Strength Test

The complete insulator string along with its hardware fitting excluding arcing horn, corona control ring, grading ring and suspension assembly/dead end assembly shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. The load shall be held for five minutes and then removed. After removal of the load, the string components shall not show any visual deformation and it shall be possible to disassemble them by hand. Hand tools may be used to, remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

1.2 Vibration Test

The suspension string shall be tested in suspension mode, and tension string in tension mode itself in laboratory span of minimum 30 meters. In the case of suspension string, a load equal to 600 kg shall be applied along the axis of the suspension string by means of turn buckle. The insulator string along with hardware fittings and the each sub-conductors tensioned at 25% of conductor UTS shall be secured with clamps. The system shall be suitable to maintain constant tension on each sub-conductors throughout the duration of the test. Vibration dampers shall not be used on the test span. All the sub-conductors shall be vertically vibrated simultaneously at one of the resonance frequencies of the insulators string (more than 10 Hz) by means of vibration inducing equipment. The peak to peak displacement in mm of vibration at the antinode point, nearest to the string, shall be measured and the same shall not be less than $1000/f^{1.8}$ where f is the frequency of vibration in cycles/sec. The insulator string shall be vibrated for not less than 10 million cycles without any failure. After the test, the insulators shall be examined for looseness of pins and cap or any crack. The hardware shall be examined for looseness, fatigue failure and mechanical strength test. There shall be no deterioration of properties of hardware components and insulators after the vibration test. The insulators shall be subjected to the Mechanical performance test followed by mechanical strength test as per relevant standards.

1.3 Salt-fog pollution withstand test

This test shall be carried out in accordance with IEC:60507. The salinity level for composite long rod insulators shall be 160Kg/m3 NACL.

2.0 Composite Longrod Insulator Units

2.1 Brittle Fracture Resistance Test

The test arrangement shall be according to Damage limit proof test with simultaneous application of 1N-HNO_3acid directly in contact with naked FRP rod. The contact length of acid shall not be less than 40mm and thickness around the core not less than 10mm.The rod shall withstand 80% of SML for 96 hours.

2.2 Recovery of Hydrophobicity Test

(1) The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the HC classification. Dry the sample surface.

(2) Treat the surface with corona discharges to destroy the hydrophobicity. This can be done utilizing a high frequency corona tester, Holding the electrode approximately 3mm from the sample surface, slowly move the electrode over an area approximately 1" x 1". Continue treating this area for 2 – 3 minutes, operating the tester at maximum output.

(3) Immediately after the corona treatment, spray the surface with water and record the HC classification. The surface should be hydrophilic, with an HC value of 6 or 7. If not, dry the surface and repeat the corona treatment for a longer time until an HC of 6 or 7 is obtained. Dry the sample surface.

(4) Allow the sample to recover and repeat the hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC 1 – HC 2 within 24 to 48 hours, depending on the material and the intensity of the corona treatment.

2.3 Silicone content test

Minimum content of silicone as guaranteed by supplier shall be verified through FT-IR spectroscopy & TGA analysis or any other suitable method mutually agreed between Owner& Supplier in Quality Assurance Programme.

2.4 High Pressure washing test

The washing of a complete insulator of each E&M rating is to be carried out at 3800kPa with nozzles of 6mm diameter at a distance of 3m from nozzles to the insulator, The washing shall be carried out for 10minutes. There shall be no damage to the sheath or metal fitting to housing interface. The verification shall be 1 minute wet power frequency withstand test at 460kV r.m.s for 220KV

2.5 Torsion Test

Three complete insulators of each E&M rating shall be subjected to a torsional load of 55Nm. The torsional strength test shall be made with test specimen adequately secured to the testing machine. The torsional load shall be applied to the test specimen through a torque member so constructed that the test specimen is not subjected to any cantilever stress. The insulator after torsion test must pass the Dye Penetration Test as per IEC 61109.

3.0 Tests on All components (As applicable)

3.1 Chemical Analysis of Zinc used for Galvanizing

Samples taken from the zinc ingot shall be chemically analysed as per IS:209-1979. The purity of zinc shall not be less than 99.95%.

3.2 Tests for Forgings

The chemical analysis hardness tests and magnetic particle inspection for forgings, will be as per the internationally recognized procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Supplier and Owner in Quality Assurance Programme.

3.3 Tests on Castings

The chemical analysis, mechanical and metallographic tests and magnetic, particle inspection for castings will be as per the internationally recognized procedures for these tests. The samplings will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Supplier and Owner in Quality Assurance Programme.

Table A-1

<u>Typical</u> transmission line details for LILO at Nagrota for Installation of 24 Fiber OPGW on AC Transmission Lines

Line Voltage	Nominal Span E/W & Conductors in mtrs.)	Wind Zone	Design Tension at Every Day Temp (32º C) and full wind condition – Earthwire)	Wind Pressure (kg/Sq-m) (including gust factor)	Max Sag – Ground Wire at 53degC (in mtrs.)	UTS – Earthwire (in Kg)	Weight – Earth wire (Kg/km)	Minimum Clearance in mtrs.		
								A1	B1	C1
220kV	350M	II	1993.62	131	7.83	5808	430	7.015	4.9	8.5
		III	2352.14	170						
		IV	2545.72	192						

A1 **Minimum clearance between conductor and ground (in meters)**

B1 **Minimum clearance between two phase conductors (in meters) – vertical in case of D/C towers and horizontal in case of S/C towers.**

C1 **Minimum clearance between conductor and earth wire (in meters)**

Appendix-B
Data Requirement Sheets

Appendix-C

Data Requirement Sheets

The following sets of Data Requirement Sheets are required to be filled up by the bidders to aid in the evaluation process. The response shall be brief and to the point and shall be supported by the printed product description and other literature.

DATA REQUIREMENTS SHEETS for OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW) – 24 Fibre:

Manufacturer: _____

Part #: _____

Configuration: _____

OPTICAL PARAMETERS			
Seq.	Parameter	Unit	Guaranteed Particulars
1	Attenuation Coefficient @1310 nm: @1550 nm:	dB/km dB/km	
2	Attenuation Variation with Wavelength (±25nm):	dB/km	
3	Attenuation at water peak:	dB/km	
4	Point discontinuity @1310 nm: @1550 nm:	dB dB	
5	Temperature dependence (induced attenuation):	dB	
6	Nominal Mode Field Diameter @1310 nm: @1550 nm:	µm	
7	Mode Field Diameter Deviation @1310 nm: @1550 nm:	µm	
8	Mode Field non-circularity:	%	
9	Chromatic Dispersion Coefficient @1310 (1288-1339) nm: @1310 (1271-1360) nm: @ 1550 nm:	Ps/nm.km	
10	Zero Dispersion wavelength:	nm	
11	Zero Dispersion Slope:	$Ps/nm^2.km$	
12	Cutoff wavelength:	nm	
13	Refractive Index		
14	Refractive Index Profile:		
15	Cladding Design:		
16	Numerical aperture:		
17	Bend Performance:		

	(37.5 mm radius,100 turns) @1310nm (30 mm radius,100 turns) @1550nm (16 mm radius,1 turn) @1550nm	dB dB	
18	Core Diameter (nominal±deviation):	µm	
19	Core non-circularity:	%	
20	Cladding Diameter (nominal±deviation):	µm	
21	Core-Clad concentricity Error:	µm	
22	Cladding noncircularity:	%	
23	Fibre cut-off wavelength:	µm	
24	Protective Coating type & material DROP & INSERT: Secondary:		
25	Protective Coating Diameter (nominal±deviation):	µm	
26	Protective Coating removal method:		
27	Coating Concentricity	µm	
28	Polarisation mode dispersion coefficient	$ps/km^{0.5}$	
29	Proof test level	GPa	
30	Minimum guaranteed design life span of optical fibres	Year	

DRS Form 2

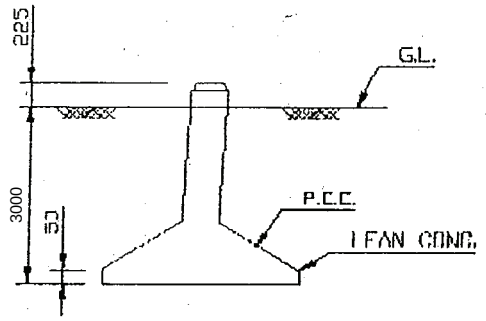
DATA REQUIREMENTS SHEETS for OPTICAL FIBRE

DUAL-WINDOW SINGLE MODE (DW-SM)

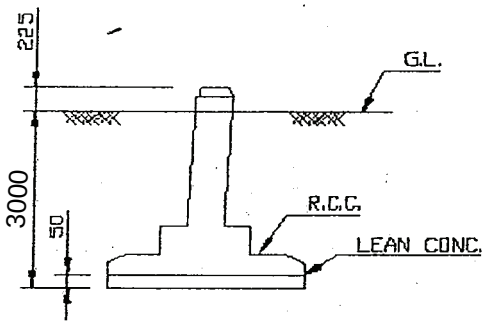
OPTICAL PARAMETERS			
Seq	**Parameter:**	**As per Technical Specification**	**As per Bidder offering**
1.	Fiber manufacturer(s)/Type:		
2.	Attenuation Coefficient@ 1310 nm: @ 1550 nm:	≤ 0.35 dB/km ≤ 0.21 dB/km	
3.	Point discontinuity @ 1310nm: @ 1550nm:	≤ 0.05 dB ≤ 0.05 dB	
4.	Nominal Mode Field Diameter @ 1310 nm:	8.6 to 9.5 µm (± 0.6 µm)	
5.	Chromatic Dispersion Coefficient @ 1310 (1288-1339) nm: @ 1310 (1271-1360) nm: @ 1550 nm:	3.5 ps/(nmxkm) 5.3 ps/(nmxkm) 18 ps/(nmxkm)	
6.	Zero dispersion wavelength:	1300 to 1324 nm	
7.	Cutoff wavelength:	≤ 1260 nm	
Physical and Mechanical Properties			
8.	Bend Performance: (37.5 mm radius, 100 turns) @1310 nm (30 mm radius, 100 turn) @1550 nm (16mm radius, 1 turn) @ 1550nm	≤ 0.05 dB ≤ 0.05 dB ≤ 0.50 dB	
9.	Cladding Diameter	125.0 µm ± 1 µm	

	(nominal ± deviation):		
10.	Polarisation mode dispersion coefficient	≤ 0.2 ps/$km^{1/2}$	
11.	Proof test level	≥ 0.69 Gpa	

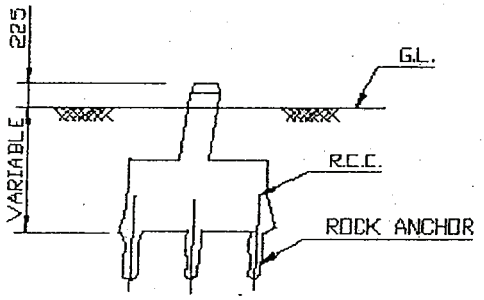
----------End of the Appendix----------



TYP. FOUNDATION SHAPE FOR P.C.C. TYPE

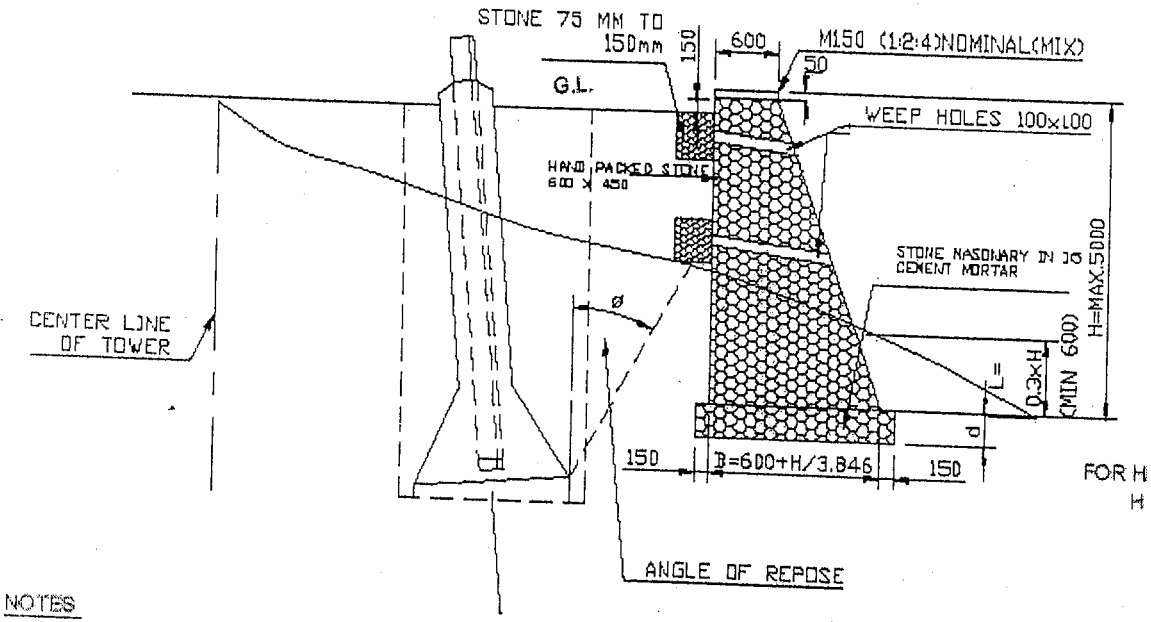


TYP. FOUNDATION SHAPE FOR R.C.C. TYPE



TYP. FOUNDATION SHAPE FOR HARD ROCK

FOR TENDER PURPOSE ONLY
TND CONSULTING SERVICES PVT. LTD. REC TRANSMISSION PROJECTS PVT. LTD.
PROJECT: 220/33kV NAGROTA GIS SUBSTATION
TITLE : TENTATIVE SHAPE OF TOWER FOOTING



FOR H ≥ 1000, d = 230
H < 1000, d = 150

NOTES

1. ALL DIM. ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. WEEP HOLES SHOULD BE OF SIZE 100mm x 100mm OR 150mm x 150mm INCASE OF LARGE SIZE REVETMENT.
3. WEEP HOLES SHOULD BE 2.5M C-C APART HORIZONTAL
4. CENTER OF TOP MOST WEEP HOLES TO BE NOT LESS THAN 900 mm BELOW TOP
5. THE MIN. DEPTH OF REVETMENT WALL BELOW G.L. WILL BE 600mm
6. DIM 'B' ARE VALID ONLY FOR 'H' NOT EXCEEDING 5.00 METER.
7. SIZE OF STONE FOR MASONARY WORK. 300 x 150 x 150 & BELOW
8. THE MASONRY WORK SHOULD BE CARRIED OUT IN 1:6 CEMENT MORTAR
9. SIZE OF STONE PACKING AT WEEP HOLE 75 mm TO 150mm

FOR TENDER PURPOSE ONLY

TND CONSULTING SERVICES PVT. LTD.
REC TRANSMISSION PROJECTS PVT. LTD.

PROJECT:220/33kV NAGROTA SS

TITLE : TOWER FOOTING

TECHNICAL SPECIFICATION FOR CIVIL WORKS

1. GENERAL SCOPE OF WORK

Jammu & Kashmir Power Transmission Corporation Ltd. i.e. JKPTCL (erstwhile JKPDD) is responsible for Transmission and distribution of electrical energy in the entire J&K UT. In order to provide reliable Power Supply in Jammu & Kashmir region.

Construction of 220/33kV Nagrota AIS Substation in Jammu Region has been entrusted to ~~RECTPCL~~RECPDCL by JKPTCL for complete implementation including Bidding, Engineering, Project Management, Quality assurance and Commissioning of Projects.

The Ownership of the said substation shall however remain vested with JKPTCL.

For the above substation, JKPTCL desires to implement the Construction of Residential Quarters, Internal Electrifications for Quarters / buildings, RCC roads, Water Supply incl. tube well reservoirs etc., Drainage & Sewerage system and External Electrification at the substation.

The broad scope of work shall include Design, Engineering, Supply & Construction of Civil Works, Plumbing & Sanitary works, Water supply, Internal and External Electrical works, Road Work, and associated allied works etc.

Scope of Work:

The broad scope of work shall include Design, Engineering, Supply & Construction of Residential Staff Quarters, associated Plumbing & Sanitary works, Water supply, Internal and External Electrical works, Road Work, and associated allied works etc.

The scope of work shall include but not be limited to the following

- **a)** Construction of Residential staff quarters & other buildings including boundary wall.
- **b)** Contouring and site leveling (if required)
- **c)** External water supply arrangement for colony & other buildings etc.
- **d)** External sewerage system
- **e)** Supply, Erection, testing & commissioning of lighting poles, panels and control cubicles of equipment (as required in complete).
- **f)** Construction of underground water storage tank for colony & other buildings
- **g)** Construction of septic tank & soak pit for control room and residential building
- **h)** Supply, Erection, Testing & Commissioning of Pole mounted 1 x 160 KVA (Minimum BEE 4 Star Rating) , 11/0.433 kV, Three Phase Distribution transformer along with 11kV Gang operated switch, Drop out fuse, Surge arrestors etc. in HV side and Main Township Distribution Board comprising of Two 200A, 20KA MCCB incoming feeders (One from MSB in ACDB Room & other from 160KVA Transformer), 200 Amps, 20KA Bus, One 200A Bus coupler MCCB and Eight outgoing MCCB feeders (2 of 63A & 4 of 32 A & 2 of 25A), LT cable from Transformer to Main Township Distribution Board etc. in LV side.
- **i)** External lighting and illumination for the Colony Area under present scope including Street Lighting with RCC htp poles with Led Lightning
- **j)** Internal Electrification of the buildings.
- **k)** From LT Sub-station - Cable Connection from LT Main Panel outgoing feeders to the Sub-Main Panels distribution box shall be provided by the Contractor as per Bid Price Schedule.
- **l)** RCC Roads 3.75 Mtr. As per approved layout of township.
- **m)** Any other item required for completion of scope of works

The work to be performed under this specification shall include providing all labour, supervision, materials, storages, inventories, all enabling works like scaffolding, watch and

ward for the works, power, fuel, construction equipment, water, tools and plants, supplies, transportation, all taxes and duties, all labour welfare and safety measures, complete and all other incidental items not shown or specified, but reasonably implied or necessary for successful completion of the work including Contractor's supervision and in strict accordance with the drawings and specifications, inspection and testing standards and field quality control and testing as given in the tender documents and the complete execution of the works.

The scope shall also include preparation of reinforcement placement drawings, fabrication drawings and bar bending schedules, based on the drawings released for construction and getting the same approved by the Engineer-in-Charge.

The contractor shall have sole responsibility of co-ordination for construction activities, though he may employ separate sub- contractors. All co-ordination and interfacing with all the sub-contractors shall be done by the contractor.

Details of Residential Quarters: -

Sr. No.	Particulars	Qty.	Area	Configuration
1.	Ornamental Works such as development of lawns and landscaping	L/S	Job	
2.	LT Distribution and Street Lighting	L/S	Job	
3.	Residential Quarters			
3.1	JEs Quarter -4 nos. (1 Block of 2 GF+2FF with common stairs)	4 Nos.	2500 Sq.Ft.	Double Story
3.2	SBA's Quarter – total 8 Nos. in 2 Blocks. Each Block having 2 Units of GF and 2 units of FF with Common Stairs)	8 Nos.	2400 Sq.Ft.	Double Story
4.	Roads for colony	L/S		
5.	Water supply incl. tube-well reservoirs etc.	Job	Job	
6.	Santry/Security Post	L/S	Job	

2. SPECIFICATION FOR WORK, QUALITY AND WORKMANSHIP

Work shall be carried out as per ~~RECTPCL~~RECPDCL Specification. If any items are not covered in ~~RECTPCL~~RECPDCL specification, CPWD specifications are to be followed for Civil/Electrical works for all the scheduled/DSR Items. For non-scheduled items the work shall be executed according to the specifications given herein or in its absence the relevant CPWD Specifications, or the best practice recommended by reputed manufacturers, or the best Public Works Department practices or to the recommendations of relevant Indian Standard/ International Practice or according to the instructions of the Engineer-in-Charge. The specifications are intended for the general descriptions of the work, quality and workmanship. The specifications are not, however, intended to cover the minute details and the work shall be executed according to the best Central Public Works Department Practices or to the recommendations of relevant Indian Standard/International Codes like ASTM/DIN or according to the instructions of the Engineer-in-Charge.

All the materials of the project shall be from the approved makes of materials specified in this specification and as approved by ~~RECTPCL~~RECPDCL. Materials for which approved makes are not available in above, the same shall be decided by the Engineer-in-charge. The procurement of various materials shall be either from the manufacturer or their main authorized dealers to ensure that no duplicate/spurious makes are used in the works. The Contractors are required to submit manufacturer's test certificates for the lots supplied at site with due endorsements by the actual dealers/vendors/sellers. Notwithstanding all the above, the contractor shall be held

responsible for the execution of works and use of proper materials as per the tender specifications. Any material shall be approved by the Engineer-in-charge before put to use.

Wherever reference to CPWD/Indian Standard Codes and Practices is made, it shall be to the latest edition/revision of the same, issued up to 7 days prior to the date of opening of this tender.

The tenderer must obtain clarifications, if any, regarding the specifications and all other tender documents before submission of the tender in writing with the Employer in respect of interpretation of any portions of these documents.

3. TESTS OF MATERIALS/WORKMANSHIP

All mandatory tests shall be carried out as per ~~RECTPCL~~RECPDCL Standard field quality plan. Test mentioned in individual items/specifications shall also be carried. All tests required for all materials shall be at the Contractor's cost. In case of items not covered in the CPWD specifications and IS code contractor shall arrange testing as per practice of the industry without any additional cost. Manufacture's test certificate of the relevant batch of material procured shall also be submitted for all measure items.

4. LAYOUT AND LEVELS

The layout and levels of all buildings, structures etc. shall be made by the Contractor at his own cost from the general grid of the plot and bench marks as approved by the Engineer-in-Charge. The Contractor shall also assist in the form of instruments, materials and men to Engineer-in-Charge for checking the detailed layout and correctness of the layout and levels, at his own cost. But the Contractor shall be solely responsible for correctness of layout and levels. The levels and heights mentioned in the tender drawings are only tentative. The works shall be carried out as per Construction drawings issued after the award of the works.

5. CONSTRUCTION METHOD

The tenderer shall submit construction schedule, names of specialized agencies/products, list of construction equipment to be deployed and write-up to indicate in a broad outline how he intends to execute the work with the best co-ordination among various sub- packages (or sub-heads). These shall form part of this Tender.

6. DRAWINGS:

The vendor shall finalize the layout plan of the township as per available land and take approval of ~~RECTPCL~~RECPDCL.

The Contractor is required to furnish a schedule indicating their requirements of 'Release for Construction' drawings compatible with the approved detailed construction program within 10 days of award of the work for scrutiny and approval and subsequent finalization of the Employers. 'Good for Construction' drawings shall be issued to the contractor progressively during the execution of the contract as per actual progress achieved and requirements at site. Based on the 'Released for Construction' drawings, contractor will prepare reinforcement placement drawings including the Bar Bending Schedule, Steel Fabrication Drawings, all other shop drawings etc. and get the same approved by the Engineer-in-Charge before execution of the work.

Any technical clarifications required regarding the drawings/specifications during the progress of works shall be obtained from the Engineer-in-Charge allowing a minimum of four working days for processing. Such "Requests for Information" (RFI) shall be in approved format which can be obtained from Engineer-in-Charge.

The actual terminal point of scope of works under this contract shall be as shown in 'Good for Construction' drawings.

Regarding conduit layout drawings, Point wiring drawing, Plumbing, water supply and sewerage

layout drawings, the Contractor will submit the shop drawings (in hard copy and in AutoCAD format) for the approval from ~~RECTPCL~~RECPDCL.

As Built Drawings should be submitted by the Contractor to Site and at ~~RECTPCL~~RECPDCL (in hard copy and in AutoCAD format) at the time of Final Bill.

7. APPROVED VENDORS AND MAKES:

The Items which are available in enclosed "Compendium of Vendors", shall be sourced from approved manufacturers. For items which are not available in the "Compendium of Vendors", the decision of Engineer-in-charge shall be final. However, to facilitate procurement, the list of Indicative makes shall be treated as indicative list.

8. Miscellaneous

The contractor shall be responsible for watch and ward of all the works, equipment's and various materials till complete handing over the works and all necessary arrangements to co-ordinate with watch and ward of other contractors working simultaneously and also of the Employers shall be made to the complete satisfaction of the Engineer-in-Charge.

The list of deliverables which are to be submitted to the Employer shall be discussed and finalized by the Employer at the time of award. The Contractor shall necessarily submit all the drawings/documents/other deliverables unless anything is waived. The contractor shall submit 4 (four) sets of drawings/design documents/test reports as may be required for the approval of the Employer.

The contractor shall co-operate with the representatives of the Employer for due verifications of various compliances of various statutory regulations and tax compliances as and when required. All the documents of record shall be made available to the Employers and copies, wherever required, shall be submitted.

Employer reserves the right to inspect all the material before dispatch. However, depending upon nature of material, waiver of inspection may be granted for which the Contractor shall take prior approval of the Employer. This will be done on case to case basis.

The work is located in the premises of existing sub-station. The Contractor shall make arrangements for regulation of traffic by engaging security staff. They shall also make necessary arrangements to prevent unauthorized entry in the premises.

Contractor shall comply with all regulations of local authorities without any financial implication to ~~RECTPCL~~RECPDCL.

9. Completion Certificate

On completion of the work the Contractor shall obtain completion certificate from local bodies or statutory body for and on behalf of the Owner for the construction as contemplated in this contract. However, the Owner may also help contractor to the extent of writing letters to Local bodies for expediting approval, if required. Further if any fee is required to be paid to the local/statutory bodies, the same shall be reimbursed to contractor by the owner against documentary evidence.

10. ROADS

a) All the roads as required for the Township area as per approved General Arrangement drawing for the Township area are in the present scope. Adequate turning space for vehicles shall be provided and bend radii shall be set accordingly.

b) All concrete roads within substation boundary wall shall be with 3.75 m RCC concrete pavement of suitable thickness and 1.3 m wide earthen shoulder on either side of the road. Below RCC concrete pavement, water bound macadam of adequate thickness as per design

(WBM) shall be laid.

c) All roads shall be designed as per relevant Indian standard codes (I S Codes)/ equivalent International Standards. All drawings of road and culverts shall be prepared by the contractor.

d) All the culverts and allied structures (required for road/rail, drain, trench crossings etc.) shall be designed as per relevant Indian standard codes (IS Codes)/ equivalent International Standards

11. SITE PREPERATION, EXCAVATION, BACKFILL & DISPOSAL OF SURPLUS EARTH.

11.1. SITE PREPERATION

The layout and levels of all structure etc. shall be made by the Contractor at his own cost from the general grids of the plot and benchmarks set by the Contractor and approved by the Employer. The Contractor shall give all help in instruments, materials and personnel to the Employer for checking the detailed layout and shall be solely responsible for the correctness of the layout and levels.

11.2. SCOPE

This clause covers clearing of the site, maintaining the finished ground level with available surplus excavated suitable back fill material generated from foundation works etc.

11.3. GENERAL

1. The Contractor shall develop the site area to meet the requirement of the intended purpose. The site preparation shall conform to the requirements of relevant sections of this specification or as per stipulations of relevant Indian standard codes (IS Codes)/ equivalent International Standards.

2. The fill material shall be suitable for the above requirement. The fill shall be with such a material that the site so designed shall not be affected by erosion from wind and water from its final compacted position or the in-situ position of undisturbed soil.

3. Material unsuitable for founding of foundations shall be removed and replaced by suitable fill material to be approved by the Employer.

4. Backfill material around foundations or other works shall be suitable for the purpose for which it is used and compacted to the density described under Compaction. Excavated material not suitable or not required for backfill shall be disposed off in areas as directed by engineer- in Charge up to a maximum lead of 2 km.

11.4. EXCAVATION AND BACKFILL

SCOPE

This clause covers excavation for foundation works of Buildings/ Staff Quarter etc. backfilling of Foundations Works.

1. Excavation and backfill for foundations shall be in accordance with the relevant Indian standard codes (IS Codes)/ equivalent International Standards.
2. Whenever water table is met during the excavation, it shall be dewatered and water table shall be maintained below the bottom of the excavation level during excavation, concreting and backfilling.
3. When embankments are to be constructed on slopes of 15% or greater, benches or steps with horizontal and vertical faces shall be cut in the original slope prior to placement of

embankment material. Vertical faces shall measure not more than 1 m in height.

4. Embankments adjacent to abutments, culverts, retaining walls and similar structures shall be constructed by compacting the material in successive uniform horizontal layers not exceeding 15 cm in thickness. (of loose material before compaction). Each layer shall be compacted as required by means of mechanical tampers approved by the Purchaser. Rocks larger than 10 cm in any direction shall not be placed in embankment adjacent to structures.
5. Earth embankments of roadways and site areas adjacent to buildings shall be placed in successive uniform horizontal layers not exceeding 20 cm in thickness in loose stage measurement and compacted to the full width specified. The upper surface of the embankment shall be shaped so as to provide complete drainage of surface water at all times.

11.5. COMPACTION

1. The density to which fill materials shall be compacted shall be as per relevant IS and as per direction of Employer. All compacted sand filling shall be confined as far as practicable. Backfilled earth shall be compacted to minimum 95% of the Standard Proctor's density at OMC. The sub grade for the roads and embankment filling shall be compacted to minimum 95% of the Standard Proctor's density at OMC. Cohesion less material sub grade shall be compacted to 70% relative density (minimum).
2. At all times unfinished construction shall have adequate drainage upon completion of the road's surface course, adjacent shoulders shall be given a final shaping, true alignment and grade.
3. Each layer of earth embankment when compacted shall be as close to optimum moisture content as practicable. Embankment material which does not contain sufficient moisture to obtain proper compaction shall be wetted. If the material contains any excess moisture, then it shall be allowed to dry before rolling. The rolling shall begin at the edges overlapping half the width of the roller each time and progress to the centre of the road or towards the building as applicable. Rolling will also be required on rock fills. No compaction shall be carried out in rainy weather.

11.6. REQUIREMENT FOR FILL MATERIAL UNDER FOUNDATION

The thickness of fill material under the foundations shall be such that the maximum pressure from the footing, transferred through the fill material and distributed onto the original undisturbed soil will not exceed the allowable soil bearing pressure of the original undisturbed soil. For expansive soils, the fill materials and other protections etc. to be used under the foundation is to be got approved by the Employer.

11.7. DISPOSAL OF SURPLUS EARTH

The surplus earth generated from foundation work shall be disposed away from levelling area boundary at low lying areas within 2Km lead. The surplus earth if disposed within substation main boundary, the same shall be spread in uniform layers and compacted with suitable compacting equipment to achieve 95% compaction at O.M.C.

12. SITE DRAINAGE

Preparation of overall drainage layout, design, drawing and providing rain water drainage system within the Residential Staff Quarter Colony under the present scope including connection at one or more points to the outfall point located outside the substation boundary wall is in the scope of contractor. Invert level of drainage system at outfall point shall be decided in such a way that the water can easily be discharged outside the substation boundary wall. In case outfall point is more than 50M away from boundary wall, only 50 metre drain outside the boundary wall is in the scope of contractor. Outfall point shall be got approved from Employer before commencement of construction. While designing the drainage system following points shall be taken care of:

a) The surface of the Residential Staff Quarter Colony shall be sloped to prevent

accumulation of water.

b) Drain shall be constructed at suitable locations in such a way that Residential Staff Quarter Colony is not flooded and roads are not affected with ponding of surface water. In the Residential Staff Quarter Colony maximum spacing between two drains shall not be more than 100 meter. It will be ensured that no area is left undrained.
c) Open surface drains having 300mm bottom width and 300mm depth at starting point of drain shall be provided. The depth of drain shall be measured with respect to finished ground level of switch yard i.e. from bottom of switch yard stone filling.
d) Longitudinal slope shall not be less than 1 in 1000.
e) Open surface drains shall be constructed with brick masonry or concrete blocks. As per design of contractor. PCC (1:2:4) shall be laid over 40mm thick layer of PCC 1:4:8 (1 cement: 4coarse sand: 8 stone aggregate 20mm nominal size.)
f) The side wall of the drains shall be 25 mm above the gravel level to prevent falling of gravel into drain. Groove of 125 mm width shall be provided at 2000 mm spacing with suitable mild steel grating.
g) The maximum velocity for pipe drains and open drains shall be limited to 2.4m/sec and 1.8m/sec respectively. However, minimum non-silting velocity of 0.6m/sec shall be ensured.
h) Pipe drains shall be provided in areas of switchyard where movement of crane will be necessary in operating phase of the substation.
i) For pipe drains, concrete pipe of class NP2 shall be used. However, for road crossings etc. higher strength pipe of class NP3 shall be provided. For rail crossings, RCC pipes of class NP4 shall be provided. For design of RCC pipes for drains and culverts, relevant Indian standard codes (I S Codes)/ equivalent International Standards. shall be followed.
j) Two Nos. of portable pumps of 3 / 5 HP capacity for drainage of water shall be provided by the Contractor.
k) Pipe drains shall be connected through manholes at an interval of max. 30m.
l) If the invert level of outfall point is above the last drain point in the substation boundary, sump of suitable size has to be constructed with in the substation boundary.
m) The drainage scheme and associated drawings shall be got approved from Employer before commencement of construction.

13. FOUNDATION / RCC CONSTRUCTION

13.1. GENERAL

1. Work covered under this Clause of the Specification comprises the design, drawing and construction of foundations and other RCC constructions for Residential Staff Quarter Colony, or for any other equipment or service and any other foundation required to complete the work. This clause is as well applicable to the other RCC constructions.

2. Concrete shall conform to the requirements mentioned in relevant Indian standard codes (IS Codes)/ equivalent International Standards. And all the tests shall be conducted as per relevant Indian standard codes (IS Codes)/ equivalent International Standards. However, a minimum grade of M25 (design Mix) concrete shall be used for all foundations and structural/load bearing members as per relevant Indian standard codes (IS Codes)/ equivalent International Standards.

3. If the site is sloppy, the foundation height will be adjusted to maintain the exact level of the top of structures to compensate such slopes.

4. Minimum 75mm thick lean concrete (1:4:8) shall be provided below all underground structures, foundations, trenches etc. to provide a base for construction.

5. Concrete made with Portland slag cement shall be carefully cured and special importance shall be given during the placing of concrete and removal of shuttering.

6. The design and detailing of foundations shall be done based on the approved soil data and sub-soil conditions as well as for all possible critical loads and the combinations thereof. The Spread footings foundation or pile foundation as may be required based on soil/sub-soil conditions and superimposed loads shall be provided.

7. If pile foundations are adopted, the same shall be cast-in-situ driven/bored or pre-cast or under reamed type as per relevant parts of relevant Indian standard codes (IS Codes)/

equivalent International Standards. Only RCC piles shall be provided. Suitability of the adopted pile foundations shall be justified by way of full design calculations. Detailed design calculations shall be submitted by the contractor showing complete details of piles/pile groups proposed to be used. Necessary initial load test shall also be carried out by the bidder at their cost to establish the piles design capacity. Only after the design capacity of piles has been established, the Contractor shall take up the job of piling. Routine tests for the piles shall also be conducted. All the work (design & testing) shall be planned in such a way that these shall not cause any delay in project completion.

13.2. DESIGN

While designing foundations, following may be taken care of:

13.2.1. All foundations except for external lighting poles shall be of reinforced cement concrete. The external lighting pole shall be embedded in plain cement concrete (1:2:4) foundation. The design and construction of RCC structures shall be carried out as per relevant IS: 456 and minimum grade of concrete shall be M-25 (design Mix). Higher grade of concrete than specified above may be used at the discretion of Contractor without any additional financial implication to the Employer.

13.2.2. Limit state method or any other method as per relevant Indian standard codes (IS Codes)/ equivalent International Standards of design shall be adopted unless specified otherwise in the specification.

13.2.3. For detailing of reinforcement IS: 2502 and SP 34 shall be followed. Cold twisted deformed bars (Fe=500N/mm^2) conforming to relevant Indian standard codes (IS Codes)/ equivalent International Standards shall be used as reinforcement. Two layers of reinforcement (on inner and outer face) shall be provided for wall & slab sections having thickness of 150 mm and above. Clear cover to reinforcement shall be as per relevant Indian standard codes (I S: 456)/ equivalent International Standards.

13.2.4. RCC water retaining structures like storage tanks, etc. shall be designed as un cracked section in accordance with relevant Indian standard codes (IS: 3370 Part I to IV)/ equivalent International Standards. However, water channels shall be designed as cracked section with limited steel stresses as per relevant IS.

13.2.5. The procedure used for the design of the foundations shall be the most critical loading combination of the steel structure and or equipment and/or superstructure and other conditions which produces the maximum stresses in the foundation or the foundation component and as per the relevant Indian standard codes (IS Codes)/ equivalent International Standards of foundation design. Detailed design calculations shall be submitted by the bidder showing complete details of piles/pile groups proposed to be used.

13.2.6. Design shall consider any sub-soil water pressure that may be encountered following relevant standard strictly.

13.2.7. Necessary protection to the foundation work, if required shall be provided to take care of any special requirements for aggressive alkaline soil, black cotton soil or any other type of soil which is detrimental/harmful to the concrete foundations.

13.2.8. RCC columns shall be provided with rigid connection at the base.

13.2.9. All sub-structures shall be checked for sliding and overturning stability during both construction and operating conditions for various combinations of loads. Factors of safety for these cases shall be taken as mentioned in relevant Indian standard codes (IS Codes)/ equivalent International Standards or as stipulated elsewhere in the Specifications. For checking against overturning, weight of soil vertically above footing shall be taken and inverted frustum of pyramid of earth on the foundation should not be considered.

13.2.10. Earth pressure for all underground structures shall be calculated using co-efficient of earth pressure at rest, co-efficient of active or passive earth pressure (whichever is applicable). However, for the design of substructures of any underground enclosures, earth pressure at rest shall be considered.

13.2.11. In addition to earth pressure and ground water pressure etc., a surcharge load of 2T/Sq.m shall also be considered for the design of all underground structures including channels,

sumps, tanks, trenches, substructure of any underground hollow enclosure etc., for the vehicular traffic in the vicinity of the structure.

13.2.12. Following conditions shall be considered for the design of water tank in pumps house, channels, sumps, trenches and other underground structures:

- **a)** Full water pressure from inside and no earth pressure & ground water pressure & surcharge pressure from outside (application only to structures which are liable to be filled up with water or any other liquid).
- **b)** Full earth pressure, surcharge pressure and ground water pressure from outside and no water pressure from inside.
- **c)** Design shall also be checked against buoyancy due to the ground water during construction and maintenance stages. Minimum factor of safety of 1.5 against buoyancy shall be ensured ignoring the superimposed loadings.

13.2.13. Base slab of any underground enclosure shall also be designed for empty condition during construction and maintenance stages with maximum ground water table (GWT). Minimum factor of safety of 1.5 against buoyancy shall be ensured ignoring the super-imposed loadings.

13.2.14. Base slab of any underground enclosure like water storage tank shall also be designed for the condition of different combination of pump sumps being empty during maintenance stages with maximum GWT. Intermediate dividing piers of such enclosures shall be designed considering water in one pump sump only and the other pumps sump being empty for maintenance.

13.3. ADMIXTURES & ADDITIVES

13.3.1. Only approved admixtures shall be used in the concrete for the Works. When more than one admixture is to be used, each admixture shall be batched in its own batch and added to the mixing water separately before discharging into the mixer. Admixtures shall be delivered in suitably labelled containers to enable identification.

13.3.2. Admixtures in concrete shall conform to relevant Indian standard codes (IS Codes)/ equivalent International Standards. The water proofing cement additives shall conform to relevant IS. Concrete Admixtures/ Additives shall be approved by Employer.

13.3.3. The Contractor may propose and the Employer may approve the use of a water-reducing set-retarding admixture in some of the concrete. The use of such an admixture will not be approved to overcome problems associated with inadequate concrete plant capacity or improperly planned placing operations and shall only be approved as an aid to overcoming unusual circumstances and placing conditions.

13.3.4. The water-reducing setting-retarding admixture shall be an approved brand as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

14. BUILDINGS

14.1. GENERAL

The scope includes the design, drawing, engineering and construction including anti-termite treatment, plinth protection, DPC of Building including sanitary, water supply, electrification, false ceiling etc. as applicable ,complete of Residential Staff Quarter Colony. Electrification and air conditioning of building shall be provided as detailed in other sections of electrical portion.

14.2. Residential Staff Quarter

GENERAL

The scope includes layout design, engineering and construction, including anti-termite treatment, plinth protection, DPC, peripheral drains, water supply, plumbing, sanitation, fire-fighting, electrification etc. of Residential Staff Quarter.

The building shall be constructed as per the building codes, relevant IS Codes, state Government norms and complete detailed Architecture drawings, structural design and

construction drawings to be developed by the contractor. The RCC Roof shall be provided for all the floors and mumty.

Additional Roof with slopes (1 Vertical: 1.5 Horizontal) shall be provided in case the township is in snow bound terrain. This roof shall be MS truss Structure covered with MS profile sheets as per CPWD Specifications.

Tentative carpet area requirement:

Sr. No.	Particulars	Qty.	Area	Configuration
1.	Ornamental Works such as development of lawns and landscaping	L/S	Job	
2.	LT Distribution and Street Lighting	L/S	Job	
3.	Residential Quarters			
3.1	JEs Quarter -4 nos. (1 Block of 2 GF+2FF with common stairs)	4 Nos.	2500 Sq.Ft.	Double Story
3.2	SBA's Quarter – total 8 Nos. in 2 Blocks. Each Block having 2 Units of GF and 2 units of FF with Common Stairs)	8 Nos.	2400 Sq.Ft.	Double Story
4.	Roads for colony	L/S		
5.	Water supply incl. tube-well reservoirs etc.	Job	Job	
6.	Santry/Security Post	L/S	Job	

It shall be constructed in the area identified in land Utilization plan for Nagrota AIS Substation.

14.3. DESIGN CRITERIA

The Buildings shall be designed:

- **a)** To the requirements of the Indian Standards.
- **b)** For the specified climatic and loading conditions.
- **c)** To adequately suit the requirements of the equipment's and apparatus contained in the buildings and in all respects to be compatible with the intended use and occupancy.
- **d)** With a functional and economical space arrangement.
- **e)** To be aesthetically pleasing. Different buildings shall show a uniformity and consistency in architectural design, as far as possible.
- **f)** Suitable Expansion joints, wherever required, shall be provided as per Codal Provisions.
- **g)** All the members of the buildings frame shall be designed for the worst combination of loads as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.
- **h)** Permissible stresses for different load combinations shall be taken as per relevant Indian standard codes (I S Codes) / equivalent International Standards.
- **i)** Seismic coefficient Method or Response spectrum method shall be used for seismic analysis of the building for Earthquake forces, as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

14.4. DESIGN LOADS

- **a)** Building structure shall be designed for the most critical combinations of dead loads, super-imposed loads, equipment loads, erection loads, wind loads, seismic loads, snow loading, if required etc. Any other incidental load, if anticipated, shall be duly accounted for in the design, and shall be clearly mentioned by the bidder.

b) Dead loads shall include the weight of structures complete with finishes, fixtures and partitions, and shall be taken as per relevant Indian standard codes (I S Codes)/ equivalent International Standards.

c) Super-imposed loads in different areas shall include live loads, minor equipment loads, cable trays, small pipe racks/hangers and erection, operation and maintenance loads, wherever these loads are expected. Equipment loads shall constitute, if applicable, all load of equipment's to be supported on the building frame.

AREA	Load
1. For buildings	5.0 kN/m2
If higher than 5.0 kN/m2	As per actual Requirement.
2. Staircases & Balconies.	5.0 kN/m2
3. Toilets.	2.0 kN/m2
4. Chequered Plate.	4.0 kN/m2
5. Corridors/Walkways.	3.0 kN/m2
6. Accessible Roofs.	1.5 kN/m2
7. Non-accessible Roofs.	0.75 kN/m2

d) Wind loads shall be calculated as per relevant Indian standard codes (IS Codes)/ equivalent International Standards. The Factors affecting the wind speed shall be taken based on the site conditions.

e) Earthquake loads shall be calculated as per relevant Indian standard codes (IS Codes)/ equivalent International Standards.

f) Wind forces and Seismic forces shall not be considered to act simultaneously.

g) All the load combinations to create worst combinations of loads shall be as per relevant International standards/Indian Standards.

h) Floors/ Slabs shall be designed to carry loads imposed by equipment's, cables, piping, movement of maintenance trucks (if required) and any other load associated with the building. In general, floors shall be designed for live loads as per relevant Indian standard codes (I S Codes)/ equivalent International Standards. Cable and piping loads shall also be considered in addition to the live loads for floors where these loads are expected.

14.5. FLOORS, WALLS & ROOFS

a) All walls shall be non-load bearing in filled panel walls, in brickwork as per the specification. Minimum thickness of external walls shall be 230 mm (one brick) with 1:6 cement sand mortar. Partition walls if any shall be of 115 mm thick brick masonary in cement sand mortar (1:4). Bricks of class 75 Kg/cm sq. shall be used.

b) All Floor/Roof slabs shall be regular beam slab construction. However, sunken RCC slab shall be provided in toilet areas as per the requirement.

c) False ceiling as per requirement shall be provided as detailed in Table-1 (Detailed Finish Schedule).

d) Minimum height of skirting above finished floor level shall be 150 mm. The skirting material shall match with the floor finish.

e) Minimum height of the parapet walls shall be 750 mm.

f) Ground floor finish shall be laid over 20 mm thick cement sand mortar,100 mm thick plain cement concrete (PCC) 1:4:8 (1 cement: 4 sand: 8 stone aggregates),100 mm thick local sand filling. The earth below ground floor shall be well rammed before laying sand filling.

g) First floor details shall comprise of finish as per schedule, 20 mm cement sand mortar and 50 mm thick PCC (1:4:8) over RCC slab.

14.6. DETAILS OF ROOF

Roof of the Building shall consist of Cast-in-situ RCC slab treated with a water proofing system which shall be an integral cement based treatment conforming to relevant Indian standard codes (IS Codes)/ equivalent International Standards. The water proofing treatment shall be of following operations:

a) Applying and grouting a slurry coat of neat cement using 2.75 kg/m^2 of cement admixed with proprietary water proofing compounds conforming to relevant Indian standard codes (IS Codes)/ equivalent International Standards. Over the RCC slab including cleaning the surface before treatment.

b) Laying cement concrete using broken stone of size from 25mm to 100mm size with 50% of cement mortar 1:5 (1 cement: 5 coarse sand) admixed with proprietary water proofing compound conforming to relevant Indian standard codes (I S Codes)/ equivalent International Standards over 20mm thick layer of cement mortar of min 1:5 (Cement: 5 coarse sand) admixed with proprietary water proofing compound conforming to relevant Indian standard codes (IS Codes)/ equivalent International Standards to required slope and treating similarly the adjoining walls up to 300mm height including rounding of junctions of walls and slabs.

c) After two days of proper curing applying a second coat of cement slurry admixed with proprietary water proofing compound conforming relevant Indian standard codes (IS Codes)/ equivalent International Standards.

d) Finishing the surface with 20mm thick joint less cement mortar of mix 1:4 (1 cement: 4 course sand) admixed with proprietary water proofing compound conforming to relevant Indian standard codes (IS Codes)/ equivalent International Standards and finally finishing the surface with trowel with neat cement slurry and making of 300 x 300 square mm.

e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by the Executive Engineer In-charge.

f) Average thickness of water proofing shall be 120 mm and minimum thickness at khurra shall be 65 mm.

14.7. PLASTERING

External surfaces of buildings shall have 18 mm thick plaster in two layers, with the under layer 12mm thick 1:5 cement sand plaster and the top layer 6 mm thick 1:6 cement sand plaster. Inside wall surfaces shall have 12/15 mm thick 1:6 cement sand plaster. Rough surfaces shall have 15mm and smooth surface shall have 12 mm thick cement sand plaster.

All RCC ceilings shall be provided with 6 mm thick cement sand (fine) plaster (1:3) except for areas with false ceiling.

14.8. EXTERNAL PAINTING

External surfaces of the Buildings shall be painted with acrylic exterior flat paint as per manufacturer's specification and approval of Employer.

14.9. DOORS, WINDOWS AND VENTILATORS

The schedule of doors, windows of the Residential Quarter g shall be as per the detailed finish schedule given in Table-1 (Detailed Finish Schedule), and shall conform to the relevant Indian standard codes (IS Codes)/ equivalent International Standards.

14.10. PLINTH PROTECTION

750 mm wide and 50 mm thick plain cement concrete 1:2:4 (1 cement:2 sand:4 graded 20 mm nominal size stone aggregate) shall be laid over 75 mm thick dry stone aggregates well rammed and consolidated with interstices filled with local sand including smooth finishing top.

14.11. PLUMBING & SANITATION

a) All plumbing and sanitation works shall be executed to comply with the requirements of the appropriate bye-laws, rules and regulations of the Local Authority having jurisdiction over such matters. The Contractor shall arrange for all necessary formalities to be met with regards to the inspection, testing, obtaining approval and giving notices etc.

b) 'SINTEX' or an equivalent make PVC Roof water tank(s) of 1000 litres shall be provide for every unit

c) Chlorinated Polyvinyl chloride (CPVC) pipes having thermal stability for hot and cold water supply including all CPVC plain and brass threading conforming to relevant Indian standard codes (IS Codes)/ equivalent International Standards shall be used for internal piping works for water supply.

d) Sand C.I. pipes with lead joints conforming to relevant Indian standard codes (IS Codes)/ equivalent International Standards shall be used for sanitary works above ground level and RCC pipes shall be used for sanitary works below ground.

e) Each toilet shall have the following minimum fittings:

(i) WC (Western type) 390 mm high along with toilet paper roll holder and all other fittings, in toilets attached to site office; or WC (Indian Type) Orissa Pattern (580 x 440 mm) with all fittings shall be provided in one toilet.

(ii) 1 nos. Urinal (430 x 260 x 350 mm size) with all fittings and built-in-sensor for automatic flush after use in the site office.

(iii) Wash basin (550 x 400 mm) with all fittings.

(iv) Bathroom mirror (600 x 450 x 6 mm thick) with hard board backing.

(v) CP brass towel rail (600 x 20 mm) with CP brass brackets.

f) One no. stainless steel kitchen sink with Drain board (510 x 1040 x 178 mm bowl depth) for pantry shall be provided.

g) All fittings, fasteners, gratings shall be chromium plated

h) All sanitary fixtures and fittings shall be of approved quality and type, manufactured by reputed manufacturers. All items brought to site must bear identification marks of the Manufacturer.

i) **Contractor shall provide necessary nos. of septic tank and soak pit of adequate capacity to treat the sewage/sullage from the buildings.**

j) **Contractor shall undertake all other activities required to complete and commission the township & office building.**

14.12. BUILDING STORM WATER DRAINAGE

a. The building design shall provide for the collection of storm water from the roof. This water shall be drained to the main drainage system of the Sub-station.

b. PVC Rainwater down comer pipes conforming to relevant International standards/Indian Standards.

c. All drains inside the buildings shall have minimum 40 mm thick grating covers; and in areas where heavy equipment loads are envisaged, Pre-Cast RCC covers shall be provided in place of steel grating.

14.13. DETAILED FINISHING SCHEDULE

The detailed finish schedule for Township is given below:

a. Internal Finish Schedule

Table- 1: DETAILED FINISH SCHEDULE

Sl. No.	LOCATION	FLOORING & SKIRTING 150 MM HIGH	WALL (INTERNAL)	CEILING	DOOR, WINDOWS, VENTILATORS
1.	Residential Buildings	Vitrified tiles 8mm thick size 600 x 600mm	Non VOC acrylic emulsion paint over 2mm POP putty upto ceiling over approved primer coat	Ceiling painted with Non VOC acrylic emulsion paint to give an even shade.	Door shall have flush door shutter 35 mm thick with commercial ply duly painted & polished as per CPWD specification & as per the approval of Engineer- in- Charge. Door frames should be of sal/hard wood/ Red Marandi as per the as per CPWD specification & as per the approval of Engineer- in- Charge. Windows should be wooden panel window with glazing as per CPWD specifications & approval of Engineers in Charge Windows frames should be of shawl/hard wood/ Red Marandi as per the as per CPWD specification & as per the approval of Engineer- in- Charge.
2.	Toilets	Ceramic tiles	DADO glazed tile 2100mm high, above that non VOC acrylic emulsion paint over 2 mm thick POP putty along with primer coat.	Non VOC acrylic Emulsion paint over approved primer coat for RCC building / False ceiling shall be provided in-case of PEB building.	
~~3~~	~~Office Rooms~~	~~Vitrified tiles 8mm thick size 600 x 600mm~~	~~Non VOC acrylic emulsion paint over 2mm POP putty upto false ceiling over approved primer coat~~	~~False ceiling painted with Non VOC acrylic emulsion paint to give an even shade.~~	

14.14. WATER PROOFING TREATMENT

Integral cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terraces etc. consisting of following operations:

a) Applying a slurry coat of neat cement using 2.75 kg/sq. m. of cement admixed with water proofing compound conforming to IS. 2645 and approved by Engineer-in-charge over the RCC slab including adjoining walls up to 300mm height including cleaning the surface before treatment.

b) Laying brick bats with mortar using broken bricks/brick bats 25 mm to 115 mm size with 50% of cement mortar 1:5 (1 cement : 5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge over 20 mm

thick layer of cement mortar of mix 1:5 (1 cement :5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge to required slope and treating similarly the adjoining walls up to 300 mm height including rounding of junctions of walls and slabs

c) After two days of proper curing applying a second coat of cement slurry using 2.75 kg/ sq. m. of cement admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-charge.
d) Finishing the surface with 20 mm thick joint less cement mortar of mix 1:4 (1 cement: 4 coarse sand) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-charge including laying glass fibre cloth of approved quality in top layer of plaster and finally finishing the surface with trowel with neat cement slurry and making pattern of 300x300 mm square 3 mm deep.
e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by the Engineer-in-Charge
f) With average thickness of 120mm and minimum thickness at khurra as 65 mm

14.15. SUNKEN WATER PROOFING (RCC):

a) Water proofing treatment shall be done in sunken portion of WCs, bathroom etc. by applying cement slurry mixed with water proofing cement compound consisting of:
   i. First layer of slurry of cement @ 0.488 kg/sq. m mixed with water proofing cement compound @ 0.253 kg/ sq. m. This layer will be allowed to air cure for 4 hours.
   ii. Second layer of slurry of cement @ 0.242 kg/sq. m mixed with water proofing cement compound @ 0.126 kg/sq. m. This layer will be allowed to air cure for 4 hours followed with water curing for 48 hours.

b) Treatment and sealing of joints, corners, junction of pipes and masonary with polymer mixed slurry shall be carried out as per CPWD specifications.

14.16. SPECIFICATIONS FOR PLUMBING, SANITATION & WATER SUPPLY ETC.

a) All plumbing and sanitation shall be executed to comply with the requirements of the appropriate bye-laws, rules and regulations of the Local Authority having jurisdiction over such matters. The Contractor shall arrange for all necessary formalities to be met in regard to inspection, testing, obtaining approval and giving notices etc.
b) Provision for water cooler shall be provided at suitable location.
c) Each toilet shall be provided with Water Closet, Wash hand basin, health faucet, Mirror, Towel Rail, Paper Holder, Liquid soap dispenser, twin coat holder.
d) In addition to general requirements of each toilet, 2 nos. Sensor based urinals shall be provided for common Gents toilet.
e) Pantry shall be provided with stainless steel kitchen sink.
f) The platform of kitchen sink and wash hand basin shall be provided with 18 mm thick Mirror polished approved granite stone.
g) The specification of different items, which are to be used for plumbing, sanitation & water supply etc. in are given below, the same shall be used during detailed engineering, unless otherwise mentioned else-where in the tender

S.No.	Items	Description
1	Wall hung Water Closet	Coloured vitreous china extended wall mounting water closet of approved size and shape including providing & fixing white vitreous china cistern with dual flush fitting, of flushing capacity 3 litre/6 litre (adjustable to 4 litre/8 litres), including seat cover, and cistern fittings, nuts, bolts and gasket etc complete
2	Squatting Pan	(Indian type W.C. pan) (white vitreous china Orissa pattern W.C. pan of size 580x440mm with integral type foot rests) shall be with 100mm sand cast iron P or S trap. 10 litre low level white P.V.C flushing cistern with manually controlled device (handle lever) conforming to IS:7231, with all fittings and fixtures complete including cutting and making good the walls

		and floors wherever required.
3	Wash Basin	Providing and fixing coloured wash basin counter type of (approximate size 630x450mm size under counter or over counter type), in case flat bash hand is required the approximate size shall be 550x400mm and shall be provided with C.P. close basin mixer (ISI approved) with CI. Brackets taps with battery based infrared sensor, 32mm C.P. brass waste and bottle trap of standard pattern, including painting of fittings and brackets, cutting and making good the walls wherever required. Other details shall be as per the drawings.
4	Urinal	White vitreous china battery based infrared sensor operated urinal of approx. size 610 x 390 x 370 mm having pre & post flushing with water (250 ml & 500 ml consumption), having water inlet from back side, including fixing to wall with suitable brackets all as per manufacturers specification and direction of Engineer-in-charge.
5	Urinal partition	10mm thk toughened glass partition with frosted film to be fixed in position for urinals on appropriate stainless steel patch fittings of desired shape and size
6	Kitchen sink	Stainless steel AISI 304 (18/8) Kitchen sink of 510x1040 mm bowl with depth of 178mm with drain board shall be provided and fixed as per IS 13983 with C.I brackets, and stainless steel plug 40mm with provision of 2 nos. CP brass long body bib cock conforming to IS Standard and weighing not less than 650 gm for CP bottle trap etc including painting of fittings and brackets, cutting and making good the wall
7	Bib cock	C.P. brass short body and long body bib cock 15mm nominal bore shall be of approved quality conforming to IS: 8931
8	Angle valve	C.P. brass angle valve of 15mm nominal bore provided and fixed in position for basin and cistern points of approved quality conforming IS :8931
9	Towel rail	C.P. brass towel rail of approved make of 600mm length, 25mm dia with a pair of brackets or flanges provided and fixed to wall beside each wash basin/set of wash basin with necessary screws, plugs, etc
10	Mirror	6mm thick beveled edge mirror approximate size 1000x600mm made of superior glass of approved make complete with a backing of 6 mm thick water proof hard board fixed to wooden cleats with 25mm dia SS studs, washers etc complete for each wash basin
11	Hooks	Double type coat & hat hooks with flanges, fixed to wall / shutter, etc. with necessary screws, washers & plugs
12	Liquid soap holder	C.P. brass liquid soap holder of approved make fixed with each wash basin to the wall with necessary CP brackets, CP screws, washers, plugs etc.
13	C.P. Brass or S.S. cockroach trap	Approved C.P. Brass cockroach trap shall be provided in the Kitchen, Toilets and pantry
14	Floor traps	PVC floor traps of self-cleansing design shall be provided & fixed in position with 100 mm dia. inlet and 75mm dia. outlet of approved make, including making connection with PVC soil/waste pipes using rubber gaskets, embedding the trap in 150 mm thick PCC 1:2:4.
15	Internal Soil, waste and vent pipe	Unplasticised rigid PVC pipes of 75mm for waste & 110mm dia. for soil shall be provided conforming to IS:13592 type B and all its fittings like bends, sockets, door bend, Y-tee etc. as per requirement with seal ring conforming to IS: 5382 including jointing with cement solvent conforms to IS:14182. All underground or under floor pipes shall be encased with 1:3:6 concrete. Minimum concrete cover shall be 75 mm thk.
16	Rain Water Pipe and fittings	a) Unplasticised rigid PVC rain water pipes of required dia. shall be provided and fixed on the wall face conforming to IS: 13592 type A as per requirement including jointing with seal ring conforming to IS: 5382 leaving 10mm gap for thermal expansion single

		socketed pipes including all fittings like bends, bat clamps gratings etc. b) Unplasticised PVC Moulded fittings/accessories including suitable dia. bend & shoes shall be provided and fixed for unplasticised rigid PVC rain water pipes conforming to IS:13592 type A including jointing with seal ring conforming to IS: 5382 leaving 10mm gap for thermal expansion. **c)** Clips of approved design shall be provided and fixed to unplasticised PVC rain water pipes by means of 50x50x50mm hard wood plugs, screwed with MS screws of required length including cutting brick work and fixing in cement mortar1:4 (1 cement : 4 coarse sand) and making good the wall etc
17	Internal & External water supply	a) All CPVC pies and fittings shall conform to IS:15778 b) All internal CPVC pipe shall be concealed including cutting of chases and making good the wall. c) Wherever CPVC pipes are buried the same shall be provided and laid in position including trenching, sand cushion and refilling, etc. For trenching, sand cushion and refilling refer CPWD specification applicable for external piping work. d) All internal CPVC pipe shall be concealed including cutting of chases and making good the wall. **e)** ISI approved CPVC ball valve, non-return valves shall be provided and fixed in position as per requirement and direction of Engineer-in-charge.
18	Water storage tanks	Triple layered Polyethylene water storage tanks shall be provided of approved brand and manufacture with cover and suitable locking arrangement, float valve and making necessary holes for inlet, outlet and overflow pipes. Capacity of water tank shall be 2x1500 litres for control room, 2X2000 litres for Transit Camp.
19	Sluice valve chamber	Masonry chamber for sluice valve shall be 600x600mm size in plan and depth 750mm, or matching with the site condition inside with 50 class designation brick work in cement mortar 1:5 (1 cement : 5 fine sand) with CI surface box 100 mm. Top diameter, 160 mm bottom dia and 180 mm deep (inside) with chained lid and RCC top slab 1:2:4 mix (1cement : 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) necessary excavation foundation concrete 1:5:10 (1 cement : 5 fine aggregate : 10 graded stone aggregate 40 mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3 coarse sand) 12 mm thick finished with a floating coat of neat cement complete as per standard design with FPS bricks of class 75.
20	External Sewerage	Glazed stoneware pipes of 100 & 150mm diameter grade 'A' shall be provided, laid and jointed with stiff mixture of cement mortar in the proportion of 1:1 (1cement :1 fine sand) including testing of joints etc. complete. SW pipes shall be encased with Cement concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate 40 mm nominal size) including bed concrete as per CPWD standard design and CPWD specifications. In case of non-availability of SW Pipe, contractor may use UPVC Pipe of similar dia with the prior approval of EIC without any financial implication to ~~RECTPCL~~RECPDCL.
21	Gully trap	100x100 mm or 150x100 mm size P type Square-mouth S.W. gully trap class SP-1 complete with C.I. grating brick masonry chamber and water tight C.I. cover frame o f 300 x300 mm size (inside), the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design. FPS Bricks class designation 75 shall be provided for brick masonry chamber.

22	Manholes	FPS brick masonry manhole shall be constructed in cement mortar 1:4 (1 cement :4 coarse sand) RCC top slab with 1:2:4 mix (1 cement : 2 fine aggregate : 4 graded stone aggregate 20 mm nominal size) foundation concrete 1:4:8 mix (1cement : 4 coarse sand :8 graded stone aggregate 40 mm nominal size) inside plastering 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with floating coat of neat cement and making channels in cement concrete 1:2:4 (1 cement: 2 coarse sand :4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement complete as per standard design. The size and depth of manhole shall be suitably decided based on requirement of layout in line with CPWD specification. a) Inside size shall be 90 x 80 cm and 60 cm deep including CI cover with frame (light duty) 455 x 610 mm internal dimensions' total weight of cover and frame shall not be less than 38 kg (weight of cover 23 kg and weight of frame 15 kg) and shall be constructed with F.P.S. bricks with class designation 75. **b)** Inside size shall be 120 x 90 cm and 90 cm or more deep including CI cover with frame (medium duty) 500mm internal diameter total weight of cover and frame to be not less than 116 kg (weight of cover 58 kg and weight of frame 58 kg) with FPS Bricks class designation 75.
23	Foot Rest	Orange colour safety foot rest of minimum 6 mm thick plastic encapsulated as per IS : 10910, on 12 mm dia. steel bar conforming to IS: 1786, having minimum cross section as 23 mmx25 mm and over all minimum length 263 mm and width as 165 mm with minimum 112 mm space between protruded legs having 2 mm tread on top surface by ribbing or chequering besides necessary and adequate anchoring projections on tail length on 138 mm as per standard drawing and suitable to with stand the bend test and chemical resistance test as per specifications and having manufacture's permanent identification mark to be visible even after fixing, fixing in manholes with 30x20x15 cm cement concrete block 1:3:6 (1 cement : 3 fine aggregate : 6 graded stone aggregate 20 mm nominal size) complete.
24	Road Gully Chamber	Brick Masonry road gully chamber of 50x45x60cm shall be provided with FPS brick with cement mortar 1:4 including 500x450mm pre cast RCC Horizontal/vertical grating with frame complete

14.17. ELECTRIFICATION

All electrification shall be executed as per details specified elsewhere in the technical specification. All details shall be as per relevant Indian standard codes (IS Codes)/ equivalent International Standards.

15. WATER SUPPLY

1. The contractor should arrange point for water connection, or arrange water tankers at his own cost, no payment shall be made for this.
2. The contractor shall carry out all the plumbing/erection works required for supply of water in township beyond the single point as at (i) above.
3. The details of tanks, pipes, fittings, fixtures etc. for water supply are given elsewhere in the specification under respective sections.
4. A scheme shall be prepared by the contractor indicating the layout and details of water supply which shall be got approved by Employer before actual start of work including all other incidental items not shown or specified but as may be required for complete performance of the works. All drawings shall be prepared by the contractor for approval of Employer.

16. SEWERAGE SYSTEM

1. Sewerage system shall be provided for all buildings wherever applicable.
2. The Contractor shall construct septic tank and soak pit suitable for 150 users. If septic and soak pit system is not acceptable by local Authority, contractor will have to install suitable sewerage system as per local statutory requirement.
3. The system shall be designed as per relevant Indian standard codes (I S Codes)/ equivalent International Standards. All drawings shall be prepared by the contractor for approval of Employer.

17. GENERAL SPECIFICATIONS FOR BUILDINGS:

These clauses are applicable for the vendor designed buildings,
For the building, most of the finishing items are explained in previous clauses, if any of items are missed or may be required for completion of the same, the below mentioned clauses may also be referred.

i. The material specification, workmanship and acceptance criteria shall be as per approved standard Field Quality Plan attached with this document. In case certain item is not covered in FQP, it shall be constructed as per CPWD specification.
ii. Post constructional Anti termite treatment shall be carried out for all buildings as per DSR item no. 2.34 & 2.35. Anti-termite chemical treatment shall be given to column pits, wall trenches, foundations of buildings, filling below the floors etc. as per IS: 6313 and other relevant Indian Standards
iii. Reinforced cement concrete with controlled water cement ratio as per IS-code shall be used for all underground concrete structures such as pump-house, tanks, and water retaining structures for achieving water-tightness.
iv. FPS or Modular clay/fly ash based Bricks having minimum 75 kg/cm2 compressive strength can only be used for masonry work. Contractor shall ascertain himself at site regarding the availability of bricks of minimum 75 kg/cm2 compressive strength before submitting his offer. However, Contractor can propose to use aerated concrete block or solid concrete blocks of compressive strength not less than 75kg/cm2 without any cost implication to ~~RECTPCL~~RECPDCL.
v. Full brickwork shall be provided with cement mortar 1:6 (1cement: 6 coarse sand). Half brick work masonry shall be provided with cement mortar 1:4 (1cement: 4coarse sand) and two no 6mm dia. MS bar at every third course.
vi. 12mm cement plaster of mix 1:6 (1cement: 6 fine sand) shall be provided on the smooth side of internal walls. However rough side of walls shall be provided with 15mm cement plaster of mix 1:6 (1cement: 6 fine sand).
vii. External plaster in two coats - 18mm Cement plaster in two coats under layer 12mm thick cement plaster 1:5 (1 cement: 5coarse sand) finished with a top layer 6mm thick cement plaster (1cement: 6 fine sand). External plastered surface shall be finished with white cement based putty of average thickness 1 mm, of approved brand and manufacturer to prepare the surface even and smooth. After putty the walls shall be finished with Premium Acrylic Smooth exterior paint of approved brand and manufacturer with Silicone additives of required shade (Two or more coats applied @ 1.43 ltr./ 10 sq. m. over and including priming coat of exterior primer applied @ 2.20 kg/ 10 sq. m). 13.8 6 mm thk. Cement plaster of mix 1:3 (1 cement: 3 fine sand) to RCC ceiling shall be done except areas where false ceiling is provided.
viii. Internal walls shall be finished with Plaster of Paris putty of average thickness 2 mm, of approved brand and manufacture, over the plaster surface to prepare the surface even and smooth complete. In case plastered surface of buildings are covered under wall paneling, dado work, skirting etc. no putty and painting are required.
ix. Internal Wall shall be painted with minimum two coats of premium acrylic emulsion paint having VOC (volatile organic compound) content less than 50gm per litre of approved brand and manufacture including applying additional coats wherever required, to achieve even shade and colour over priming coat as per manufacturer specification/ recommendation
x. Non - VOC premium acrylic emulsion paint having volatile organic compound content less than 50gm per litre of approved brand and manufacture shall be used wherever specified.

xi. Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade shall be provided on the steel doors, flush doors and rolling shutters in various buildings or as specified in the drawings. Two or more coats over an under coat of suitable shade with primer paint of approved brand and manufacture.

xii. Two or more coats of French spirit polishing with a coat of wood filler shall be provided on the wooden doors and frames.

xiii. Polished vitrified tiles in 60x60 cm size (thickness to be specified by the manufacturer) in flooring and skirting, with water absorption's less than 0.08% and conforming to IS: 15622 of approved make in all colours and shades, laid on cement mortar 20mm thick min. for flooring & 12mm thick for skirting 1:4 (1 cement: 4coarse sand) including grouting the joints with white cement and matching pigments etc., complete.

xiv. Glazed Ceramic floor tiles 300x300mm (thickness to be specified by the manufacturer) of 1st quality conforming to IS:15622 of approved make in colours as approved by Engineering- charge in toilet and pantries area on 20mm thick min. cement mortar 1:4 (1 cement: 4coarsesand) including grouting the joints with white cement and matching pigments etc., complete.

xv. 62 mm thick cement concrete flooring with concrete hardener topping, under layer 50 mm thick cement concrete 1:2:4 (1 cement: 2 fine aggregate: 4 graded stone aggregate 20mm nominal size) and top layer 12mm thick cement hardener consisting of mix 1:2 (1 cement hardener mix: 2 graded stone aggregate, 6mm nominal size) by volume, hardening compound mixed @ 2 litre per 50 kg of cement or as per manufacturer's specifications.

xvi. Cement plaster skirting (up to 15 cm height) with cement mortar 1:3 (1 cement: 3 coarse sand) mixed with metallic concrete hardener in same ratio as for floor finished with a floating coat of neat cement. 21 mm thick in ACDB/DCDB room.

xvii. Granite stone of 18mm thick gang saw cut mirror polished pre-molded and pre-polished, machine cut for of required size of approved shade, colour and texture laid over 20mm thick base cement mortar 1:4 (1 Cement: 4 coarse sand) with joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing molding and polishing to edge to give high gloss finish etc. complete for staircase.

xviii. Granite stone of flooring with 18mm thick gang saw cut mirror polished premoulded and prepolished, machine cut for of required size of approved shade, colour and texture laid over 20mm thick cement mortar 1:4. The joints are filled with jointing compound matching to the granite. Wherever granite is specified for the floor, 100mm granite skirting shall be provided with the walls. The granite outer surface shall be flushed to the plaster finish of the wall by molding / beveling of granite at top edge.

xix. Granite counter of approved shade shall be provided and fixed with 18mm thick gang saw cut, mirror polished, premoulded and pre-polished, machine cut for pantry & kitchen platform facias and similar locations of required size, approved shade, colour & texture laid over 20mm thick base cement mortar 1:4 (1cement : 4 Coarse sand) joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing moulding and polishing to edges to give high gloss finish etc. complete at all levels.

xx. Ceramic glazed wall tiles of 1st quality conforming to IS: 15622 (thickness to be specified by the manufacture) of approved make in all colours, shades as approved by Engineer-in- Charge in dados over 12mm thick bed of cement Mortar 1:3 (1 Cement: 3 Coarse sand) and jointing with grey cement slurry @ 3.3kg per sq. m including pointing in white cement mixed with pigment of matching shade complete. Height of dado shall be 2.1m high in toilet, kitchen and pantry or elsewhere specified in the drawings or TS.

xxi. Circular/hexagonal M.S. sheet ceiling fan box shall be provided in the ceiling with clamp of internal dia. 140 mm, 73 mm height, 3 mm thick rim, top and bottom lid of 1.5 mm M.S. Sheet. Lids shall be screwed in to M. S. box by means of 3 mm round headed screws, clamps shall be made of 12 mm dia. M. S. bar bent to shape as per standard drawing with overall length as 80 cm.

xxii. All doors except for toilet shall have 100mm 6 lever CP Brass mortice lock. Anodized aluminum handles of ISI marked and approved size shall be provided for all doors and windows as per requirement and instruction of E.I.C.

xxiii. Cylindrical keyless lock of 25 mm diameter and 50mm diameter knob on both sides (ISI marked) shall be provided for toilets.

xxiv. Kitchen door shall have 250x16mm C.P. brass sliding door bolt.

xxv. Door shall be provided with anodized aluminum tower bolt (barrel type) 250x10mm wherever door closers are not provided.

xxvi. All windows shall have aluminum tower bolt (barrel type) 150x10mm as per requirement.

xxvii. Plinth protection 50 mm thick of cement concrete 1:2:4 (1 cement: 2 fine aggregate : 4 graded stone) aggregate 20 mm nominal size) shall be laid over 75 mm bed of dry brick ballast 40 mm nominal size well rammed and consolidated and shall be grouted with fine sand including finishing the top smooth. Minimum width of plinth protection shall be 1000 mm.

xxviii. Ward Robes of required height and about 600 mm deep shall be made out of 18 mm. thk anti termite treated commercial board ISI marked at end verticals, top and bottom, shutters, partition etc. complete. The rear side of the unit shall be made with 6mm thk commercial ply ISI marked, which shall have French spirit polish on the exterior face. Inner surface of the storage cabinet shall be finished with 0.8mm thk approved laminate. The horizontal partition shall be of removable type fixed with necessary SS fittings and hardware. All external surfaces shall be finished with 4.0 mm thk approved veneer with melamine including making necessary grooves, teak wood moulding as per approved drawings. Each shutter shall have piano type stainless steel hinges and C.P. Brass or SS 125mm long handle. The unit shall have necessary fittings such as tower bolts, 4 lever CB locks etc. complete.

xxix. Angles 50x50x6 mm (minimum) with lugs shall be provided for edge protection all round cut outs/openings in floor slab.

xxx. Item/ components of buildings not explicitly covered in the specification but required for completion of the project shall be deemed to be included in the scope.

18. EXTERNAL WATER SUPPLY FROM BORE-WELL TO FIRE WATER TANK/ BUILDING AND / OR TRANSIT CAMP:

i. The drawing for the water supply from bore-well to fire water tank shall be developed by the Contractor. Water supply will be made available to the Contractor from a bore-well by the Employer at any one location within the sub-station. 80 mm dia CPVC pipe shall be provided by the Contractor from the bore-well to the fire water tank. The underground pipe line shall be laid as per CPWD Specification. The ball valve, NRV etc. shall be provided as per requirement. From this pipe line a 25 mm dia tap off shall be connected by the Contractor to the roof water tank provided for the control room building & transit camp.

ii. The Contractor shall carry out all the external plumbing/erection works required for supply of water to the control room building, firewater tank and/ or transit camp beyond the single point as given above.

iii. A scheme shall be prepared by the Contractor indicating the layout and details of water supply which shall be got approved from the Employer before actual start of work including all other incidental items not shown or specified but as may be required for complete performance of the works.

19. SUBMISSIONS

The following information/documents/drawings shall be submitted for review and approval

1. Structural design calculations, Structural drawings (including construction/ fabrication), both in hard and soft copies, for all reinforced concrete and structural steel structures.
2. Fully dimensioned and detailed floor plans, cross-sections, longitudinal sections and elevations identifying the major building components.
3. Product information of building components and materials, including walls, partitions, flooring, ceilings, roofing, doors, wall panelling and windows and building finishes along with BOQ.
4. A detailed schedule of building finishes including colours schemes along with item description.
5. A door & window schedule showing door & window types and locations, lock sets and latch sets and other door hardware along with item details. Approval of the above information shall be obtained before ordering materials or starting construction/fabrication, as applicable.

20. MISCELLANEUS REQUIREMENTS

i. The material specification, workmanship and acceptance criteria shall be as per approved standard Field Quality Plan attached with this document. In case certain item is not covered in FQP, it shall be constructed as per CPWD specification.
ii. Items/ components of buildings not explicitly covered in the specification but required for completion of the project shall be deemed to be included in the scope.

21. INTERFACING

The proper coordination & execution of all interfacing civil works activities like fixing of conduits in roofs/walls/floors, fixing of foundation bolts, fixing of lighting fixtures, fixing of supports/embedment, provision of cut outs etc. shall be the sole responsibility of the Contractor. He shall plan all such activities in advance and execute in such a manner that interfacing activities do not become bottlenecks and dismantling, breakage etc. is reduced to minimum.

22. STATUTORY RULES

i. Contractor shall comply with all the applicable statutory rules pertaining to factories act (as applicable for the State), Fire Safety Rules of Tariff Advisory Committee, Water Act for pollution control etc.
ii. Statutory clearance and norms of State Pollution Control Board shall be followed as per
iii. Water Act for effluent quality from plant.
iv. Requirement of sulphate resistant cement (SRC) for sub structural works shall be decided in accordance with the Indian Standards based on the findings of the detailed soil investigation. In case sulphate resistant cement is used as per requirement, differential cost between sulphate resistant cement and PPC cement shall be payable as an extra item.
v. All building/construction materials shall conform to the best quality specified in CPWD specifications if not otherwise mentioned in this specification.
vi. All tests as required in the standard field quality plans have to be carried out without any financial implication to employer

VOLUME-II

TECHNICAL SPECIFICATION FOR

INTERNAL AND EXTERNAL ELECTRIFICATION OF TOWNSHIP

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TECHNICAL SPECIFICATIONS

1. Preamble

Jammu & Kashmir Power Transmission Corporation Ltd. i.e. JKPTCL (erstwhile JKPDD) is responsible for Transmission and distribution of electrical energy in the entire J&K UT. In order to provide reliable Power Supply in Jammu & Kashmir region.

Construction of 220/33kV Nagrota AIS Substation in jammu Region has been entrusted to RECPDCL by JKPTCL for complete implementation including Bidding, Engineering, Project Management, Quality assurance and Commissioning of Projects.

The Ownership of the said substation shall however, remain vested with JKPTCL.

2. Intent of Specification

The equipment and work shall conform in all respect to high standards of engineering, design and workmanship and shall be capable of performing in continuous operation in a manner acceptable to the owner who will interpret the meaning of the specifications and drawings and shall have right to reject or accept any equipment or work which in his assessment is not complete to meet the requirements of this specification and/or applicable codes and standards mentioned elsewhere in the specifications.

3. General Design Criteria

The illumination system shall be designed on the basis of best engineering practice and shall ensure uniform, reliable, aesthetically pleasing and glare free illumination. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection. The diffusers/ louvers used in the lighting fixtures shall be made of impact resistant polystyrene sheet and shall have no yellowing property over a prolonged period Illumination. The type of Lighting Fixture to be used in different areas shall be as per Annexure-1.

For Indoor and Outdoor Illumination, detailed drawings showing the lighting layout and electrical distribution diagram shall be prepared by the Contractor and submitted for approval. The above layout drawings will include disposition and location of lighting fixtures, receptacles, lighting panels etc. while finalizing the detailed layout of lighting fixtures, the position/location and layout of equipment should be taken into account to have adequate illumination at desired locations.

Indoor Illumination

Indoor illumination shall be done by LED Luminaries as per the requirement of buildings.

Outdoor Illumination

Outdoor illumination shall be done by LED luminaries as per the requirement. For Street Lighting, lighting poles & nearby buildings (if any) shall be used for installation of LED fixtures, Mounting Structures/Accessories for Mounting of LED Lighting Fixtures will be prefabricated and will be hot dip galvanized.

4. SCOPE of work

The tender includes the supply, erection, testing and commissioning of electrical installation work in complete as required for the electrification of township ~~including all associated buildings~~ and shall cover but not limited to the following items of work:

a. Supply and Laying of cable from ACDB room in CR Building to the Main Township Distribution Board, from Main Township Distribution Board to Sub-main panel and from Sub-main panels to Distribution boards, and within the Colony/substation area if required for completion of the work.
b. Supply, Erection, Testing & Commissioning of Pole mounted 1 x 160 KVA (Minimum BEE 4 Star Rating), 11/0.433 kV, Three Phase Distribution transformer along with 11kV Gang operated switch, Drop out fuse, Surge arrestors etc. in HV side and Main Township Distribution Board comprising of Two 200A, 20KA MCCB incoming feeders (One from MSB in ACDB Room & other from 160KVA Transformer), 200 Amps, 20KA Bus, One 200A Bus coupler MCCB and Eight outgoing MCCB feeders (2 of 63A & 4 of 32 A & 2 of 25A), LT cable from Transformer to Main Township Distribution Board etc. in LV side.
c. Complete concealed conduiting and wiring for Light, Fan, Call Bell, all power Plug/Socket for Heater, Geyser, Air Conditioner etc., exhaust fan, sub-mains points etc.
d. Concealed conducting and wiring of Telephone points & TV Cable points.
e. Providing and fixing of Switch Boards, metal boxes, prewired MCB distribution boards, meter panel including all external and Internal Wiring.
f. Fixing of light fittings/fixtures/fans, bells, multi-function energy meters with RS - 485 communication port, exhaust fans in all buildings as per BOQ/drawing.
g. Providing and fixing of Distribution Board, Meter Board complete with Internal Wiring.
h. Earthing Stations and earth connections as required for the various electrical Installations and Lightening Arrestor as per standard practice.
i. Any other work required for the complete electrification of the housing complex.
j. Wirings shall be done in concealed conduits.
k. Providing and fixing external lighting /Compound Lighting / street lighting considering power saving and colony beautification.
l. Providing automatic Lighting control for the external lighting system through the timer/contactor. The Timer should have provision for multiple user defined setting in control of lighting.
m. Laying of cable for external electrification.

5. **Lighting System Description**

The scope of work comprises of design, engineering, testing, supply, installation, testing and commissioning of 415V, Main Township Distribution board / Energy meter Boards/Flat DBs etc., Power and Control cables, various lighting fixtures complete with LED lamps, supports and accessories, automatic control of Lighting system through automation, ceiling fans complete with electronic regulators, exhaust fans for toilets and pantry & accessories, lighting panels, lighting poles complete with distribution boxes, galvanized rigid steel/PVC conduits, lighting wires, G.I. Earth wire , tag block & telephone socket, bells, boxes for telephone/ television & Air conditioners points, switchboards, switches, junction boxes, pull out boxes complete with accessories as outlined in electrical drawings enclosed with tender documents for various type of quarters, parking, pump house, ~~recreation center and transit camp~~ associated with township.

External Electrification Works

The entire External Electrification work including connection to various quarters, ~~recreation centers & transit camp~~ associated with township including street lighting of township shall be in the scope of the contractor. 415V, 200A Main Township distribution board shall be fed from 415V, 630A MSB (being supplied under LT switchgear package) located in ACDB/DCDB Room of CR Building through 3 ½ x300 sq.mm XLPE insulated power cable. Supply of Main Township DB & associated 3 ½ x300 sq.mm XLPE cable along with its interconnection, installation etc. shall be as per BPS.

The entire external electrification work comprising of feeder pillars, Cables and associated glands and lugs, steel tubular poles, street lights, MS junction boxes, GI pipes for cable protection, danger plates, Hume pipes, fire extinguishers, cable route markers etc. as required shall be in the scope of the contractor. The exact location of quarters, recreation center, transit camp, streets etc. shall be intimated to successful bidder during detailed engineering. The bidder shall quote unit prices for items under external electrification work as per bill of quantity indicated in BPS.

Internal Electrification Works

The scope shall broadly consist of entire concealed conduit work with all accessories and junction boxes, Copper wiring for lights/power points /fans/telephones/ TV cables & air-conditioners, supply and fixing of metal boxes, plates, modular switches, modular sockets, call bells, buzzers, exhaust fans, ceiling fans with electronic regulator modular type, MCBs etc.
Technical Specification for Internal and External Lighting system for Township and MCCBs, light fittings, energy meters' boards & flat DBs etc. shall be as per the requirements of various quarters, recreation centers and transit camps.

In addition to above complete Earthing (through separate earth pit) and lighting protection for each type of quarters recreation center and transit camp shall be provided as per standard guidelines given in relevant Indian standards and code of practices. The complete drawing for Earthing and lightning protection shall be submitted to owner for approval. The loop Earthing inside the buildings shall be carried out with minimum 1 C x 1.5 sq.mm PVC stranded Copper wire. All materials required or Earthing and lightning protection of township buildings shall be in the scope of contractor.

6. Specifications/ General Information

The specifications generally applicable to this work shall be as per the section: civil works and following standard sections enclosed herewith. In case of any ambiguity between the standard sections and the section: Civil works, the provisions of the section: Civil Works shall prevail. Where the technical specifications are not available, the requirements of C.P.W.D. requirements/Specification shall be followed by the Contractor. The requirements of these specifications including those of C.P.W.D. requirements/specifications shall be fulfilled by the contractor within his tendered cost and without extra charges/ claims. The amount quoted shall be deemed to have taken these specifications into account irrespective of item description in BOQ. The specification, drawings & BOQ are to be followed together and RECPDCL/JKPTCL decision shall be final in case of any contradiction.

RECPDCL Specifications

1. Section: Civil Works
2. Power and control cables
3. LT Switchgear

C.P.W.D. Specification (Where RECPDCL Specification is not available)

1. Electrical Works - Part I (for internal Lighting) in Central Government buildings while complying in all respects
2. Electrical works - Part II (for external Lighting) in Central Government buildings while complying in all respects

In addition to above, the requirement of the latest Indian Electricity Rules in force for the time being shall also be complied in all respects.

7. Authorities/ Rules

The contractor, while executing the work, shall conform to the provisions of Government act relating to the work and to the Regulations and bye-laws of the local authorities and of the Company to whose system of supply the installation is proposed to be connected. The contractor shall give all notices required by the Acts, Regulations or Bye-laws. He will also undertake to provide Test Certificate, Statutory clearance etc. for the electrical installations also carried out by him. The Contractor shall also obtain all approval for the items of work done under this contract from the appropriate competent authorities. All inspection fees or submission fees paid by the Contractor will be reimbursed by the owner against valid official receipts. The contractor shall be responsible for providing type tested equipment.

The Contractor and his licensed Electrical Contractor will be responsible for any approvals/sanctions and obtaining connections for the main and individual flats from JKPTCL and any other Government Agency of the Electrical Installation work carried out by him. Test Certificates of the Elect. Installations for individual flats shall be given by the Contractor on the prescribed forms of JKPTCL authority as applicable for installation of KWH meters by them.

8. Manpower & Supervision of Work

Contractor shall provide adequate and capable manpower and supervision for electrical installation work covered under this contract. The staff provided shall be adequate to provide detailed supervision at each stage/site of the work and shall be licensed to handle respective jobs to satisfy the requirements of the electric supply and other connected authorities. The contractor shall submit a list of the staff available for electrical work along with the tender. The contractor shall employ at least one qualified Degree/ Diploma Holder Electrical Engineer having minimum five years' experience in similar works to supervise the execution of electrical work. He will be available at site of work to take instructions from the RECPDCL/ Engineer in charge of the work.

9. Description of Items

9.1 Lighting Panels

9.1.1 Constructional Features of Lighting Panels

i. The Lighting panels shall conform to IS-8623.
ii. All Outdoor Lighting Panels shall be of Stainless sheet steel of Grade 304 and shall be dust, weather and vermin proof. Panels shall be of thickness not less than 2.0 mm smoothly finished, leveled and free from flaws. Stiffeners shall be provided wherever necessary.
iii. The panels shall be of front single door hinged construction, suitable for either floor mounting on channels, sills or on walls/columns by suitable M.S. brackets. Indoor Lighting panels shall be modular flush mounted and wall embedded of slim depth.
iv. All panels shall have a dead front assembly provided with hinged door(s) and with suitable locking arrangement.
v. All Outdoor panel's removable covers and doors shall be gasketed all around with neoprene/EPDM gaskets/ puff arrangement.
vi. The outdoor panels shall be suitable for cable/conduit entry from the bottom. Suitable removable cable gland-plate shall be provided in the bottom of panels. For indoor lighting panels the provision of cable/conduit entry shall be from both top and bottom side with suitable removable gland plate. The thickness of the gland plate shall be 3 mm. Necessary number of double compression brass type cable gland shall be supplied, fitted on to these gland plates.
vii. The panels shall be so constructed as to permit free access to connection of terminals and easy replacement of parts.
viii. Each panel shall have a caution notice fixed on it.
ix. Each panel will be provided with laminated as built circuit diagram suitably pasted in the panel. The panel shall be metal enclosed, single front, indoor, floor/wall mounted, free standing type with compartmentalized construction. The panel shall be designed for a degree of protection of IP 52.
x. All cutouts & covers shall be provided with synthetic rubber gaskets.
xi. The panel shall be divided into distinct vertical sections each comprising of:
    a) A completely enclosed bus bar compartment for running horizontal and vertical bus bars.
    b) Completely enclosed switchgear compartment one for each circuit for housing switch fuse unit etc.
    c) A compartment alley for power and control cables of at least 175mm width covering entire height.
xii. The panel shall be provided with three phase horizontal and vertical bus bars & neutral bus bar of uniform aluminum sections of electrical grade E-91E as per IS:5082 - 198I throughout the length of switchgear panel and shall be adequately supported and braced. Maximum temperature rise of bus bars and bus bar connections while carrying rated current shall not exceed 35°cover an ambient of 50°C.
xiii. The minimum clearance in air between phases and between phase and earth for the entire run of bus bars, bus bar connections shall be 35 mm. Bus bar support insulators shall be made of non-hydroscopic non-combustible track resistant & high strength type DMC or SMC material. Materials such as hylam are not acceptable.
xiv. A galvanized steel earth bus shall be provided at the bottom of the panel throughout the length. The size of GI bus shall be equal to half the cross sectional area of phase bus.
xv. All fuses shall be of HRC cartridge plug in type and shall be 80 KA rms breaking capacity.

xvi. The neutral link shall be provided for each circuit.

xvii. Indicating lamps shall be of panel mounting, filament type and shall have plates marked with its function wherever necessary. The colour of lamp cover shall be RED for 'ON' and Green for 'OFF'. Indicating lamp shall be provided with series resistor.

xviii. All Outdoor Lighting Panels shall be erected such that a minimum height of 1000mm is maintained between FGL & bottom of the Lighting Panel. Size of Outdoor Lighting panels shall be such that cables are properly terminated and wires are dressed with provision of loops.

Distribution Boards:

Prewired MCB distribution boards should be as per enclosed RECPDCL/CPWD's latest technical specification. Distribution Boards shall comprise of outgoing MCBs, neutral links and a controlling TPN/SPN, switch/MCB isolator/ELCB as detailed in the schedule of quantities. The above shall be housed in a sheet metal box of sample dimension made out of 2mm thick M.S. sheet and shall have a hinged metal cover suitably painted after necessary rust treatment. All components shall be mounted on a stout framework. All the internal connections will be concealed by providing suitable bakelite back paneling as per sample approved.

Suitable arrangements shall be made to close and lock the metal box. All Distribution Boards shall be fitted with MCBs connected on the live side of the bus bar and shall be such that the circuits could be isolated easily. The capacity of the MCBs/fuses will be as detailed in the Schedule of quantities.

All distribution boards shall be painted with approved shade of paint. Each circuit shall have an independent neutral and shall be numbered and marked as required by the Engineer in charge. Sample of complete board should be got approved before fabrication. All MCB type DBs will be of the approved make as specified and approved by the RECPDCL.

The rate per item will include all the above mentioned material and labour required. Measurement will be in numbers of complete sets as described in the Schedule of quantities.

Main Bus Bars

Bus bars shall be of Copper/aluminum alloy conforming to IS: 5082 and shall have adequate cross-section to carry the rated continuous current and withstand short circuit currents. Maximum operating temperature of the bus bars shall not exceed 85 deg. C. The bus bars shall be able to withstand a fault level of 9 kA for 1 sec. for AC panels and 4 kA for 1 sec. for DC panels.

9.1.2 Auxiliary Items for Lighting Panels

MCBs

The miniature circuit breakers shall be suitable for manual closing, opening, automatic tripping under overload and short circuit. The MCBs shall also be trip free. MCB of Type C tripping characteristics as per IS 8828 will be used for Illumination purposes.
The terminals of the MCBs and the 'open/trip' and 'close' conditions shall be clearly and indelibly marked

Contactors:
Contactors shall be of the full voltage, direct-on line air break, single throw, electromagnetic type. They shall be provided with at least 2'NC' and 2'NO' auxiliary contacts 3-phase contractor shall be provided

with the three elements positive acting ambient temperature compensated time lagged, hand reset type thermal overload relay with adjustable settings to suit the rated current. Hand reset button shall be flush with the front of the cabinet and suitable for resetting with starter compartment door closed. The Contactor shall check the adequacy of the Contactors rating, wires with respect to lighting load.

Push Buttons

All push buttons shall be of push to actuate type having 2 'NO' and 2 'NC' self-reset contacts. They shall be provided with integral escutcheon plates engraved with their functions. Push buttons shall be of reputed make.

Labels

Designation labels shall be provided on the front of lighting Panels. The panel designation labels shall be of 3 mm thick plastic plate. The letter shall be black engraved on white back ground.

All incoming and outgoing circuits shall be provided with labels. Labels shall be made of non-rusting metal or 3 ply lamicoid. Labels shall have white letters on black or dark blue background.

Earthing Terminals

Outdoor Panels shall be provided with two separate and distinct earthing terminals suitable to receive the earthing conductors of size 50x6 G.S. Flat.

9.2 Lighting Accessories

Mains and Sub-mains

Mains and Sub-mains shall consist of wires, cables and M.S. conduits, bends, junction boxes, PVC/rubber bushes, checknuts etc. as specified. The sizes and capacities of conduits and wires shall be as stated in the schedule of quantities and will commence from the main switches to various distribution boards. Wires shall be drawn in the recess or surface conduits as required without being damaged. For this purpose, draw boxes shall be located at convenient places to facilitate easy drawing. Every main and sub main will run in an independent conduit with an earth wire of 4.0mm dia. G.I. wire running along the entire run of conduit. For single phase one earth wire shall run and for three phase 2 earth wires shall run. Necessary provisions of wire lengths entering and emerging from the conduit must be made for connections. Termination of the sub main at both ends shall be done with crimped cable end sockets.

Measurements will be taken of the actual conduit run containing the wires from one switchgear to another. Per meter rate shall include all materials, connections, labour etc. as specified above.

Switch and Switchboard

All Switch board/boxes and electronic fan regulators located in office/building areas shall be modular flush mounted type.

Switch boards/boxes shall have conduit knock outs on all the sides.

The exact number of Switches including regulator for fans and layout of the same in the switchboard shall be suitable as per the requirement during installation.

The maximum number of luminaries controlled by one no. 5 Amp Switch shall be 8 nos. However, each Switchboard shall have minimum 2 Nos. of 5A Switches to control the Luminaries. For DC fixtures there will be no switch and the same shall be directly controlled from DCP.

The Luminaries shall be wired in such a fashion that luminaries on each phase are evenly distributed all over the room.

5/15A, 240V AC modular flush mounted socket with switch outlet shall be provided in indoor areas as per drawing. 25A, 240V AC modular flush mounted socket with switch shall be provided at strategic locations in as per drawing.

Ceiling, Wall Mounted & Exhaust Fans and Regulators

The Contactor shall supply and install 1400 mm sweep ceiling fans complete with electronic regulator and board for mounting switch, suspension rod, canopy and accessories. The electronic regulator for Ceiling fans will be housed in common switchboard for lighting and shall be of similar make and model as that of modular switches. The wall mounted fans shall be of 400 mm sweep. Exhaust fans shall be of 300mm size.

Winding of the fans shall have Class-E insulating material. Winding shall be of copper wire.

Wall Socket

Wall socket will be of the following type: -

a) For light socket point - 5 amps capacity 5 pin type
b) b) For Power Plug Point 15/5 amps capacity 6 pin type.

The rate for the above will be included in point wiring rate and the make will be as specified.

Lighting Wires

Wiring from Lighting/Sub-Lighting Panels to junction boxes / Switchboards/ fixtures etc. is covered under Lighting Wires. The wiring used for lighting shall be standard products.

The wires shall be of 630V grade (Phase to ground), PVC insulated products.

The conductor sizes for wires used for point wiring shall be 1.5 sq.mm, 2.5 sq.mm, 4 sq.mm and 6 sq.mm stranded copper wire as required.

The wires used for connection of a lighting fixture from a nearest junction box or for loop-in loop-out connection between two fixtures shall be single core copper stranded conductor, 630V grade (Phase to ground) flexible PVC insulated cords, unsheathed, conforming to IS:694 with nominal conductor cross sectional areas of 2.5 sq. mm.
The wires shall be colour coded as follows:

Red for R - Phase
Yellow for Y - Phase

Blue for B - Phase
Black for Neutral
Green for Earth

Conduits & Accessories

The conduits shall be Rigid PVC conduits of 20/25 /32 mm diameter for Lighting, Telephone wiring & LAN Cabling and shall be ISI marked.

Flexible conduits wherever required shall be PVC type.

All conduits accessories shall be ISI marked.

All accessories required for making the conduits installation complete, including but not limited to couplers, bends, ordinary and inspection tees and elbow, reducers, enlargers, male and female bushings. G.I. wires for cable/wire pulling, terminal boxes pull outboxes, saddles, clips, spacing plates, nuts-bolts and screws, other clamping materials and all necessary supporting work shall be supplied by the contractor along with the conduits. The price of the accessories/ fittings shall be deemed to be included in the price of wiring/conduit items quoted.

Pull Out Boxes

The pull out boxes shall be concealed type for indoor lighting and suitable for mounting on column, structures etc., for outdoor lighting.

The pull out boxes shall be circular of minimum 16 SWG sheet steel and shall have cover with good quality gasket lining.
The pull out boxes shall be completed with conduit knock outs/threaded hubs and provided at approximately 3 meters intervals in a conduit run.

Junction Boxes

The Indoor junction boxes shall be provided with 4 way knockouts suitable for two numbers 10 sq. mm. wire/ Cable. These junction boxes shall be concealed type for indoor lighting.

The outdoor junction boxes shall be complete with conduit knockouts/threaded nuts and provided with terminal strips. The junction boxes shall be suitable for termination of Cable glands of required size. The junction boxes shall be provided with 4 way knockouts suitable for street lighting/switchyard lighting terminals suitable for 2 numbers 4C x 16 Sq.mm Al. cable or as per requirement. All Outdoor Junction boxes shall be of Stainless Steel of thickness 1.5mm of grade 304. Outdoor Junction Boxes shall be suitable for mounting on columns, structures etc. for Outdoor Lighting. The outdoor Junction shall have IP 55 protection.

The junction boxes shall have the following indelible markings

i. Circuit Nos. on the top.

ii. Circuit Nos. with ferrules (inside) as per drawings.
iii. DANGER sign in case of 415-volt junction box

9.3 Lighting Poles

The Contactor shall supply, store and install the following types of galvanized steel tubular lighting poles required for street lighting and decorative lighting, as per the attached drawing of poles.

i. Type L 1 Street Lighting Pole of 6 meter - for SL-L 1 type fixture

"L 1" type poles shall be used for street lighting. "D l" type (Decorative post top lantern) poles and Bollards shall be installed as finalized during detailed engineering.

Lighting poles shall be complete with fixing brackets. Cable termination box will be built inside the pole itself as per drawing enclosed.

Poles and its Cable termination box shall be hot dip galvanized and PU (Polyurethane) coated in Suzuki silver color and inside with bituminous paint.

Terminal strips provided in street - lighting poles shall be suitable for terminating up to 2 nos. 4C x 16 sq. mm aluminum cables.

Wiring from junction box at the bottom of the pole to the fixture at the top of the pole shall be done through 2.5 sq. mm Copper wire laid inside the tubular pole.

Distance of center of pole from street edge should be approximately 1000 to 1200 mm or as per site conditions.

Earthing of the poles should be connected to the switchyard main earth mat wherever it is available, else, the same should be earthed through 3M long, 20 mm dia, earth electrode

9.4 415V, 200 Amp Main Township Distribution Board and Sub-Main Distribution Board with Each type of Apartment/recreation center

200 Amp Main Township Distribution Board required for township lighting system shall conform to standard technical specification for LT switchgear, Sec- LT Switchgear annexed with bidding documents..

9.5 LED Luminaires

LED Luminaries shall be used for the lighting of all the indoor and outdoor areas. The LED luminaries shall be surface mounting type.

Suitable heat sink with proper thermal management shall be provided in the luminaries. All LED Luminaries shall be RECPDCL approved make. The making on luminaries & safety requirements of luminaries shall be as per IS standards.

Necessary Care shall be taken so that there is no water stagnation anywhere in the Luminaries. The entire housing shall be dust and water proof protection as per IS 12063.

Parameters of outdoor & indoor Lighting fixtures are detailed in Annexure-11.

9.6 Wires and cables:

The design, manufacture, testing & supply of wires for point, circuit wiring & submain wiring etc. shall be 1100 volts grade PVC insulated copper conductor cable/wire of size specified in the schedule of quantities and shall conform to IS:694. The wires shall be colour coded for RYB phases & neutral. Twin flexible cables wherever specified shall have cross sectional area of 0.001 sq. in (equivalent to 23/0076) or larger, and insulated in accordance with relevant IS specifications.

Power and Control cables required under township lighting shall conform to standard technical specification, Section-Power and Control cables.

i. Wires in a conduit shall be drawn simultaneously, no subsequent drawing is permissible.
ii. Wires shall not be pulled through more than two equivalent 90° bends in a single conduit run. Wherever required, suitable pull boxes shall be provided.
iii. Wiring shall be spliced only at switch/fan box.
iv. Wiring of same phase shall be drawn in same conduit in case of general light and power wiring. Separate conduit shall be laid for each service such as light/power/emergency light/power, telephone, T.V. No extra payment other than point rate will be made to the contractor.

9.7 Earthing:

Earthing and lightning protection system installation shall be in strict accordance with the latest editions of Indian Electricity Rules, relevant Indian Standards and Codes of practice and Regulations existing in the locality where the system is installed.

a) Code of practice for Earthing IS: 3043
b) Code of practice for the protection of Building and allied structures against lightning IS: 2309.
c) Indian Electricity Rules 1956 with latest amendments.

Lighting Fixtures & Miscellaneous Items for Township Lighting: - Please refer Annexure-I

Types of Earth Electrodes:

a) Pipe earth electrode.
b) Plate-earth electrode.
c) Strip or conductor earth electrode

9.8 Automation

The meter panels will be supplied with multi-function energy meters having RS-485 ports.

Automatic control of External Lights

The street Lights shall be provided with timers having adequate range to ensure the automatic operation of street lights. The lights shall be automatically ON and OFF at predefined time setting.

Automatic Operation of Pumps

The pumps shall be provided with the arrangement of automatic control of operation. The Pumps shall be automatically ON and OFF at pre-set time. Further, the pumps shall also be made ON by sensing the low water level in water tank.

10. Type Test Requirements:

Lighting Panels, Receptacles, and Junction Boxes etc. shall conform to following degree of protection:

- Installed outdoor: IP- 55
- Installed indoor in air conditioned area: IP-31
- Installed in covered area: IP-52
- Installed indoor in non-air conditioned area where possibility of entry of water is limited: IP-41.

11. ERECTION

11.1 General

- In accordance with the specified installation instructions as shown on manufacturer's drawings or as directed by Employer, Contractor shall unload, erect, install, test and put into commercial use all the electrical equipment included in the contract. Equipment shall be installed in a neat, workmanship manner so that it is level, Plumb Square and properly aligned and oriented. Tolerances shall be as established in manufacturers drawing or as stipulated by Purchaser.

- The work will be carried out in the best workman - like manner and any defect in the work or changes in the design etc., if pointed out, shall be carried out by the Contractor without any extra charge.
- The Electrical work will be carried out simultaneously with the building work and will be continued till it is completed satisfactorily along with the completion of essential portions of Building work.
- All apparatus, connections and cabling shall be designed so as to minimize risk of fire or any damage which will be caused in the event of fire. All Lighting accessories mentioned in Clause 9.2 shall be supplied and erected as a part of Lighting System Installation works.

During the progress of work, completed portions of the building may be occupied and put to use by the owner but Contractor will remain fully responsible, for maintenance of the Electrical installations till the entire work covered by this Contract is satisfactorily completed by him and taken over by the owner.

11.2 Conduit System

- Contractor shall supply, store and install conduits required for the lighting installation as specified. All accessories/fittings required for making the installation complete, including but not limited to pull out boxes (as specified in specification ordinary and inspection tees and elbow, check nuts, male and

female bushings (brass or galvanized steel), caps, square headed make plugs, nipples, gland sealing fittings, pull boxes, conduits terminal boxes, glands, gaskets and box covers, saddle terminal boxes, and all steel supporting work shall be supplied by the Contractor. The conduit fittings shall be of the same material as conduits. Separate Conduit should be laid for Communication purpose. The contractor shall also supply & install 20 mm PVC conduit and accessories for telephone wiring and LAN Cabling wherever feasible, telephone and LAN cabling can be laid in the same conduit.

- The conduits shall be laid before casting in the upper portion of a slab or otherwise, as may be instructed in accordance with approved drawings, so as to conceal the entire run of conduits and ceiling outlet boxes. Vertical drops shall be buried in columns or walls. Wherever necessary, chases will be cut by the contractor to sufficient depth to allow full thickness of plaster over conduits. Width of the chases will be made to accommodate the required number of conduits. The chases will be filled with cement coarse sand mortar (1 :3) and shall be properly cured by watering. If a chase is cut in an already finished surface the contractor shall fill the chase and finish it to match the existing finish within the tendered rates. When the conduit is to be embedded in a concrete member it shall adequately be tied to the reinforcement to prevent displacement during casting. The contractor shall provide cover blocks bound with reinforcement steel at suitable place as per direction of Engineer-In Charge. Conduits in chases or laid above the slab shall be held by hooks at maximum of 1.0 M centers.
- When the conduit is laid above on the slab the same shall be covered with cement concrete mixture I: 3:6 using W' thick stone aggregate and coarse sand.

- Suitable expansion joint with PUCA flexible conduit/fittings shall be provided at all the points where the conduit crosses any expansion joint in the building.

- The entire conduit system, whether embedded or exposed, shall be electrically continuous and thoroughly grounded.

- All unarmored cables/wires shall run within the conduits from lighting panels to lighting fixtures, receptacles etc.

- Size of conduit shall be suitably selected by the contactor.

- Conduit support shall be provided at an interval of 750 mm for horizontal runs and l000 mm for vertical runs.

- Conduit supports shall be clamped-on spacer plates or brackets by saddles or U-bolts. The spacer plates or brackets in tum, shall be securely fixed to the building steel by welding and to concrete or brick work by grouting or by nylon raw plugs Wooden plug inserted in the masonry or concrete for conduit support is not acceptable.

- For directly embedding in soil, the conduits shall be coated with an asphalt-base compound. Concrete pier or anchor shall be provided wherever necessary to support the conduit rigidly and to hold it in place.

- For long conduit run, pull boxes shall be provided at suitable intervals to facilitate wiring.

- Conduit shall be securely fastened to junction boxes or cabinets, each with a lock nut inside and outside the box.

- Conduits joints and connections shall be made through water-tight and rust proof by application of a thread compound which insulates the joints. White lead is suitable for application on embedded conduit and red lead for exposed conduit.

- Conduits and fittings shall be properly protected during construction period against mechanical injury. Conduit ends shall be plugged or capped to prevent entry of foreign material.

- Where conduit terminate at a drilled hole entry connection shall be made by means of coupler & checknuts.
- All wires in a conduit shall be drawn simultaneously.

- Conduits shall run along wall, floor, ceiling, on steel structures, embedded in wall, floor or ceiling, in accordance with relevant layout drawings. The contractor shall closely co-ordinate his work with the civil contractor. Exposed conduits shall be run in straight lines parallel to a building columns, beams and walls. Unnecessary bends and crossings shall be avoided to present a neat appearance.

- Spacing of embedded conduits shall be such as to permit flow of concrete between them and in no case shall be less than 40mm.

- Conduits shall be kept, wherever possible, at least 300mm away from hot pipes, heating devices etc.

11.2A Cross Sections

The conduits shall be of ample sectional area to facilitate the drawing of cable. In no case shall be the total cross section of cables measured overall, be more than half the area of the conduit. For the wires to be drawn in conduit the contractor will follow RECPDCL/ latest C.P.W.D. specifications for internal electrical installations. For the sub-mains the size of the conduits will be as specified in the schedule of quantities.

The size of the conduit shall be governed by the number & size of wires to be drawn through it & shall be as per following table.

Table except for variations specified in Spec's/ Dwg. / BOQ for Max. No. of wires to be drawn in one conduit.

Size of Wires	20mm	25mm	32mm
1.5 sq.mm.	4	8	12
2.5 sq.mm.	3	6	10
4.0 sq.mm.	2	5	08
6.0 sq.mm.	-	4	07

10.0 sq.mm.	-	3	05

The above table shows the maximum capacity of conduits for simultaneous drawing of wires.

Ceiling outlet boxes:

C.I. outlet boxes with 12mm projected, threaded collars to receive conduits having 7.0cm depth shall be so installed as to maintain continuity throughout. These shall, be so protected at the time of laying that no mortar finds its way inside during concrete filling or Plastering. For each fluorescent light fitting two outlet boxes shall be provided one foot off center for a four feet 40W fitting and 6" off center for two feet 20W fitting.

Draw Boxes:

M.S. Draw boxes of ample dimensions shall be provided at convenient points on walls/ceiling to facilitate pulling of long runs of cables.

They will be completely concealed and covered with While Bakelite sheet 3mm covers flush with plaster work. These boxes will be as few as possible. All the M.S. boxes used for housing switches, plugs, drawings of wires etc. shall have five sides.

The entire conduit system including outlets and boxes shall be thoroughly cleared after completion of erection and before drawing of cables.

11.3 Wiring

- The scope also includes wiring from nearest Lighting/Sub-Lighting Panel to the Controlling Switch/MCB/Lighting Fixtures.
- Wiring shall be generally carried out by PVC insulated wires in conduits. All wires in a conduit shall be drawn simultaneously. No subsequent drawing of wires is permissible.
- Wires shall not be pulled through more than two equivalent 90 deg. bends in a single conduit run. Where required, suitable junction boxes shall be used.
- Wiring shall be spliced only at junction boxes.
- For lighting fixtures, connection shall be teed off through suitable round conduit or junction box, so that the connection can be attended without taking down the fixture.
- Maximum two wires can be terminated to each way of terminal connections.
- AC and DC wiring should run through the separate conduits. Similarly, Communication & LAN cables shall run in separate conduit than that of AC & DC Conduits.

11.3A Point Wiring

The point wiring shall include all work necessary for complete wiring of a switch circuit/point of any length from the tapping point on the distribution board via switch up to respective point with specified size of Copper wires, deemed to be included in the point wiring.

- Switch (Modular type)
- Ceiling rose or connector as required.
- Fan box with fan hook and 3mm thick white bakelite cover for fan box, including supply and fixing of Electronic regulator in case of fan points.

- Conduit with all accessories and junction boxes.
- Switchboard/box of M.S. sheet with 3.0mm thick white bakelite sheet.
- Earth wire from S pin socket outlet/fan regulator to the common earth including connections.
- All M.S. sheet/boxes of l .6mm thick to be recessed for mounting switches, fan regulator and socket outlets but excluding those under main & distribution switch gear.
- Circuit wiring from DB to switch board/box including G.I. earth wire.
- Suitable Terminal for lopping of wires block.
- SA Socket outlet & SA Modular type switch in case of SA-S pin plug points.
- IS/SA socket outlet and ISA Modular type switch in case of ISA-6 pin power plug points.
- Bell push with switch board/box.
- All fixing accessories such as screws, rail plugs, clamps and other hardware as required. Wooden plugs are not accepted for any fixing.

11.3B Position of Light/Fan Switchboards, Dbs., Meterboards Etc.

Mounting Height of the Switchboard/boxes, DBs, Light points, Light & Power plug points from the finished floor level shall be as given below.

Switchboard with Light/Fan Switches	+ 1200mm	from FFL
Distribution Board	+ 1500mm	-do-
Meter Board (wall mounted)	+ 1200mm	-do-
SA Socket outlets (Separate Pts)	+ 200mm	-do-
5 / 15 A Power socket outlet	+ 200mm	-do-
Power Socket outlet for Geyser in Bathroom	+ 1500mm	-do-
T/L Bracket Light on wall	+2100mm	-do-

11.3C Switch Boxes

M.S. Boxes of required sizes shall be provided to house speed regulators, switches, and sockets. These will be so designed that accessories could be flush mounted on the cover plate or mounting sheet leaving ample space at the back and on the sides for accommodating wires and checkout entries. These shall be completely concealed leaving edges flush with wall surfaces. Cover plates shall be fixed to these by means of brass machines crews. No timber shall be used for any support. The boxes shall be painted with 2 coats of Red Oxide before and one coat after erection. The switchboxes shall be fabricated out of l .6mm thick M.S. sheet and shall have conduit knockouts on two sides The switch box shall be provided with 3.0mm thick white Bakelite sheet cover.

11.3D Fan Box:

Fan boxes with fan hooks shall be made out of sheet steel not less than 2.0mm thick and hexagonal in shape with one 'U' shape 12mm dia. rod inside held tightly with the top reinforcement of the roof. 3.0mm thick-white Bakelite sheet cover as approved by the Engineer-in-charge shall be provided. Over the fan boxes, the boxes shall be as per drawing and specifications.

11.4 Lighting Panels

- The lighting panels shall be erected at the locations to be finalized during detailed engineering.
- Suitable foundations/supporting structures for all outdoor type lighting panels shall be provided by the Contractor.
- The Sub lighting Panel shall be provided where independent switch of fixtures is required.

11.5 General Requirements for Cabling Work

- Each cable run shall be tagged with number that appears in the cable schedules. Cables shall be tagged at their entrance and/or exit from any piece of equipment, junction or pull box, floor opening etc.
- The tag shall be made up of aluminum with the number punched on it and securely attached to the cable by not less than two turns of G.I. wire. Cable tags shall be rectangular in shape for power cables and circular shape for control cables.
- Location of cables laid directly under ground shall be indicated clearly by cable marker made of galvanized iron plate embedded in concrete block.
- The location of underground cable joints if any shall be clearly indicated with cable marker with an additional inscription "cable joint".
- The marker, which is a concrete block, shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change of direction. It shall also be located on both sides of the road or drain crossing.
- Road crossing of cables through suitable size of GI pipe/Hume pipe as required at site.
- Cable termination arrangement for power cables shall be suitable for stranded Aluminium conductors, armoured; PVC insulated and sheathed 1100 V grade cables.
- The gland plates shall be shall be removable type and shall cover the entire cable alley. Bidder shall ensure that sufficient space is provided for all cable glands.

11.6 Earthing

Pipe Earth Electrode:

G.I. pipe shall be of medium class, 40mm dia. and 4.5m length. Galvanizing of the pipe shall conform to relevant Indian Standards. G.I. pipe electrode shall be cut tapered at the bottom and provided with holes of 12mm dia. drilled not less than 7.5cm from each other up to 2.5 m of length from bottom. The electrode shall be buried in the ground vertically with its top not less than 20cm below ground level. Watering funnel attachment shall be housed in a masonary enclosure of not than 300mm x 300mm x 300mm - complete with C.1. /M.S. Frame with cover having locking arrangement to be embedded in the masonry enclosure.

Plate Earth Electrode:

The electrode shall be buried in the ground with its faces vertical and top not less than 3m below ground level. The connection between the main bar and the plate shall be made by means of2 Nos. 3/8" dia. G.I. nuts and bolts fixed at 150mm centers. The pit shall be filled with coke/charcoal and salt in layers around the electrode as directed.

Method of Installing Watering Arrangement:

a) In the case of plate earth electrode, a watering pipe of 20mm dia of medium class G.I. pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided on the top of this pipe for watering the earth. In the case of pipe electrode, a 40mm x 20mm reducer shall be used for fixing the funnel. The watering funnel attachment shall be housed in masonry enclosure of not less than 300x300x300mm.

b) A cast iron/M.S. frame with cover having locking arrangement shall be suitably embedded in the masonry enclosure.

Location of Earth Electrode:

i. Normally an earth electrode shall not be situated less than l .5m from any building. Care shall be taken that the excavations for electrode may not affect the column footings or foundations of the building; in such cases electrode may be further away from the building.
ii. The location of the earth electrode will be such where the soil has reasonable change of remaining moist, as far as possible. Entrances, pavements and roadways are definitely avoided for locating the earth electrode.

Method of Connecting Earthing Lead to Earth Electrode

i. In the case of plate earth electrode, the Earthing lead shall be securely bolted to the plate with the two bolts, nuts, checknuts and washers. In the case of pipe earth electrode, it shall be connected by means of a through bolt and nut and washers and cable socket.

ii. All materials used for connecting the earth lead with electrode shall be G.I. in case of G.I. pipe and G.I. plate earth electrode and of tinned brass in case of Copper plate electrode.

iii. Loop Earthing shall be provided for all mounting on main board and other metal clads witches and distribution fuse boards with not less than 14 SWG G.I. or 4 sq.mm. Aluminium wire.

iv. The Earthing lead shall be securely connected at the other end to main board.

Protection of Earthing Lead

The Earthing lead from electrode onwards shall be suitably protected from mechanical injury by a 15mm dia. G.I. pipe in case of wire and by 40mm dia. medium class G.I. pipe in case of strip. Portion of this protection pipe within ground shall be buried at least 30cm deep (to be increased to 60 cm in case of road crossing or pavements). The portion within the building shall be recessed in walls and floors to adequate depth.

11.7 Lightning Conductor

Installation of Lightening conductor shall be done in accordance with I.S.2309-1969.

The materials of Lightening conductors, down conductors, Earth terminations etc. of the protective system shall reliably resistant to corrosion or be adequately protected against corrosion. with hot

dipped galvanizing steel. The entire lightening protection system shall be mechanically strong to withstand the mechanical forces produced in case of a lightening stroke. The system shall be so installed that it does not spoil the Architectural or Aesthetic beauty of the building and painted to matching color of the building.

The vertical Air Termination shall project at least 30cms above the highest point of project, salient point or network on which it is fixed. All metallic finials chimneys ducts, vent pipes, railings, gutters etc. on or above the main surface of the roof of the structure shall be bonded to and shall form part of the Air termination network.

All air terminals shall be effectively secured against overturning either by attachment to the object to be protected by means of substantial braces and fixing which shall be rigidly and permanently attached to the building. The method and nature of fixing shall be simple, solid, and permanent, due attention being given to climatic conditions and possible corrosion.

The lightening protective system shall have as few joints as possible. Wherever joints in the down conductors above ground level are necessary they shall be mechanically and electrically effective. The joints shall be revetted, sweated or welded.

Conductor shall be securely attached to the building or other object by fasteners which shall be substantial in construction not subject to breakage and shall be galvanized steel or other suitable materials with suitable precautions to avoid corrosion. The lightning conductors shall be secured at not more than l .20m apart for horizontal run and 1 m for vertical run.

Each down conductor shall have an independent earth termination.

Earth electrode shall be constructed and installed as laid down m the Earthing specification.

11.8 Painting of All Steel Work

The steel used for fabrication of electrical equipment should be stove enameled/treated as per IS:6005. The process shall be as follows:

a) Degreasing: All the steel components, to be painted should be effectively cleaned by alkaline degree.
b) Pickling: Oxide scale rust formation are to be removed in a hot bath of sulphuric acid. Pitting of the surface is to be prevented by the use of pickling.
c) Cold Rinsing: The parts are then washed with cold water to remove all traces of acidic solution.
d) Phosphating: In order to attain durable paint coating the metal surface is to be given phosphating treatment by development and phosphate layer of class 'C' on the surface. Preferably, hot granodine solution is to be used in the phosphating plant.
e) Passivating: This process is to be carried out by using deodilate solution.
f) Drying: The treat parts should then be dried in a hot chamber in dust free atmosphere to ensure that they are absolutely clear and dry before the paint is applied.
g) Primer Coating: The treated and dried parts are to be sprayed with high corrosion resistance primer.

h) Stove Drying: The primer coating is to be baked in an electrical heated, circulated area type storing oven.
i) Finishing Coat: The finishing painting coat is to be applied by spraying two coats each of 25-micron thickness synthetic enamel of shade as specified elsewhere.

12.0 Completion tests:

On completion of the installations the following tests shall be carried out:

1. Insulation resistance test.
2. Polarity test of switch.
3. Earth continuity test.

12.1 Insulation Resistance Test

The insulation resistance will be measured by applying between earth and the whole system of conductors or any section thereof with all fuses in place and all switch closed and except in earthed concentric wiring all lamps in position or both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it need not exceed 500 volts for medium voltage circuit. Where the supply is derived from the three wire D.C. or a poly phase A.C. system, the neutral pole of which is connected to earth either direct or through added resistance, the working pressure shall be deemed to be that which is maintained between the phase conductor and the neutral.

The insulation resistance shall also be measured between all conductors connected to one pole or phase conductor of the supply and all connectors connected to the neutral or to the other pole or phase conductors of the supply with all lamps in position and switches in 'OFF' position and its value shall be, not less than the specified in sub clause below.

The insulation resistance in mega ohms measured as above shall not be less than 50 Mega ohms by the number of outlets of when PVC insulated cables are used for wiring 12.5 Mega ohms divided by number of outlets. Where a whole installation is being tested, a lower value than that given by the formula, subject to a minimum of I Mega ohm, is acceptable.

A Preliminary and similar test may be made before lamps etc. are installed and in this event the insulation resistance to earth should not be less than 100 Mega ohm divided by the number of outlets or when PVC insulated cables are used for wiring 25 Mega ohms divided by the number of outlets.

The terms "Outlet includes every point along with every switch except that a switch combined with a socket outlet, appliance or light fitting is regarded as one outlet, Control rheostat, heating and power appliances and electric signs may, if required be disconnected from the circuit during the test, but in

that event the insulation resistance between the case of framework, and all live parts of each rheostat, appliance and sign, shall be not less than half a mega ohm.

12.2 Polarity Test of Switch:

a) In a two wire installation a test shall be made to verify that all switches in every circuit have been fitted in the same conductor throughout and such conductor shall be labelled or marked for connection to the phase conductor or to the non-earthed conductor of the supply.
b) In a three wire or four wire installation, a test shall be made to verify that every non linked single pole switch is fitted in a conductor which is labelled or marked for connection to one of the phase conductor of the supply.
c) The installation shall be connected to the supply for testing. The terminals of all switches shall be tested by a test lamp, one lead of which is connected to earth. Glowing of test lamp to its full brilliance when the switch is in 'ON' position irrespective of appliance in position or not shall indicate that the switch is connected to the right polarity.

12.3 Testing of Earth Continuity Path:

The earth continuity conductor including metal conduits and metallic envelope of cable in all cases shall be tested for electric continuity and the electrical resistance of the same along with the Earthing load but excluding any added resistance of the earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the complete installation shall not exceed one ohm.

The contractor shall notify in writing to the Architects/Engineer-in-charge about the completion of the work within 7 days from the date of this notification. The Architects/Engineers-in-charge shall send their representative to remain present at the time of carrying out of the tests by the Contractor. The contractor will fix up this date in consultation with the RECPDCL for such tests.

Should the above tests not comply with limits and requirements as above the conductor shall rectify the faults until the required results are obtained.

The contractor shall be responsible for providing the necessary instruments and subsidiary earths for carrying out the tests. The above tests will be carried out by the Contractor without any extra charge.

13.0 General Requirements:

13. l The Bidders are advised to visit Sub-stations site and acquaint themselves with the topography, infrastructure, etc.

13.2 The bidder shall be responsible for safety of human and equipment during the working. It will be the responsibility of the Contractor to co-ordinate and obtain Electrical Inspector's clearance before commissioning. Any additional items, modification due to observation of such statutory authorities shall be Provided by the Contractor at no extra cost to the Owner.

13.3 The tentative total requirements of various items given in schedule of quantities are for bidding purposes only. The quantities may vary at the time of actual execution of work. Owner reserves the right to vary the quantities as may be necessary during the execution of contract.

13 .4 Materials and components not specifically stated in these specification but are necessary for operation of the system or complete the scope as per BOQ, deemed to have been included in the scope of work and cost of these shall be included in unit rates quoted by the contractor

13.5 The contractor shall furnish all relevant drawings, data catalogues, test reports, instructions manuals of the equipment supplied by him as per the requirements of the contract.

13.6 Only RECPDCL approved makes of the material shall be used for the Electrical Installation work. Samples and fabrication drawings will be submitted by the contractor according to the schedule/specifications. Any deviation from the schedule/specifications will have the written consent of the owner. The items for which make is not specified in the specifications/schedule, the contractor shall submit the samples of the material along with type test reports (if applicable) for approval of the owner as per applicable standards

13.7 Circuit wiring from DB to first switch board/ boxes with 2x2.5 sq.mm. insulated copper conductor wires shall not be paid separately within flats. The rates for the wiring of points shall be inclusive of the circuit wiring.

13.8 In case of group controlled light points the first point shall be wired from DB or switchboard & subsequent points shall be looped from the first point but for measurement purposes the number of points shall be counted.

13.9 Any change in layout of electrical points at any stage during execution of the contract shall have to be carried out by the contractor irrespective of change in location / length of point / ckt. without any cost adjustments/ commercial implication.

13 .10 The recommended positions of the lighting points, control switches, distribution boards and switchgears etc., ~~as shown on the layout drawings will be generally adhered to~~ shall be finalized by Contractor in consultation/approval of RECPDCL

13.11 The vendor shall submit the detailed drawings and documents for approval to RECPDCL engineering, indicating the SLD and Layout, wiring diagram, control and automation drawing, catalogues of the electrical fittings/appliances/components etc., any other drawing as required by employer during execution, and the work shall be carried out accordingly.

13.12 Should there be any discrepancy or incomplete description, ambiguity or omission in the drawings and other documents; whether original or supplementary, forming the contract, completion or maintenance of the installation, the contractor shall immediately on discovering the same draw attention of the RECPDCL.

13 .13 Prior to the installation of lighting, fan and plug points and the distribution boards, switches etc., final positions shall be ascertained by the contractor with the RECPDCL.

13 .14 The dimensions and other details of the electrical drawings shall be compared with the civil drawings at site before executions of the work.

13 .15 Any other items not specifically mentioned in the specification but which are required for erection, testing and commissioning and satisfactory operation of the substation are deemed to be included in the scope of the specification unless specifically executed.

13 .16 Owner has standardized its technical specification for various equipment and works for different voltage levels. Items which are not applicable for the scope of this package as per schedule of quantities described in BPS (Vol-III), the technical specification for the items should not be referred to.

13.17 For execution of the work, the checklist points for Internal and External electrification has been enclosed at Annexure-IV and V respectively for reference purpose. However, the inspection points shall not be limited to the checklist items/Points only. The work at site shall be executed in consultation with site In charge and any other point, in addition to the checklist, shall be inspected /measured as required by RECPDCL.

TOWNSHIP ILLUMINATION

Annexure I

Sr. No.	Locations	Type & No of Lighting Fixture	Anti-Glare Film Requirement	Type of Fans
01.	Township Quarters			
(i)	Bed Room	SL-I : 1 Nos. and SC: 2 Nos.	Yes	Ceiling Fan
(ii)	Drawing Room	SSQ-I: 2Nos. and SC 2 Nos.	Yes	Ceiling Fan
(iii)	Dining Room	SSQ-I: 2 Nos.	Yes	Ceiling Fan
(iv)	Kitchen	SL-I: 1 Nos. and SC: I Nos.	Yes	Exhaust Fan
(v)	Lobby	SSQ-I and SC 2 Nos.	Yes	---
(vi)	Toilet	SC-I: 1 Nos.	Yes	Exhaust Fan
(vii)	Servant room	SC-I: 1 Nos.	Yes	Ceiling Fan
(viii)	Car Parking	BL-I: 1 Nos.	No	----
(ix)	Stair	SC-I: 4 Nos.	No	-----
(x)	Terrace/Balcony	BL-I: 1 Nos.	No	----

Annexure II

Details of Lighting Fixture

(a) Indoor Application

Sr. No	Technical Specification	SL-1(Surface Mounted Linear LED Tube with Box)	RL-1 (Recessed Mounted 4X1 Feet LED Panel)	SC-1 (Recessed Mounted Circular LED Down light Luminair	Type RC-1 (Recessed Mounted Circular LED Down light	Type SSQ-1 (Surface mounted 2x2 LED Luminaire)	Type RSQ-1 (Recessed mounted 2x2 LED Luminaire)	Type IIIB (LED Indoor High Bay)

				e)	Luminaire)			
1	System Wattage	≤ 2 X 20 W	≤ 40 W	≤ 15 W	≤ 15 W	≤ 40 W	≤ 40 W	≤ 150 W
2	System Lumen Output	≥ 3600	≥ 3600	≥ 1200	≥ 1200	≥ 3400	≥ 3600	≥ 14000
3	System Efficiency (Lumens/ watt)	≥ 100	≥ 100	≥ 80	≥ 80	≥ 85	≥ 85	≥ 100
4	Housing	CRCA Housing	CRCA Housing	Pressure Die Cast Housing	Pressure Die Cast Housing	CRCA Housing	CRCA Housing	Pressure Die Cast Aluminum Housing
5	Ingress Protection	IP 20	IP 20	IP 20	IP 20	IP 20	IP 20	IP 65
6	Surge Protector	2 kV	2 kV	2 kV	2 kV	2 kV	2 kV	4 kV(Internal) & 10kV (External)
7	Mounting	Surface Mounted	False Ceiling	Surface Mounted	False Ceiling	Surface Mounted	False Ceiling	Hanging type under shed
8	THD	< 10 %	< 10 %	< 10 %	< 10 %	< 10 %	< 10 %	< 10 %
9	CRI	>80	>80	>80	>80	>80	>80	>70
10	CCT	5700k±300k	5700k±300k	5700k±300k	5700k±300k	5700k±300k	5700k±300k	5700k±300k
11	Power Factor	>0.95	>0.95	>0.95	>0.95	>0.95	>0.95	>0.95
12	IK Protection	NA	NA	NA	NA	NA	NA	IK-05
13	Operating Humidity	90% RH	90% RH	90% RH	90% RH	90% RH	90% RH	90% RH
14	Burning Hours	50000	50000	50000	50000	50000	50000	50000
15	Operating Temperature	-5 deg C to 45 deg C						
16	Lumen Maintenance	70% at the End of Burning Hours						

(b) Outdoor Application

Sr. No.	Technical Specification	BL-1(Surface Mounted Bulk Head)	Type SL-L1 (LED street light Luminaire)	Type SL-D1 (Pole mounted LED Post Top Luminaire)	Type FL-1 (LED Flood light Luminaire)	Type FL-2 (LED Flood light Luminaire)
1	System Wattage	≤ 10 W	≤ 45 W	≤ 30 W	≤ 150 W	≤ 250 W
2	System	≥ 800	≥4000	≥ 2600	≥ 14000	≥ 23000

	Lumen Output					
3	System Efficiency (Lumens/watt)	≥ 80	≥ 100	≥ 90	≥ 100	≥ 100
4	Housing	Pressure Die Cast Housing and with polycarbonate diffuser	Pressure Die Cast	Die Cast Aluminum	Pressure Die Cast Housing	Pressure Die Cast Housing
5	Ingress Protection	IP65	IP 65	IP 65	IP 65	IP 65
6	Surge Protector (Internal)	3 kV	3 kV	3 kV	3 kV	3 kV
7	Surge Protector (External)	10 kV	10 kV	10 kV	10 kV	10 kV
8	Mounting	Wall Mounting	Pole mounting for 40mm max O.D	Suitable for 60 mm max O.D	On Lattice structure	On Lattice structure
9	THD	< 20 %	< 10 %	< 10 %	< 10 %	< 10 %
10	CRI	>70	>70	>70	>70	>70
11	CCT	5700k±300k	5700k±300k	5700k±300k	5700k±300k	5700k±300k
12	Power Factor	>0.95	>0.95	>0.95	>0.95	>0.95
13	IK Protection	IK-09	IK-05	IK-05	IK-05	IK-05
14	Operating Humidity	90% RH	90% RH	90% RH	90% RH	90% RH
15	Burning Hours	50000	50000	50000	50000	50000
16	Operating Temperature	-5 deg C to 45 deg C				
17	Lumen Maintenance	70% at the End of Burning Hours				

Annexure-III

CODE AND STANDARDS

Distribution Boards/ Meter Boards & components shall conform to the requirements of the latest revision including amendments of the following codes and standards.

IS: 8623 Specification for factory built assemblies of switchgear and control gear for voltages up to and including 1000V AC/1200V DC.

IS: 4237 General requirements for switchgear and control gear for voltages not exceeding 1000V.

IS: 2147 Degree of protection provided by enclosures for low voltage switchgear and control gear.

IS: 10118 Switchgear & Control gear selection/ Installation maintenance.

IS: 9224 HRC cartridge fuses.

IS: 4064 Air break switches and fuse combination units for voltages not exceeding 1000V AC or 1200V DC.

IS: 6005 Code of Practice for Phosphating of Iron & Steel

Annexure IV

Checklist Points and procedures for checking (Internal Electrification)

Sl. No.	Components/Operations & Description of test	Sampling Plan	Ref. Document & Acceptance norms	Testing Agency	Type of Check	Remarks
1	**GENERAL**					
I	DOCUMENTATION					
I	Check availability of approved construction drawing(s)	100%	Approved drg of RECPDCL	Jointly with RECPDCL	Review	
Ii	Approval of MAKE, for all the items to be supplied	100%	As approved by RECPDCL	-do-	Review	
iii	Source of purchase (Authorized Dealership Certificate etc.) of materials	100%	-do-	-do-	Review	
2	**STORAGE**					
i	To be stored in a dry place and not in direct contact with water/soil	100%	-do-	-do-	Visual	
ii	Primary packing should be retained till erection/installation	100%	-do-	-do-	Visual	
II	**ITEMS**					
I	**Lamps, Fitting & Ceiling Fan**					
A	**Receipt of Materials**					
I	Any Physical damage	100%	As per RECPDCL Specifications/BOQ	-do-	Visual	
B	**ERECTION**					
i	check for mounting arrangement / bracket	100%	-do-	-do-	Visual	
ii	Check for physical alingment	100%	--do--	--do--	Visual	
iii	Check for earth continuity	100%	--do--	--do--	Meggering	
2	**Lighting Pannels**					
A	**Receipt of Material**					
i	Any physical damage	100%	--do--	--do--	Visual	
ii	Painting & Physical diemensions	100%	--do--	--do--	Visual	

B	**Erection**					
i	Proper placement, alignment & component tightening	100%	As per RECPDCL Specifications/BOQ	--do--	Visual	
C	**Pre-Commissioning**					
i	Check earthing	100%	As per RECPDCL Specification	--do--	By meggering	
Ii	Check Incoming/ Outgoing with Ckt. Diagrams	100%	--do--	--do--	Visual	
iii	Check component working	100%	--do--	--do--	physical	
D	Commissioning					
	Energise lighting pannels check voltage, current	100%	As per RECPDCL Specifications/BOQ	--do--	By measuring instrument	
3	**Conduit Wiring**					
A	**Receipt of Materials**					
i	Check Conduit Diemensions	100%	As per RECPDCL Specifications/BOQ	Jointely with RECPDCL representative	By Micrometer /Callipers	
ii	Check Conduit surface finish	Random	--do--	--do--	Visual	
B	Erection					
I	Ensure that small pieces of wire are not joined to run through the conduit	100%	As per RECPDCL Specifications	--do--	Visual	
ii	Ensure that conduit are plugged to prevent entry of any foreign materials	100%	--do--	--do--	Visual	
iii	Ensure for electrical continuity of GI conduits & ensure that they are permanently Earthed	100%	--do--	--do--	Visual	
iv	Ensure that all bends arc smooth & undamaged	100%	--do--	--do--	Visual	
4	**Wires & Cables**					
A	**Receipt**					
i	Check					
a	Size of the Cables/Wires as written on the surface insulation	100%	As per RECPDCL Specs/BOQ	--do--	Visual	
b	Any damage during transit	100%	--do--	--do--	Visual	
c	Check for end seals	100%	--do--	--do--	Visual	
d	Check continuity	100%	--do--	--do--	By mongering/ continuity tester	
e	Review manufacturers test certificate	100%	--do--	--do--	Visual	
f	Check IR values & Continuity	100%	--do--	--do--	By meggering	
B	**Erection & Termination**					

i	Ensure Correct color coding and correct connection for each circuit	100%	As per RECPDCL Specs/BOQ	--do--	Visual	
ii	'Ensure proper Lugging & Glanding. Wherever applicable	100%	--do--	--do--	Visual	
iii	Check IR values & Continuitv	100%	--do--	--do--	By meggering	
5	**RECEPTACLES**					
A	**RECEIPT**					
I	Any damage during Transit	100%	Asper RECPDCL Specs.	--do--	Visual	
II	Whether all fasteners/Washers/Neoprene Etc are included	random	--do--	--do--	Visual	
B	**ERECTION**					
I	check that Receptacle is securely fixed	100%	Asper RECPDCL Specs.	Jointly with RECPDCL	Visual	
II	Check the alignment of Receptacles	100%	--do--	--do--	Visual	
III	Ensure that Earth line is connected	100%	--do--	--do--	Visual	
IV	Check that the connection/ Looping to the panel Sub-circuit is in line with the approved drawing	100%	--do--	--do--	Visual	
6	**Main township Distribution BOX**					
A	**RECEIPT**					
I	Check Dimensions	100%		--do--	Visual	
B	**PRE-ERECTION**			--do--		
I	Check switch operation	100%	--do--	--do--	Physical	
Ii	Check Mechanical interlock	100%	--do--	--do--	Physical	
iii	Check Fuse unit	100%	--do--	--do--	Visual	
C	**ERECTION**			--do--		
I	Check location & mounting as per Approved. Drg.	100%	--do--	--do--	Visual	
II	Check lncoming/ Outgoing connections	100%	--do--	--do--	Visual	
III	Check earthing & earthing connection	100%	--do--	--do--	Visual	
D	**PRE -COMMISSIONING**					
I	Check component tightening	100%	--do--	--do--	Visual	
Ii	Check earthing connection	100%	--do--	--do--	Visual	
iii	Check earth continuity from MDB earth point & to each switch board	100%	--do--	--do--	By Meggering	
7	**SUR-DISTRIBUTIONROARD**					
A	**RECEIPT**					

i	Check for any damage during transit	100%	As per RECPDCL Specs/BOQ	--do--	Visual	
B	**ERECTION**					
i	Check cable identification tags	100%	As per RECPDCL Specs/BOQ	--do--	Visual	
ii	Check fur cable glands, lugs & terminations	100%	--do--	--do--	Visual	
iii	Check earthing	100%	--do--	--do--	Visual	
iv	Check final IR value	100%	--do--	--do--	By meggering	
v	Check position of cable markers	100%	--do--	--do--	Visual	
11	**EARTHING**					
A	**RECEIPT**					
i	Cable size & gauge	100%	--do--	--do--	Visual	
B	**ERECTION**					
I	Check tightening Etc. at technical points with proper washers	100%	--do--	--do--	Visual	
Ii	Check cable identification tags	100%	--do--	--do--	Visual	
Iii	Check for proper lug crimping	100%	--do--	--do--	Visual	
Iv	Check continuous running of E/W with wiring	100%	--do--	--do--	Visual	
V	Check depth of pit, length of electrode & items to be poured into the pits	100%	--do--	--do--	Visual	
vi	Check earth electrode installation	100%	--do--	--do--	Visual	
C	**PRE -COMMISSIONING**					
I	Earthing continuity Check	100%	--do--	--do--	By Multimeter	
ii	Check earth resistance value	100%	--do--	--do--	By meggering	
12	**AUTOMATION SYSTEM**					
A	**RECEIPT**					
i	Check for supply of complete items as per Technical specification, Approved drawing, BOQ					
ii	Check for damage during transit					
B	**ERECTION**					
i	Check location & mounting as per Approved Dwg.					
C	**COMMISSIONING**					
i	Check whether all desired data as per TS/Approved					

	drawing /BOQ are available in SCADA					
8	**TESTING & COMMISSIONING**					
	TESTING & COMMISSIONING shall be done as per the applicable and relevant standards. Codes of practice of Indian Electricity Rules. The following test MUST be done for the installations					
I	insulation resistance test	100%	-	Jointly with RECPDCL	By meggering	
II	Earth continuity test	100%	-	-do-	By meggering	
III	Polarity test on the single pole switch/MCB	60%	-	-do-	By test lamp	
IV	Check that Phase wire is connected to switch	Random	-	--do-		
V	**For Lighting circuit**					
a	All switches in ON position, along with the light fitting in circuit, both poles connected together and the resistance to earth measured	100%	-	-do-	By meggering	
b	Check tripping of MCBs, MCCBs/ELCBs	100%	-	-do-	By stimulating fault	
c	Resistance between the poles & the clamps, with Light fitting removed & switch in ON position	40%	-	-do-	By meggering	
d	Resistance as above (C), but with the switch in OFF position & light fitting included	40%	-	-do-	By meggering	

1. All the Tests/Cheeks mentioned here are Mandatory. The Test which are not covered here, but felt essential by the RECPDCL site-in-charge for successful commissioning, shall be carried out at site.
2. This is a general checklist for reference purpose. However, it is to be ensured that the work has been executed in line with Technical specification/Approved drawing.

Sl. No.	Components/Operations & Description of test	Sampling Plan	Ref. Document & Acceptance norms	Testing Agency	Type of Check	Remarks
1	**DOCUMENTATION**					
I	Check availability of approved construction drawing	100%	Approved drg of RECPDCL	Jointly with RECPDCL	Review	
Ii	Approval of MAKE, for all the items to be supplied	100%	As per RECPDCL Specifications	-do-	Review	
Iii	Source of purchase (Original Bill) of materials	100%	-do-	-do-	Review	
Iv	Copy of Manufacturer's test certificate	100%	-do-	-do-	Review	
v	Packing list &. MJCC (for all the items, wherever the items are cleared after inspection)	100%	-do-	-do-	Review	
2	**STORAGE**					
	To be stored in a dry place and not in direct contact with water/soil	100%	-do-	-do-	Visual	
	Primary packing should be retained till erection/installation	100%	-do-	-do-	Visual	
3	**RECEIPT**					
A	LIGHTING POLES					
I	Type of pole	100%	As per RECPDCL Specs/BOQ	-do-	Visual	
Ii	Dimension of pole: Outer dia of Top, Middle and bottom section. Length of Pole & Thickness of pipe at the Top and Bottom	Randomly for 10% of total qty	-do-	-do-	By measurement	
Iii	Dimension of Base plate	-do-	-do-	-do-	By measurement	
Iv	Painting of poles	100%	-do-	-do-	Visual	
V	Straightness of Pole	100%	-do-	-do-	Visual	
vi	Provision of earthing bolt	100%	-do-	-do-	Visual	
C	CABLE(S)					
I	Type of cable	100%	-do-	-do-	Visual	
Ii	Dimensions	100%	-do-	-do-	By measurement	
Iii	Continuity Check	100%	-do-	-do-	By meggering	
Iv	Intactness of end sealing	100%	-do-	-do-	Visual	
V	Check. IR before installation	100%	-do-	-do-	By meggering	

vi	Any Physical damage	100%	-do-	-do-	Visual	
D	JUNCTION BOX & ACCESSORIES (Al Lugs, Cable Glands, Cable Route Marker)					
i	Dimension(s)	100%	As per RECPDCL Specs/BOQ	Jointly with RECPDCL	Visual	
E	LUMINARIES					
I	Type	100%	-do-	-do-	Visual	
Ii	Completeness with fittings	100%	-do-	-do-	Visual	
Iii	Manufacturer's test certificate	100%	-do-	-do-	Review	
Iv	Any damage in transit	100%	-do-	-do-	Visual	
V	Checking luminaries outting, on ckt	100%	-do-	-do-	Visual	
vi	Checking automatic timer operation of ckt	100%	-do-	-do-	Visual	
F	PANELS					
I	Dimension(s)	100%	-do-	-do-	By measurement	
Ii	Provisions of components as per BOQ	100%	-do-	-do-	Visual	
Iii	Any damage during transit	100%	-do-	-do-	Visual	
Iv	Painting of panels after erection	100%	-do-	-do-	Visual	
v	Test report of Energy meters	100%	-do-	-do-	Review	
G	EARTHING					
I	Dimension of GI pipe	100%	-do-	-do-	By measurement	
Ii	Dimension of GS Flat for earthing	100%	-do-	-do-	By measurement	
Iii	Completeness of Earthing sets	100%	-do-	-do-	Visual	
iv	Dimension of GI wire	100%	-do-	-do-	By measurement	
4	**ERECTION**					
	Check					
I	Dimension of Burried Cable Trench	Randomly	As per RECPDCL Specs/BOQ	Jointly with RECPDCL	By measurement	
Ii	Cable laying JB connections. Cable tags	100%	-do-	-do-	Visual	
Iii	slump test of Cone Mix for Pole foundation	Randomly 10% of Total Qty	-do-	-do-	By measurement	
Iv	Mounting of Panels	100%	-do-	-do-	Visual	
V	Continuity of cables	100%	-do-	-do-	By meggering	

Vi	IR Value measurement of the cabling	100%	-do-	-do-	By meggering	
Vii	Fixing & tightness of lugs & Glands	100%	-do-	-do-	Physical	
Viii	Operation of components	100%	-do-	-do-	Physical	
Ix	Erection of Pole(s): Foundation Concreting, Alignment/ verticality of pole. Painting of poles, Fixing of Pole caps etc.	100%	-do-	-do-	Visual	
X	Fixing cable route marker	100%	-do-	-do-	Visual	
Xi	Bituminous painting at the Bottom section.	100%	-do-	-do-	Visual	
xii	Painting of poles after erection	100%	-do-	-do-	Visual	
xiii	Check IR before installation	100%	-do-	-do-	By meggering	
5	**TESTING & COMMISSIONING**					
	Check					
I	IR Value & Continuity of the complete system	100%	-do-	-do-	By meggering	
Ii	Earth continuity test	100%	-do-	-do-	By meggering	
Iii	Polarity check of MCB	100%	-do-	-do-	Physical	
Iv	Circuit Operation	100%	-do-	-do-	By Energisation	
v	Voltage of the system	100%	-do-	-do-	By mesurement	

NOTE:

1. All the Tests/Cheeks mentioned here are Mandatory. The Test which are not covered here, but felt essential by the RECPDCL site-in-charge for successful commissioning, shall be carried out at site.
2. This is a general checklist for reference purpose. However, it is to be ensured that the work has been executed in line with Technical specification/Approved drawing.

Checklist Points and procedures for checking (External Electrification) Annexure V

1. As per the approved specification by RECPDCL /CPWD Specification.

A. INDICATIVE LIST OF MAKES OF MATERIALS -CIVIL WORKS

Sr. No.	DESCRIPTTION	MAKES
1	CHEMICAL USED FOR ANTI TERMITE TMENT A) CHLORPYRIPH'OS 20% EC	NOCIL (DURSBAN TC) LUPIN (CLASSIC 20) MONTARI INDUSTRIES (PYRAMID) CYNAMID (DURAMET),PEST CONTROL INDIA LTD, PEST CON INDIA, PEST CONTROL INCORPORATED
2	WATER PROOFING COMPOUND AS ADMIXTURES IN CONCRETE	M. C. BAUC HM IE, STRUCTURAL WATER PROOFING CO., ACC, SUNANDA, PIDILITE
3	BITUMEN	INDIAN OIL, HINDUSTAN PETROLEUM, BHARAT PETROLEUM
4	PVC STRIPS, PVC NOSING, PVC WATER STOPS, PVC HAND RAIL	FIXOPAN ENGINEERS, CALIPLAST, WAVIN, FIXOPAN OR APPROVED EQUIV
5	ORDINARY PORTLAND CEMENT (AS PER IS:269) POZZOLANA PORTLAND CEMENT AS PER IS 1489 (Part 1): 2015	ULTRATECH, VIKRAM, AMBUJA , ACC, JK, JP, BIRLA, SHREE or as approved by RECPDCL
6	WHITE PORTLAND CEMENT	BIRLA WHITE, JK WHITE
7	REINFORCEMENT BARS (IS PER FE 500 D) (may be procured either from main producer directly or through the authorised dealers who can produce mtc from main producer with tracebility)	TATA , SAIL, RASTRIYA ISPAT NIGAM or as approved by RECPDCL
8	DISTEMPER (DRY/OIL BOUND) WATER PROOFING PAINT	NEROLAC , BERGER PAINTS, AKZONOBEL INDIA (ICI), ASIAN PAINT
9	SYNTHETIC ENAMEL PAINT/ACRYLIC EMULSION	NEROLAC , BERGER PAINTS, AKZONOBEL INDIA (ICI), ASIAN PAINT, SUNANDA SPECIALTY COATINGS, JOHNSON & NICHOLSON
10	EPOXY PAINT	FOSROC, APURVA BUILDCARE, MC BAUCHEMIE
11	CERAMIC TILES & VITRIFIED TILES	RAK, H&R JOHNSON. KAJARIA, ORIENT, SOMANI, MARBITO
12	EXPANSION BOLT	HILTI FISHNER
13	GLAZING SEALANT	DOW CORNING , GE SEALANT, WACKER
14	COMMERCIAL BOARD/PLYBOARD/ FLUSH DOOR	JWALA ,DUROPLY,CENTURY, NATIONAL BOARD, ALPRO , GREENPLY, ARIN, DURO
15	SHEET GLASS , FLOAT GLASS , MIRROR GLASS	MODI GUARD, ASAHI , TATA, ST GOBAIN
16	RCC HUME PIPE	INDIAN HUME PIPE, JAIN HUME PIPE, HINDUTAN PIPES
17	WELDING ELECTRODE	ADVANI OERLINKON
18	WELDESH MESH	SHAKTI WELD MESH, IRC, MULTIWELD WIRE co.

19	PUTTY	SHALIMAR, ASIAN PAINT, SNOWCEM INDIA LTD., BERGER PAINTS. JK WALL PUTTY
20	STAINLESS STEEL	SALEM STAINLESS STEEL (SAIL), JINDAL
21	ROLLING SHUTTERS	DIANA , RAMA , SARTAJ
22	SILICONE	NISIWA, COATSI L, PERMACOTE
23	WATER PROOF CEMENT PAINT	ASIAN PAINT ,SNOWCEM INDIA, BERGER PAINT, AKZONOBEL INDIA (ICI), NEROLAC
24	IMPREGNATED FIBRE BOARD	SHALITEX BY SHALIMAR TAR PRODUCTS
25	UPVC & OTHER PVC PIPES AND FIT TINGS. PVC FITTINGS	SUPREME, AJAY , PRINCE , PRAYAG, FINOLEX OR EQUIVALENT ISI MAKE
26	MILD STEEL PIPES, PLATES, CHEQUERED PLAT E, BEAMS, STRIPS ETC.	TISCO, SAIL, RASHTRIYA ISPAT, ASTL
27	NON-METALIC MINERAL BASED FLOOR HARDENER	MC BRAUCHMIE, FOSROC, SUNANDA CHEMICALS, PIDILITE
28	POLYSULPHIDE SEALANT FOR EXPANSION JOINTS AND WATER PROOFING	CHOCKSEYCHEMICALS, STRUCTURAL WATERPROOFING CO., SHALIMAR PRODUCTS SUNANDA SPECIAL TY COATINGS PVTD LTD
29	POLYMER MODIFIED CONCRETE	MS BRAUCHEMIE, FOSROC, PIDILITE, STRUCO, ACC, SUNANDA SPECIALTY COATINGS LTD
30	DOOR SENSORS	DORMA. GODREJ, HCL
31	LIFT	OTIS, SCHINDLER, KONE, MITSUBUSHI, THYSSENKRUPP ELEVATOR
32	CONNOR MEMA SPORTS FLOORING	FREE WILL INFRASTRUCTURE PVT. LTD, PUNE
33	TERAFLEX 5MM/7MM THICK SPORTS FLOORING	UNIFLEX SPORTS FLOORING, UNITED BOGER & BENTA SPORTS FLOORING
34	CREATION CLIC FLOORING	TERAFLEX SPORTS FLOORING
35	STRUCTURAL GLASS	SAINT GOBAIN, GLAVERBELL, PILKINGTON, ASAHI INDIA
36	PAVER BLOCKS & PAVER TILES	DURACRETE, EUROCON , JOHNSON
37	PATCH FITTINGS	DORMA, HETTICH, KITCH, GODREJ , OZONE, HAFELE
38	TEAK WOOD	NAGPUR , GHANA
39	VENEERS	DURO, ARIN, GREEN PLY
40	LAMINATES	MERINO , FORMICA, GRRENLAM
41	ADHESIVE FOR WOOD WORK	FEVICOL , VAMICOL
42	GYPSUM BOARD	GYPSUM INDIA LIMITED
43	ALUMINIUM EXTRUSIONS	JINDAL, HINDALCO, NARMADA , BHARUKA, INDAL, MAHAVIR
44	GLASS WOOL TILES	DECOPHON, ECHOPHON
45	45 TEXTURE PAINT	HERITAGE, ACRO, UNILITE
46	TILES ADESIVE/GROUT	LATECREAT, FERROUS, BAL ENDURA

47	POLISH	ICI, ASIAN, BERGER
48	ALUMINIUM SECTION	HINDALCO JINDAL
49	BLINDS	TRAC. VISTA, HUNTERDOUGLAS
50	GLASS MOSIAC TILE	PILLADIO, BIZASA
51	PLASTER OF PARIS	JK LAKSHMI, SAKRANI

B. INDICATIVE LIST OF MAKES OF MATERIALS:-PUBLIC HEALTH WORKS:

Sr. No.	DESCRIPTTION	MAKES
1	CENTRIFUGAL CAST (SPUN) IRON S&S FITTINGS	NECO, RIF,
2	G.I. PIPES/ M.S. PIPES	GUJARAT TUBES, TATA, SURYA, JINDAL, ITC, PRAKASH, RAVINDRA
3	G.I. FITTINGS BRAND (MALLEABLE CAST IRON)	KENT, UNIK, ZOLOTO OR EQUIVALENT ISI MAKE
4	GUN METALS/BALL VALVES (FULL WAY, NON-RETURN AND GLOBE VALVES)	ZOLOTO, LEADER , AUDCO
5	BALL VALVES	ZOLOTO,LEADER,AUDCO
6	STOPCOCK	ZOLOTO, LEADER, PARKO, JAQUAR
7	STAINLESS STEEL SINK	NEELKANT, SALEM STEEL, AMC, NIRALI, JAYNA, KINGSTON
8	PVC FLUSHING	HINDUSTAN, CERA
9	STONEWARE PIPES & GULLY TRAP	PERFECT, BURN
10	RCC PIPES	HINDUSTAN PREFAB, INDIAN, HUMEPIPES, JAIN
11	C.I. MANHOLE COVERS AND FRAMES C.I. GRATINGS	NECO, RIF
12	SLUICE VALVE	KARTAR, KALPANA, GEETA, KIRLOSKAR
13	BUTTERFLY VALVE	IVC, GEETA, KIRLOSKAR
14	SENSORS	JAQUAR, AOS, HINDWARE , PARRYWARE
15	HAND DRYER	KIMBERLY CLARK,ASKON, AOS, KOPAL, ATMAS, UTEC SYSTEM, TOSHI
16	CENTRIFUGAL & SUBMERSIBLE PUMPS	KIRLOSKAR, CUMMINS, CGL
17	VITREOUS CHINA SANITARY WARE	HINDUSTAN SANITARY WARE ,CERA, PARYWARE
18	WC CONNECTORS	MULTIKWIK (UK) , SUPREME
19	SHOWER TRAY	WOVEN GOLD, EUROSPA, AQUABATCH
20	CP BRASS FITTINGS AND TOILET ACCESSORIES	GEM, LAURET, AQUA PLUS, JAQUAR

21	ANGLE VALVE WITH FILTER	ARCO, AQUA PLUS, PARKO, SEIKO
22	C.P. GRATING FOR FLOOR TRAP	SEIKO, COBRA, NEALKANTH
23	PIPE CLAMPS	CHILLY OR EQUIVALENT ISI MAKE
24	PRESSURE REDUCING VALVE	LEADER, ZOLOTO, RBM
25	T/Y STRAINER	LEADER,ZOLOTO,ADVANCE
26	CPVC PIPE FITTING	FINOLEX,SU PREME,ASTRAL,PRINCE
27	SWR PIPE FITTINGS	FINOLEX,SUPREME,ASTRAL,PRINCE

INDICATIVE LIST OF MAKES OF MATERIAL, -ELECTRICAL AND OTHER WORKS

Sr. No.	DESCRIPTTION	MAKES
1	LOW TENSION, XLPE ARMOURED, 1.1KV GRADE, ALUMINIUM/COPPER CONDUCTOR CABLES, TYPE A2XFY/YRY	KEI / GEMSCAB / CORDS CABLE INDUSTRIES LTD/ KEC International Ltd / VIKAS CABLE COMPANY/ Ravin Cables Ltd / Polycab/ Special Cables Pvt Ltd/ Havells / Suyog
2	LOW TENSION, TPN SFU WITH HRC FUSES, 415 VOLTS, AC, 3 PHASE, 50 HZ.	ABB/ GE POWER, SIEMENS, L&T
3	LOW TENSION,TP, MOULDED CASE CIRCUIT BREAKER, 415 VOLTS AC, 3 PHASE 50 HZ50 KA-STR. MICROPROCESSOR / THERMAL RELEASE	GE POWER CONTROLS INDIA PRIVATE LIMITED/ ABB LIMITED / CROMPTON GREAYES LIMITED / M&G/ KM / LARSEN & TOUBRO(L&T) / C&S ELECTRIC LTD / BCH ELECTRIC LIMITED / ERA ELECTRICALS PVT LTD / AREYA T&D INDIA LIMITED/ SPACEAGE SWITCHGEARS LIMITED/ Havells India Limited
4	LOW TENSION, DRY TYPE CAPACITORS, 440 VOLTS, 50 HZ 3 PHASE WITH APFC PANEL	POWER MATRIX, VISA,L&T, POWERTECH, SIEMENS, CROMPTON KHATAU
5	INDICATING LAMPS HOLDERS WITH LED TYPE LAMPS	GE / VAISHNO / TEKNIC / VENSON ELECTRIC PRIVATE LIMITED/ LARSEN & TOUBRO(L&T) / GROUPE SCHINEDER / C&S ELECTRIC LTD / SPRECHER & SCHUH (S&S) / SRI TULSI SWITCHGEAR / SIEMENS / EAO / ESSEN DIENKI/ (Indicating, lamp)
6	SELECTOR SWITCHES FOR AMMETER/VOLTMETER	GE/KAYCEE/RECOM/SWITRON/SALZER CONTROLS,

7	LOAD MANAGERS, DIGITAL TYPE AMMETERS, VOLTMETERS, PF METERS, FREQUENCY METERS.	MERIN GERIN, ENERCON, TRINITY/ CONSERVE, L&T, AUTOMATIC ELECTRIC, RISHABH, DUCATI BHARAT ELECTRONICS & ELECTRICALS/ NIPPEN ELECTRICAL INSTRUMENTS CO / NIPPEN ELECTRICAL INSTRUMENTS CO (Indicating meter)
8	DIGITAL ENERGY METERS	MERLIN GERIN, L&T, HAVELL ' S, SECURE, BENTEC
9	MICRO PROCESSOR RELAYS	ABB SEGC, SIEMENS, L&T
10	PANEL WIRES, GRAY / BLACK COLOUR IN 660/1100 VOLTS. GRADE (FR).	RR KABEL, POLYCAB, FINOLEX, HENSEL
11	CABLE GLANDS - SINGLE COMPRESSION TYPE	STANDARD METAL INDUSTRIES/ CENTRAL HARDWARE/ SUNIL & COMPANY/ COMET BRASS PRODUCTS (COMET BRAND)/COMET INDUSTRIES (BRAND COSMOS)/Hex Cable Accessories Pvt Limited
12	LUGS, CRIMPING TYPE, TINNED COPPER HEAVY DUTY ONLY	DOWEL'S
13	HRC CONTROL FUSES WITH BAKELITE I TYPE MOULDED FUSE HOLDERS	GE, SIEMENS, L&T
14	PUSH BUTTON STATIONS TYPE, IN DIFFERENT COLOUR CODES.	VAISHNO/TEKNIK/SIEMENS/ LARSEN & TOUBRO(L&T) / VENSON ELECTRIC PRIVATE LIMITED/ BCH/ CONCORD/ ESSEN DIENKI
15	TERMINAL BLOCKS, PUSH ON TYPE	CONNECTWELL/ PHOENIX CONTACT (INDIA) PRIVATE LIMITED/ ESSEN DIENKI
16	MS FABRICATED PANELS	ANAND CONTROL GEAR, RISHA CONTROL, BOE SWITCHGEAR, VIDHUT CONTROL, TRICOLITE
17	STARTERS, CONTACTOR, TIMERS	MERLIN GERIN, SIEMENS
18	MINIATURE CIRCUIT BREAKER OF 10 KA BREAKING CAPACITY AND BOARDS	STANDARD ELECTRICALS LIMITED/ SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED/ LEGRAND (INDIA) PRIVATE LIMITED/ INDO KOPP/ CROMPTON GREAVES LIMITED/ M&G/ MERLIN GERIN (MGE)/ ABB LIMITED/ MERLIN GERIN (MGE)/ SPRECHER & SCHUH (S&S)/ MOS/ C&S ELECTRIC LTD
19	CTS 1100 VOLTS GRADE CAST RESIN ONLY	AUTOMATIC ELECTRIC KAPPA/RECO
20	AUTOMATIC POWER FACTOR PANEL MICROPROCESSOR BASED WITH 3 PHASE CT SENSING	POWERMATRIX, VISAPOWERTECH, L&T,GE POWER
21	LOAD MANAGER WITH RS 485 PORT & SOFTWARE	MERLIN GERIN, ENERCON, CONSERVE

22	ALL LIGHT FITTINGS	CROMPTON GREAVES LIMITED/ PHILIPS INDIA LIMITED/ PHILIPS INDIA LIMITED/ APEX LUMINAIRES (P) LIMITED/ Crompton Greaves Consumer Electricals Limited/ CGL/HAVELS/PHILIPS/INSTA POWER/BAJAJ
23	GI CONDUITS	MANUFACTURER HAYING VALID BIS LICENCE/ BEC LIMITED/ JHAVERI INDUSTRIES/ KK INDUSTRIES
24	GI CONDUIT ACCESSORIES	VIMCO/P&I
25	FR WIRES IN 660/1100 VOLTS GRADE FOR POINT WIRING.	RR KABLE, FINOLEX , POLYCAB, SKY LINE
26	SINGLE POLE SWITCHES AND SOCKETS 6/16 AMPS. MODULAR TYPE	CRABTREE, MOS- LEGRAND, MK, SCHNIDER, ANCHOR, ROMA
27	CEILING FAN	CROMPTON, USHA, ORIENT, BAJAJ, HAYELLS, GE, PHILLIPS
28	EXHAUSTAXIAL FLOW / VENTILATION FAN	CROMPTON, USHA, GE ALSTOM, G.E, CROMPTON GREAYES, BAJAJ
29	LAMPS, TUBES	PHILIPS, OSRAM, CROMPTON, HAYELLS, INSTA, CGL, BAJAJ
30	TELEPHONE SOCKETS	D-LINK, AMP, SYSTMEX
31	DATA CABLES, CAT-6	D-LINK, AMP. SYSTMEX
32	COMPUTER DATA SOCKETS AND RELATED HARDWARE. CABLES (TELEPHONES)	D-LINK, AMP, SYSTMEX
33	ELECTRONIC REGULATING BALLAST FOR LIGHT FITTINGS	WIPRO, PHILIPS, ATCO, CROMPTON
34	TELEPHONE TAG BLOCK	KRONE
35	SPEAKERS FOR ADDRESS SYSTEM	BOSCH, AHUJA, BOSE
36	AMPLIFIERS	ATIS, BOSCH, AHUJA
37	3 CD/DVD PLAYERS	SONY, PHILIPS, TECHNIC, PANASONIC, SAMSUNG
38	MICROPHONES	ATIS , AUDIO , TECHNICA, AHUJA
39	CRCA SHEETS FOR PANELS/ BUS DUCT/RISING MAINS	JINDAL, TATA, RAYMOND
40	PAINTS & PRIMERS	ASIAN, DUCO
41	INDUSTRIAL PLUGS & SOCKETS	LEGRAND, SIEMENS, MERIN GERIN
42	NI-CD BATTERY	EXIDE, HBL
43	WOOD SCREWS	NITTLE FOLD, HILTI, FISCHER
44	CABLE TRAYS, JUNCTION BOXES, RACEWAYS & PERFORATED TRAYS	PROFAB, RICO, INDIA TECH, METALAM
45	RIGID PVC PIPES WALL THICKNESS AND ACCESSORIES	PERCISION, SUPREME, DIAMOND
46	11 KV VCB PANELS	CROMPTON, MELIN GERIN, GE, ABB

47	11/0.433 KV, 100KVA DISTRIBUTION TRANSFORMER	CG, ABB, SIEMENS, SCHNEIDER, AREYA
48	HT CABLES	UNIVERSAL, HAYELLS, POLYCAB, FINOLEX
49	HT TERMINATION KITS	M-SEAL
50	FIRE ALARM SYSTEM	SECUTRON NOTIFIER, GE MORLEY
51	WATER LEAK SYSTEM	STAR ELECTRONICS, EMNET, SONTEY
52	RODENT REPELLENT	MESER ELECTRONICS
53	HIGH SENSIVITY SYSTEM	VESDA, ICAM, VISTA
54	LIGHTING CONTROL	GODREJ, PHiLLIPS CLIPCEL, ATCO, LUTRON , WIPRO
55	D.G. SET	KIRLOSKAR, CUMINS, CATTER PILLER
56	FIRE DETECTORS MODULE	SIEMENS, NOTIFIER, ESSAR, HONEYWELL, CEASEFIRE
57	PVC CONDUIT	BEC/AKG /PRECISION
58	FLEXIBLE CONDUIT	HENSEL/LEGRAND/TRINITY TOUCH/LAPP
59	TELEPHONE CABLE	DELTON/SKY LINE/ VINAYI FINOLEX/SKY TONE
60	MCB ISOLATOR, RCCB, ELCB (OF ALL RATlNGS)	L&T /HAVELLS /SCHNIDER/ANCHOR
61	LIGHTFIXTURES/FITTINGS	PHILIPS /CGL/ HAYELLS/HAYELLS/BAJAJ
62	TV COAXIAL CABLE	DELTON/SKY LINE/NATIONAL/ SHYAM/ ANCHOR
63	MCCB	L&T/HAVELLS/SCHNIDER
64	MCB DISTRIBUTION BOARD	L&T / HAYELLS/SCHNIDER
65	CONTROL & instrumentation CABLE	DELTON / SKYLINE / NATIONAL/ GR[NDLAY/ LAPP/ ANCHOR
66	ACCESS SYSTEM	SIEMENS OR EQ UIV
67	PA SYSTEM	JBC, PH ILIP S, BOSS , AHUJA
68	AUDIONIDEO SYSTEM	PHILIPS, PANASONIC. SONY, LG. SAMSUNG
69	CABLE	HAYELLS/FENO LEX/ANCHOR

GENERAL NOTES-

1. **ALL MATERIALS & ITEMS SHALL COMPLY WITH THE RELEVANT BIS CODES AND SHALL BE BIS MARKED WHEREVER APPLICABLE.**

2. **THE CONTRACTOR SHALL PRODUCE THE SAMPLES FOR MATERIALS AND ITEMS BEFORE PROCUREMENT OF THE SAME FOR APPROVAL OF THE ENGINEER-IN-CHARGE.**

3. **THE MAKES ARE ONLY INDICATIVE FOR REFERENCE PURPOSE. THE VENDOR SHALL SUBMIT THE LIST OF OFFERED MAKE ALONGWITH THE PROPOSAL.**

4. **CONTRACTOR MAY PROPOSE NEW MAKE/SUB-VENDOR MEETING TECHNICAL (QUALIFYING) REQUIREMENT AS STIPULATED IN TECHNICAL SPECIFICATION FOR ABOVE MENTIONED BROUGHT-OUT ITEMS WITHIN 90 DAYS FROM THE DATE OF NOA**

FOR APPROVAL OF RECPDCL. THE COST OF ASSESSMENT SHALL BORNE BY CONTRACTOR IN CASE OF NEW VENDORS AS PER RECPDCL REQUIREMENT.

STANDARD FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	REC PDCL Projects
Date of Issue	
Validity	Till next revision

SFQP No.	RECPDCL/SFQP/01 (Rev-01)
Project Name	Construction of Township at Nagrota Substations
LOA No	

S.N	Description of activity	Items to be checked	Test/check to be done	Ref. Document	Checking/Testing		Counter Check/Test by RECPDCL	Accepting Authority in RECPDCL
					Agency	Extent		
1.	Detailed Soil Investigation	a) Bore log	1. Depth of bore log 2. SPT Test 3. Collection of samples	As per RECPDCL Specification	Contractor	100% at Field	To witness 20% at Field	RECPDCL HO based upon report of Soil Investigation submitted
		b) Tests on samples	As per tech. Specs.	As per RECPDCL Specification	Contractor (Testing in RECPDCL approved Lab/ Govt Approved Lab/Govt technical Educational Institutes)	100% by testing lab (Reports to be signed by Testing person & Checking person)	Review of lab test results (All soil reports to have signature of RECPDCL executive reviewing the report)	
2.	Earth Work (site leveling)	1. Mandatory testing for filling						
			1. Proctor compaction test for maximum dry density	IS:2720 (Part-7) & RECPDCL Specification	Contractor (Testing in RECPDCL approved Lab/ Govt Approved Lab/Govt technical Educational Institutes).	One sample for every 25x25 sqmtr of filling area	100% review of lab test results	Site In charge
			2. Optimum Moisture Content	do	do	do	do	do
		2. Field Compaction Test	1. Field dry density & Moisture content test for each layer of compaction	IS:2720 (Part-29) & RECPDCL Specification	Contractor Field lab./ RECPDCL approved Lab.	One sample for every 2500 Sqm. or part thereof for compacted soil for each compacted layer.	do	do

STANDARD FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	REC PDCL Projects
Date of Issue	
Validity	Till next revision

SFQP No.	RECPDCL/SFQP/01 (Rev-01)
Project Name	Construction of Township at Nagrota Substations
LOA No	

S.N	Description of activity	Items to be checked	Test/check to be done	Ref. Document	Checking/Testing		Counter Check/Test by RECPDCL	Accepting Authority in RECPDCL
					Agency	Extent		
3	Checking of foundation material							
	A. Materials	1. Cement	1. Brand approval	Major Brands as per RECPDCL approved brands	Contractor	As proposed by Contractor	Cement of approved brands as per RECPDCL approval.	RECPDCL
			2. Physical tests	As per document at **Annexure-1** of this FQP	Material to be jointly inspected by RECPDCL and contractor	Review of 100% MTC's.	100% review of lab test results and MTC.	Site in charge
			3. Chemical Tests Chemical composition of Cement	-do-	Contractor to submit MTC	Review of all MTC's	100% review of MTC results	Site in charge
		2. a) Reinforcement Steel	1. Source approval	May be procured either from producers directly or through the authorized dealers who can produce MTC from producers with traceability.	Contractor	As proposed by Contractor	Material shall be supplied from producers / authorized dealers.	Site in charge
			2. Physical and Chemical analysis test	As per document at **Annexure-2** of this FQP	Contractor to submit MTC	100% MTC's One sample*/ 300 MT /Manufacturer shall be jointly sealed by RECPDCL and Testing in RECPDCL approved Lab/ * Note: All sizes of 10mm and above shall be taken for testing in every 300MT	100% review of MTC and embossing. 1) Review of test lab results shall be sent by the Lab, directly to RECPDCL;	Site in charge

STANDARD FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	REC PDCL Projects
Date of Issue	
Validity	Till next revision

SFQP No.	RECPDCL/SFQP/01 (Rev-01)
Project Name	Construction of Township at Nagrota Substations
LOA No	

S.N	Description of activity	Items to be checked	Test/check to be done	Ref. Document	Checking/Testing		Counter Check/Test by RECPDCL	Accepting Authority in RECPDCL
					Agency	Extent		
		2. b) Miscellaneous structural steel excluding cable trench, transformer & reactor foundation.	Source to be proposed by contractor.	Source with material meeting RECPDCL Specification	Contractor	As proposed by contractor	To verify documents.	Site In charge
			1. Dimensional check 2. Visual check for damages rusting pitting etc.	RECPDCL specification and approved drawing.	Contractor	100%	Random	Site Engineer
		2. c) Structural steel used in cable trench, transformer & reactor foundation.	Source to be proposed by contractor.	RECPDCL Specification	Contractor	As proposed by contractor	To verify documents.	
			1. Dimensional check	RECPDCL specification and approved drawing	Contractor	100%	Random	Site Engineer
			2. Visual check for damages rusting pitting etc.	RECPDCL specification and approved drawing	Contractor	100%	Random	Site Engineer
			3.Visual check for welding defects primer coating and painting/ galvanizing as applicable	RECPDCL specification and approved drawing	Contractor	100%	Random	Site Engineer
			4. Physical properties of Structural steel	IS 2062: 2011, reaffirmed 2016 RECPDCL specification and approved drawing	Contractor	1 sample per lot of 40MT or part thereof for tensile tests and 1 sample per lot of 20MT or part thereof for bend test of each size.	Review of lab test results by RECPDCL.	Site Engineer
		3.Coarse Aggregate						
		a.	Source approval	Source meeting RECPDCL	Siemens / Sub-vendor	Proposed by Contractor,	To review the proposal based on the documents.	Site in charge RECPDCL

STANDARD FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	REC PDCL Projects
Date of Issue	
Validity	Till next revision

SFQP No.	RECPDCL/SFQP/01 (Rev-01)
Project Name	Construction of Township at Nagrota Substations
LOA No	

S.N	Description of activity	Items to be checked	Test/check to be done	Ref. Document	Checking/Testing		Counter Check/Test by RECPDCL	Accepting Authority in RECPDCL
					Agency	Extent		
				Specification		indicating the location of the quarry & based on the test results of Joint samples tested in RECPDCL approved lab.		
		b.	Physical tests	As per document at **Annexure-3** of this FQP	Samples to be tested in site test lab	One sample per lot of 1000 cum or part thereof per source.	100% review of site - lab test results	Site in charge RECPDCL
		4.Fine Aggregate						
		a.	Source approval	Source meeting RECPDCL Specification	Siemens / Sub-vendor	Proposed by the Contractor, indicating the location of the quarry & based on the test results of Joint samples tested in site test lab.	To review the proposal based on the documents.	Site in charge RECPDCL
		b.	Physical tests	As per document at **Annexure-4** of this FQP	Samples to be tested in site test lab	One sample per lot of 500 cum or part thereof per source.	100% review of site - lab test results	Site in charge RECPDCL
		5. Water	1. Cleanliness	RECPDCL Specification (Water shall be fresh and clean)	Contractor	100% visual check at Field	Verification at random	Site Engineer
			2.PH Value	-do-	Contractor	One sample per	100% review of the test results	Site Engineer

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S.N	Description of activity	Items to be checked	Test/check to be done	Ref. Document	Checking/Testing		Counter Check/Test by RECPDCL	Accepting Authority in RECPDCL
					Agency	Extent		
						source	Ph value not less than 6	
		6.Finishing materials of building	Physical verification of Different items as per specification	As per Specification.	Contractor	100%	MTC/Manufacturer catalogue To be reviewed by RECPDCL.	Site In charge in consultation with HQ.
	B. Concrete Work a) Before concreting							
		1. Dimensions of excavation	**Dimension & Depth of foundation**	Approved Drawing.	Contractor	100% at Field	100% check by RECPDCL	Site In charge.
		2. Stub Setting/Setting of Foundation Bolts, Embedment etc.	1) Centre Line	-do-	-do-	-do-	-do-	-do-
			2) Diagonals	-do-	-do-	-do-	-do-	-do-
			3) Level of stubs./ Foundation bolts	-do-	-do-	-do-	-do-	-do-
		3. Reinforcement steel	Placement	bar bending schedule	-do-	-do-	-do-	-do- *-*At least 5% locations shall be cross verified by immediate Reporting officer, at Random with respect to stub setting and reinforcement steel placement
		4. Concrete mix proportion (Applicable for Design Mix)	ration of mix proportion	Approval of Design Mix submitted by contractor based on inputs furnished by RECPDCL	-do-	-do-	-do-	Site In charge.
	b) During concreting	1. Workability	Slump test	Range 25 mm to 75 mm refer document at	Contractor	Minimum 01 sample per day	20% check at random	Site In charge.

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S.N	Description of activity	Items to be checked	Test/check to be done	Ref. Document	Checking/Testing		Counter Check/Test by RECPDCL	Accepting Authority in RECPDCL
					Agency	Extent		
				Annexure-5 of this FQP				
		2. Concrete Strength	Cubes Compressive Strength	As per RECPDCL Specifications & **Annexure-5** of this FQP	Contractor Casting of cubes at site. Cubes to be tested for 7& 28 days strength at RECPDCL approved Lab / At site (if testing machine installed by contractor is duly calibrated. Cubes at 100% location are to be taken in presence of RECPDCL officials	10% of total concrete volume as mentioned below:- a) GIS halls (400cum)- 40 samples b) 220/ 33kV Tower- (434cum)-44 samples c) 220/ 33kV Equp- (88.34 cum)- 9 samples d) Trafo and firewall – (652 cum)- 65 samples e) LT Trafo (15.33 cum)- 2 samples) f) CRB (590.50 cum)-60 samples g) 33kV GIS (150cum)-15 samples h) Road- 135 Cum	100% review of Lab test results. Cubes at 100% location are to be taken in presence of RECPDCL officials. Samples shall be tested at RECPDCL approved Labs. In this case, test results shall be sent by the Lab, by E mail & post directly to RECPDCL.	M/s Siemens shall establish a duly calibrated UTM at site for testing of concrete cubes. Which shall be witnessed by site manager, however site incharge of RECPDCL shall also witness at least 50% of tests. 10% of samples shall be test checked at TPL to be witnessed by RECPDCL Site Engineer.

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S.N	Description of activity	Items to be checked	Test/check to be done	Ref. Document	Checking/Testing		Counter Check/Test by RECPDCL	Accepting Authority in RECPDCL
					Agency	Extent (14 Samples) Total Qty approximately (2465 cum) breakup		
	c) After Concreting	Backfilling	a)water & ramming for compaction	RECPDCL specification	Contractor	100%	random	Site Engineer
			b)compaction test	RECPDCL specification	Contractor at site/ RECPDCL approved lab	a) Tower Locations - One Sample of three specimen for 50% of tower location b) Equipment foundation - One Sample of three specimen for 20% of Equipment Foundation location c) Buildings- 3 Samples (three specimen for one sample) for every Building	Physically at Random & 100% review of Test results	Site In charge
4.	**Brick Masonry**							
		a) BRICKS	1. Dimension tolerance	RETPCL Specification/ enclosed **Annexure 6**	Contractor (samples to be taken jointly and tested in RECPDCL accepted lab	Enclosed Annexure 6	Review 100% of test results	Site In charge
			2. Compressive Strength	RETPCL Specification/ enclosed **Annexure 6**	-do-	-do-	-do-	Site In charge

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					Agency	Extent		
			3. Water Absorption	RETPCL Specification/ enclosed **Annexure 6**	-do-	-do-	-do-	Site In charge
			4. Efflorescence	RETPCL Specification/ enclosed **Annexure 6**	-do-	-do-	-do-	Site In charge
		b) Mortar Mix	Cement sand Proportion	RETPCL Specification	Contractor	100%	random	Site In charge
5.	**P.C.C.**	Grade, thickness, plan, dimension	completeness	IS 456: 2000, reaffirmed 2016 and RECPDCL approved foundation drawings & specification	Joint Inspection by RECPDCL and CONTRACTOR	For all locations	Joint Inspection by RECPDCL and CONTRACTOR	Site In charge
6.	**PLASTERING**							
		1. Plastering	thickness and evenness	RECPDCL specification	Contractor	100%	Random	Site In charge
		2. Ingredient	Mortar Mix/ Proportion	RECPDCL specification	Contractor	100%	Random	Site In charge
7.	**Switchyard earthing**							
		1. Check for dimension of earth mat	Physical check	RECPDCL spec & approved drawings	Contractor	100%	Random	Site In charge
		2. Depth of excavation	Physical check	RECPDCL spec & approved drawings	Contractor	100%	Random	Site In charge
		3. Check for weld joints and anti-corrosion treatment	Physical check	RECPDCL spec & approved drawings	Contractor	100%	Random	Site In charge
8.	**Site Surfacing (Gravelling)**							

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S.N	Description of activity	Items to be checked	Test/check to be done	Ref. Document	Checking/Testing		Counter Check/Test by RECPDCL	Accepting Authority in RECPDCL
					Agency	Extent		
		1. Leveling, Level & Height & evenness	Physical check	RECPDCL spec & approved drawings	Contractor	100%	Random	Site In charge
		2. Soil sterilization : spraying of chemicals	Physical check	RECPDCL spec & manufacturers recommendation	Contractor	100%	Random	Site In charge
		3. P.C.C (Grade, thickness & Size) a) PCC 1:5:10	Physical check	RECPDCL specifications	Joint inspection by RECPDCL & Contractor	100%	Random	Site In charge
		4. 20/40mm stone aggregate	Grading	IS 383: 2016, *IS: 2386: Part 1, reaff. 2016* and RECPDCL Specification. The grading shall be as per single sized nominal size.	RECPDCL accepted lab)	1 sample per lot of 500 Cubic Meter or part thereof from each source for each size.	100% review of test report	Site In charge
		5. Resistivity of 20/40mm stone aggregate.	Electrical Check	RECPDCL Technical Specification. (resistivity of the stone for spreading over the ground shall be minimum 3000 ohm-m under wet condition)	Contractor	1 sample of stone from each source (in case stones are supplied from more than one source)	100% review of test report.	Site In charge
		6. Compacted thickness of 40mm stone layers as applicable	Physical	RECPDCL specification & approved drawings	Contractor	100%	Random	Site In charge
9.	**Road (WBM)**							
		1. Alignment & level	Physical check	RECPDCL specification & approved drawings	Contractor	100%	Random	Site In charge

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S.N	Description of activity	Items to be checked	Test/check to be done	Ref. Document	Checking/Testing		Counter Check/Test by RECPDCL	Accepting Authority in RECPDCL
					Agency	Extent		
	Material	A. Coarse Aggregates	1. Source approval	Source with materials meeting RECPDCL Specification	Contractor	Proposed by the Contractor indicating the location of the quarry and based on the test results of Joint samples tested in RECPDCL approved lab.	To review the proposal based on the documents	RECPDCL
			2. Physical tests	As per document at Annexure-7 of this FQP	Samples to be taken jointly and tested in RECPDCL approved lab	One sample per lot of **200** cum or part thereof per source	100% review of lab test results	Site In charge
		B. Stone Screening						
			1. Source approval	Source with materials meeting RECPDCL Specification	Contractor	Proposed by the Contractor, indicating the location of the quarry and based on the test results of Joint samples tested in RECPDCL accepted lab	To review the proposal based on the documents	RECPDCL
			2. Grading	As per document at Annexure-7 of this FQP	Samples to be taken jointly and tested in RECPDCL approved lab	One sample per lot of **200** cum or part thereof	100% review of lab test results	Site In charge
		C. Binding material	Plasticity Index	As per document at Annexure-7 of this FQP	Contractor	One sample per lot of **25** cum or part thereof	100% review of lab test results	Site In charge
		D. Laying of sub-base course	Physical check	As per CPWD spec clause 17.7.2	Contractor	100%	Random	Site Engineer
		E. Laying of base Curse	Physical check	As per CPWD spec	Contractor	100%	Random	Site Engineer

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S.N	Description of activity	Items to be checked	Test/check to be done	Ref. Document	Checking/Testing		Counter Check/Test by RECPDCL	Accepting Authority in RECPDCL
					Agency	Extent		
				clause 17.8.1				
10.	**Drain**	Alignment and invert level	Physical	RECPDCL Spec and approved drawing	Contractor	100%	Random	Site Engineer

Note: Third Party Test Lab means (Testing in RECPDCL approved Lab/ Govt Approved Lab/Govt technical Educational Institutes).

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ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CEMENT

Annexure-1 (page 1 of 3)

ORDINARY PORTLAND CEMENT					
S.No.	**Name of the test**	**Ordinary Portland Cement 33 grade as per IS 269: 2015**	**Ordinary Portland Cement 43 grade as per IS 269: 2015**	**Ordinary Portland Cement 53 grade as per IS 269: 2015**	**Remarks**
a)	**Physical tests**				**To be conducted in approved lab.**
(i)	Fineness	Specific surface area shall not be less than 225 sq.m. per kg. or 2250 cm2 per gm.	Specific surface area shall not be less than 225 sq.m. per kg or 2250 cm2 per gm	Specific surface area shall not be less than 225 sq.m. per kg or2250 cm2 per gm.	Blaine's air permeabilit IS 4031 (Part-2):1999, Reaffirmed 2013
(ii)	Compressive strength	72 ± 1 hour : Not less than 16 Mpa (16 N/mm2) 168 ± 2 hour : Not less than 22 Mpa (22 N/mm2) 672 ± 4 hour : Not less than 33 Mpa (33 N/mm2), *Not more than 48Mpa (48 N/mm2)*	72 ± 1 hour : Not less than 23 Mpa (23 N/mm^2) 168 ± 2 hour : Not less than33Mpa (33 N/mm^2) 672 ± 4 hour : Not less than43 Mpa (43 N/mm^2), *Not more than 58Mpa (58N/mm2)*	72 ± 1 hour : Not less than27Mpa (27 N/mm^2) 168 ± 1 hour : Not less than37Mpa (37 N/mm^2) 672 ± 1 hour : Not less than 53 Mpa (53 N/mm^2)	As per IS 4031(Part-6): 1988, Reaffirmed 2014
(iii)	Initial & Final setting time	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	Initial setting time : Not less than30 minutes Final setting time : Not more than600 minutes	As per IS 4031 (Part-5): 1988 Reaffirmed 2014. -do-
(iv)	Soundness	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test.	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and0.8% by Autoclave test.	Le Chatlier and Autoclave test as per IS4031 (Part-3): 1988, Reaffirmed 2014.

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ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CEMENT

Annexure-1 (page 2 of 3)

S.No.	Name of the test	Ordinary Portland Cement 33 grade as per IS 269: 2015	Ordinary Portland Cement 43 grade as per IS 269: 2015	Ordinary Portland Cement 53 grade as per IS 269: 2015	Remarks
b)	**Chemical Composition tests**				**Review of MTC only**
		a) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	a) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	a) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	
		b) Insoluble residue, percentage by mass, Max. *5.00%*	b) Insoluble percentage by mass, Max. *5.00%*	b) Insoluble percentage by mass, Max. *5.00%*	
		c) Magnesia percentage by mass Max. 6%	c) Magnesia percentage by mass Max. 6%	c) Magnesia percentage by mass Max. 6%	
		d) Total sulphur content calculated as sulphuric anhydride (SO_3), percentage by mass not more than 3.5%.	d) Total sulphur content calculated as sulphuric anhydride (SO_3), percentage by mass not more than 3.5%.	d) Total sulphur content calculated as sulphuric anhydride (SO_3), percentage by mass not more than 3.5%.	
		e) Total loss on ignition shall not be more than 5 percent	e) Total loss on ignition shall not be more than 5 percent	e) Total loss on ignition shall not be more than 4 percent	
		f) Chloride content, percent by mass, max 0.1%	f) *Chloride content, percent by mass, max 0.1%*	f) *Chloride content, percent by mass, max 0.1%*	

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ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CEMENT

Annexure-1 (page 3 of 3)

S. No.	Name of the test			Remarks
2.	**POZZOLANA PORTLAND CEMENT AS PER IS 1489 (Part 1): 2015**			
a)	**Physical Tests**			
		i. Fineness	Specific surface area shall not be less than 300m2/Kg. or 3000 cm^2/gm.	IS 4031 (Part-II)
		ii. Compressive strength	a) 72 ± 1 hour : Not less than 16 Mpa (16 N/mm^2) b) 168 ± 2 hour : Not less than 22 Mpa (22 N/mm^2) c) 672 ± 4 hour : Not less than 33 Mpa (33 N/mm^2)	IS 4031 (Part-VI)
		iii. Initial & Final setting time	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	IS 4031 (part-V)
		iv. Soundness	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier test and 0.8% by Autoclave test as per IS 4031 (Part-3)	
b)	**Chemical composition test**			
		a) Magnesia percentage by mass Max. 6%		Review at MTC only
		b) Insoluble residue, percent by mass, (a) Maximum {x + 4 (100-x)/100} (b) Minimum 0.6x, where x is the declared % of fly ash in the given Portland pozzolana cement.		-do-
		c) Total sulphur content calculated as sulpuric anhydride (SO3), percentage by mass not more than3.5		-do-
		d) Total loss on ignition shall not be more than 5 percent		
		e) Chloride content, percent by mass, max 0.1%		

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ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR REINFORCEMENT STEEL

AS PER IS 1786-2008 (Reaffirmed 2013), Amendment No. 1 **Annexure-2**

S.No.	Name of the test	Fe 415	Fe 500	Fe 500D
i)	**Chemical analysis Test** Carbon	**0.30 Percent Maximum**	**0.30 Percent Maximum**	**0.25 Percent Maximum**
	Sulphur	**0.060 Percent Maximum**	**0.055 Percent Maximum**	**0.040 Percent Maximum**
	Phosphorous	**0.060 Percent Maximum**	**0.055 Percent Maximum**	**0.040 Percent Maximum**
	Sulphur & Phosphorous	**0.110 Percent Maximum**	**0.105 Percent Maximum**	**0.075 Percent Maximum**
	Carbon Equivalent	**0.42 Percent Maximum**	**0.42 Percent Maximum**	**0.42 Percent Maximum**
ii)	**Physical Test**			
	a) Tensile Strength/Yield stress ratio,	*≥1.10, but tensile strength not less than 485.0 N/mm²*	*≥1.08, but tensile strength not less than 545.0 N/mm²*	*≥1.10, but tensile strength not less than 565.0 N/mm²*
	b) 0.2% of proof stress/Yield stress Minimum, N/mm ²	415	500	*500*
	c) *Elongation* percent , Minimum	14.5	12	*16*
	d) *Total elongation at maximum force, percent, Minimum*	---	---	*5*
iii)	**Bend & Rebound Tests**	Pass	Pass	Pass

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ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR COARSE AGGREGATES AS PER IS 383: 2016

Annexure-3

3.	**Coarse Aggregates**										
i)	Physical Tests										
	a. Determination of particles size	a. IS Sieve Designation	%age passing for Single-Sized Aggregate of nominal size					Percentage Passing for grades Aggregate of nominal size			
			40 mm	**20 mm**	**16 mm**	**12.5 mm**	**10 mm**	**40 mm**	**20 mm**	**16 mm**	**12.5 mm**
		63 mm	100	-	-	-	-	-	-	-	-
		40 mm	85 to 100	100	-	-	-	90 to 100	100	-	-
		20 mm	0 to 20	85 to 100	100	-	-	30 to 70	90 to 100	100	100
		16 mm	-	-	85 to 100	100	-	-	-	90-100	-
		12.5 mm	-	-	-	85 to 100	100	-	-	-	90 to 100
		10 mm	0 to 5	0 to 20	0 to 30	0 to 45	85 to 100	10 to 35	25 to 55	30 to 70	40 to 85
		4.75 mm	-	0 to 5	0 to 5	0 to 10	0 to 20	0 to 5	0 to 10	0 to 10	0 to 10
		2.36 mm	-	-	-	-	0 to 5	-	-		-
	b. b. Combined Flakiness and Elongation index		*Not to exceed 40%*								
	c. Crushing Value		*Not to exceed 30%*								
	d. Presence of deleterious material		*Total presence of deleterious materials not to exceed 5% for uncrushed, 2% for crushed and manufactured coarse aggregates as per Annexure- 3A.*								
	e. Hardness		*Abrasion value not more than 50%, Impact value not more than 45%*								
	f. Soundness test (for concrete work subject to frost action)		*12% when tested with sodium sulphate and 18% when tested with magnesium sulphate*								

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Annexure-3A

Deleterious Substance	***Percentage by Mass, Max***		
	Uncrushed	*Crushed*	*Manufactured*
a. Coal and lignite	*1.0*	*1.0*	*1.0*
b. Clay lumps	*1.0*	*1.0*	*1.0*
c. Materials finer than75 micron	*1.0*	*1.0*	*1.0*
d. Soft fragments	*3.0*	*--*	*3.0*
e. Shale	*--*	*--*	*--*
f. Total of percentages of all deleterious materials(except mica) including S. No. a) to e) for uncrushed and crushed aggregates	*5.0*	*2.0*	*2.0*

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ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR FINE AGGREGATES AS PER IS 383: 2016

Annexure-4

4.	**Fine aggregates**	**IS Sieve Designation**	**Percentage passing for graded aggregate of nominal size**		
i)	Physical Tests		**F.A. Zone I**	**F.A. Zone II**	**F.A. Zone III**
	a. Determination of particle size	10 mm	100	100	100
		4.75 mm	90-100	90-100	90-100
		2.36 mm	60-95	75-100	85-100
		1.18 mm	30-70	55-90	75-100
		600 microns	15-34	35-59	60-79
		300 microns	5 to 20	8 to 30	12 to 40
		150 microns	0-10	0-10	**0-10**
	b. Silt content		Not to exceed 8%	Not to exceed 8%	Not to exceed 8%
	c. Presence of deleterious material	*Total presence of deleterious materials not to exceed 5% for uncrushed, 2% for crushed/Mixed and manufactured fine aggregates as per Annexure- 4A.*			
	d. Soundness Applicable to concrete work subject to frost action	*10% when tested with sodium sulphate and 15% when tested with magnesium sulphate*			

Annexure-4A

STANDARD FIELD QUALITY PLAN

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Deleterious Substance	***Percentage by Mass, Max***		
	Uncrushed	*Crushed/Mixed*	*Manufactured*
a. Coal and lignite	*1.0*	*1.0*	*1.0*
b. Clay lumps	*1.0*	*1.0*	*1.0*
c. Materials finer than75 micron	*3.0*	*15.0(for crushed sand)* *12.0 (for mixed sand)*	*10.0*
d. Soft fragments	*--*	*--*	*--*
e. Shale	*1.0*	*--*	*1.0*
f. Total of percentages of all deleterious materials(except mica) including S. No. a) to e) for uncrushed/mixed and manufactured aggregates	*5.0*	*2.0*	*2.0*

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ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS CONCRETE WORKS

Annexure-5

1)	**Concrete**	a) Workability	Slump shall be recorded by slump cone method and it shall between 25-75 mm. depending upon workability requirement as per IS 456: 2000, reaffirmed 2016.
		b) Compressive strength	**For Design mix as per IS:456 for Grade M15 or above For nominal (volumetric) concrete mix compressive strength for 1:1.5:3 (Cement : Fine aggregates : Coarse aggregates) concrete 28 days strength shall be min265Kg/cm² and for 1:2:4(Cement: Fine Aggregate: Coarse aggregate) nominal mix concrete 28 days strength shall be min 210Kg/cm².**

Notes:

1) ***ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTHS FOR NOMINAL MIX CONCRETE: As per clause 5.4.10.4 of CPWD Specifications, Volume 1***

(a) The average of the strength of three specimen be accepted as the compressive strength of the concrete provided the strength of any individual cube shall neither be less than 70% nor higher than 130% of the specified strength.

(b) If the strength of any individual cube exceeds more than 30% of specified strength, it will be restricted to 130% only for computation of strength.

(c) If the actual average strength of accepted sample is equal to or higher than specified strength upto 30% then strength of the concrete shall be considered in order and the concrete shall be accepted at full rates.

(d) If the actual average strength of accepted sample is less than specified strength but not less than 70% of the specified strength, the concrete may be accepted at reduced rate after reconfirmation by NDT/Core test on the location portion represented by the cube samples.

(e) If the actual average strength of accepted sample is less than 70% of specified strength, the Engineer-in-Charge shall reject the defective portion of work represented by sample and nothing shall be paid for the rejected work. Remedial measures necessary to retain the structure shall be taken at the risk and cost of contractor. If, however the Engineer-in-Charge so desires, he may order additional tests to

be carried out to ascertain if the structure can be retained. All the charges in connection with these additional tests shall be borne by the contractor.

2) 53 Grade cement shall be used after obtaining specific approval of the Engineer in charge.
3) Portland slag cement conforming to IS 455:2015 may be used as per Technical Specification.
4) All Design Mix concrete shall be as per IS 456: 2000, reaffirmed 2016
5) **ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTHS FOR DESIGN MIX CONCRETE: As per Table-11, given below:**

Specified Grade	***Case No.***	***Sampling***	***Acceptance Criteria for Mix Design as per Is 456:2000***	***Remarks***
M15 and above	A1	*Mean of Group of 4 non-overlapping consecutive test results.*	*Shall greater than or equal to fck+0.825 x established standard deviation (rounded off to nearest 0.5 N/sq. mm)** *Or* *fck + 3 N/sq. mm, whichever is greater*	
	A2	*Individual test result out of A 1.*	*Greater than or equal (fck+3) N/ sq.mm*	*Out of four non overlapping consecutive test results, one individual test result only.*
	B1	*Group of non-overlapping consecutive if test results are less than 4*	*fck + 4, N/sq.mm, minimum*	
	B2	*Individual test result out of B 1.*	*fck - 2, N/sq.mm, minimum*	*Out of less than four non-overlapping consecutive test results, one individual test result only.*
	C1	*When number of sample is only one.*	*fck + 4, N/sq.mm, minimum*	

Established value of standard deviation shall be determined based on Note of Table-11 of IS 456

STANDARD FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	REC PDCL Projects
Date of Issue	
Validity	Till next revision

SFQP No.	RECPDCL/SFQP/01 (Rev-01)
Project Name	Construction of Township at Nagrota Substations
LOA No	

SAMPLING PLAN FOR BRICK WORK

Annexure-6
(Page 01 of 02)

Scale of sampling and permissible number of defectives for visual and dimensional characteristics.

No of Bricks in the lot	**For characteristics specified for individual bricks**		**For Dimensional characteristics for group of 20 bricks**
	No of bricks to be selected	Permissible no of defective in the sample.	No of bricks to be selected
(1)	(2)	(3)	(4)
2001-10000	20	1	40
10001-35000	32	2	60
35001-50000	50	3	80

Note: In case the lot contains 2000 or less bricks the sampling shall be as per decision of the Engineer – in-charge

Scale of sampling for physical characteristics

Lot size	**Sampling size for compressive strength, water absorption and efflorescence**	**Permissible No of defectives for efflorescence**
(1)	(2)	(3)
2001-10000	5	0
10001-35000	10	0
35001-50000	15	1

STANDARD FIELD QUALITY PLAN

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Date of Issue	
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SFQP No.	RECPDCL/SFQP/01 (Rev-01)
Project Name	Construction of Township at Nagrota Substations
LOA No	

SAMPLING PLAN FOR BRICK WORK

ACCEPTABLE CRITERIA FOR BRICK WORK

1) Dimensional Tolerances: The dimensions of modular/ Non modular bricks when tested shall be within the following limits per 20 bricks.

S. No	DESCRIPTION	MODULAR BRICKS	NON-MODULAR BRICKS
1	LENGTH	372 to 388 cm (380± 8 cm)	*452 to 468 cm (460± 8 cm)*
2	WIDTH	*176 to 184 cm (180± 4 cm)*	*216 to 224 cm (220± 4 cm)*
3	HEIGHT	176 to 184 cm (180± 4 cm)	*136 to 144 cm (140± 4 cm)*

2) Compressive strength: the bricks shall have a minimum average compressive strength as specified in RECPDCL specification. The compressive strength of any individual brick tested shall not fall below the min. average compressive strength specified for the corresponding class of brick by more than 20%. in case compressive strength of any individual brick tested exceeds the upper limit specified for the corresponding class of bricks, the same shall be limited to upper limit of the class as specified for the purpose of calculating the average compressive strength.

3) Water Absorption: The average water absorption of bricks shall not be more than 20% by weight.

4) Efflorescence: The rating of efflorescence of bricks shall not be more than moderate.

STANDARD FIELD QUALITY PLAN

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PHYSICAL REQUIREMENT OF COARSE AGGREGATE

Annexure-7
(Page 01 of 02)

S.No.	Type of Constn.	Type of W.B.M	Test Method	Requirements
1.	Sub-base	Los Angeles Abrasion Value or Aggregate Impact value	IS 2386 (Part-IV) IS 2386 (Part-IV) IS 5640***	60% max. * 50% max
2.	Base	a) Los Angeles Abrasion Value or Aggregate Impact value b) Flakiness Index	IS 2386 (Part-IV) IS 2386 (Part-IV) IS 5640*** IS 2386(Part-I)	50% max. * 40% max **15% max
3.	Surface Course	a) Los Angeles Abrasion Value or Aggregate Impact value b) Flakiness Index	IS 2386(Part-IV) IS 2386(Part-IV) IS 2386(Part-I)	40% max. 30% max **15% max
4	Binding Material	Plasticity index	IS 2720 (Part-V)	Less than 6

*Aggregates may satisfy requirements of either of the two tests

** The requirements of flakiness index shall be enforced only in case of crushed/broken stone and crushed slag.

***Aggregates like brick metal, kankar and laterite which get softened in presence of water, shall be tested for impact value under wet conditions in accordance with IS 5640.

STANDARD FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	REC PDCL Projects
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PHYSICAL REQUIREMENT OF COARSE AGGREGATE **Annexure-7**
(Page 02 of 02)

GRADING REQUIREMENT OF COARSE AGGREGATE FOR W.B.M

Grading No.	Size Range	Sieve designation	% by weight passing the sieve
1	90mm to 45mm (Suitable for sub base courses of compacted layer of not less than 90mm thickness).	125mm 90mm 63mm 45mm 22.4mm	100 90-100 25-60 0-15 0-5
2.	63mm to 45mm	90mm 63mm 53mm 45mm 22.4mm	100 90-100 25-75 0-15 0-5
3.	53mm to 22.4mm	63mm 53mm 45mm 22.4mm 11.2mm	100 95-100 65-90 0-10 0-5
4	Screening		
	A) 13.2 mm	13.2 mm 11.2 mm 5.6 mm 180 micron	100 95-100 15-35 0-10
	B) 11.2 mm	11.2 mm 5.6 mm 180 micron	100 90-100 15-35

STANDARD FIELD QUALITY PLAN

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General Notes:

1. This Field Quality Plan is not to limit the supervisory checks which are otherwise required to be carried out during execution of work as per drawings/Technical specifications etc.
2. All materials under supply contract should have Cat-A CIP before they are erected.
3. Contractor shall be responsible for implementing/documenting the FQP. Documents shall be handed over by the contractor to RECPDCL after the completion of the work.
4. Project incharge means over all incharge of work. Site Incharge means incharge of the Site. Site Engineer means in charge of the section. Site Engineer' responsibility may be allocated to Site JE, with the approval of HO Head, only in such cases where, Site Engineer is not in position.
5. In case of deviation the approving authority will be one step above the officer designated for acceptance in this quality plan subject to minimum level of Site incharge.
6. Acceptance criteria and permissible limits for tests are indicated in the Annexures. However for further details/tests RECPDCL specification and latest relevant Indian standards shall be referred.
7. Tests as mentioned in this FQP shall generally be followed. However E.I.C. reserves the right to order additional tests wherever required necessary at the cost of the agency.
8. All counter checks/tests by RECPDCL shall be carried out by RECPDCL official's atleast at the level of Site Engineer. .
9. The authorized dealer of reinforcement steel means the dealer whose are approved by RECPDCL Authority
10. Accepting Authority for testing Laboratory shall be HO Head.

11. READYMIX CONCRETE (RMC) IS ACCEPTABLE FOR USE. HOWEVER, SITE INCHARGE SHALL APPROVE THE SOURCE OF MATERIALS TO BE USED FOR RMC .The documentation to be maintained shall be as per IS 4926:2003, Reaffirmed 2012 i.e.

    i) Information to be supplied by the purchaser (clause 7)

    ii) Information to be supplied by the producer (clause 8)

    iii) Sampling for concrete strength should be one set of 3 nos. of cubes for every 50 cum or part thereof for each day of concreting and 28 days compressive strength shall be tested in line with IS 456: 2000, Reaffirmed 2016.

12. Epoxy coating on reinforcement steel wherever required shall be done as per IS 13620: 1993, Reaffirmed 2015.
13. Cement is to be used in the order; it is delivered (i.e. First in First Out). In case the cement remains in storage for more than 3 months, the cement shall be retested before use and shall be rejected, if it fails to conform to any of the requirements given in the

relevant Indian Standard. Cement shall be packed in bags and stored in accordance with the provisions in IS 4082:1996, Reaffirmed 2003.

14. Three samples of each size of steel (all sizes of 10mm & above) out of 100MT steel Lot need to be physically weighted to ascertain their acceptance as per technical specification. The weighted samples at site may be kept under custody for three months.
15. If e-mail facility is not available in RECPDCL approved Lab, report may be collected directly by RECPDCL /Speed Post / Register Post / UPC.
16. In case any Laboratory refuses to allow RECPDCL representative for witnessing the test, same shall be taken in writing and approved by HO Head.
17. Latest IS codes shall be followed.
18. Standard marking of ISI mark along with license number (Seven digit no., represented as CM/L-----) should be verified for construction materials.
19. The mix design shall be approved in line with standard format for mix design concrete and final approval of mix design shall be done in consultation with HO engineering department.
20. Tolerance of cement weight shall be governed by clause no. 10.1.1 of IS 269:2015 for OPC and by clause no. 10.1.1 of IS 1489 (Part 1):2015 for PPC.
21. Digital Photographs during major construction activities shall be taken and kept in record.

MODEL TECHNICAL SPECIFICATION

SECTION: LT SWITCHGEAR

SECTION: LTSWITCHGEAR

Table of contents

Clause No.	Description
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1.6	**MOULDED CASE CIRCUIT BREAKER (MCCB) and MCB**
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SECTION: LT SWITCHGEAR

1.1. CONSTRUCTIONAL DETAILS OF SWITCHBOARDS AND DISTRIBUTION BOARDS

1.1.1. All boards shall be of metal enclosed, indoor floor mounted, compartmentalized double front construction and freestanding type.

1.1.2. All board frames, shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness not less than 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness not less than 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary. ***Gland plate shall be cold rolled sheet steel having thickness not less than 3 mm in all cases. However, in case of termination of single core power cables, gland plate shall be of non-magnetic material of at least 4mm thickness.***

1.1.3. All panel edges and cover/door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members.

1.1.4. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cut-outs shall be true in shape and devoid of sharp edges.

1.1.5. All boards shall be of dust and vermin proof construction and shall be provided with a degree of protection of IP: 52, ***for category I enclosure*** as per IS 13947 (Part-1). However, the busbar chambers having a degree of protection of IP: 42, in accordance with IS 13947 (Part-1), are also acceptable where continuous busbar rating exceeds 1000 Amp. Provision shall be made in all ***draw out Air Circuit Breaker*** compartments for providing IP: 52 degree of protection, when Circuit breaker trolley, has been removed. ***Panels with lighting transformers shall have IP 31 degree of protection in accordance with IS 13947 (Part-1)***. ***Door frame of panels, meters, relays, Breaker*** cut-outs shall be provided with neoprene ***rubber*** gaskets ***generally conforming to Type-II, Class 2A as per IS: 11149.***

1.1.6. Provision of louvers on boards would not be preferred. However, louvers backed with metal screen are acceptable on the busbar chambers where continuous busbar rating exceeds 1000 Amps. ***Panels with lighting transformers in lighting distribution boards shall have louvers.***

1.1.7. All boards shall be of uniform height not exceeding 2450 mm.

1.1.8. Boards shall be easily extendible on both sides, by the addition of the vertical sections after removing the end covers ***of bus bar chambers***.

1.1.9. Boards shall be supplied with base frames made of structural steel sections, alongwith all necessary mounting hardware required for welding the base frames to the insert plates.

1.1.10. ***a)*** All boards shall be *of* double front construction and shall have: -

(i) A completely enclosed busbar compartment for running horizontal busbars and vertical busbars. Busbar chambers shall be completely enclosed with metallic portions. Bolted covers shall be provided for access to horizontal and Vertical busbars for repair and maintenance, which shall be feasible without disturbing feeder compartment. Vertical bus bar chambers shall be accessible from front as well as back side of the panel ***and shall be of at least 350 mm width***. One set of

vertical busbars shall be used in between two adjacent sections for switchgear connections. In case of ACB feeders, ***the panel shall have single front without any vertical busbar chamber, however*** vertical busbars ***associated with ACBs shall be*** located in rear side ***and*** shall be additionally covered with metallic perforated***/ transparent acrylic or polyvinyl*** bolted sheets to avoid direct access after opening rear door of chamber.

(ii) Completely enclosed switchgear compartment(s) one for each circuit for housing circuit breaker or MCCB or motor starter.

(iii) A distinct compartment or alley for power and control cables on each side of panel. Cable alley compartment shall have a through metallic partition for segregating cables on both sides. Cable alley door shall preferably be hinged. Cable alley shall have no exposed live parts. Any live terminals shall be fully shrouded/insulated from safety aspects. However, it shall be of atleast 350mm width.

(iv) A compartment for relays and other control devices associated with a circuit breaker.

b) Distribution transformers shall be supplied in separate and distinct panel completely assembled for incoming cable connection from bottom and outgoing connection through busbar with adjacent associated lighting distribution board. Lighting transformers shall have provision of base channel with rollers for taking in and out from the panel in case of maintenance after disconnecting incoming and outgoing connections. Provision of single phase fans at least two (2) numbers of suitable ratings shall be made in the panel for ventilation. These fans shall run in sequential mode at suitable time interval to be controlled by thermostat and timer. The offered design of panel should be such that in no case, temperature rise of lighting transformers shall exceed the permissible limits for the class of insulation of lighting transformer.

1.1.11. Sheet steel barriers shall be provided between two adjacent vertical panels running to the full height of the switchboard, except for the horizontal busbar compartment. Each shipping section shall have full metal sheets at both ends for transport and storage.

1.1.12. All equipments associated with a single circuit except MCB circuits shall be housed in a separate compartment of the vertical section. The Compartment shall be sheet steel enclosed on all sides with the withdrawal units in position or removed. The front of the compartment shall be provided with the hinged single leaf door, with locking facilities.
In case of circuits controlled by MCBs, group of MCB feeders can be offered in common compartment. In such case number of MCB feeder to be used in a common compartment shall not exceed 4 (four) and front of MCB compartment, shall have a viewing port of toughen glass sheet for viewing and sheet steel door of module shall be lockable with star knob/panel key.

1.1.13. After isolation of power and control circuit connections it shall be possible to safely carryout maintenance in a compartment with the busbar and adjacent circuit live. Necessary shrouding arrangement shall be provided for this purpose over the cable terminations located in cable alley.

1.1.14. The minimum clearance in air between phases and between phase and earth for the entire run of horizontal and vertical busbars, shall be 25 mm. For all other components, the

clearance between "two live parts", " A live part and an earthed part" and isolating distance shall be atleast ten (10) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers. However, for horizontal run of busbar minimum clearance of 25 mm should be maintained even if they are sleeved.

1.1.15. The temperature rise of horizontal & vertical busbars when carrying rated current along its full run shall in no case exceed 55°C, with silver plated joints and 40°C with all other type of joints over an outside ambient temperature of 50°C.

1.1.16. All busbar chambers shall be provided with removable bolted covers. The covers shall be provided with danger labels.

1.1.17. All identical circuit breakers and module chassis of same test size shall be fully interchangeable without having to carryout modifications.

1.1.18. All Circuit breaker boards shall be of Single Front type, with fully drawout circuit breakers, which can be drawn out without having to unscrew any connections. The circuit breakers shall be mounted on rollers and guides for smooth movement between SERVICE, TEST and ISOLATED positions and for withdrawal from the Switchboard. Testing of the breaker shall be possible in the TEST position.

1.1.19. Wherever two breaker compartments are provided in the same vertical section, insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit.

1.1.20. All disconnecting contacts for power circuits shall be of robust design and fully self-aligning. Fixed and moving contacts of the power drawout contact system shall be silver plated. Both fixed and moving contacts shall be replaceable.

1.1.21. All AC & DC boards shall be of double Front type.

1.1.22. All module shall be fixed type except air circuit breaker module, which shall be drawout type.

1.1.23. The connections from busbars to the main switch shall be fully insulated/shrouded, and securely bolted. The partition between the feeder compartment and cable alley may be non-metallic and shall be of such construction as to allow cable cores with lugs to be easily inserted in the feeder compartment for termination.

1.1.24. All equipment and components shall be neatly arranged and shall be easily accessible for operation and maintenance. The internal layout of all modules shall be subject to PURCHASER approval. Bidder shall submit dimensional drawings showing complete internal details of Busbars and module components, for each type and rating for approval.

1.1.25. The tentative power and control cable entries shall be from bottom. However, Purchaser reserves the right to alter the cable entries, if required, during detailed engineering, without any additional commercial implication.

1.1.26. Adopter panels and dummy panels required to meet the various busbar arrangements and layouts required shall be included in Bidder's scope of work.

1.2. DERATING OF EQUIPMENTS

1.2.1. The current ratings of all equipments as specified in the ***Single Line Diagram For AC & DC System*** are the minimum standards current ratings at a reference ambient temperature as per relevant Indian Standards.

1.3. POWER BUS BARS AND INSULATORS

1.3.1. All AC Distribution Boards shall be provided with three phase buses and neutral bus bars and the DC Distribution Boards shall be provided with two busbars.

1.3.2. All busbars and jumper connections shall be of high conductivity aluminium/copper of adequate size.

1.3.3. The Cross-Section of the busbars shall be uniform through out the length of Switchgear and shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents.

1.3.4. All busbars shall be adequately supported by ***adequate numbers of*** high strength type Polyester fibre glass Moulded Insulators ***to withstand short circuit withstand capability of panel***. Separate supports shall be provided for each phase and neutral busbar. If a common support is provided anti-tracking barriers shall be provided between the supports.

1.3.5. All busbars joints shall be provided with high tensile steel bolts. Belleville/spring washers and nuts, so as to ensure good contacts at the joints. Non-silver plated Busbars joints shall be thoroughly cleaned at the joint locations and a suitable contact grease shall be applied just before making a joint.

1.3.6. All busbars shall be colour coded as per IS: 11353-***1985: Guide for Uniform System of Marking and Identification of Conductors and Apparatus Terminals.***

1.3.7. The Bidder shall furnish calculations, establishing the adequacy of busbar sizes for specified current ratings, On the basis of short circuit current and temperature rise consideration at specified ambient temp.

1.4. EARTH BUS

1.4.1. A galvanised steel earthing shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded/bolted to the frame work of each panel and breaker earthing contact bar vertical bus shall be provided in each vertical section which shall in turn be bolted/welded to main horizontal ground bus.

1.4.2. The earth bus shall have sufficient cross-section to carry the momentary short circuit and short time fault currents to earth without exceeding the allowable temperature rise.

1.4.3. Suitable arrangements shall be provided at each end of the horizontal earth bus for bolting to Purchaser's earthing conductors. The horizontal earth bus shall project out the switchboard ends and shall have predrilled holes for this connection. A joint spaced and taps to earth bus shall be made through at least two bolts.

1.4.4. All non-current metal work of the Switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosures frame work and the truck shall be maintained even after painting.

1.4.5. The truck and breaker frame shall get earthed while the truck is being inserted in the panel and positive earthing of the truck and breaker frame shall be maintained in all positions. SERVICES & ISOLATED, as well as through out the intermediate travel.

1.4.6. ***Air Circuit Breaker (ACB)*** module frame shall get engaged to the vertical earth bus, before the disconnecting contacts on these module are engaged to the vertical busbar.

1.4.7. All metallic cases of relays, instruments and other panel mounted equipments shall be connected to earth by independent stranded copper wires of size not less than 2.5 mm^2. Insulation colour code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors and soldering is not acceptable. Looping of earth Connection which would result in loss of earth connection to the devices when a device is removed is not acceptable. However, looping of earth connections between equipment to provide alternative paths or earth bus is acceptable.

1.4.8. VT and CT secondary neutral point earthing shall be at one place only, on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit.

1.4.9. All hinged doors shall be earthed through flexible earthing braid.

1.4.10. Caution nameplate `Caution-Live Terminals' shall be provided at all points where the terminals are like to remain live and isolation is possible only at remote end.

1.5. AIR CIRCUIT BREAKERS

1.5.1. Circuit breakers shall be three-pole air break horizontal drawout type and shall have inherent fault making and breaking capacities as specified in "Technical Parameters". The circuit breakers which meet specified parameter only after provision of releases or any other devices shall not be acceptable.

1.5.2. Circuit breakers shall be mounted along with it operating mechanism on a wheeled carriage. Suitable guides shall be provided to minimise misalignment of the breaker.

1.5.3. There shall be `Service', `Test' and `Fully withdrawn positions for the breakers. In `Test' position the circuit breaker shall be capable of being tested for operation without energising the power circuits i.e. the power Contacts shall be disconnected while the Control circuits shall remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the `SERVICE', `TEST' OR FULLY WITHDRAWN' position. It shall be possible to close the door in TEST position.

1.5.4. All circuit breakers shall be provided with 4 NO and 4 NC potentially free auxiliary contacts. These contacts shall be in addition to those required for internal mechanism of the breaker. Separate limit switches each having required number of contacts shall be provided in both `SERVICE' & `TEST' position of the breaker. All contacts shall be rated for making continuously carrying and breaking 10 Amps at 240V AC and 1 Amp (Inductive) at 220V DC.

1.5.5. Suitable mechanical indications shall be provided on all circuit breakers to show `OPEN'. `CLOSE', `SERVICE', `TEST' and `SPRING CHARGED' positions.

1.5.6. Main poles of the circuit breakers shall operate simultaneously in such a way that the

maximum difference between the instants of contacts touching during closing shall not exceed half cycle of rated frequency.

1.5.7. All circuit breakers shall be provided with the interlocks as explained in further clauses.

1.5.8. Movement of a circuit breaker between SERVICE AND TEST positions shall not be possible unless it is in OPEN position. Attempted with drawl of a closed circuit breaker shall trip the circuit breaker.

1.5.9. Closing of a circuit breaker shall not be possible unless it is in SERVICE, TEST POSITION or in FULLY WITHDRAWN POSITION.

1.5.10. Circuit breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage to cover the stationary isolated contacts when the breaker is withdrawn. It shall however, be possible to open the shutters intentionally, against spring pressure for testing purpose.

1.5.11. A breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.

1.5.12. Circuit breakers shall be provided with electrical anti-pumping and trip free feature, even if mechanical antipumping feature is provided.

1.5.13. Mechanical tripping shall be possible by means of front mounted RED `Trip' push- button. In case of electrically operated breakers these push buttons shall be shrouded to prevent accidental operation.

1.5.14. Breaker controlled motors shall operate satisfactorily under the following conditions:

(i) Direct on-line starting of Induction Motors rated 110 kW to 220 kW with a locked rotor current of seven times the rated current, and starting time of up to 30 seconds.

(ii) Breaking on-load, full load and locked rotor currents of Induction Motors for rated 100 kW to 220 kW.

1.5.15. Means shall be provided to slowly close the circuit breaker in withdrawn position. If required for inspection and setting of Contacts, in service position slow closing shall not be possible.

1.5.16. Power operated mechanism shall be provided with a universal motor suitable for operation 220V DC Control supply with voltage variation from 90% to 110% rated voltage. Motor insulation shall be class `E' or better.

1.5.17. The motor shall be such that it requires not more than 30 seconds for fully charging the closing spring.

1.5.18. Once the closing springs are discharged, after the one closing operation of circuit breaker, it shall automatically initiate, recharging of the spring.

1.5.19. The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.

1.5.20. Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.

1.5.21. All circuit breakers shall be provided with closing and trip coils. The closing coils shall operate correctly at all values of Voltage between 85% to 110% at rated control voltage. The trip coil shall operate satisfactorily under all values of supply voltage between 70% to 110% of rated control voltage.

1.5.22. Provision for mechanical closing of the breaker only in `TEST' and `WITHDRAWN' positions shall be made.

1.5.23. PROTECTION CO-ORDINATION

1.5.23.1. It shall be the responsibility of the Contractor to fully co-ordinate the overload and short circuit tripping of the circuit breakers with the upstream and downstream circuit breakers/fuses/motor starters, to provide satisfactory discrimination.

1.6. MOULDED CASE CIRCUIT BREAKER (MCCB) andMCB

1.6.1. MCCB shall in general conform to IS: 13947 Part-2. All MCCB ***offered*** shall ***have Ics = 100% Icu rating***. ***Type test reports for offered model of MCCB shall be submitted during detailed engineering for owner's acceptance.***

1.6.2. MCCB shall be flush mounted on the AC/DC distribution boards ***and shall have extended handle.***

1.6.3 MCCBs shall be provided with thermo-magnetic type release for over current and short circuit protection. The setting of the thermal release shall be adjustable between ***80%*** to 100% of the rated current. The MCCB shall have breaking capacity not less than 20kA.

1.6.4 MCCBs used for ACDB incomers and Bus coupler shall be equipped with stored energy mechanism for electrical closing and tripping. All other MCCBs shall be manually operated. The operating handle should give a clear trip indication.

1.6.5 Miniature circuit breaker (MCB) shall conform to IEC: 898-1987 and IS: 8828.

1.7 RELAYS

1.7.1 All relays and timers in protective circuits shall be flush mounted on panel front with connections from the inside. They shall have transparent dust tight covers removable from the front. All protective relays shall have a drawout construction for easy replacement from the front. They shall either have built-in test facilities, or shall be provided with necessary test blocks and test switches located immediately below each relay. The auxiliary relays and timers may be furnished in non-drawout cases.

1.7.2 All AC relays shall be suitable for operation, at 50 Hz with 110 volts VT secondary and 1 amp or 5 amp CT secondary.

1.7.3 All protective relays and timers shall have at least two potentially free output contacts. Relays shall have contacts as required for protection schemes. Contacts of relays and timers shall be silver faced and shall have a spring action. Adequate number of terminals shall be available on the relay cases for applicable relaying schemes.

1.7.4 All protective relays auxiliary relays and timers shall be provided with hand reset operation indicators (Flags) for analysing the cause of operation.

1.7.5 All relays shall withstand a test voltage of 2 KV (rms) for one minute.

1.7.6 Motor starters shall be provided with three element, ambient temperature compensated, time lagged, hand reset type overload relays with adjustable settings. The setting ranges shall be properly selected to suit the motor ratings. These relays shall have a separate black coloured hand reset push button mounted on compartment door and shall have at least one changeover contact.

1.7.7 All fuse-protected contactor-controlled motors shall have single phasing protection, either as a distinct feature in the overload relays (by differential movement of bimetallic strips), or as a separate device. The single phasing protection shall operate even with 80% of the set current flowing in two of the phases.

1.8 CONTACTORS

1.8.1 Motor starter contactors shall be of air break, electromagnetic type rated for uninterrupted duty as per IS:13947 (Part 4).

1.8.2 Contactors shall be double break, non-gravity type and their main contacts shall be silver faced.

1.8.3 Direct on line starter contactors shall be of utilisation category AC2. These contactors shall be as per IS:13947 (Part 4).

1.8.4 Each contactor shall be provided with two (2) normally open (NO) and two (2) normally close (NC) auxiliary contacts.

1.8.5 Operating coils of contactors shall be of 240V AC Unless otherwise specified elsewhere. The Contactors shall operate satisfactorily between 85% to 110% of the rated voltage. The Contactor shall drop out at 70% of the rated voltage.

1.9 INSTRUMENT TRANSFORMERS

1.9.1 All current and voltage transformers shall be completely encapsulated cast resin insulated type suitable for continuous operation at the temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated condition and the outside ambient temperature is 50°C.

1.9.2 All instrument transformers shall be able to withstand the thermal and mechanical stresses resulting from the maximum short circuit and momentary current ratings of the associated switchgear.

1.9.3 All instrument transformer shall have clear indelible polarity markings. All secondary terminals shall be wired to a separate terminal on an accessible terminal block where star-point formation and earthing shall be done.

1.9.4 Current transformers may be multi or single core type. All voltage transformers shall be single phase type. The Bus VTs shall be housed in a separate compartment.

1.9.5 All VTs shall have readily accessible ***MCBs*** on both primary and secondary sides.

1.10 INDICATING INSTRUMENTS

1.10.1 All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96 mm square size with 90 degree scales, and shall have an accuracy class of 2.5 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.

1.10.2 All instruments shall be compensated for temperature errors and factory calibrated to directly read the primary quantities. Means shall be provided for zero adjustment without removing or dismantling the instruments.

1.10.3 All instruments shall have white dials with black numerals and lettering. Black knife edge pointer with parallax free dials will be preferred.

1.10.4 Ammeters provided on Motor feeders shall have a compressed scale at the upper current region to cover the starting current.

1.10.5 Watt-hour meters shall be of 3 phase three element type, Maximum demand indicators need not be provided.

1.11 CONTROL & SELECTOR SWITCHES

1.11.1 Control & Selector switches shall be of rotary type with escutcheon plates clearly marked to show the function and positions. The switches shall be of sturdy construction suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred.

1.11.2 Circuit breaker selector switches for breaker Controlled motor shall have three stay put positions marked `Switchgear', `Normal' and `Trial' respectively. They shall have two contacts of each of the three positions and shall have black shade handles.

1.11.3 Ammeter and voltmeter selector switches shall have four stayput position with adequate number of contacts for three phase 4 wire system. These shall have oval handles Ammeter selector switches shall have make before break type contacts to prevent open circuiting of CT secondaries.

1.11.4 Contacts of the switches shall be spring assisted and shall be of suitable material to give a long trouble free service.

1.11.5 The contact ratings shall be at least the following :

(i)	Make and carry continuously	10 Amp.
(ii)	Breaking current at 220V DC	1 Amp (Inductive)
(iii)	Breaking current at 240V AC	5 Amp (at 0.3 pf lagging)

1.12 AIR BREAK SWITCHES

1.12.1 Air breaker switch shall be of the heavy duty, single throw group operated, load break, fault make type complying with IS:***13947,Part-3.***

1.12.2 The Bidder shall ensure that all switches are adequately rated so as to be fully protected by the associated fuses during all abnormal operating conditions such as overload, locked

motor, short circuit etc.

1.12.3 Switch operating handles shall be provided with padlocking facilities to lock them in `OFF' position.

1.12.4 Interlocks shall be provided such that it is possible to open the cubicle door only when the switch is in `OFF' position and to close the switch only when the door is closed. However suitable means shall be provided to intentionally defeat the interlocks explained above.

1.12.5 Switches and fuses for AC/DC control supply and heater supply wherever required shall be mounted inside and cubicles.

1.13 PUSH BUTTONS

1.13.1 Push-buttons shall be of spring return, push to actuate type. Their contacts shall be rated to make, continuously carry and break 10A at 240V and 0.5A (inductive) at 220V DC.

1.13.2 All push-buttons shall have one normally open and one normally closed contact, unless specified otherwise. The contact faces shall be of silver or silver alloy.

1.13.3 All push-buttons shall be provided with integral escutcheon plates marked with its function.

1.13.4 The colour of the button shall be as follows :

(i)	GREEN	:	For motor START, Breaker CLOSE
(ii)	RED	:	For motor TRIP, Breaker OPEN
(iii)	BLACK	:	For overload reset.

1.13.5 All push-buttons on panels shall be located in such a way that Red-push-buttons shall always be to the left of green push-buttons.

1.14 INDICATING LAMPS

1.14.1 Indicating lamps shall be of the panel mounting cluster LED type. The lamps shall have escutcheon plates marked with its function, wherever necessary.

1.14.2 Lamps shall have translucent lamp-covers of the following colours, as warranted by the application :

(i)	RED	:	For motor ON, Breaker CLOSED
(ii)	GREEN	:	For motor OFF, Breaker OPEN
(iii)	WHITE	:	For motor Auto-Trip
(iv)	BLUE	:	For all healthy conditions (e.g. control supply, and also for 'SPRING CHARGED"
(v)	AMBER	:	For all alarm conditions (e.g. overload) Also for `SERVICE' and `TEST' positions indicators.

1.14.3 Lamps shall be easily replaceable from the front of the cubicle.

1.14.4 Indication lamps should be located just above the associated push buttons/control switches. Red lamps shall invariable be located to the right of green lamps. In case a white lamp is also

provided, it shall be placed between the red and green lamps along with the centre line of control switch/push button pair. Blue and Amber lamps should normally be located above the Red and Green lamps.

1.14.5 When associated with push-buttons, red lamps shall be directly above the green push button, and green lamps shall be directly above the red push-button. All indicating lamps shall be suitable for continuous operation at 90 to 110% of their rated voltage.

1.15 FUSES

1.15.1 All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC Circuits shall be of class 2 type, 20 kA (RMS) breaking current at 415 AC, and for DC circuits Class 1 type 4 kA breaking current.

1.15.2 Fuses shall have visible operation indicators.

1.15.3 Fuses shall be mounted on fuses carriers, which are mounted on fuse bases, wherever it is not possible to mount fuses on carriers fuses shall be directly mounted on plug in type of bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchgear.

1.15.4 Fuse rating shall be chosen by the Bidder depending upon the circuit requirements and these shall be subject to approval of PURCHASER.

1.16 TERMINAL BLOCKS

1.16.1 Terminal blocks shall be of 750 volts grade and have continuous rating to carry the maximum expected current on the terminals. It shall be complete with insulating barriers, clip-on-type/stud type terminals for Control Cables and identification strips. Marking on terminal strip shall correspond to the terminal numbering on wiring on diagrams. It shall be similar to `ELEMEX' standard type terminals, cage clamp type of Phoenix or WAGO or equivalent

1.16.2 Terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary leads shall be provided with short circuiting and earthing facilities. It shall be similar to `Elem.' `CATD' - Type.

1.16.3 In all circuit breaker panels at least 10% spare terminals for external connections shall be provided and these spare terminals shall be uniformly distributed on all terminal blocks. Space for adding another 10% spare terminals shall also be available.

1.16.4 All terminal blocks shall be suitable for terminating on each side, two (2) Nos. of 2.5 mm square size standard copper conductors.

1.16.5 All terminals shall be numbered for identification and grouped according to the function. Engraved white-on-black labels shall be provided on the terminal blocks.

1.16.6 Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.

1.16.7 Terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal block. The minimum clearance between the first row of terminal block and the

associated cable gland plate shall be 250 mm.

1.17 NAME PLATES AND LABELS

1.17.1 All switchgears, AC/DC distribution boards, shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear also.

1.17.2 All name plates shall be of non-rusting metal or 3-ply lamicoid with white engraved lettering on black back ground. Inscriptions and lettering sizes shall be subject to PURCHASER approval.

1.17.3 Suitable plastic sticker labels shall be provided for easy identification of all equipments, located inside the panel/module. These labels shall be positioned so as to be clearly visible and shall give the device number as mentioned in the module wiring drawings.

1.18 SPACE HEATER

1.18.1 Space heater shall be provided in all the boards for preventing harmful moisture condensation.

1.18.2 The space heaters shall be suitable for continuous operation on 240V AC, 50 Hz, single phase supply, and shall be automatically controlled by thermostats. Necessary isolating switches and fuses shall also be provided.

1.19 CONTROL AND SECONDARY WIRING

1.19.1 All switchboards shall be supplied completely wired internally upto the terminal blocks ready to receive Purchaser's control cables.

1.19.2 All inter cubicle and inter panel wiring and connections between panels of same switchboard including all bus wiring for AC and DC supplies shall be provided by the bidder.

1.19.3 All internal wiring shall be carried out with 1100 V grade, single core, 1.5 square mm or larger stranded copper wires having colour coded, PVC insulation. CT circuits shall be wired with 2.5 square mm copper wires. Voltage grade and insulation shall be same as above.

1.19.4 Extra-flexible wires shall be used for wiring to device mounted on moving parts such as hinged doors.

1.19.5 All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminals blocks.

1.20 POWER CABLES TERMINATION

1.20.1 Cable termination compartment and arrangement for power cables shall be suitable for stranded aluminium conductor, armoured XLPE/PVC insulated and sheathed, single core/three core, 1100 V grade cables.

1.20.2 All necessary cable terminating accessories such as Gland plates, supporting clamps and brackets, power cable lugs, hardware etc. shall be provided by the successful bidder, to suit the final cable sizes which would be advised later.

1.20.3 The gland plate shall be of removable type and shall cover the entire cable alley. Bidder shall also ensure that sufficient space is provided for all cable glands. For all single core cables, gland plates shall be of non-magnetic Material.

1.21 TYPE TESTS

1.21.1 Type tests reports on Panels (Switchgear and Control gear assemblies) as per IS 8623 Part-I shall be submitted for the following tests in line with clause 9.0 of Section GTR :

i) Verification of temperature rise limits
ii) Verification of the dielectric properties
iii) Verification of short circuit strength
iv) Verification of the continuity of the protective circuit
v) Verification of clearances and creepage distances
vi) Verification of mechanical operation
vii) Verification of degree of protection

1.21.2 Contractor shall submit type test reports for the following Switchgear and Control gears before the fabrication of switchgear is started:

1. Circuit breakers/MCCB as per IS 13947 Part-II
2. Protective Relays as per IEC: 60255.
3. ***Lighting transformers as per IS:2026***

For above equipments, test conducted once are acceptable (i.e. The requirement of test conducted within last ***ten*** years shall not be applicable)

1.22 ERECTION, TESTING AND COMMISSIONING

1.22.1 The Contractor shall unload, erect, install, test and put into commercial use all electrical equipment included in this specification.

1.22.2 Equipment shall be installed in a neat, workman like manner so that it is level, plumb, square and properly aligned and oriented. Tolerance shall be as established in Contractor's drawings or as stipulated by purchaser. No equipment shall be permanently bolted down to foundations until the alignment has been checked and found acceptable by the purchaser.

1.22.3 Contractor shall furnish all supervision, labour tools equipment rigging materials, bolts, wedges, anchors, concrete inserts etc. in proper time required to completely install, test and commission the equipment.

1.22.4 Manufacturer's and purchaser's instructions and recommendations shall be correctly followed in handling, setting, testing and commissioning of all equipment.

1.22.5 Contractor shall move all equipment into the respective room through the regular door or openings specifically provided for this purpose. No part of the structure shall be utilised to lift or erect any equipment without prior permission of Purchaser.

1.22.6 All boards shall be installed in accordance with ***relevant code of practices*** and at Purchaser's instructions. All boards shall be installed on finished surfaces, concrete or steel stills. Contractor shall be required to install and align any channel sills which form part of foundations. In joining shipping sections of switchboards together adjacent housing of panel sections or flanged throat sections shall be bolted together after alignment has been completed. Power bus, enclosures ground and control splices of conventional nature shall

be cleaned and bolted together being drawn up with torque spanner of proper size or by other approved means.

1.22.7 All boards shall be made completely vermin proof.

1.22.8 Contractor shall take utmost care in holding instruments, relaying and other delicate mechanism wherever the instruments and relays are supplied separately they shall be mentioned only after the associated panels have been erected and aligned. The packing materials employed for safe transit of instrument and relays shall be removed after ensuring that panel have been completely installed and to further movement of the same should be necessary. Any damage shall be immediately reported to Purchaser.

1.22.9 Equipment furnished with finished coats of paint shall be touched by up Contractor if their surface is specified or marred while handling.

1.22.10 After installation of panels, power and control wiring and connections, Contractor shall perform operational tests on all switchboards, to verify proper operation of switch-boards/panels and correctness of all equipment in each and every respect. The cable opening and cables entries for cables terminating to the panels shall be sealed with fire sealing materials.

1.23 COMMISSIONING CHECK TESTS

The Contractor shall carry out the following commissioning checks, in addition to the other checks and tests recommended by the manufacturers.

1.23.1 General

1.23.1.1 Check name plate details according to the specification.

1.23.1.2 check for physical damage.

1.23.1.3 Check tightness of all bolts, clamps, joints connecting terminals.

1.23.1.4 Check earth connection.

1.23.1.5 Check cleanliness of insulators and bushings.

1.23.1.6 Check all moving parts for proper lubrication.

1.23.1.7 Check settings of all the relays.

1.23.2 Circuit Breakers

1.23.2.1 Check alignment of breaker truck for free movement.

1.23.2.2 Check correct operation of shutters.

1.23.2.3 Check control wiring for correctness of connections, continuity and IR values.

1.23.2.4 Manual operation of breaker completely assembled.

1.23.2.5 Power closing/opening operation, manually and electrically.

1.23.2.6 Breaker closing and tripping time.

1.23.2.7 Trip free and anti-pumping operation.

1.23.2.8 IR values, minimum pick up voltage and resistance of coils.

1.23.2.9 Contact resistance

1.23.2.10 Simultaneous closing of all the three phases.

1.23.2.11 Check electrical & mechanical interlocks provided.

1.23.2.12 Check on spring charging motor, correct operation of limit switches, and time of charging.

1.23.2.13 All functional checks.

1.23.3 Current Transformers

1.23.3.1 Megger between winding and winding terminals to body.

1.23.3.2 Polarity test

1.23.3.3 Ratio identification checking of all ratios on all cores by primary injection of current.

1.23.3.4 Spare CT cores, if available, to be shorted and earthed.

1.23.4 Voltage Transformer

1.23.4.1 Insulation resistance test

1.23.4.2 Ratio test on all cores.

1.23.4.3 Polarity test.

1.23.4.4 Line connections as per connection diagram.

1.23.5 Cubicle Wiring

1.23.5.1 Check all switch developments.

1.23.5.2 Each wire shall be traced by continuity tests and it should be made sure that the wiring is as per relevant drawing. All interconnections between panels/equipment shall be similarly checked.

1.23.5.3 All the wires shall be meggered to earth.

1.23.5.4 Functional checking of all control circuit e.g. closing, tripping control, interlock, supervision and alarm circuit.

1.23.6 Relays

1.23.6.1 Check connections and wiring.

1.23.6.2 Megger all terminals to body.

1.23.6.3 Megger AC to DC terminals.

1.23.6.4 Check operating characteristics by secondary injection.

1.23.6.5 Check minimum pick up voltage of DC coils.

1.23.6.6 Check operation of electrical/mechanical targets.

1.23.6.7 Relays settings.

1.23.6.8 Check CT and VT connections with particular reference to their polarities for directional relays, wherever required.

1.23.7 Meters

1.23.7.1 Check calibration by comparing it with a sub-standard.

1.23.7.2 Megger all insulated portions.

1.23.7.3 Check CT and VT connections with particular reference to their polarities for power type meters.

1.24 SPECIAL TOOLS AND TACKLES

1.24.1 The Bidder shall include in his proposal any special tools and tackles required for erection, testing commissioning and maintenance of the equipments offered.

1.24.2 The list of these special tools and tackles shall be given in the bid proposal sheets alongwith their respective prices.

1.24.3 The total price of the special tools and tackles shall be included in proposal sheets.

1.25 EQUIPMENT TO BE FURNISHED

1.25.1 The Bidder shall quote for various AC/DC distribution boards in accordance with this specification.

1.25.2 Standard scheme of interconnection of switchboards and distribution boards alongwith tentative feeder disposition for each board is indicated in Standard SLD of AC & DC system enclosed alongwith bid documents. The bidder shall quote board prices on the basis of standard SLD and their estimation of feeders for entire present and future baysrequirement. Any other feeder required as per system requirement for efficient and reliable operation shall be deemed to be included in bidder's scope.

1.25.3 The Bill of Materials for each type of module shall be as under. These are minimum indicative requirement of the system. The necessary auxiliary relays, push buttons and indicating lamps shall be provided as per scheme requirement. Any other item/component required with in a module for efficient and reliable operation shall be deemed to be included in bidder's scope.

1.25.4 Module Type AE (Electrically controlled circuit breaker for incoming and Bus Coupler Circuit).

(i)	One (1)	Triple pole air circuit breaker complete with all accessories and power operated mechanism as specified.
(ii)	Two (2)	Neutral link.
(iii)	Three (3)	Current Transformer for metering.
(iv)	One (1)	Ammeter with selector switch.
(v)	Three (3)	Current Transformer for relaying.
(vi)	One (1)	Triple pole instantaneous over-current relay having the setting range of 200-800% or 500-2000% of CT secondary and adjustable definite minimum time.
(vii)	One (1)	Instantaneous earth fault relay having an adjustable setting range of 10-40% or 20 - 80% of CT secondary current and adjustable definite minimum time. The earth fault relay shall be provided with a stabilising resistor.
(viii)	One(1) set	Current and Voltage transducers.
(ix)	One(1) set	High speed tripping relays.

1.25.5 Module Type - M1 (Circuit Breaker Controlled Motor Feeder)

(i)	One (1)	Triple pole Air Circuit Breaker complete with accessories, and power operated mechanism as specified.
(ii)	One (1)	Three position 6 pole selector switch 'SWITCHGEAR/NORMAL /TRIAL'.
(iii)	Three (3)	Current Transformer for metering.
(iv)	One (1)	Ammeter with Ammeter Selector Switch
(v)	Three (3)	Current Transformer for relaying.
(vi)	One (1)	Triple pole instantaneous over-current relay for providing positive sequence current protection in all the three phases. The relay setting range shall be continuously adjustable between 200-800% or 400-1600% of CT secondary rated current as required.
(vii)	One (1)	Double pole inverse definite minimum time over current relays connected in R & B phases for over current protection of motor rated 110 kW - 200 kW. The relay shall have an adjustable setting range of 50% - 200% of CT Secondary current and time setting range of 0-30 Second. The relay shall be CDGM-22 of EE or equivalent.

(viii)	One (1)	Single pole adjustable definite time delay relay for motor overload alarm connected in Y-phase only. The relay shall have resetting ratio of not less than 90%. The relay shall have continuously adjustable time delay range of 2.5 to 25 Sec.
(ix)	One (1)	Instantaneous earth fault relay having an adjustable setting range of 10-40% or 20-80% of CT secondary current. The earth fault relay shall be provided with a stabilising resistor.
(x)	***One(1) set***	***Current and Voltage transducers.***
(xi)	***One(1) set***	***High speed tripping relay.***

1.25.6 Module Type E

(i) One (1) Four pole MCCB

1.25.7 Module G-1 (VT Module with under Voltage Relay)

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(i)	Three (3)	415 110 volts single phase voltage transformer star/star √3 √3 connect with star point solidly earthed mounted on common draw out chassis. Accuracy Class 0.5 for protection and metering with 50VA Burden.
(ii)	Six (6)	HRC Fuses mounted on the above chassis.
(iii)	One (1)	Four position voltmeter selector switch.
(iv)	One (1)	Voltmeter (0-500V)
(v)	One (1)	Double pole instantaneous under voltage relays with continuous variable setting range of 40-80% of 110 Volts.
(vi)	One (1)	Time delay pick up relay having a time setting range of 0.5 to 3 secs. with 3 `NO'. Self reset contacts, suitable for 220V DC.
(vii)	One (1)	Auxiliary relay 220V DC with 2 NO. self reset contacts.
(viii)	Three (3)	Indicating lamps with series resistor and colour lenses (Red, Blue & Yellow).

1.25.8 Module Type G-2

(i)	Three (3)	HRC Fuse Voltmeter (0-
(ii)	One (1)	500V)
(iii)	One (1)	Voltmeter selector switch four position (R-Y, Y-B, B-R OFF).
(iv)	Three (3)	Indication lamps (Red, Blue & Yellow)

1.25.9 Module Type H & H (BC) (Isolating Switch Controlled Incoming Circuit)

(i)	One (1)	Four pole MCCB
(ii)	One (1)	Red Indicating lamp to indicate isolating switch closed position.

1.25.10 Module Type S : (DC Metering and Protection Module)

(i)	One (1)	Voltmeter 300-0-300V DC for 220V DC DB/Voltmeter 0- 75V DC for 50V DCDB
(ii)	One (1)	Three (3) position voltmeter selector switch
(iii)	One (1)	Instantaneous under voltage relay with 95% of 220V DC. The resetting ratio of relay of relay should not be more than 1.25. The relay shall be provided with a series resistor and a push button across if for resetting (pick up) the relay at about 105% of the drop out voltage.
(iv)	One (1)	Instantaneous over voltage relay with setting range of 110% of 220V DC. The resetting ratio of relay should not be less than 0.8. the relay shall have a push button in series of resetting the relay at about 95% of the operating voltage
(v)	One (1)	Earth leakage relay only for 220 V DC system having adjustable pickup range b/w 3 to 7 mili amps. The relay shall be suitable for 220 V DC /240 Volt AC auxiliary supply

1.25.11 Module Type X

One (1) Double pole 250 V MCB

1.25.12 Module Type-DC (Incomer from Battery & Chargers)

(i)	One (1)	Double pole 250V DC MCCB for incomer from Battery.
(ii)	One (1)	DC ammeter with shunt and range of 90-0-400 Amps. For220V DC DB and 90-0-200 Amp for 50V DC DB.
(iii)	Two (2)	Double pole 250V DC MCCB/MCB

(iv)	One (1)	Double pole single throw 250V DC air break switch connecting battery & charger sections to DC DB.
(v)	One(1) set	Voltage and Current Transducers

1.25.13 Module Type DG-1 (Electrically Controlled Circuit Breaker for Incomer from DG Set)

a)	One (1)	Triple pole circuit breaker complete with all accessories and power operated mechanism as specified.
b)	One (1)	Frequency meter.
c)	One (1)	Voltmeter with selector switch.
d)	One (1)	Remote/Local Selector switch.
e)	Three (3)	Current transformer for metering.
f)	Six (6)	Current Transformers for differential protection (out of this 3 Nos. will be supplied loose for mounting in DG set panel).
g)	Three (3)	Current transformer for relaying.
h)	One (1)	Ammeter Selector Switch.
i)	One (1)	Ammeter
j)	One (1)	Wattmeter of range 0-300 KW.
k)	One (1)	Three pole voltage controlled definite time delay relay having current setting range of 50-200% of CT secondary current and adjustable time delay 0.3 to 3 secs.
l)	One (1)	Watt hour meter with six (6) digits and minimum count of one (1) kwh.
m)	One (1)	Single pole definite time over current relay having a continuous setting range of 50-200% of CT secondary current and a time delay of 2.5-25 secs connected in CT of Y phase for overload alarm. The relay shall have a setting ratio of not less than 90%.
n)	One (1)	Three pole differential protection relay having an operating current setting range of 10-40% of generator full load current. The relay shall be of high impedance type, with necessary stabilizing resistors.
o)	Two (2)	Push buttons for Remote starting & stopping of DG Set (Red, Green).
p)	***One(1) set***	***Current and Voltage transducers.***
q)	***One(1) set***	***High speed tripping relays.***

1.25.14 Module Type H1

One (1) Double pole DC Switch with pad locking facility in off position.

1.25.15 Module Type EL

(i) One (1) Four pole MCCB

(ii) One (1) Contactor

(iii) Electronic Timer suitable for continuous operation, push button and selector switch be as per scheme requirement

1.26 **PARAMETERS**

1.26.1 **Power Supply**

1.26.1.1	AC System		3 phase, 4 wire, solidly earthed
	a)	Voltage	415 Volts, ± 10%
	b)	Frequency	50 Hz ± 5%
	c)	Combined variation	± 10% Absolute Sum in Voltage & frequency
	d)	Fault Level	20 kA (rms)
1.26.1.2	**DC System**		2 Wire, unearthed
	a)	System voltage	220V ± 10%
	b)	Fault Level	4 kA
	c)	System Voltage	***48*** V ± 10%
	d)	Fault Level	--

1.26.2 **Control Supply Voltage**

a) Trip and closing coils	220V DC Unearthed
b) Spring charging	220V DC Unearthed

1.26.3 **Cubicle Data**

1.26.3.1 **Busbar Rating**

a) Continuous As specified in ***Standard SLD***

	for Vertical panels.	***For AC & DC system.***
b)	Short time (1 sec. kA (rms)	20 kA
c)	Momentary (kA) PEAK	45 kA
d)	**Ambient Temperature**	**50°C**
e)	**One Minute Power Frequency Withstand**	
	I. Power Circuit	2500 Volts (rms)
	II. Control Circuit	2500 Volts (rms)

1.26.3.2 Cubicle Colour Finish

a) Interior	Smoke Grey shade No.692 of IS:5
b) Exterior	Smoke Grey shade No.692 of IS:5

1.26.4 Circuit Breaker

a)	Type	Air Break
b)	No. of poles	3
c)	Voltage & Frequency	415 ± 10%, 50 HZ + 5%
d)	Rated Operating Duty	As per IS
e)	Rated service short-circuit Breaking capacity (Ics)	20 kA (RMS)
f)	Short Circuit making current	45 kA (Peak)
g)	Short time withstand current for 1 sec. duration.	20 kA (RMS) for 1 sec.
h)	Operating Mechanism current for 1 sec. duration.	20 kA (RMS) for 1 sec.
i)	No. of auxiliary contacts	4 NO & 4 NC contacts for Purchaser's use on fixed portion of the cubicle
j)	Short Circuit breaking current	
	I. AC Component	20 kA (RMS)
	II. DC Component	As per IS: 13947 (Part 2)

1.26.5 MOULDED CASE CIRCUIT BREAKER

		AC System	DC System
a)	No. of poles	4	2
b)	Voltage & Frequency	415 ± 10%, 50 HZ ± 5%	250V
c)	Rated Operating Duty	As per IS	
d)	Rated service short-circuit Breaking capacity (Ics)	20 kA (RMS)	4 kA
e)	Short Circuit making current	45 kA (Peak)	-
f)	No. of auxiliary Contacts ***(only for incomer And bus-coupler MCCBs)***	***1*** NO &***1*** NC	***1*** NO &***1*** NC
g)	***Rated Ultimate*** Short Circuit ***breaking capacity***		
	I. AC Component	20 kA (RMS)	As per IS
	II. DC Component	As per IS 13947	As per IS 13947

1.26.6 **Meters**

a)	Accuracy class	2.5
b)	One minute power frequency withstand test voltage in KV	2.0

1.26.7 **Current Transformers**

a)	Type	Cast resin, Bar primary
b)	Voltage class and frequency	650V, 50 Hz
c)	Class of Insulation	E or better
d)	Accuracy class metering CT	Class 1, VA adequate for application but not less than 7.5 VA.
e)	Accuracy class protection CT	5 P 15, VA adequate for application, but not less than 7.5 VA.
f)	Accuracy class differential protection	PS, KPV = 300V

	g)	Short Time Current Rating (for CTs Associated with circuit breakers)	
		I. Current	20 kA (RMS)
		II. Duration	One Second
		III. Dynamic Rating	45 kA (Peak)
		IV. One minute power frequency withstand test voltage.	2.5 kV (rms)

1.26.8 **Voltage Transformer**

	a)	Type	Cast Resin
	b)	Rated Voltage	
		Primary	415/√3 V
		Secondary	110/√3 V
	c)	Method of connection	
		Primary	Star
		Secondary	Star
	d)	Rated voltage factor	1.1 continuous, 1.5 for 3 seconds
	e)	Class of insulation	E or better
	f)	One minute power frequency withstand voltage	2.5 KV (RMS)
	g)	Accuracy class	0.5, not less than 20VA

1.26.9 **Relay**

a) One minute power Frequency withstand test	2 kV (rms)

1.26.10	***Transducers (1 phase)***	***Current***	***Voltage***
	a) Operating Voltage	***220 V DC***	***220V DC***
	b) I/P	***1A.***	***110V AC***
	c) O/P	***4-20 mA***	***4-20 mA***
	d) Type	***Analogue***	***Analogue***

1.26.11 Lighting Transformers

Lighting transformers shall be of 300 KVA rating (in case of substations where highest voltage is 765 kV)/ 100 KVA rating (in case of substations where highest voltage is 400 kV) / 25 KVA rating (in case of substations where highest voltage level is 132kV), 415/415 V, 3 phase, 50 Hz Dry type natural air cooled ***type***. The technical parameters of these lighting transformers are as follows:

Technical Parameters of Lighting Transformer

Type of transformer	:	Dry type natural air cooled
Rating	:	***300 KVA,*** 100 KVA or 25 KVA (as applicable)
Voltage ratio	:	415/415 volts
No. of phases	:	Three
Frequency	:	50 Hz
Winding connection	:	Dyn-1
Class of insulation	:	'B' class
Impedance	:	4% ± 10%
No. of taps & steps	:	5, ± 5% in steps of 2.5%
Ref. standard	:	IS:2026

1.27 AUTOMATIC CONTROL OF OUTDOOR LIGHTING

1.27.1 EL-type module of 415V Main lighting distribution board and Emergency lighting distribution board and shall be controlled by timer and contactor module to facilitate its operation automatically.

1.28 AUTOMATIC SUPPLY CHANGEOVER

Automatic changeover between Incomer I, Incomer II, and DG set is to be carried out during the failure of supply in one/or both the incomers. After the restoration of the supply, system shall be restored to normal condition automatically. The requirement of changeover under various conditions are as below:

(i) Under normal conditions i.e. when supply is available in both the incomers, incomers I&II of 415 V Main switchboard, ACDB shall be in closed condition and Bus couplers and DG set breaker shall be in open condition.

(ii) In case of failure of either of the sources, the incomer of that source shall trip and Bus coupler shall get closed. On restoration of supply, normal conditions described above are to be established automatically.

iii) In case of failure of supply in both the sources, both incomers, incomers of ACDBs and ACDB Bus coupler shall trip and DG set breaker switched on.
On restoration of one or both sources, DG set breaker shall trip, DG set stopped and conditions described in paragraph (i) /(ii) shall be restored.

To avoid unnecessary operation of switchgear for momentary disturbances all changeovers from one state to another shall be initiated after a time delay, after the conditions warranting such change has been detected.

1.29 ANALOGUE INPUTS

LT System shall have provision of following analogue inputs for owner's substation automation purpose. These analogue inputs shall be generated by distinct transducers to be provided in respective modules. These inputs shall be wired up to respective terminal blocks.

<u>ANALOGUE INPUTS</u>:

i) Voltage R-Y, Y-B, B-R of Main Switch Board section-I
ii) Voltage R-Y, Y-B, B-R of Main Switch Board section-II
iii) Current from LT transformer-I
iv) Current from LT transformer-II
v) Voltage of 220V DCDB-I
vi) Voltage of 220V DCDB-II
vii) Current from 220V Battery set-I
viii) Current from 220V Battery set-II
ix) Voltage of 48V DCDB-I
x) Voltage of 48V DCDB-II
xi) Current from 48V Battery set-I
xii) Current from 48V Battery set-II

1.30 DIGITAL (Potential Free) INPUTS:

LT System shall have provision of following digital inputs for owner's substation automation purpose. These digital inputs shall be made available in the form of potential free contacts to be provided in respective modules. These potential free contacts shall be wired up to respective terminal blocks.

i) Main (MSB) Incomer-I breaker On/Off
ii) Main (MSB) Incomer-II breaker On/Off
iii) Main(MSB) 415V Bus-I/II U/V
iv) Main (MSB) bus coupler breaker on/off
v) DG set breaker on/off
vi) LT transformer-I Bunchholz Alarm & trip
vii) LT transformer-II Buchloz Alarm & trip
viii) LT transformer-I WTI Alarm & trip
ix) LT transformer-II WTI Alarm & trip
x) LT transformer-I OTI Alarm & trip
xi) LT transformer-II OTI Alarm & trip
xii) 220 V DC-I earth fault
xiii) 220V DC-II earth fault

SECTION: POWER AND CONTROL CABLE

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SECTION: POWER & CONTROL CABLES

1. POWER & CONTROL CABLES[FOR WORKING VOLTAGES UP TO AND INCLUDING 1100 V]

CRITERIA FOR SELECTION OF POWER & CONTROL CABLES

1.1.1. Aluminium conductor XLPE insulated armoured cables shall be used for main power supply purpose from LT Aux. Transformers to control room, between distribution boards, ***supply to oil filtration units, DG supply to AC distribution board*** and for supply for colony lighting from control room.

1.1.2 Aluminium conductor PVC insulated armoured power cables shall be used for various other applications in switchyard area/control room except for control/protection purposes.

1.1.3 For all control/protection purposes, PVC insulated armoured control cables of minimum 2.5 sq. mm. size with stranded Copper conductors shall be used.

1.1.4 Employer has standardised the sizes of power cables for various feeders. Bidders are to estimate the quantity of cables and quote accordingly. The sizes of power cables to be used per feeder in different application shall be as follows:

S.No.	From	To	Cable size	Cable type
1.	Main Switch Board	LT Transformer	2-1C X 630 mm^2 per phase 1-1C X 630 mm^2 for neutral	XLPE
2.	Main Switch Board	AC Distribution Board	2-3½C X 300 mm^2	XLPE
3.	Main Switch Board	Oil Filtration Unit ***& looping to other oil filtration units.***	1-3½C X 300 mm^2	XLPE
4.	Main Switch Board	Colony Lighting	1-3½C X 300 mm^2	XLPE

5.	Main Switch Board	HVW pump LCP	1-3½C X 300 mm^2	XLPE
6.	Main Switch Board	Main Lighting distribution board	1-3½C X 300 mm^2	XLPE
7.	AC Distribution Board	D.G. Set AMF Panel	2-3½C X 300 mm^2	XLPE
8.	AC Distribution Board	Emergency Lighting distribution board	1-3½C X 70 mm^2	PVC
9.	AC Distribution Board	ICT MB	1-3½C X 70 mm^2	PVC
10.	AC Distribution Board	Bay MB	1-3½C X 70 mm^2	PVC
11.	Bay MB	AC Kiosk	1- 3 ½ x 35 mm^2	PVC
12.	AC Distribution Board	Battery Charger	1-3½C X 70 mm^2	PVC
13.	DCDB	Battery	2-1C X 150 mm^2	PVC
14.	DCDB	Battery Charger	2-1C X 150 mm^2	PVC
15.	DCDB	Protection/PLCC panel	1-4C X 16 mm^2	PVC
16.	Main Lighting DB	Lighting panels(Indoor)	1-3½C X 35 mm^2	PVC
17.	Main Lighting DB	Lighting panels (outdoor)	1-3½C X 70 mm^2	PVC
18.	Main Lighting DB	Receptacles (Indoor)	1-3½C X 35 mm^2	PVC
19.	Main Lighting DB	Receptacles (Outdoor)	1-3½C X 70 mm^2	PVC
20.	Lighting Panel	Sub lighting panels	1-4C X 16 mm^2	PVC
21.	Lighting Panel	Street Lighting Poles	1-4C X 16 mm^2	PVC
22.	Lighting Panel/ Sub lighting panels	Lighting Fixtures (Outdoor)	1-2C X 6 mm^2	PVC
23.	Bay MB	Equipments	1-4C X 16 mm^2 /1-4C X 6 mm^2 /1-2C X 6 mm^2	PVC

1.1.5 Bidder may offer sizes other than the sizes specified in clause 1.1.4. In such case and for other application where sizes of cables have not been indicated in the specification, sizing of power cables shall be done keeping in view continuous current ***(including future bays/load requirement)***, voltage drop & short-circuit consideration of the system. Relevant calculations shall be submitted by bidder during detailed engineering for purchaser's approval. ***The entire power and control cables & special cables (if any) required shall be executed by contractor for completion of present scope of work.***

1.1.6 Cables shall be laid conforming to IS : 1255.

1.1.7 While preparing cable schedules for control/protection purpose, following shall be ensured:

1.1.7.1 Separate cables shall be used for AC & DC.

1.1.7.2 Separate cables shall be used for DC1 & DC2.

1.1.8 For different cores of CT & CVT separate cable shall be used

1.1.9 At least one (1) cores shall be kept as spare in each copper control cable of 4C, 5C or 7C size whereas minimum no. of spare cores shall be two (2) for control cables of 10 core or higher size.

1.1.10 For control cabling, including CT/VT circuits, 2.5 sq.mm. size copper cables shall be used per connection. However, if required from voltage drop/VA burden consideration, additional cores shall be used. Further for potential circuits of energy meters, separate connections by 2 cores of 2.5 sq.mm. size shall be provided.

1.1.11 Standard technical data sheets for cable sizes up to and including 1100V are enclosed at Annexure. Cable sizes shall be offered/manufactured in accordance with parameters specified in standard technical data sheets. Technical data sheet for any other cores/sizes required during detailed engineering shall be separately offered for owner's approval by the contractor/supplier. ***Submission of standard technical data sheets for these cable sizes are not required for approval. Contractor/supplier shall intimate name of proposed approved cable manufacturer along with cable sizes, its quantity required during detailed engineering for purchaser's information and acceptance.***

1.2. TECHNICAL REQUIREMENTS

1.2.1. General

1.2.1.1. The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground buried installation with uncontrolled back fill and chances of flooding by water.

1.2.1.2. They shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operating conditions. The XLPE /PVC insulated L.T. power cables of sizes 240 sq. mm. and above shall withstand without damage a 3 phase fault current of at least 45 kA for at least 0.12 second, with an initial peak of 105 kA in one of the phases at rated conductor temperature (70 degC for PVC insulated cables and 90 degC for XLPE insulated cables). The armour for these power cables shall be capable of carrying 45 kA for at least 0.12 seconds without exceeding the maximum allowable temperature of PVC outer sheath.

1.2.1.3. The XLPE insulated cables shall be capable of withstanding a conductor temperature of 250°C during a short circuit without any damage. The PVC insulated cables shall be capable of withstanding a conductor temperature of 160°C during a short circuit.

1.2.1.4. The Aluminium/Copper wires used for manufacturing the cables shall be true circular in shape before stranding and shall be uniformly good quality, free from defects. All Aluminium used in the cables for conductors shall be of H2 grade. In case of single core cables armours shall be of H4 grade Aluminium.

1.2.1.5. The fillers and inner sheath shall be of non-hygroscopic, fire retardant material, shall be softer than insulation and outer sheath shall be suitable for the operating temperature of the cable.

1.2.1.6. Progressive sequential marking of the length of cable in metres at every one metre shall be provided on the outer sheath of all cables.

1.2.1.7. Strip wire armouring method (a) mentioned in Table 5, Page-6 of IS : 1554 (Part 1) – 1988 shall not be accepted for any of the cables. For control cables only round wire armouring shall be used.

1.2.1.8. The cables shall have outer sheath of a material with an oxygen index of not less than 29 and a temperature index of not less than 250°C.

1.2.1.9. All the cables shall pass fire resistance test as per IS:1554 (Part-I)

1.2.1.10. The normal current rating of all PVC insulated cables shall be as per IS:3961.

1.2.1.11. Repaired cables shall not be accepted.

1.2.1.12. Allowable tolerance on the overall diameter of the cables shall be plus or minus 2

mm.

1.2.2. XLPE Power Cables

1.2.2.1. The XLPE (90°C) insulated cables shall be of FR type, C1 category conforming to IS:7098 (Part-I) and its amendments read alongwith this specification. The conductor shall be stranded aluminium circular/sector shaped and compacted. In multicore cables, the core shall be identified by red, yellow, blue and black coloured strips or colouring of insulation. A distinct inner sheath shall be provided in all multicore cables. For XLPE cables, the inner sheath shall be of extruded PVC of type ST-2 of IS:5831. ***All cables shall be of armoured type***. For single core cables, the ***armouring*** shall consist of aluminium wires/strips. The outer sheath shall be extruded PVC of Type ST-2 of IS:5831 for all XLPE cables.

1.2.3. PVC Power Cables

1.2.3.1. The PVC (70°C) insulated power cables shall be of FR type, C1 category, conforming to IS: 1554 (Part-I) and its amendments read alongwith this specification and shall be suitable for a steady conductor temperature of 70°C. The conductor shall be stranded aluminium. The Insulation shall be extruded PVC to type-A of IS: 5831. A distinct inner sheath shall be provided in all multicore cables. ***All cables shall be of armoured type.*** For multicore armoured cables, the inner sheath shall be of extruded PVC. The outer sheath shall be extruded PVC to Type ST-1 of IS: 5831 for all cables.

1.2.4. PVC Control Cables

1.2.4.1. The PVC (70°C) insulated control cables shall be of FR type C1 category conforming to IS: 1554 (Part-1) and its amendments, read alongwith this specification. The conductor shall be stranded copper. The insulation shall be extruded PVC to type A of IS: 5831. A distinct inner sheath shall be provided in all cables. ***All cables shall be of armoured type.*** The over sheath shall be extruded PVC to type ST-1 of IS: 5831 and shall be grey in colour.

1.2.4.2. Cores shall be identified as per IS: 1554 (Part-1) for the cables up to five (5) cores and for cables with more than five (5) cores the identification of cores shall be done by printing legible Hindu Arabic Numerals on all cores as per clause 10.3 of IS 1554 (Part-1).

2. HV POWER CABLES[FOR WORKING VOLTAGES FROM 3.3 kV AND INCLUDING 33 kV]

2.1. *HV* POWER CABLE FOR AUXILIARY POWER SUPPLY

(a) The HV cable of 1Cx185 mm^2 (Aluminium Conductor) or 1Cx120mm^2 (Copper Conductor) of voltage class as specified for 630 kVA ***and 800 kVA*** LT transformer for interconnecting 630kVA ***and 800 kVA*** LT transformer to the SEB feeder shall be, XLPE insulated, armoured cable conforming to IS 7098 (Part-II) or IEC 60502-2 1998. Terminating accessories shall conform

to IS 17573- 1992 or IEC 61442-1997/IEC60502-4 1998.

(b) The HV cable of 3Cx95 mm^2 (Aluminium Conductor) or 3Cx70mm^2 (Copper Conductor) of voltage class as specified for 250kVA LT transformer for interconnecting 250kVA LT transformer to the SEB feeder shall be, XLPE insulated, armoured cable conforming to IS 7098 (Part-II) or IEC 60502-2 1998. Terminating accessories shall conform to IS 17573-1992 or IEC 61442-1997/IEC60502-4 1998.

2.2. Only overhead connection has been foreseen for interconnecting ***630 kVA and*** 800 kVA, LT transformer to the tertiary of the ICT. However, HV cable connections in place of overhead connection, if necessary shall also be in the scope of contractor. In this case contractor shall provide 1C x 185 mm^2 (Aluminium Conductor) or 1Cx120mm^2 (Copper Conductor), 38/66kV HV cable along with necessary terminating accessories. The construction of XLPE insulated, armoured HV cable shall be generally conforming to IS 7098 (Part-III). Terminating accessories shall conform to IEC60840 1999.

2.3. Bidder may offer sizes other than the sizes specified in clause 2.1 and 2.2. In such case sizing of power cables shall be done keeping in view continuous current, voltage drop & short-circuit consideration of the system. Relevant calculations shall be submitted by bidder during detailed engineering for purchaser's approval.

2.4. Constructional Requirements

Cable shall have compacted circular Aluminium conductor, Conductor screened with extruded semi conducting compound , XLPE insulated, insulation screened with extruded semi conducting compound, ***distinct extruded PVC inner sheath (Type ST-2) with FR properties***, armoured with non-magnetic material ***for single core cables and galvanized steel wire/strip for multicore cables*** , followed by extruded PVC outer sheath(Type ST-2), with FR properties . ***The armour shall be capable of withstanding rated short time current of conductor***.

2.5 Progressive sequential marking of the length of cable in metres at every one metre shall be provided on the outer sheath of the cable.

2.6 The cables shall have outer sheath of a material with an Oxygen Index of not less than 29 and a Temperature index of not less than 250°C.

2.7 Allowable tolerance on the overall diameter of the cables shall be plus or minus 2 mm.

3. EHV XLPE POWER CABLE [FOR WORKING VOLTAGES FROM 66 kV UP TO AND INCLUDING 500 kV]

3.1 TECHNICAL REQUIREMENTS

The XLPE insulated, EHV cable shall conform to the requirements of IEC 60502-2 (applicable clauses only) for construction and IEC 60840/ IEC62067 (as applicable)

for testing. The terminating accessories shall conform to IEC 60840 / IEC62067 (as applicable).

3.2 The cable shall be of specified EHV grade, single core, unarmoured, stranded compacted Copper conductor, core screening by a layer of semiconducting tape followed by a layer of semiconducting compound, cross linked polyethylene (XLPE) dry cured insulation, insulation screening with semiconducting compound extruded directly over the insulation, longitudinal sealing by a layer of non woven tape with water swellable absorbent over insulation screen, followed by radial sealing (Metal sheath of Lead alloy 'E'), metallic screening by concentric layer of plain copper wire followed by an open helix of copper & overall ***HDPE*** sheathed & graphite coated and conforming to the technical particulars of specification.

3.3 The construction of cable shall generally conform to the description mentioned in above mentioned clause of the specification. Bidder may offer necessary layers such as separation tape, binder tapes etc additionally as per their manufacturing practices for meeting required performance of the offered cable. The bidder shall enclose with the bid, drawing showing cross section of the cable. The conductors screen (non- metallic semi-conductive) shall be extruded in a single one-time process to ensure homogeneity and absence of voids.

3.4 The conductors screen (non-metallic semi-conductive) shall be extruded in a single one-time process to ensure homogeneity and absence of voids.

3.5 They shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operating conditions.

3.6 Progressive sequential marking of the length of cable in metres at every one metre shall be provided on the outer sheath of the cable.

3.7 The cables shall have outer sheath of ~~a~~ ***HDPE*** material.

3.8 Repaired cables shall not be accepted.

3.9 Allowable tolerance on the overall diameter of the cables shall be plus or minus 2 mm.

4 CABLE DRUMS

4.1 Cables shall be supplied in returnable wooden or steel drums of heavy construction. Wooden drum shall be properly seasoned sound and free from defects. Wood preservative shall be applied to the entire drum. ***Drums offered shall conform to relevant standards. Drum drawings are not required to be submitted for approval.***

4.2 Standard lengths for each size of power and control cables shall be 500/1000 meters. The cable length per drum shall be subject to a tolerance of plus or minus 5% of the standard drum length. The owner shall have the option of rejecting cable drums with shorter lengths. Maximum, One (1) number non standard length of cable

size(s) may be supplied in drums for completion of project.

4.3 A layer of water proof paper shall be applied to the surface of the drums and over the outer most cable layer.

4.4 A clear space of at least 40 mm shall be left between the cables and the lagging.

4.5 Each drum shall carry the manufacturer's name, the purchaser's name, address and contract number and type, size and length of the cable, net and gross weight stencilled on both sides of drum. A tag containing the same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

4.6 Packing shall be sturdy and adequate to protect the cables, from any injury due to mishandling or other conditions encountered during transportation, handling and storage. Both cable ends shall be sealed with PVC/Rubber caps so as to eliminate ingress of water during transportation and erection.

5 TYPE TESTS

5.1 All cables shall conform to all type, routine and acceptance tests listed in the relevant IS.

5.2 XLPE INSULATED POWER CABLES (For working voltages up to and including 1100V):-

5.2.1 Following type tests (on one size in a contract) as per IS: 7098 (Part 1) – 1988 including its amendments shall be carried out as a part of acceptance tests on XLPE insulated power cables for working voltages up to and including 1100 V:

a) Physical tests for insulation
   - i) Hot set test
   - ii) Shrinkage test

b) Physical tests for outer sheath
   - i) Shrinkage test
   - ii) Hot deformation
   - iii) Heat shock test
   - iv) Thermal stability

5.2.2 Contractor shall submit type test reports as per clause no. 9.2 of Technical Specification, Section: GTR for the following tests-

a) Water absorption (gravimetric) test.
b) Ageing in air oven
c) Loss of mass in air oven
d) Short time current test on power cables of sizes 240 sqmm and above on
   - i) Conductors.
   - ii) Armours.

e) Test for armouring wires/strips.
f) Oxygen and Temperature Index test.
g) Flammability test.

5.3 ***PVC INSULATED POWER & CONTROL CABLES (For working voltages up to and including 1100V)-***

5.3.1 Following type tests (on one size in a contract) as per IS: 1554 (Part 1) - 1988 including its amendments shall be carried out as a part of acceptance tests on PVC insulated power & control cables for working voltages up to and including 1100 V:

a) Physical tests for insulation and outer sheath
   i) Shrinkage test
   ii) Hot deformation
   iii) Heat shock test
   iv) Thermal stability
b) High voltage test (water immersion test only a.c. test as per clause no. 16.3.1).

5.3.2 Contractor shall submit type test reports as per clause no. 9.2 of Technical Specification, Section: GTR for the following-

a) High voltage test (water immersion d.c. test as per clause no. 16.3.2 of IS: 1554 (Part 1) - 1988).
b) Ageing in air oven.
c) Loss of mass in air oven.
d) Short time current test on power cables of sizes 240 sqmm and above on
   i) Conductors.
   ii) Armours.
e) Test for armouring wires/strips.
f) Oxygen and Temperature Index test.
g) Flammability test.

5.4 ***XLPE INSULATED HV POWER CABLES(For working voltages from 3.3 kV and including 33 kV)-***

5.4.1 Contractor shall submit type test reports as per clause no. 9.2 of Technical Specification, Section: GTR for XLPE insulated HV power cables (as per IS 7098 Part-II including its amendment or as per IEC).

5.5 ***XLPE INSULATED EHV POWER CABLES (For working voltages from 66kV up to and including 500 kV)-***

5.5.1 Contractor shall submit type test reports as per clause no. 9.2 of Technical Specification, Section: GTR for XLPE insulated EHV cables (as per IEC60840 for cables up to 150 kV & IEC 62067 for cables above 150 kV).

5.6 ***TERMINATING & JOINTING ACCESSORIES-***

5.6.1 Contractor shall submit type test reports as per clause no. 9.2 of Technical Specification, Section: GTR for Terminating/jointing accessories as per IS 17573:1992/ IEC 60840:1999/ IEC62067.

STANDARD TECHNICAL DATA SHEET
(1.1 kV GRADE XLPE POWER CABLES)

SN	CUSTOMER :	RECPDCL	
	Name of manufacturer :	**As per approved list**	
	Cable Sizes	**1 C x 630**	**3½ C x 300**
1	Manufacturer's type designation	: A2XWaY	A2XWY
2	Applicable standard	: ----------IS: 7098/PT-I/1988 & its referred specifications----------	
3	Rated Voltage(volts)	: ----------1100 V grade----------	
4	Type & Category	: FR & C1	FR & C1
5	Suitable for earthed or unearthed system	: ----------for both----------	
6	Continuous current rating when laid in air in a ambient temp. of 50°C and for maximum conductor temp. of 70 °C of PVC Cables[For information only]	: 732	410
7	Rating factors applicable to the current ratings for various conditions of installation:	: ----------As per IS-3961-Pt-II-67----------	
8	Short circuit Capacity		
	a) Guranteed Short Circuit Amp. (rms)KA for 0.12 sec duration at rated conductor temperature of 90 degree C, with an initial peak of 105 KA.	: 45 KA	45 KA
	b) Maximum Conductor temp. allowed for the short circuit duty (deg C.) as stated above.	: ----------250 °C----------	
9	Conductor		
	a) Material	Stranded Aluminium as per Class 2 of IS : 8130	
	b) Grade	: ---------- H 2 (Electrolytic grade) ----------	
	c) Cross Section area (Sq.mm.)	: 630	300/150
	d) Number of wires(No.)minimum	: 53	30/15
	e) Form of Conductor	Stranded and compacted circular	Stranded compacted circular/sector shaped
	f) Direction of lay of stranded layers	: -------- Outermost layer shall be R.H lay & opposite in successive layers --------	
10	Conductor resistance (DC) at 20 °C per km-maximum	0.0469	0.1 / 0.206
11	Insulation		
	a) Composition of insulation	: ----------Extruded XLPE as per IS-7098 Part(1)----------	
	b) Nominal thickness of insulation(mm)	: 2.8	1.8/1.4
	c) Minimum thickness of insulation	: 2.42	1.52/1.16
12	Inner Sheath		
	a) Material	: ----------Extruded PVC type ST-2 as per IS-5831-84----------	
	b) Calculated diameter over the laid up cores,(mm)	: NA	52
	c) Thickness of Sheath (minimum)mm	: N.A	0.6
	d) Method of extrusion	NA	Pressure/Vacuum extrusion
13	Armour		
	a) Type and material of armour	: Al. Wire[H4 grade]	Gal. Steel wire
	b) Direction of armouring	: ----------left hand----------	
	c) Calculated diameter of cable over inner sheath (under armour), mm	: 33.9	53.2
	d)Nominal diameter of round armour wire (minimum)	: 2	2.5
	e)Guranteed Short circuit capacity of the armour for 0.12 sec at room temperature.	45 KA	45 KA
	f) DC resistance at 20 °C (Ω/Km)	$	0.577
14	Outer Sheath		
	a) Material (PVC Type)	: ST-2& FR	ST-2& FR
	b) Calculated diameter under the sheath	: 38.3	59.50
	c) Min.thickness of sheath(mm)	: 1.72	2.36
	d) Guaranteed value of minimum oxygen index of outer sheath at 27 °C	Min 29.0	Min 29.0
	e) Guranteed value of minimum temperature index at 21 oxygen index	Min 250	Min 250
	f) colour of sheath	: Black	Black
15	a) Nominal Overall diameter of cable	$	$
	b) Tolerance on overall diameter (mm)	: ----------+2/-2 mm----------	
16	Cable Drums	: ---------- shall conform to IS 10418 and technical specification	
	a) Max./ Standard length per drum for each size of cable (single length) with ±5% Tolerance (mtrs)	1000/500	1000/500
	b) Non standard drum lengths	: Maximum one(1) non standard lengths of each cable size may be supplied in drums only over & above the standard lengths as specified above.(if required for completion of project).	
17	Whether progressive sequential marking on outer sheath provided at 1 meter interval	: ---------- YES ----------	
18	Identification of cores		
	a) colour of cores	As per IS 7098 Part(1)	
	b) Numbering	: ---------- N.A ----------	
19	Whether Cables offered are ISI marked	: ---------- YES ----------	
20	Whether Cables offered are suitable for laying as per IS 1255	: ---------- YES ----------	

$'- As per manufacturer design data

STANDARD TECHNICAL DATA SHEET
(1.1 kV GRADE PVC POWER CABLES)

SN	CUSTOMER :		RECPDCL					
	Name of manufacturer :		As per approved list					
	Cable Sizes		1 c x 150	3.5 cx 70	3.5 cx 35	4 c x 16	4c x 6	2 c x 6
1	Manufacturer's type designation	:	AYWaY	AYFY	AYFY	AYFY	AYWY	AYWY
2	Applicable standard	:	---------- IS: 1554/PT-1/1988 & its referred standards----------					
3	Rated Voltage(volts)	:	----------1100 V grade----------					
4	Type & Category	:	FR & C1	FR & C1	FR & C1	FR & C1	FR & C1	FR & C1
5	Suitable for earthed or unearthed system	:	----------for both----------					
6	Continuous current rating when laid in air in a ambient temp. of 50°C and for maximum conductor temp. of 70 °C of PVC Cables[For information only]	:	202	105	70	41	24	28
7	Rating factors applicable to the current ratings for various conditions of installation:	:	x----------As per IS-3961-Pt-II-67----------					
8	Short circuit Capacity							
	a) Short Circuit Amp. (rms)KA for 1 sec duration	:	11.2	5.22	2.61	1.19	0.448	0.448
	b) Conductor temp. allowed for the short circuit duty (deg C.)	:	----------160 °C----------					
9	Conductor							
	a) Material	:	----------STRANDED ALUMINIUM ----------					
	b) Grade	:	---------- H 2 (Electrolytic grade) ----------					
	c) Cross Section area (Sq.mm.)	:	150	M-70 N-35	M-35 N-16	16	6	6
	d) Number of wires(No.)	:	---------- as per Table 2 of IS 8130 ----------					
	e) Form of Conductor		Non-compacted Standed circular	shaped conductor	shaped conductor	shaped conductor	Non-compacted Standed circular	Non-compacted Standed circular
	f) Direction of lay of stranded layers	:	-------- Outermost layer shall be R.H lay & opposite in successive layers --------					
10	Conductor resistance (DC) at 20 °C per km-maximum		0.206	0.443/ 0.868	0.868/ 1.91	1.91	4.61	4.61
11	Insulation							
	a) Composition of insulation	:	----------Extruded PVC type A as per IS-5831-84----------					
	b) Nominal thickness of insulation(mm)	:	2.1	1.4/1.2	1.2/1.0	1.0	1.0	1.0
	c) Minimum thickness of insulation	:	1.79	1.16/0.98	0.98/0.8	0.8	0.8	0.8
12	Inner Sheath							
	a) Material	:	----------Extruded PVC type ST-I as per IS-5831-84----------					
	b) Calculated diameter over the laid up cores,(mm)	:	N.A	27.6	20.4	15.7	11.6	9.6
	c) Thickness of Sheath (minimum)mm	:	N.A	0.4	0.3	0.3	0.3	0.3
13	Armour	:	---------- as per IS 3975/88 ----------					
	a) Type and material of armour	:	Al. Wire[H4 grade]	Gal.steel strip	Gal.steel strip	Gal.steel strip	Gal. Steel wire	Gal. Steel wire
	b) Direction of armouring	:	----------left hand----------					
	c) Calculated diameter of cable over inner sheath (under armour), mm	:	18	28.4	21	16.3	12.2	10.2
	d) Nominal diameter of round armour wire/strip	:	1.6	4 x 0.8	4 x 0.8	4 x 0.8	1.4	1.4
	e) Number of armour wires/strips	:	----------Armouring shall be as close as practicable----------					
	f) Short circuit capacity of the armour along for 1 sec-for info only	:	--K x A√t (K Amp)(where A = total area of armour in mm ^{2} & t = time in seconds), K=0.091 for Al & 0.05 for steel					
	g) DC resistance at 20 °C (Ω/Km)	:	0.44	2.57	3.38	3.99	3.76	4.4
14	Outer Sheath							
	a) Material (PVC Type)	:	ST-1& FR	ST-1& FR	ST-1& FR	ST-1& FR	ST-1& FR	ST-1& FR
	b) Calculated diameter under the sheath	:	21.2	30.1	22.6	17.9	15	13
	c) Min.thickness of sheath(mm)	:	1.4	1.56	1.4	1.4	1.4	1.24
	d) Guaranteed value of minimum oxygen index of outer sheath at 27°C		Min 29.0	Min 29.0	Min 29.0	Min 29.0	Min 29.0	Min 29.0
	e) Guranteed value of minimum temperature index at 21 oxygen index		Min 250	Min 250	Min 250	Min 250	Min 250	Min 250
	f) colour of sheath	:	Black	Black	Black	Black	Black	Black
15	a) Overall diameter of cable		;----------$----------					
	b) Tolerance on overall diameter (mm)	:	----------+2/-2 mm----------					
16	Cable Drums	:	---------- shall conform to IS 10418 and technical specification					
	a) Max./ Standard length per drum for each size of cable (single length) with ±5% Tolerance (mtrs)		1000/500	1000/500	1000/500	1000/500	1000/500	1000/500
	b) Non standard drum lengths	:	Maximum one(1) non standard lengths of each cable size may be supplied in drums only over & above the standard lengths as specified above.(if required for completion of project).					
17	Whether progressive sequential marking on outer sheath provided	:	---------- YES ----------					
18	Identification of cores							
	a) colour of cores		Red	R,Y,Bl &Bk	R,Y,Bl &Bk	R,Y,Bl &Bk	R,Y,Bl &Bk	Red & Bk
	b) Numbering	:	---------- N.A ----------					
19	Whether Cables offered are ISI marked	:	---------- YES ----------					
20	Whether Cables offered are suitable for laying as per IS 1255	:	---------- YES ----------					

$'- As per manufacturer design data

TECHNICAL DATA SHEET
(1.1 kV GRADE PVC CONTROL CABLES)

	CUSTOMER :	RECPDCL							
SN	Name of manufacturer :	As per approved list							
	Cable Sizes	2c x 2.5	3c x 2.5	5c x 2.5	7c x 2.5	10c x 2.5	14c x 2.5	19c x 2.5	27c x 2.5
1	Manufacturer's type designation	: YWY	YWY	YWY	YWY	YWY	YWY	YWY	YWY
2	Applicable standard	: ----------IS: 1554/PT-I/1988 & its referred standards----------							
3	Rated Voltage(volts)	: ----------1100----------							
4	Type & Category	: ----------FR & C1----------							
5	Suitable for earthed or unearthed system	: ----------for both----------							
6	Continuous current rating when laid in air in a ambient temp. of 50°C and for maximum conductor temp. of 70°C of PVC Cables[For information only]	: 22	19	19	14	12	10.5	9.7	8
7	Rating factors applicable to the current ratings for various conditions of installation:	: ----------As per IS-3961-Pt-II-67----------							
8	Short circuit Capacity								
	a) Short Circuit Amp. (rms)KA for 1 sec-for information only	: 0.285	0.285	0.285	0.285	0.285	0.285	0.285	0.285
	b) Conductor temp. allowed for the short circuit duty (deg C.)	: ----------160 °C----------							
9	Conductor								
	a) Material	: ---------- Plain annealed High Conductivity stranded Copper (as per IS 8130/84) -----							
	b) Grade	: ---------- Electrolytic----------							
	c) Cross Section area (Sq.mm.)	: 2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	d) Number of wires(No.)	: ---------- as per Table 2 of IS 8130 ----------							
	e) Form of Conductor	: ----------Non-Compacted stranded circular conductor---------							
	f) Direction of lay of stranded layers	: ---------- Outermost layer shall be R.H lay ----------							
10	Conductor resistance (DC) at 20 °C per km(maxm	7.41	7.41	7.41	7.41	7.41	7.41	7.41	7.41
11	Insulation								
	a) Composition of insulation	: ----------Extruded PVC type A as per IS-5831-84----------							
	b) Nominal thickness of insulation(mm)	: 0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	c) Minimum thickness of insulation	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
12	Inner Sheath								
	a) Material	: ----------Extruded PVC type ST-I as per IS-5831-84----------							
	b) Calculated diameter over the laid up cores,(mm)	: 7.2	7.8	9.7	10.8	14.4	15.9	18	22.1
	c) Thickness of Sheath (minimum)mm	: 0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
13	Armour	: ---------- as per IS 3975/99 ----------							
	a) Type and material of armour	: Gal. Steel wire	Gal. Steel wire	Gal. Steel wire	Gal. Steel wire	Gal. Steel wire	Gal. Steel wire	Gal. Steel wire	Gal. Steel wire
	b) Direction of armouring	: ----------left land----------							
	c) Calculated diameter of cable over inner sheath (under armour), mm	: 7.8	8.4	10.3	11.4	15	16.5	18.6	22.7
	d) Nominal diameter of round armour wire / dimensions of armour strip	: 1.4	1.4	1.4	1.4	1.6	1.6	1.6	1.6
	e) Number of armour wires	: ----------Armouring shall be as close as practicable----------							
	f) Short circuit capacity of the armour and duration-for info only	: --0.05 x A√t (K Amp)(where A = total area of armour in mm^2& t = time in seconds)----							
	g) DC resistance at 20 °C (Ω/Km) & Resistivity of armour	: ----------As per IS 1554 Part(1), whereever applicable & IS 3975-1999----------							
14	Outer Sheath								
	a) Material (PVC Type)	: ST-1& FR	ST-1& FR	ST-1& FR	ST-1& FR	ST-1& FR	ST-1& FR	ST-1& FR	ST-1& FR
	b) Calculated diameter under the sheath	: 10.6	11.2	13.1	14.2	18.2	19.7	21.8	25.9
	c) Min.thickness of sheath(mm)	: 1.24	1.24	1.24	1.24	1.4	1.4	1.4	1.56
	d) Guaranteed value of minimum oxygen index of outer sheath	: Min 29.0	Min 29.0	Min 29.0	Min 29.0	Min 29.0	Min 29.0	Min 29.0	Min 29.0
	e) Guranteed value of minimum temperature index at 21 oxygen index	Min 250	Min 250	Min 250	Min 250	Min 250	Min 250	Min 250	Min 250
	f) colour of sheath	: Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey
15	a) Overall diameter of cable	: $							
	b) Tolerance on overall diameter (mm)	: ----------+2/-2 mm----------							
16	Cable Drums	: ---------- shall conform to IS 10418 and technical specification							
	a) Max./ Standard length per drum for each size of cable (single length) with ±5% Tolerance (mtrs)	: 1000/500	1000/500	1000/500	1000/500	1000/500	1000/500	1000/500	1000/500
	b) Non standard drum lengths	: Maximum one(1) non standard lengths of each cable size may be supplied in drums only over & above the standard lengths as specified above.(if required for completion of project).							
17	Whether progressive sequential marking on outer sheath provided	: ---------- YES ----------							
18	Identification of cores	:							
	a) colour of cores	R & Bk	R,Y &Bl	,Y,Bl,Bk&	Grey	Grey	Grey	Grey	Grey
	b) Numbering	N.A.	N.A.	N.A.	Numerals in black ink	Numerals in black ink	Numerals in black ink	Numerals in black ink	Numerals in black ink
19	Whether Cables offered are ISI marked	: ---------- YES ----------							
20	Whether Cables offered are suitable for laying as per IS 1255	: ---------- YES ----------							

$'- As per manufacturer design data

VOLUME-II, SECTION-VII

DISTRIBUTION TRANSFORMER

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SECTION
DISTRIBUTION TRANSFORMER

1.0 **INTENT**

This specification is intended to cover outdoor type oil filled 11/0.433KV, 100 KVA/160 KVA transformers.

2.0 **SCOPE OF WORK**

2.1 **Scope of Supply**

- Transformers as listed above, with insulating oil, all materials and accessories, and complete in all respects.
- Gland plates, power cable, lugs, anchor bolts and hardwares.
- Mandatory & optional spares and special maintenance equipment's if any.

2.2 **Scope of Service**

The scope includes but is not limited to the following items of work to be performed for all equipment and materials furnished under this Section:

a) Design, manufacturing, shop testing, packing & dispatch

b) Transportation inclusive of insurance and delivery, FOR site basis

c) Unloading, handling, storing, transportation at site up to foundations, oil filling and treatment, erection, testing and commissioning

d) Civil Works

e) Supply of external cables and termination as required.

f) Fire protection system.

3.0 **General Information**

3.1 All temperature indicators, Buchholz relays and other auxiliary devices shall be suitable for 220/110 V DC Control supply. All alarm and trip Contacts shall also be suitable for connection in 220/110V DC Circuits.

3.2 Bidders may specifically note that transformers offered shall conform to dynamic short circuit test and dielectric test as per IEC: 60076. Test report for the same shall be submitted during detail engineering for approval.

4.0 TECHNICAL REQUIREMENTS

4.1 Core

The core shall be constructed from high grade, non-aging, cold rolled grain-oriented silicon steel laminations. The maximum flux density in any part of the cores and yoke at normal voltage and frequency shall be such that the flux density at any tap position with 12.5% combined voltage & frequency variation from the rated voltage & frequency corresponding to the tap shall not exceed 1.9 Wb/sq-m.

4.2 Windings

HV and LV windings shall be wound from Super Enamel covered / Double Paper covered Electrolytic Copper conductor, free from scales and burrs.

4.3 Insulating Oil

The oil supplied with transformer shall be unused and have the parameters for unused new oil conforming to IEC: 60296 while tested at oil Contractor's premises. No inhibitors shall be used in oil. Ten percent extra oil shall be supplied for topping up after commissioning in nonreturnable containers suitable for outdoor storage. Oil shall be filtered and tested for break down voltage (BDV) and moisture content before filling. The oil shall be filled under vacuum.

4.4 Terminal Arrangement

a) Bushing terminals shall be provided with suitable terminal connectors of approved type and size for cable/overhead conductor’s termination of HV side and cable termination on LV side.

b) The neutral terminals of 433V winding shall be brought out on a bushing along with the 433 volt phase terminals to form a 4 wire system for the 250 volt. Additional neutral bushing shall also be provided for earthing.

4.5 Off Circuit Tap Changing Equipment

The tap Change switch is required for **100/160 KVA DT**. The tap change switch shall be three phase, hand operated for simultaneous switching of similar taps on the three phases by operating an external hand wheel. The Tapping shall be as per provisions of IS: 1180 Part – I

(2014). Each tap change shall result in variation of 2.5% in voltage. Arrangement for pad locking shall be provided. Suitable aluminium anodized plate shall be fixed for tap changing switch to know the position number of tap.

4.6 **Marshalling Box**

A metal enclosed, weather, vermin & dust proof marshalling box shall be provided with each transformer to accommodate temperature indicators, terminal blocks etc. It shall have a degree of protection of IP 55 as per IS: 13947 / IEC: 60947 Part-1.

4.7 **Cable boxes**

Whenever cable connections are required, suitable cable boxes shall be provided and shall be air insulated. They shall be of sufficient size to accommodate Employer's cables and shall have suitable removable side/top cover to facilitate cable termination and inspection. Cable boxes shall be dust & vermin proof.

5.0 **Inspection and Testing**

a) The Contractor shall draw up and carry out a comprehensive inspection and testing program during manufacture and commissioning of the transformer. The programme shall be duly approved by the Employer.

b) The Contractor shall carryout all routine tests on all the transformers as per relevant standards. Type test report shall be submitted for approval during detail engineering.

6.0 **Inspection**

6.1 **Tank and Accessories**

a) Physical and dimensional check of transformer tank and accessories.

b) Crack detection of major strength weld seams by dye penetration test.

6.2 **Core**

a) Physical inspection and check of quality of varnish, if used.

b) Sample testing of core material for checking specific loss, bend properties, magnetization characteristics and thickness.

c) Check on completed core for measurement of iron loss and check for any hot spot by exciting the core so as to induce the designed value of flux density in the core.

d) HV Test

6.3 **Insulating Material**

a) Sample checks for physical properties of the material

b) Check for dielectric strength

c) Check for the reaction of hot oil on insulating material

6.4 **Winding**

a) Sample check on winding conductor for mechanical properties and electrical conductivity and on installation covering.

b) Sample check on insulation paper for pH value, Bursting strength, Electric strength.

6.5 **Assembled Transformer**

a) Check complete transformer against approved outline drawing provision for all fittings, finish etc.

b) Jacking test on all the assembled transformers.

6.6 **Oil**

All Standard tests in accordance with relevant Standards shall be carried out on oil samples taken from the transformer before and after testing of the transformer.

The contractor shall also prepare a comprehensive inspection and testing programme for all bought out sub-contracted items and shall submit the same to the Employer for approval. Such programme shall include the following components:

a) Buchholz Relay
b) Winding temperature Indicator
c) Bushings
d) Marshaling Box
e) Tap changer switch
f) Oil temperature indicator

7.0 **Factory Test**

7.1 All standard routine tests in accordance with latest issue of IS: 1180 / IS: 2026 / IEC: 60076 shall be carried out on each transformer.

7.2 The transformer shall conform to all the type tests in accordance with latest issues of IS: 1180 / IS: 2026 / IEC: 60076. The manufacturer shall submit type tests & additional test reports as listed above as already carried out on transformers of identical design for owner's acceptance. In such a case validity of type test reports shall be in line with clause 9.2 of Section 2-GTR of technical specifications. Following parameters in general shall be ensured for establishment of identical design as per IEC: 60076, Part-V.

a) Same Voltage ratio, KVA rating, vector group & impedance.
b) Same conceptual design of core and winding.
c) Same arrangement and geometrical sequence of the main windings.
d) Same type of winding conductors.
e) Same type of main windings.
f) Absorbed power at short circuit (i.e. rated power/per unit short circuit impedance) between 30% and 130% of that relating to the reference transformer.
g) Axial forces and winding stresses occurring at short circuit not exceeding 120% of those relating to the reference transformer.
h) Same manufacturing process.
i) Same Clamping and winding support arrangement.

7.3 In addition to all type and routine tests, transformer shall also conform to following additional type tests as per IS: 1180 / IS: 2026 / IEC: 60076.

a) Measurement of zero sequence impedance

b) Short circuit test

c) Measurement of acoustic noise level. This shall conform to NEMA standard publication TR-1.

d) Measurement of capacitance and tan delta of transformer winding.

e) Test on oil samples as per IS: 60296

7.4 All auxiliary equipment shall be tested as per the relevant IS Test Certificates shall be submitted for bought out items.

7.5 High voltage withstand test shall be performed on auxiliary equipment and wiring after complete assembly.

7.6 Tank Tests:

i) Routine Tests: As per IEC: 60076 Part-1 including
ii) Vacuum Tests: As per IEC: 60076 Part-1
iii) Pressure Test: As per IEC: 60076 Part-1

7.7 In addition to the above, the following checks should be carried out at manufacturer's works before despatch for all transformers:

a) Check for interchangeability of components of similar transformers and for mounting dimensions.

b) Check for proper packing and preservation of accessories like radiators, bushings explosion vent, dehydrating breather, Buchholz relay, conservator etc.

c) Check for proper provision of bracings to arrest the movements of core and winding assembly inside the tank.

d) Test for gas tightness and derivation of leakage rate. To ensure adequate reserve gas capacity during transit and storage.

7.8 The Contractor shall submit a detailed inspection and testing programme for field activities, covering areas right from the receipt of material stage up to commissioning stage as per IS: 1886 - Code of practice for installation and maintenance of transformers. The indicative checks and tests are given below.

a) Physical checks on each transformer on receipt at site for any damage or short supply.
b) Tests on oil samples
c) Oil leakage test
d) Physical checks for colour of silica in breather
e) Check for oil level in breather housing, conservator tank, etc.
f) Check for correct operation of all protections and alarms.
g) Insulation Resistance Measurement for Main Winding, control wiring etc.
h) Continuously observe the transformer operation at no load for 24 hours.

8.0 **Fittings**

The following fittings shall be provided with each transformer covered under this specification.

i) Conservator with drain plug and oil filling hole with blanking plate
ii) Plain oil Gauge
iii) Silica gel Breather
iv) Pressure Relief vent

v) Pocket on tank cover for Thermometer
vi) Valves
vii) Earthing Terminals
viii) Rating & Terminal Marking Plates
ix) Lifting Lugs
x) Rollers
xi) Air Release Plug

The fittings listed above are only indicative and any other fittings which generally are required for satisfactory operation of transformer are deemed to be included.

9.0 Spare Parts

9.1 The list of spares for outdoor type transformers covered under this Section shall be as specified in Section 1- PSR

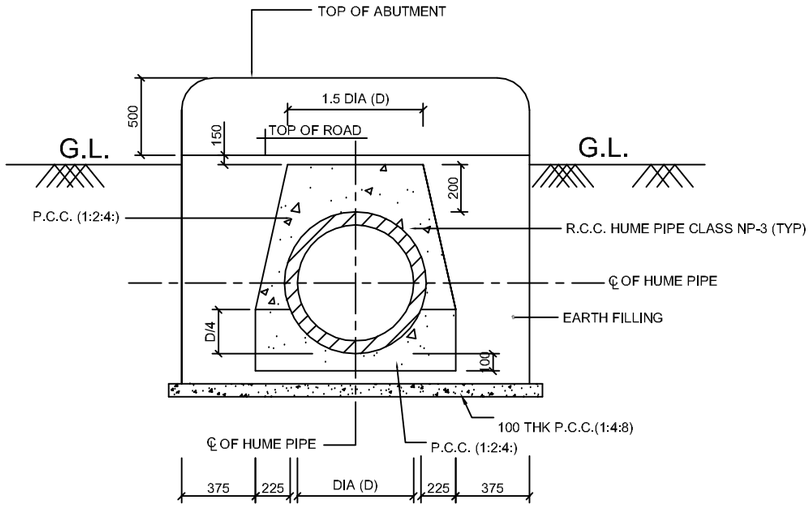
9.2 In addition, the Bidder shall also recommend optional spare parts and maintenance equipment necessary for three (3) years of successful operation of the equipment. The prices of these shall be indicated in respective schedules and these shall not be considered for the purpose of evaluation.

10.0 Technical Specification

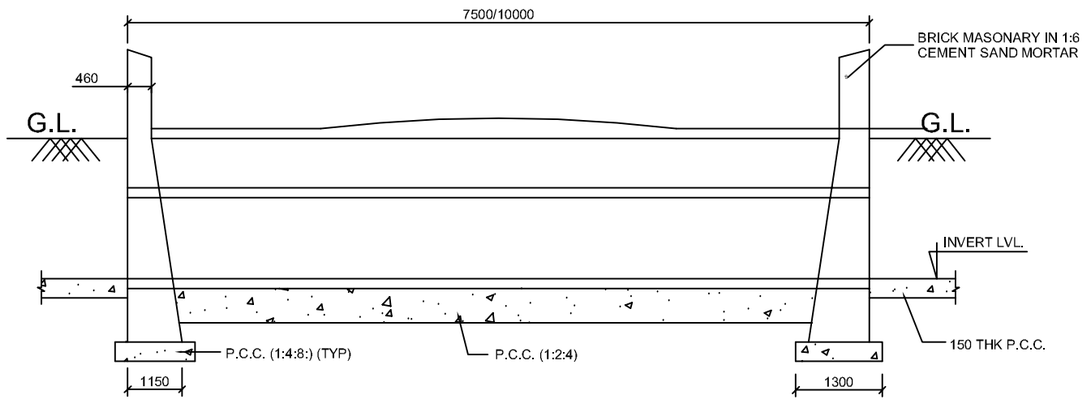
S No	Description	Unit	Parameters
1	Rated Capacity	kVA	100/160
2	Rated Voltage		
a)	HV	kV	11
b)	LV	kV	0.433
3	Type of Winding		Two Winding
4	Service		Outdoor
5	No of Phases	No.	Three
6	Frequency	Hz	50
7	Type of Cooling		ONAN
8	Impedance at 75 Deg C	%	4.5
9	Tolerance on Impedance	%	±10

S No	Description	Unit	Parameters
10	Duty		Continuous
11	Overload		IS:6600
12	Max. Temp. Rise over an ambient of 50 Deg C		
a)	Oil (Temperature rise measurement by thermometer)	^{0}C	35
b)	Winding Temperature rise measurement by resistance method)	^{0}C	40
13	Windings		
a)	System Apparent Short circuit level (kA)		As per IEC: 60076-Part 1
b)	Winding Connection		
(i)	HV		Delta
(ii)	LV		Star
14	Vector Group		Dyn1
15	Insulation		Uniform
16	Insulation Level	kVrms	
a)	Power Frequency Test Level		
(i)	HV	kVrms	28
(ii)	LV	kVrms	3
17	Basic Impulse Level		
(i)	HV	kVp	75
(ii)	LV	kVp	-
18	Highest voltage (kV) for each winding	kV	12
19	Method of earthing		Solidly earthed
20	Tap changer		
a)	(i) Tap Change		+2.5% to -5% in step of 2.5% on HV side
b)	(ii) Tap control		Off Circuit Tap Change Switch

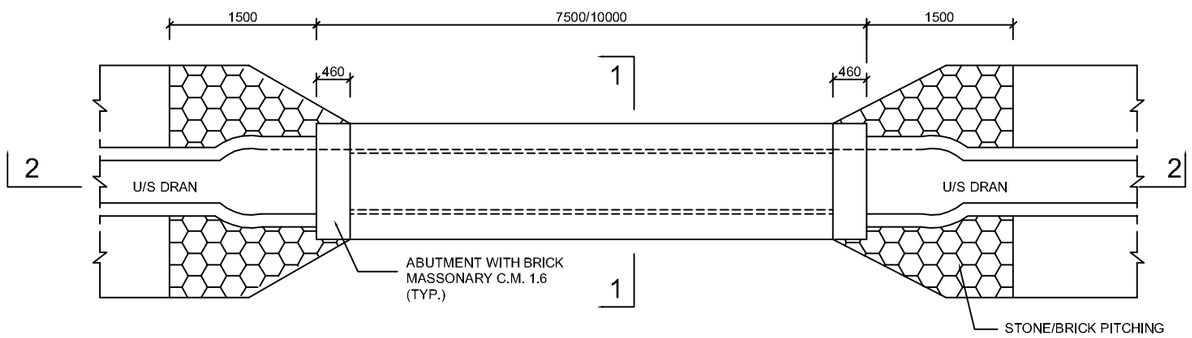
S No	Description	Unit	Parameters
21	HV Bushing		
a)	Rated Voltage	kV	17.5
b)	Rated current	A	100
c)	Basic Impulse Level (kVp)	kVp	95
d)	Wet & Dry Power frequency Withstand Voltage	kVrms	38
e)	Min. Total Creepage Distance	mm	437.5
f)	Mounting		Tank / Transformer Body
22	LV & Neutral Bushing		
a)	Rated Voltage	kV	1.1
b)	Rated current	A	630
c)	Basic Impulse Level (kVp)	kVp	-
d)	Wet & Dry Power frequency Withstand Voltage	kVrms	10 & 12
e)	Mounting		Tank / Transformer Body
23	Terminal Details		
a)	HV		Suitable for 11kV Cable or Over Head Conductor
b)	LV & Neutral		Cable Box
24	Min. Clearance in Air	mm	
a)	Ph-Ph (HV/LV)	mm	255/75
b)	Ph-Earth (HV/LV)	mm	140/40
24	Losses		
	-Total loss (No load loss + load loss at 75degC) at 50% of rated load		Should not be more than 475W
	-Total loss at 100% of rated load		Should not be more than 1650W
25	Audible noise at rated voltage & frequency		51 decibels



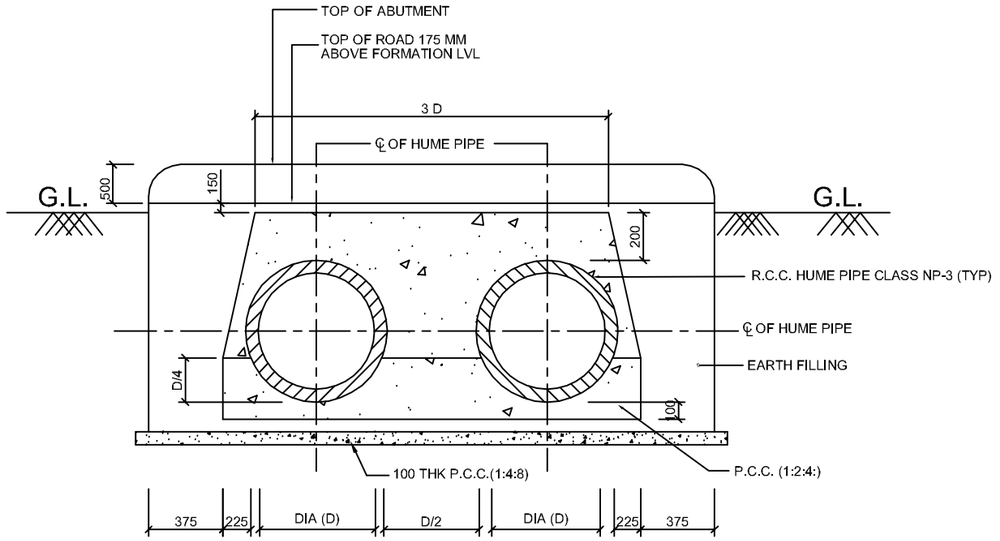
SECTION 1-1 FOR SINGLE PIPE



SECTION 2-2



PLAN OF PIPE CULVERT



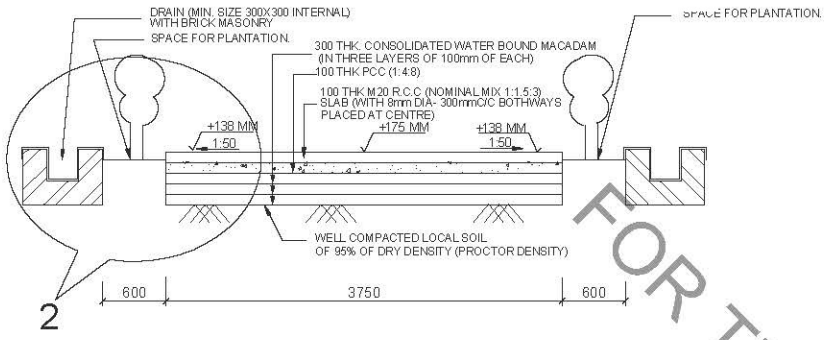
SECTION 1-1 FOR DOUBLE PIPE CULVERT

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. DO NOT SCALE THE DRG.
3. WORK SHALL BE DONE AS PER C.P.W.D. SPECIFICATION.

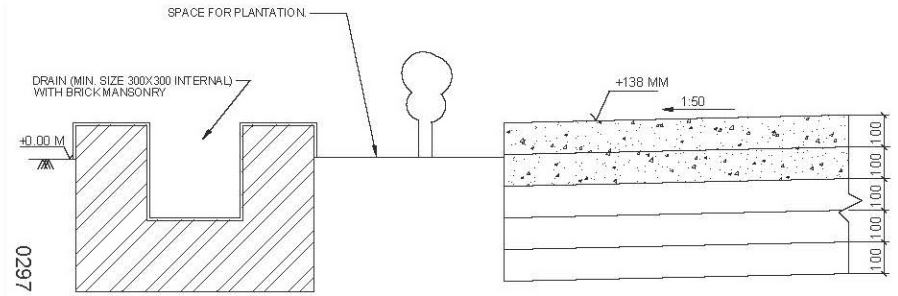
RELEASED FOR TENDER

REC TRANSMISSION PROJECTS COMPANY LIMITED	
PROJECT :	**Residential Staff Quarter of Lassipora GIS Substation**
TITLE :	**DETAIL OF ROAD CULVERTS**
SHEET 1 OF 1	

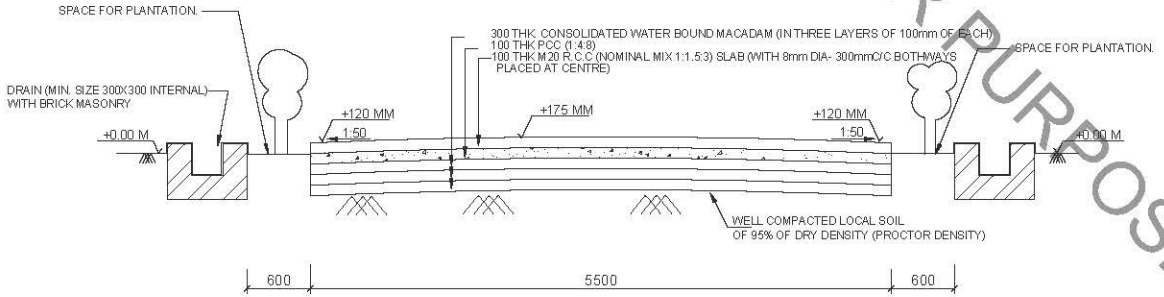


2

TYP. CROSS SECTION OF 3.75 M WIDE ROAD
(VALID FOR SWITCHYARD INTERNAL ROADS)



DETIAL - 2



TYP. CROSS SECTION OF 5.5 M WIDE ROAD
(VALID FOR APPROACH TO SWITCHYARD)

FOR TENDER PURPOSE ONLY

NOTES:

1. ALL DIMESION ARE IN MM UNLESS NOTED OTHERWISE.
2. CAMBER OF 1:50 SHALL BE PROVIDED.
3. EXPANSION JOINT (12 MM THICK) SHALL BE PROVIDED AT EVERY 8.0M.
   EXPANSION JOINT SHALL ALSO BE PROVIDED AT CENTRE.
4. POLYTHENE SHEET OF 125 MICRONS SHALL BE PLACED BETWEEN THE PCC AND RCC SLAB. (TOP SLAB)
5. 100MM DIA. RCC HUME PIPE (NP-3) SHALL BE PLACED ACROSS THE ROAD AT EVERY 100M INTERVAL
   ALONG THE ROAD.
6. FINISHED TOP OF ROAD CREST SHALL BE 175 MM (MIN.) ABOVE F.G.L. (SWITCHYARD FORMATION LEVEL)

RELEASED FOR TENDER

REC TRANSMISSION PROJECTS COMPANY LTD.

PROJECT : 765 / 400 / 220 Kv SUBSTATIONS

TITLE : DETAIL OF CONCRETE ROAD (RIGID PAVEMENT)

REC POWER DEVELOPMENT AND CONSULTANCY LIMITED

(As Project Implementing Agency)

On Behalf of Jammu & Kashmir Power Transmission Corporation Limited

Invites Bid through e-Tendering mode only

FOR

Construction of balance works of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15 on Turn Key Basis

Tender Specification No. RECPDCL/PIA/JKPTCL/SS & LILO-01 of 2024
Dated: 15-01-2024

VOL-III

01/ 2024

REC Power Development Consultancy Limited
(A wholly owned subsidiary of REC, a *'Maharatna CPSE'*
Under the Ministry of Power, Govt of India)
D-Block, REC Corporate Headquarter,
Plot No. I-4, Sector-29
Gurugram, Haryana– 122 001
Website: www.recpdcl.in

General guidelines for filling up the Attachments	
Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15	
Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024	
1	**Fill up only green shaded cells in the relevent attachments.**
2	**Attachments 3(QR), 4, 4(A), 5, 5(A) 6, 9, 10, 11, 12, 13, 14, 15, 16, 17 , 18 & 19 and Bid Form for 1st Envelope are included here.**
3	**Attachment 1 Bid Security : To be submitted as per proforma provided in the Bidding Document.**
4	**Attachment 2 Power of Attorney : No specific format is provided by RECTPCL. Bidder may use their own format.**
5	**Attachment 8 Manufacturer's Authorisation Form : To be furnished as per proforma provided in the bidding document, on the letter head of the each Manufactures proposed to supply main items. This attachment is not included here.**
6	**Attachment 14 Integrity Pact : To be submitted as per ITB Clause No. 9.3(n) and as per remarks in the Attach 14-IP.**
7	**Attachment 18 Safety Pact : To be submitted as per ITB Clause No. 9.3(r).**
Click for Detailed General Instructions	Click to skip Instructions & Proceed

REC Power Development and Consultancy Limited
(A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE'
Under the Ministry of Power, Govt of India)
D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29,
Gurugram (Haryana)-122001.
Website: www.recpdcl.in

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15	
Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024	
Enter following details of the bidder	
Specify type of Bidder [Select from drop down menu]	Sole Bidder
Name of the Sole Bidder	
Address of the Sole Bidder	
	....
	....
	....
	....
Name of other Partner - 2	....
Address of other Partner-2	....
	....
	....
Printed Name	
Designation	
Date :	
Place :	

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024	Attachment-3(JV) SS & LILO-1

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

(Joint Venture Agreement and Power of Attorney for Joint Venture*)

Bidder's Name and Address (Sole Bidder) :	
Name :	
Address :	

To,
REC Power Development and Consultancy Limited
(A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE'
Under the Ministry of Power, Govt of India)
D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29,
Gurugram (Haryana)-122001.
Website: www.recpdcl.in

Dear Sir,

The Joint Venture Agreement (as per the proforma attached at no. 15 in Section-IX, Sample Forms and Procedures, Conditions of Contract, Vol.-I of the Bidding Documents) and Power of Attorney for Joint Venture (as per the proforma attached at no. 14 in Section-IX, Sample Forms and Procedures, Conditions of Contract, Vol.-I of the Bidding Documents) are enclosed herewith.

Date : 0 **Printed Name :** 0

Place : 0 **Designation :** 0

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024		Attachment-3(QR) SS & LILO-1
Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15		
(Qualifying Requirement Data)		
Bidder's Name and Address (Sole Bidder) :		To:
Name :		To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001. Website: www.recpdcl.in
Address :		
Dear Sir,		
For our Qualifying Requirements Data, please refer Schedule-QR of this VOLUME		
Date :	Printed Name :	
Place :	Designation :	

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024	**Attachment-4 SS & LILO-1**

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

(Form of Certificate of Origin and Eligibility)

Bidder's Name and Address (Sole Bidder) :		**To:**	
Name :		To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001. Website: www.recpdcl.in	
Address :			
Dear Sir,			

We hereby certify that equipment and materials to be supplied are produced in [Name of Countries], eligible source country.
We hereby certify that our company is incorporated and registered in [Name of Countries], eligible source country.

Date :	0	**Printed Name :**	0
Place :	0	**Designation :**	0

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024		Attachment-4(B) SS & LILO-1
Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15		
(List of Special Maintenance Tools & Tackles)		
Bidder's Name and Address (Sole Bidder) :		**To:**
Name :		To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001.
Address :		
Dear Sir,		
We are furnishing below the list of special maintenance tools & tackles for various equipment under the subject package. The prices for these tools & tackles which are to be taken back after the completion of the work by us are not included in our lumpsum bid price. We further confirm that the list of special maintenance tools & tackles includes all the items specifically identified in your bidding documents as brought out below:		
(a)		
(b)		
(c)		
(d)		
(e)		
(f)		
Date :	**Printed Name :**	
Place :	**Designation :**	

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS &				**Attachment-5 SS & LILO-1**
Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15				
(Sub-contracted Items)				
Bidder's Name and Address (Sole Bidder) :			**To:**	
Name :			To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India)	
Address :				
Dear Sir,				

1.We hereby furnish the details of the items/ sub-assemblies (supply items), we propose to buy for the purpose of furnishing and installation of the subject Package :

Sl. No.	Item Description	Quantity proposed to be bought/sub-	Details of the proposed sub-	
			Name	Address
1				
2				
3				
4				
5				

2. We hereby delare that we would not subcontract the erection portion of the contract without prior approval of the Employer.

Sl. No.	Item Description	Quantity proposed to be bought/sub- contracted	Details / write-up to engage the Locals sub-contractor/sub-vendor
1			
2			
3			
4			
5			

For additional write-up details, extra sheet may be added in the bid

Date :	0	**Printed Name :**	0	
Place :	0	**Designation :**	0	

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024		ATTACHMENT-5A

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

(Items, Components, Raw Material, Services proposed to be sourced from Micro and Small Enterprises)

Bidder's Name and Address (Sole Bidder) :			**To,** **REC Power Development and Consultancy Limited** **(A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE'** **Under the Ministry of Power, Govt of India)** **D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001.**	
Name :				
Address :				
Dear Sir,				

1. We hereby furnish the details of the items, components, raw material, services which we propose to buy/avail from Micro and Small Enterprises (MSEs) for the purpose of completion of works under the subject package :

Sl. No.	**Item Description**	**Quantity proposed to be sub-contracted**	**Name of Micro and Small Enterprises (MSEs)**	
			Name & Address	**Category (Micro or Small)**
1				
2				
3				
4				
5				

2. 2. The above is a list of items we propose to procure from MSEs. However, based on the situations during the execution of the contract, the above list may undergo changes. We hereby confirm that the details regarding actual procurement from MSEs carried out by us, as per the format provided at Section IX, Forms and Procedures, Volume-I of bidding documents, shall be submitted along with the bills for payment against supplies made/works done during execution of contract.

Date :			**Printed Name :**	
Place :			**Designation :**	

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01			Attachment-6 SS & LILO-01
Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15			
(Alternative, Deviations and Exceptions to the Provisions)			
Bidder's Name and Address (Sole Bidder) :			**To:**
Name :			To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India)
Address :			
Dear Sir,			

The bidder shall itemize any deviation from the Specifications included in his bid. Each item shall be listed (separate sheets may be used and enclosed with this Attachment) with the following information:

Sl. No.	Reference clause in the Specifications	Deviation	Cost of withdrawal of the deviation

The above deviations and variations are exhaustive. We confirm that we shall withdraw the deviations proposed by us at the cost of withdrawal indicated in this attachment, failing which our bid may be rejected and Bid Security forfeited.

Except for the above deviations and variations, the entire work shall be performed as per your specifications and documents.
Further, we agree that any deviations, conditionality or reservation introduced in this Attachment-6 and/or in the Bid form, Price schedules & Technical Data Sheets and covering letter, or in any other part of the bid will be reviewed to conduct a determination of the substantial responsiveness of the bid.

Date :		**Printed Name :**	
Place :		**Designation :**	

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-		Attachment-7 SS & LILO-01
Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15		
(Details of Alternative Bid)		
Bidder's Name and Address (Sole Bidder) :	**To:**	
Name :	To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001. Website: www.recpdcl.in	
Address :		
No Alternative Bid is allowed		
Date :	**Printed Name :**	
Place :	**Designation :**	

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated:		Attachment-9

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

(Work Completion Schedule)

Bidder's Name and Address (Sole Bidder) :		**To:**
Name :		To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001.
Address :		
Dear Sir,		

We hereby declare that the following Work Completion Schedule shall be followed by us in furnishing and installation of the subject Package i.e., Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15"

Sl. No.	**Description of Work**	**Period in months from the effective date of contract**
1	Detailed Engineering and drawing submission	
	a) commencement	
	b) completion	
2	Procurement of equipment/ components &	
	a) commencement	
	b) completion	
3	Type Tests	
	a) commencement	
	b) completion	
4	Manufacturing	
	a) commencement	
	b) completion	
Sl. No.	**Description of Work**	**Period in months from the effective date of contract**
5	Shipments & Delivery	
	a) commencement	
	b) completion	
6	Establishment of site office	
7	Installation at Site	
	a) commencement	
	b) completion	
8	Testing & Pre-commissioning	
	a) commencement	
	b) completion	
9	Trial Operation	
	a) commencement	
	b) completion	

Date :		**Printed Name :**
Place :		**Designation :**
Note :	Bidders to enclose a detailed network covering all the activities to be undertaken for completion of the project indicating key dates for various milestones for each phase constituent-wise.	

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

(Guarantee Declaration)

Bidder's Name and Address (Sole Bidder) :		
Name :		To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001. Website: www.recpdcl.in
Address :		
Dear Sir, We conform that the equipments offered shall have minimum (or a muximum, as the case may be) performance specified in Technical Specification. We further guarantee the performance/efficiency of the equipments in response to the Technical Specifications.		

Equipment	**Guaranteed losses at rated output (KW) per Unit (applicable for each item/unit of the facilities)**		
	Copper loss at 75 degree C at rated current	Iron loss at rated voltage and frequency	Cooler loss (Power consumptions by all fan and pumps, except standby one) at rated voltage & frequency
50 MVA, (220/√3)/ (33/√3) kV 3-Phase Transformer			

Applicable in case of 50 MVA, 220/33kV, 3-phase Power Transformers

We note that in the above guaranteed losses are not meeting the criteria specified in the technical Specifications i.e " Copper loss (Load Loss)> iron Loss (No Load Loss)> Cooler loss(Auxiliary Loss)", our bid will be considered non-responsive in line with ITB Clause 24.1 (b).

Date: Printed Name:
Place: Designation:

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated:		Attachment-11 SS & LILO-01	
Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15			
Bidder's Name and Address (Sole Bidder) :		**To:**	
Name :		To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India)	
Address :			
Dear Sir,			

Information Regarding Ex-employee of RECTPCL

(NOT APPLICABLE FOR THIS TENDER)

We declare that we are aware of and have gone through the "Code of Business Conduct and Ethics for Senior Management Personnel"1 and "Code of Business Conduct and Ethics for Board Members"1 of RECPDCL (hereinafter referred to as the "Code of Conduct"). We further understand that as per the "Code of Conduct", Senior Management Personnel including Board Members, who have retired/resigned from RECPDCL, shall not accept any appointment or post, as detailed in the referred "Code of Conduct", within 1 year from the date of cessation of service/directorship unless approved by the Competent Authority.
Accordingly,We hereby furnish the details of ex-employees of RECPDCL who had retired/ resigned at the level of General Manager and above from RECPDCL and subsequently have been employed by us:

Sl. No.	Name of the person with designation in RECTPCL	Date of Retirement/ resignation from RECTPCL	Date of joining and designation in our organisation
1			
2			
3			
4			

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024	Attachment-12 SS & LILO-01

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

Click here for next attachment

(Price Adjustment Data)

Bidder's Name and Address (Sole Bidder) :			**To,** **REC Power Development and Consultancy Limited** **(A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE'** **Under the Ministry of Power, Govt of India)** **D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001.** **Website: www.recpdcl.in**	
Name :				
Address :				
Dear Sir,				

We hereby furnish the relevant details pertaining to the price adjustment provisions for equipment as specified in your specifications and documents for the Tender Package "Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Kishenpur-Barn on D/C Tower at Nagrota Substation under PMDP Sceme-15"

Sl. No.	Name of Materials	Value of co- efficient	Name of the published index	Value of index
1	*2*	*3*	*4*	*5*
	TOWER PORTION			
A	For Fabricated Tower Parts (including bolts & nuts)			
a	Steel Blooms, co-efficient a =		IEEMA	
b.	Electrolytic High Grade Zinc, co-efficient b =		IEEMA	
c.	Labour, Co-efficient l=		Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.in)	
Coefficient 'a' shall be between 0.51 to 0.57 and coefficient 'b' shall be between 0.08 to 0.10 and coefficient 'l' shall be between 0.20 to 0.24 and sum of Coefficients 'a', 'b' and 'l' shall be 0.85				
B.	**LINE MATERIALS**			
1.A	**Conductor**			
1	EC grade aluminium ingots, co-eifciant a =	0.65	CACMAI	
2		OPTION-A		
	High Carbon Steel Rods , co efficient b =	0.13		
	High Grade Electrolytic Zinc , co-efficient c =	0.02		
3	Labour, Co-efficient l=		Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.in)	
2	**Hardware Fittings**			
i)	Raw Material			

Sl. No.	Name of Materials	Value of co- efficient	Name of the published index	Value of index
A	EC Grade Aluminium Ingots, coefficient a =		IEEMA	
B	Electrolytic High Grade Zinc, coefficient b =		IEEMA	
C	Ferrous Metals, coefficient c=		Wholesale Price Index Number for 'Ferrous Metals' (Group Item) (monthly) (Base: 2004-05=100) as published by Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in)	
ii)	Labour, coefficient l =		Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.in)	
Coefficient 'a' shall be between 0.35 to 0.45 and coefficient 'b' shall be between 0.04 to 0.06 and coefficient 'c' shall be between 0.18 to 0.22 and coefficient 'l' shall be between 0.13 to 0.17 and sum of Coefficients 'a', 'b', 'c' and 'l' shall be 0.80				
3	**Conductor Accessories**			
3(a)	**Mid Span Compression Joint for Conductor**			
i)	Raw Material			
A	EC Grade Aluminium Ingots, coefficient a =		IEEMA	
Sl. No.	**Name of Materials**	**Value of co- efficient**	**Name of the published index**	**Value of index**
ii)	Labour, coefficient l =		Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.i	
Coefficient 'a' shall be between 0.63 to 0.67 and coefficient 'l' shall be between 0.13 to 0.17 and sum of Coefficients 'a' and 'l' shall be 0.80				
3(b)	**Repair Sleeve for Conductor**			
i)	Raw Material			
A	EC Grade Aluminium Ingots, coefficient a =		IEEMA	
ii)	Labour, coefficient l =		Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.in)	
Coefficient 'a' shall be between 0.63 to 0.67 and coefficient 'l' shall be between 0.13 to 0.17 and sum of Coefficients 'a' and 'l' shall be 0.80				
3(c)	**Vibration Damper for Conductor**			
i)	Raw Material			
A	EC Grade Aluminium Ingots, coefficient a =		IEEMA	
ii)	Labour, coefficient l =		Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.in)	

Sl. No.	Name of Materials	Value of co- efficient	Name of the published index	Value of index
Coefficient 'a' shall be between 0.63 to 0.67 and coefficient 'l' shall be between 0.13 to 0.17 and sum of Coefficients 'a' and 'l' shall be 0.80				
3(d)	**Flexible Copper Bond**	**Firm**		
C.	**For Erection Price Component**			
1	**Installation Price Component {including civil works but excluding 'supply & placement of reinforcement steel', 'concreting', survey, soil investigation and aviation signal for river crossing towers(if any)}**			
A	High Speed Diesel, coefficient a =		Wholesale Price Index Number for 'High Speed Diesel' (Individual commodity) (monthly) (Base: 2004-05=100) as published by Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in)	
L	Labour, coefficient l =		Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100)	
Coefficient 'a' shall be between 0.20 to 0.24 and coefficient 'l' shall be between 0.56 to 0.60 and sum of Coefficients 'a' and 'l' shall be 0.80				
2	**Supply & Placement of Reinforcement Steel**			
A	High Speed Diesel, coefficient a =		Wholesale Price Index Number for 'High Speed Diesel' (Individual commodity) (monthly) (Base: 2004-05=100) as published by Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in)	
L	Labour, coefficient l =		Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.in)	
B	Ferrous Metals, coefficient b =		Wholesale Price Index Number for 'Ferrous Metals' (Group Item) (monthly) (Base: 2004-05=100) as published by Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in).	
Coefficient 'a' shall be between 0.09 to 0.11 and coefficient 'b' shall be between 0.63 to 0.67 and coefficient 'l' shall be between 0.04 to 0.06 and sum of Coefficients 'a', 'b' and 'l' shall be 0.80				
3	**For Concreting**			

Sl. No.	Name of Materials	Value of co- efficient	Name of the published index	Value of index
A	High Speed Diesel, coefficient a =		Wholesale Price Index Number for High Speed Diesel' (Individual commodity) (monthly) (Base: 2004-05=100) as published by Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in)	
L	Labour, coefficient l =		Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.i	
B	Cement & Lime, coefficient b =		Wholesale Price Index Number for 'Cement & Lime' (Group Item) (monthly) (Base: 2004- 05=100) as published by Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in).	
C	Structural Clay Products, coefficient c =		Wholesale Price Index Number for 'Structural Clay Products' (Group Item) (monthly) (Base: 2004- 05=100) as published by Office of Economic Advisor, Ministry of Commerce	
Sl. No.	**Name of Materials**	**Value of co- efficient**	**Name of the published index**	**Value of index**
SUBSTATION PORTION				
Sl. No.	**Name of Materials/Labour**	**Value of co- efficient**	**Name of the published index**	**Value of index as 30 days prior to date set for**
1	*2*		*4*	*5*
In accordance with Clause 2, Appendix-2, Form of Contract Agreement, Section-VI; Forms. Volume-I				
A) For Equipment Price Component:				
I.	**Circuit Breaker**			
a)	**Raw Material**			
i)	a=		IEEMA	
ii)	b=		IEEMA	
iii)	c=		IEEMA	
iv)	d=		IEEMA	
b)	Labour I=		Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.i	
The sum of the value of coefficients for raw materials: a+b+c+d=0.55 to 0.65 and sum of all the coefficients including labour shall be a+b+c+d+l=0.85.				
II	**Current Transformer**			
a)	**Raw Material**			
i)	a=		IEEMA	
ii)	b=		IEEMA	
iii)	c=		IEEMA	
iv)	d=		IEEMA	
b)	Labour I=		Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.i	
The sum of the value of coefficients for raw materials: a+b+c+d=0.55 to 0.65 and sum of all the coefficients including labour shall be a+b+c+d+l=0.85.				
III	**Capacitive VoltageTransformer**			
a)	**Raw Material**			
i)	a=		IEEMA	
ii)	b=		IEEMA	

Sl. No.	Name of Materials	Value of co- efficient	Name of the published index	Value of index
iii)	c=		IEEMA	
iv)	d=		IEEMA	
b)	Labour I=		Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.i	
The sum of the value of coefficients for raw materials: a+b+c+d=0.55 to 0.65 and sum of all the coefficients including labour shall be a+b+c+d+l=0.85.				
Sl. No.	**Name of Materials**	**Value of co- efficient**	**Name of the published index**	**Value of index**
IV	**Isolators**			
a)	**Raw Material**			
i)	a=		IEEMA	
ii)	b=		IEEMA	
iii)	c=		IEEMA	
iv)	d=		IEEMA	
b)	Labour I=		Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.i	
The sum of the value of coefficients for raw materials: a+b+c+d=0.55 to 0.65 and sum of all the coefficients including labour shall be a+b+c+d+l=0.85.				
V	**Surge Arrester**			
a)	**Raw Material**			
i)	a=		IEEMA	
ii)	b=		IEEMA	
iii)	c=		IEEMA	
iv)	d=		IEEMA	
b)	Labour I=		Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.i	
The sum of the value of coefficients for raw materials: a+b+c+d=0.55 to 0.65 and sum of all the coefficients including labour shall be a+b+c+d+l=0.85.				
VI	**PVC/XLPE Insulated Power and Control Cable**			
a)	**a=PVC Compound**			
b)	Published Price of Metal		IEEMA	
	i) Aluminium per MT		IEEMA	
	ii) Copper per MT		IEEMA	
c)	Weight in MT of Metal per kM(Size wise)			
	i)			
	ii)			
	iii)			
	iv)			
	v)			
VII	**Substation Structures**			
i)	**Lattice Steel Structures & Pipe Structures (including bolts & nuts, washers & foundation bolts)**			
a)	Raw Materials			
i)	a=Structural steel	0.58	JPC Market Price (Retail) for average Price of Steel Angles of size 50 x 50 x 6 mm of all cities in Rs./MT as published by Joint Plant Committee(JPC).	
ii)	b=Electrolytic Zinc	0.16	IEEMA	
b)	Labour	0.11	Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.in)	
B (I) For Ex-works Price Component of Power Transformer/ Reactor without Insulating oil:				
a)	**Raw Material**			
i)	Copper a=		Price of Copper wire bars, in Rupees per MT, as	

Sl. No.	Name of Materials	Value of co- efficient	Name of the published index	Value of index
ii)	Electrical Lamination Steel b=		Price of CRGO Electrical Steel Sheets: C&F Price converted into Indian Rupees per MT for Transformer of rating above 10MVA or voltage	
iii)	Construction Steel c=		Wholesale Price Index Number for 'Ferrous Metals' (Group Item) (monthly) (Base: 2004-05=100) as published by Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in)	
iv)	Insulating Material d=		Price of Insulating Materials , as published	
b)	**Labour I=**		Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.i	
Sl. No.	**Name of Materials**	**Value of co- efficient**	**Name of the published index**	**Value of index**
The sum of the value of coefficients for raw materials: a+b+c+d=0.65 to 0.73 and value of coefficient for labour shall be between 0.12 and 0.20, so that sum of all the coefficients including labour shall be a+b+c+d+l=0.85				
B (II) For Ex-works Price Component of Insulating oil for Power Transformer/ Reactor:				
a)	Insulating Oil e=		Transformer Oil base stock (TOBS): C&F price of Group- II 70 grade oil converted into Indian Rupees, as published by IEEMA.	
C). For Ex-works Price Component of L. T. Transformer:				
a)	**Raw Material**			
i)	Copper a=		Price of Copper wire bars, in	
ii)	Electrical Lamination Steel b=		Price of CRGO Electrical Steel Sheets: C&F Price converted into Indian Rupees per MT for Transformer of rating up	
iii)	Construction Steel c=		Wholesale Price Index Number for 'Ferrous Metals' (Group Item) (monthly) (Base: 2004-05=100) as published by Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in).	
iv)	Insulating Material d=		Price of Insulating Materials , as published by IEEMA.	
v)	Insulating Oil e=		Transformer Oil Base Stock	
b)	**Labour I=**		Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.i	
The sum of the value of coefficients for raw materials: a+b+c+d+e =0.65 to 0.73 and value of coefficient for labour shall be between 0.12 and 0.20, so that sum of all the coefficients including labour shall be a+b+c+d+e+l=0.85				
C.	**For Installation Price Component**			

Sl. No.	Name of Materials	Value of co- efficient	Name of the published index	Value of index
I	**Installation price component (including Civil works but excluding 'supply & placement of reinforcement steel' and 'concreting')**			
i)	Labour I=	0.8	Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.in)	
II	**Supply & Placement of Reinforcement Steel**			
i)	High Speed Diesel	0.1	Wholesale Price Index Number for 'High Speed Diesel' (Individual commodity) (monthly) (Base: 2004-05=100) as published by Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in).	
ii)	Labour I=	0.05	Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100) (www.labourbureau.nic.i	
iii)	Ferrous Metal	0.65	Number for 'Ferrous Metals' (Group Item) (monthly) (Base: 2004-05=100) as published by Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in).	
iii)	**For Concereting**			
i)	High Speed Diesel	0.2	Wholesale Price Index Number for 'High Speed Diesel' (Individual commodity) (monthly) (Base: 2004-05=100) as published by Office of Economic Advisor, Ministry of	
ii)	Labour I=	0.1	Indian Labour Bureau, Shimla, Govt. of India (monthly) (Base: 2001 = 100)	
iii)	Cement & Lime	0.3	Wholesale Price Index Number for 'Cement & Lime' (Group Item) (monthly) (Base: 2004-05=100) as published by Office of Economic Advisor, Ministry of	
iii)	Structural Clay Products	0.2	Wholesale Price Index Number for 'Structural Clay Products' (Group Item) (monthly) (Base: 2004- 05=100) as published by Office of Economic Advisor	
Coefficient 'a' shall be between 0.18 to 0.22 and coefficient 'b' shall be between 0.25 to 0.35 and coefficient 'c' shall be between 0.18 to 0.22 and coefficient 'l' shall be between 0.09 to 0.11 and sum of Coefficients 'a', 'b', 'c' and 'l' shall be 0.80				

Sl. No.	Name of Materials	Value of co- efficient	Name of the published index	Value of index
The Bidders are required to estimate and indicate the values of different coefficients for each of the items in the price variation formulae within the specified range such that their summation is as specified in the Bidding Documents. Where no value or '-' or 'shall be furnished later' is specified against the coefficient, the same will be deemed to be zero and the fixed component would be suitably adjusted. If the values of all coefficients in price variation formulae indicated by the Bidder are within the specified range but their sum exceeds the summation specified in the Bidding Documents, the values of the coefficients shall be pro rata adjusted such that the summation remains as per the provisions of the Bidding Documents. If the values of all coefficients indicated by the Bidder are within the specified range but their summation is less than the value specified in the Bidding Documents, the values of the coefficients as indicated by the Bidder shall be considered as such and the fixed component in the price variation formulae would be suitably adjusted. Further, if any of values of the coefficients indicated by the Bidder is out of the range specified in the Bidding Documents, the lower of the values, as indicated by the Bidder vis-à-vis lower value of the range for that coefficient specified in the Bidding Documents, shall be considered and the fixed component would be suitably adjusted.				
Date :		**Printed Name :**		
Place :		**Designation :**		

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated:		Attachment-13 SS & LILO- 01
Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15		
(Declaration regarding Social Accountability)		
Bidder's Name and Address (Sole Bidder) :		**To:**
Name :		To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India)
Address :		
Dear Sir,		
We conform that we stand committed to comply to all requirements of Social Accountability Standards i.e., SA8000 (latest Standard available at *www.sa-intl.org*) and maintain the necessary records.		
Date :		**Printed Name :**
Place :		**Designation :**

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-		Attachment-14 SS & LILO- 01	
Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15			
Integrity Pact			
Bidder's Name and Address (Sole Bidder) :		**To:**	
Name :		To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29,	
Address :			
Dear Sir,			
Bidders are requested to refer Section-IX of VOL-I for the format of INTEGRITY PACT			
Date :		**Printed Name :**	
Place :		**Designation :**	

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated:		Attachment-15 SS & LILO-01

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

Click here for next attachment

Option for Initial Advance (either Interest Bearing Initial Advance or No Initial Advance) and Information for E-payment, PF details and declaration regarding Micro/Small & Medium Enterprises

Bidder's Name and Address (Sole Bidder) :		**To.**
Name :		To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India)
Address :		
Dear Sir,		
I	We have read the provisions in the Bidding Documents regarding furnishing the option for advance payment. Accordingly, as per ITB Clause 9.3 as provided in Section BDS, Section III, Vol.-I of the Bidding Documents, we hereby confirm to opt the following:	
	Interest Bearing Initial Advance **NOT APPLICABLE**	
	Supply Portion:	
	Services Portion:	
II	We are furnishing the following details of Statutory Registration Numbers and details of Bank for electronic payment.	
1.	Name of the Supplier/ Contractor in whose favour payment is to be made	
2.	Address with PIN Code and State	
	Registered Office:	
	Branch Office:	
	Correspondence Address:	
3.	Status – Company/others	
	[Declaration of Micro/ Small/ Medium Enterprise under Micro/ Small & Medium Enterprises Development Act 2006, if applicable]	
4.	Permanent Account (PAN) No.	
5.	**GSTIN Numbers**	
I.	GSTIN in the Sates/UT from where the supply of goods take place	
	Name of the States/UT	GSTIN number
(i)		
(ii)		
(iii)		
II.	GSTIN in the States/UT where the supply for services take place (states where sites under the subject package is situated)	
	Name of the States/UT	GSTIN number
6.	PF Registration No. of the Company	
7.	PF Regional Office covered (with Address)	
8.	Name of Contact Person	
	Designation	
9.	Contact Details	
	Landline(s):	
	Mobile(s):	
	Email ID :	
10.	Bank Details for Electronic Payment	
	Name of the Bank:	
	Address of Branch:	
	Account No.:	
	Type of Account:	
	Type of Account: Saving Account Current Account	Current Account
11.	9 digit MICR code printed at bottom in middle, next to cheque no.	
12.	IFSC (for RTGS)/NEFT Code (*to be obtained from the Bank*) Sample Cancelled Cheque to be enclosed	

We hereby declare that the above information are true and correct and we agree that the payment on account of this Contract, in the event of award, be made in the above account maintained in the above mentioned Bank.

Date :	**Printed Name :**	
Place :	**Designation :**	

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024	**Attachment-16 SS & LILO-01**

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

(Additional Information)

Bidder's Name and Address (Sole Bidder) :		**:To,** **REC Power Development and Consultancy Limited** **(A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE'** **Under the Ministry of Power, Govt of India)** **D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001.** **Website: www.recpdcl.in**
Name		
Address		
Dear Sir,		

In support of the additional information required as per ITB Sub-Clause 9.3 (p) of the Bidding Documents, we furnish herewith our data/details/documents etc., alongwith other information, as follows (the stipulations have been reproduced in italics for ready reference):

1.0	The Bidder shall furnish	
	A certificate from their Banker(s) (as per prescribed formats in Form 16, Section-IX: Sample Forms and Procedures) indicating various fund based/non fund based limits sanctioned to the Bidder and the extent of utilization as on date. Such certificate should have been issued not earlier than three months prior to the date of bid opening. Wherever necessary the Employer may make queries with the Bidders' Bankers. [Reference ITB clause 9.3(p)(i)]	
1.1	*In accordance with 1.0, certificate(s) from banker as per requisite format, indicating various fund based/non fund based limits sanctioned to the bidder or each member of the joint venture and the extent of utilization as on date is/are enclosed, as per the following details:*	
	Name of the Bidder (Sole Bidder)	
	Name of the Banker by whom certificate issued	
	Date of certificate (should not be earlier than **3 months** prior to date of bid opening)	
	Whether fund based/non fund based limits are indicated in the certificate	
	Whether extent of utilization is indicated in the certificate	
1.2	*The Bidder should accordingly also provide the following information/documents*	
(i)	Details of Banker:	

	Name of Banker		
	Address of Banker		
	Telephone No.		
	Contact Name and		
	Fax No.		
	E-mail ID		

(ii) *As per para 1.0, Authorization Letter(s) from the bidder (in case of JV bidder, from all the partners)*

Sl. No.	Letter Ref.	Date	Addressed to (name of the Bank)

(iii) *As per para ITB clause 9.3 q, Bidder shall furnish the details of their Provident Fund Code Number*

Sl. No.	Name of Bidders/JV Partners	Provident Fund Code	Details

2.0	**Litigation**				
	The bidder should provide detailed information on any litigation or arbitration arising out of contracts completed or under execution by it over the last five years. A consistent history of awards involving litigation against the Bidder or any partner of JV may result in rejection of Bid. [Reference ITB clause 9.3(n)(ii)]				
2.1	*Details of litigation history resulting from Contracts completed or under execution by the bidder over the last five years*				

Year	Name of client, cause of litigation/arbitration and matter in dispute	Details of Contract and date	Award for or against the bidder	Disputed amount
1				
2				
3				
4				
5				

3.0	**OTHER INFORMATION**										
3.1	Current Contract Commitments of										
	Bidders (individual firms or each partners of JV) should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.										

Details of Contract	Value of outstanding work (Rs.)	Estimated completion date

3.2	Financial Data:										
										Figures Rs in	

Details	Actual (Previous five years)					Projection for next five years				
	2022-2023	2021-2022	2020-2021	2019-2020	2018-2019	2023-2024	2024-2025	2025-2026	2026-2027	2027-2028
Total Assets										
Current Assets										
Total Liability										
Current Liability										
Profit before taxes										
Profit after taxes										

Date :		**Printed Name**	
Place :		**Designation :**	

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024				**Attachment-17 SS & LILO-01**
Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15				
(Declaration for tax exemptions, reductions, allowances or benefits)				
Bidder's Name and Address (Sole Bidder) :			**To:**	
Name :			To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India)	
Address :				
Dear Sir,				
1	We confirm that we are solely responsible for obtaining following tax exemptions, reductions, allowances or benefits in respect of supplies under the subject package, in case of award. We further confirm that we have considered the same in our bid thereby passing on the benefit to POWERGRID while quoting our prices. In case of our failure to receive such benefits, partly or fully, for any reason whatsoever, the Employer will not compensate us.			
2	We are furnishing the following information required by the Employer for issue of requisite certificate if and as permitted in terms of the applicable Govt. of India policies/procedures (in case of award):			
Applicable Act, Notification No. and Clause Ref. No.	Sl. No.	Description of item on which applicable	Country of origin	Remarks, if any
(The requirements listed above are as per current Notification of Govt. of India indicated above. These may be modified, if necessary, in terms of the Notifications.)				
Date :		**Printed Name :**		
Place :		**Designation :**		

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024	**Attachment-18 SS & LILO-01**

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

(Safety Pact)

Bidder's Name and Address (Sole Bidder) :		**To:**	
Name :		:To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001.	
Address :			
Dear Sir,			

Bidders are requested to refer Section-IX of VOL-I for the format of SAFETY PACT

Date :		**Printed Name :**	
Place :		**Designation :**	

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated: 15-01-2024	**Attachment-19 SS & LILO-01**

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

Click here for next attachment

(Declaration)

Bidder's Name and Address (Sole Bidder) :	**To:**
Name :	REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001. Website: www.recpdcl.in
Address :	
Dear Sir,	

We confirm that Bid Form and Price Schedules in the Second Envelope have been filled up by us as per the provisions of the Instruction to Bidders. Further, we have noted that the same shall be evaluated as per the provisions of the Bidding Documents.

Further, we hereby confirm that except as mentioned in the Attachment – 6 (Alternative, Deviations and Exceptions to the Provisions) hereof forming part of our First Envelope :

(i) there are no discrepancies/inconsistencies and deviations/omissions/ reservations to the Bidding Documents, in the Second Envelope bid;
(ii) the description of items and the unit thereof in the price schedules in the Second Envelope bid are in conformity with those indicated in the price schedule of the Bidding Documents without any deviation to the specified scope of work.
We also confirm that in case any discrepancies/ inconsistencies and deviations/ omissions/ reservations, as referred to in para (i) and (ii) above, is observed in the Second Envelope, the same shall be deemed as withdrawn/rectified without any financial implication, whatsoever to RECTPCL. However, in case of any arithmetical errors, the same shall be governed as per the provision of ITB Sub-Clause 27.2

Date :	**Printed Name :**
Place :	**Designation :**

Tender Pakage No.:-RECPDCL/PIA/JKPTCL/SS & LILO-01 dated:	Attachment-20 SS & LILO-01

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

(Declaration of Key Managerial Person and Power of Attorney holder)

Bidder's Name and Address (Sole Bidder) :	:To, REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001. Website: www.recpdcl.in
Name :	
Address :	
Dear Sir,	

1. We confirm that the declarations made in our bid, particularly Attachment-3 (QR) regarding eligibility/qualification data and documents submitted in our bid in support of the declarations, are true and correct to the best of our knowledge.
2. We further confirm that we have filled up Attachment-3(QR). We also confirm that in support of meeting the Technical experience requirement as per Qualification Requirement (Section-III, Vol-I), we have enclosed self-certified copy of Contract/ Award Letter and certificate from the utility for which the contract has been executed.
3. We shall furnish clarification to bid, if any sought by Employer pursuant to ITB clause 21.1. We understand that if we fail to rectify/furnish the requested documents if any, within 7 working days' notice, our bid is liable to be rejected.
4. We understand that any false declaration and/or misrepresentation of facts and/or furnishing of false/forged documents /information may lead to our debarment from participation in Employer tenders and that our Bid Security/ Contract Performance Guarantee may be forfeited besides other actions as deemed to be appropriate as per the provisions of the Bidding Document/Integrity Pact/Employer's policy.

5*. Our Balance Bid Capacity net of works under execution, calculated (i.e. 3T-B), as on 1st date** of the Quarter in which First Envelope Bids are to be opened i.e. 01st

	(MM/YYYY) in equivalent Indian Rupees is	

Crore. The details of value used for working out the Balance Bid Capacity as above, are as follows:

A. Maximum value of similar works (e.g. value related to EHV Transmission Lines /Substations of 110 kV and above in case of Tower/ Substation Packages respectively) executed during the last 5 financial years taking into account the completed as well as the works in progress(T)

S N	FY	Value of Total Sales (including Taxes and Duties)(T)

B. Value of existing commitments and ongoing similar works yet to be completed as on the 1st date of quarter of the financial year in which the bids are opened(B) as on 1st date of the Quarter in which First Envelope Bids are to be opened

S N	Value of Balance Works (B1) against the Contracts awarded by Employer	Value of Balance Works (B2) against the Contracts awarded by Utilities other than Employer	Total value of Balance Works (B){B=B1+B2}

[**1st day of the quarter in which the first envelope bids are opened for e.g. If the actual date of opening of first envelope bids is 15th June 2016, the Balance bid capacity as on 01st April 2016 is to be declared)]
*(Applicable only in case of package for which the stipulated Qualification Requirements in respect of Technical experience pertains primarily to erection, testing and commissioning/civil works viz. transmission Line tower packages/Substation package/civil works package etc.)

6***. Our/Our proposed manufacturer's annual manufacturing capacity as certified by a Chartered Engineer or similar Professional/ Professional body/Govt Agencies is:…… MT/annum (for tower/tower parts)

[Certificate from Chartered Engineer or similar Professional/ Professional body/Govt Agencies in the country of the bidder/proposed manufacturer is to be enclosed along with this Attachment.
Annual manufacturing capacity of all the manufacturers to be furnished separately]
***(Applicable only in case of Tower packages with scope for tower supply)

7. Notwithstanding above, we also understand that the Bid Capacity/Manufacturing Capacity as declared hereinabove, shall be subject to assessment, if any, by the Employer, which shall be final and binding. We also confirm that the Employer may verify the supporting documents/ details in connection with above declarations. We further understand that in case of any unethical practices inter-alia including any misrepresentation of facts, submission of false and/or forged details/
documents/ declaration by us, we may be debarred from the participation in Employer's tenders in future as considered appropriate by Employer and our Bid Security/ Contract Performance Guarantee shall be forfeited besides taking other actions as deemed appropriate.

Date :		**Printed Name :**	
Place :		**Designation :**	

Note: signed and stamped with company seal by a full time Director/ CEO/ Chairman-cum-Managing Director and attested/ notarized by a Magistrate/ Notary for correctness of all the information/details/data/documentary evidences etc. as submitted by the bidder are correct

Tender Pakage No.:- RECPDCL/PIA/JKPTCL/SS	**Bid Form 1st Envelope**

BID FORM (First Envelope)

Bid Proposal Ref. No.

Date :

To,
HoD
REC Power Development and Consultancy Limited
(A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE'
Under the Ministry of Power, Govt of India)
D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001.
Website: www.recpdcl.in

Name of Contract : **Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15**

Dear Ladies and/or Gentlemen,

1.0 Having examined the Bidding Documents, including Amendment Nos. ...[Enter the Amendment]... dated ...[Enter the Date in dd-mm-yyyy]... the receipt of which is hereby acknowledged, we the undersigned, offer to design, manufacture, test, deliver, install and commission (including carrying out Trial operation, Performance & Guarantee Test as per the provision of Technical Specification) the Facilities under the above-named package in full conformity with the said Bidding Documents. In accordance with ITB Clause 9.1 of the Bidding Documents, as per which the bid shall be submitted by the bidder under "Single Stage - Two Envelope" procedure of bidding. Accordingly, we hereby submit our Bid, in two envelopes i.e. First Envelope – Techno – Commercial Part & Second Envelope - Price Part (to be opened subsequently).
The above amounts are in accordance with the price schedules attached herewith and are made part of this bid

2.0 Attachments to the Bid Form (First Envelope) in line with the requirement of the Bidding Documents, we enclose herewith the following Attachments:

(a) Attachment 1	Bid Security, in a separate envelope, in the form of Bank Guarantee for a sum of INR (Rs. Zero Only) initially valid for a period of Zero (0) months from the date set for opening of bids. Or documentary evidence in support of exemption of Bid Security, in separate envelope in accordance with clause 13.1 of ITB, Section-II
(b) Attachment 2	A power of attorney duly authorized by a Notary Public indicating that the person(s) signing the bid have the authority to sign the bid and thus that the bid is binding upon us during the full period of its validity in accordance with the ITB Clause 14.
(c) Attachment 3	The documentary evidence that we are eligible to bid in accordance with ITB Clause 2. Further, in terms of ITB Clause 9.3 (c) & (e), the qualification data has been furnished as per your format enclosed with the bidding documents Attachment- 3(QR). Further, the required joint venture Agreement signed by us and our partners has also been furnished as per your format Attachment 3 (JV). Further the required deed of Joint Undertaking signed by us and Tower Manufacturer has also been furnished as per your format.
(d) Attachment 4	The documentary evidence establishing in accordance with ITB Clause 3, Vol.-I of the Bidding Documents that the facilities offered by us are eligible facilities and conform to the Bidding Documents has been furnished as Attachment 4. A list of Special Tools & Tackles to be used by us for erection, testing & Commissioning and to be handed over to Employer, the cost of which is included is our Bid Price, is also enclosed as per your format as Attachment 4A. A list of Special Tools & Tackles to be brought by the contractor for erection, testing & Commissioning and to be taken back after completion of work, whose cost in not included in our bid price, is enclosed as per your format as Attachment 4B.
(e) Attachment 5	The details of all major items of services or supply which we propose subletting in case of award, giving details of the name and nationality of the proposed subcontractor/sub-vendor for each item.
(f) Attachment 5A	(Items, Components, Raw Material, Services proposed to be sourced from Micro and Small Enterprises): The details of the items, components, raw material, services which is proposed to bought/availed from Micro and Small Enterprises for the purpose of completion of works
(g) Attachment 6	The variation and deviations from the requirements of the Conditions of Contract, Technical Specification and Drawings (excluding critical provisions as mentioned at clause 6.0 below) in your format enclosed with the Bidding Documents, including, inter alia, the cost of withdrawal of the variations and deviations indicated therein.
(h) Attachment 7	The details of Alternative Bids made by us indicating the complete Technical Specifications and the deviation to contractual and commercial conditions. (Not Applicable)
(i) Attachment 8	Manufacturer's Authorisation Forms.
(j) Attachment 9	Work Completion Schedule.
(k) Attachment 10	Guarantee Declaration.

(l) Attachment 11	**Not Applicable**
(m) Attachment 12	Filled up information regarding Price Adjustment Data as per the format enclosed in the bidding documents.
(n) Attachment 13	Declaration regarding Social Accountability.
(o) Attachment 14	Integrity Pact, in a separate envelope, duly signed on each page by the person signing the bid.
(p) Attachment 15	**Not Applicable**
(q) Attachment 16	Additional Information.
(r) Attachment 17	Declaration for tax exemptions, reductions, allowances or benefits
(s) Attachment 18	Safety Pact, in a separate envelope, duly signed on each page by the person signing the bid.
(t) Attachment 19	
(u) Attachment 20	Affidavit Declaration of Key Managerial Person jointly with Power of Attorney holder

2.2	We are a Micro and Small Enterprise (MSE) registered with a designated Authority of GoI under the Public Procurement Policy for MSEs order 2012. (applicable for MSE only)
3.0	We are aware that, in line with Clause No. 27.1 (ITB), our Second Envelope (Price Part) is liable to be rejected in case the same contains any deviation/omission from the contractual and commercial conditions and technical Specifications other than those identified in this First Envelope.
3.1	We are aware that the Price Schedules do not generally give a full description of the Work to be performed under each item and we shall be deemed to have read the Technical Specifications and other sections of the Bidding Documents and Drawings to ascertain the full scope of Work included in each item while filling-in the rates and prices in Second Envelope.
3.2	We declare that as specified in Clause 11.5, Section –II:ITB, Vol.-I of the Bidding Documents, prices quoted by us in the Price Schedules in Second Envelope shall be subject to Price Adjustment during the execution of Contract in accordance with Appendix-2 (Price Adjustment) to the Contract Agreement.
4.0	We confirm that except as otherwise specifically provided our Bid Prices in Second Envelope include all GST and charges as may be assessed on us, our Sub-Contractor/Sub-Vendor or their employees by all municipal, state or national government authorities in connection with the Facilities, in and outside of India.
4.1	100% of applicable GST which are payable by the Employer under the Contract, shall be reimbursed by the Employer on production of satisfactory documentary evidence by the Contractor in accordance with the provisions of the Bidding Documents.
4.2	We further understand that notwithstanding 4.0 above, in case of award on us, you shall also bear and pay/reimburse to us, GST in respect of supplies by us to you, imposed on the Plant & Equipment including Mandatory Spare Parts to be incorporated into the Facilities including Type Test charges for Type test to be conducted specified in Schedule No. 1, Installation Services specified in Schedule No. 3 and Charges for Training to be imparted specified in Schedule No. 4 of the Price Schedule in Second Envelope, by the Indian Laws.
4.3	We confirm that we have also registered/we shall also get registered in the GST Network with a GSTIN, in all the states where the project is located and the states from which we shall make our supply of goods
5.0	**Construction of the Contract**
5.1	We declare that we have studied Clause ITB 31.4.1 relating to mode of contracting for Domestic Bidders and we are making this proposal with a stipulation that you shall award us two separate Contracts viz 'First Contract' for ex-works supply of all equipment and materials including mandatory spares and 'Second Contract' for providing all the services i.e. inland transportation for delivery at site, insurance, unloading, storage, handling at site, installation, testing and commissioning including Trial operation in respect of all the equipment supplied under the 'First Contract' and other services specified in the Contract Documents. We declare that the award of two contracts, will not, in any way, dilute our responsibility for successful operation of plant/equipment and fulfillment of all obligations as per Bidding Documents and that both the Contracts will have a cross-fall breach clause i.e. a breach in one Contract will automatically be classified as a breach of the other contract which will confer on you the right to terminate the other contract at our risk and cost.
6.0	We have read the provisions of following clauses and confirm that the specified stipulations of these clauses are acceptable to us:

(a)	ITB 13	Bid Security	
(b)	GCC 5(i)(b)	Governing Law	
(c)	GCC 7 (i)	Contractor's Responsibility	
(d)	GCC 9.0	Performance Security	
(e)	GCC 27	Liquidity Damage	
(f)	GCC 31(i)(a)	Defect Liability	
(g)	GCC 33	Payment Terms	
(h)	GCC 26	Limitations of Liability	
(i)	GCC 47	Settlement of Disputes	
(j)	GCC 48	Arbitration	
(k)	SCC 14	Taxes & Duties	
(l)	Appendix 2 to Form of Contract Agreement	Price Adjustment	

Further we understand that deviation taken in any of the above clauses by us may make our bid non-responsive as per provision of bidding documents and be rejected by you.

7.0	We undertake, if our bid is accepted, to commence the work immediately upon your Notification of Award to us, and to achieve the delivery of goods and related services within the time stated in the Bidding Documents.
8.0	If our bid is accepted, we undertake to provide a Performance Security in the form and amounts, and within the times specified in the Bidding Documents.
9.0	We agree to abide by this bid for a period of six (06) months from the date fixed for opening of bids as stipulated in the Bidding Documents, and it shall remain binding upon us and may be accepted by you at any time before the expiration of that period.
10.0	Until a formal Contract is prepared and executed between us, this bid, together with your written acceptance thereof in the form of your Notification of Award shall constitute a binding contract between us.
11.0	We understand that you are not bound to accept the lowest or any bid you may receive.
12.0	Commissions or gratuities, if any, paid or to be paid by us to agents relating to this Bid, and to contract execution, if we are awarded the contract, are listed below:-

	Name and	Amount and Currency	Purpose of Commission or		
	(If none, state				

13.0		# (For Joint Venture only) We, the partners of Joint Venture submitting this bid, do agree and confirm that in case of Award of Contract on the Joint Venture, we shall be jointly and severally liable and responsible for the execution of the Contract in accordance with Contract terms and conditions.
14.0		We, hereby, declare that only the persons or firms interested in this proposal as principals are named here and that no other persons or firms other than those mentioned herein have any interest in this proposal or in the Contract to be entered into, if the award is made on us, that this proposal is made without any connection with any other person, firm or party likewise submitting a proposal is in all respects for and in good faith, without collusion or fraud.

	Thanking you, we	
		Yours faithfully,
		For and on behalf of
Date		**Printed Name :**
Place		**Designation :**

Please provide additional information of the Bidder	
Business Address :	
Country of	
State/Province to be	
Name of Principal	
Address of Principal Officer :	

Note: Bidders may note that no prescribed proforma has been enclosed for Attachment 2(SS01B) Power of Attorney. Bidders may use their own proforma for furnishing the required information with the bid.

Bidder's Name and Address (Sole Bidder) :			**To:**	
Name :			REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001. Website: www.recpdcl.in	
Address :				
Dear Sir,				

We are furnishing below the list of special maintenance tools & tackles for various equipment under the subject package. The prices for these tools & tackles are included in our lumpsum bid price. We further confirm that the list of special maintenance tools & tackles includes all the items specifically identified in your bidding documents as brought out below:

S.No.	For Equipment	Item Description	Unit	Quantity
1				
2				
3				
4				
5				

Notwithstanding what is stated above, we further confirm that any additional special maintenance tools and tackles, required for the equipment under this package shall be furnished by us at no extra cost to the employer.

Date :		**Printed Name :**		
Place :		**Designation :**		

Tender Package "Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15"

(Qualifying Requirement Data)

Bidders Name & Address:

To
REC Power Development and Consultancy Limited
(A wholly owned subsidiary of REC Limited, a 'Maharatna CPSE'
Under the Ministry of Power, Govt of India)
D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001.
Website: www.recpdcl.in

Dear Ladies and/or Gentlemen,

In support of the Qualification Requirements (QR) for bidders, stipulated in Section - III, Volume-I & additional information required as per ITB clause 9.3(c) of the Bidding Documents, we furnish herewith our QR data/details/documents etc., alongwith other information, as follows (The QR stipulations have been reproduced in italics for ready reference, however, in case of any discrepancy the QR as given in Section-III, Vol-I shall prevail).
* We have submitted bid as individual firm.

* We have submitted bid as joint venture of following firms:

(i) ……

(ii) ……

(iii) ……
(* ***Strike-off whichever is not applicable***)
[For details regarding Qualification Requirements of a Joint Venture, please refer para 4.0 below.]

We are furnishing the following details/document in support of Qualifying requirement for the subject package.

A. Attached copies of original documents defining:

a) The constitution or legal status;
b) The principal place of business;
c) The place of incorporation (for bidders who are corporations); or the place of registration and the nationality of the Owners (for applicants who are partnerships or individually-owned firms).

B. Attached original & copies of the following documents.

a) Written power of attorney of the signatory of the Bid to commit the bidder.

b)** Joint Venture Agreement

*[** To be submitted only in case of Joint Ventures. Strike off in case of individual firms.]*

1.0 General Information

[The information in this form is to be completed for individual firms and each Partner of a Joint Venture]

Where the Bidder proposes to use named subcontractor(s) for critical components of the works or for work contents in excess of 10 percent of the bid price, the following information should also be furnished for the subcontractor(s)].

Sl. No.	Particulars	For Individual Firm	In case of Joint Venture		
			For Lead Partner	For Other Partner - 1	For Other Partner - 2
1.	Name of the Firm				
2.	Head Office/ Registered Office Address				
3.	Telephone				
4.	Fax				
5.	Contact Person				
5(a)	Email				
6.	Place of Incorporation/ Registration				
7.	Year of Incorporation/ Registration				
8.	Nationality of				
	Owner (i)				
	Owner (ii)				
	Owner (iii)				

(Necessary documents to establish legal status of the bidder (all the partners in case of Joint Venture) should be enclosed with the bid.

2.0 Technical experience

2.1 ***(Reference: QR mentioned in Section-III of Vol-I & anywhere in the Bidding Document)***

2.2 On a separate page, using the following format, Bidder is requested to furnish the details of the previous experience, on the basis of which the Bidder wishes to qualify, as detailed at para 2.0 above. The information is to be summarised using following formats, as applicable, for each previous experience of the Bidder.
(Documentary evidence, such as copies of utility certificates etc., in support of its experience shall be attached with the filled-up format for each experience/Contract)

Format A Format for the Bidder (Single Firm / Partner in case of Joint Venture) [In case of Joint Venture bidder, the QR data of each of the partner (in support of meeting the requirement of para 1.1 of QR mentioned in Section-III of Vol-I, Conditions of Contract, Volume-I of the bidding documents] is also is to furnished, as applicable, using this format

Name of the Bidder (Single Firm/Lead partner/Partners of a JV)		
A1.	Name of Contract (executed during the last 7 years as on the date of bid opening):	
A2.	Contract Reference No. & Date of Award	
A3.	Name and Address of the Employer/Utility by whom the Contract was awarded e-mail ID Telephone No. Fax No.	 _____ _____ _____
A4(i) (ii) (iii) (iv)	Name of sub-station or switchyard executed under the Contract Voltage level of sub-station or switchyard No. of bays in the sub-station or switchyard (a) No. of CB in the bay (b) No. of single phase CTs or Bushing CTs in the bay (c) No. of disconnectors in the bay	_____ _____ _____
A5(i) (ii)	Date of successful execution of the Contract No. of years the above referred substation is in successful operation as on the date of bid opening	_____years
A6.	Scope of work executed under the above contract	
A7.	Capacity in which the Contract was undertaken (Check One)	○ Prime Contractor ○ Sub Contractor ○ Partner of JV

		(Tick whichever is applicable)
A8.	Details/documentary evidence submitted in support of stated experience/Contract	

3.0 **Financial Position**

3.1 ***(QR mentioned in Section-III of Vol-I & anywhere in the Bidding Document)***

3.2 In support of its 'Financial Position', in line with the above, the Bidder (Individual firm or all the JV partners in case of JV bidder) must provide the relevant information, alongwith documentary evidence, in the following formats A & B:

Name of the Bidder [Single Firm / Lead Partner of a JV / Partner of a JV		
A. Annual Turnover details:		
Sl. No.	**Financial year**	**Annual turnover in Rs. Million**
1.0		
2.0		
3.0		
4.0		
5.0		
Average annual turnover for best three years is:		
B. Liquid Assets		
Details of evidence of access to or availability of credit facilities		_____ _____

4.0 **Joint Venture (JV) Firms**

4.1 **(QR mentioned in Section-III of Vol-I & anywhere in the Bidding Document)**

Format A	**Format for the Bidder (Single Firm / Partner in case of Joint Venture) [In case of Joint Venture bidder, the QR data of each of the partner (in support of meeting the requirement of para 1.1 of QR mentioned in Section-III of Vol-I, Conditions of Contract, Volume-I of the bidding documents] is also is to furnished, as applicable, using this format**

Name of the Bidder (Single Firm/Lead partner/Partners of a JV)		
A1.	Name of Contract (executed during the last 7 years as on the date of bid opening):	
A2.	Contract Reference No. & Date of Award	
A3.	Name and Address of the Employer/Utility by whom the Contract was awarded e-mail ID Telephone No. Fax No.	 _____ _____ _____ _____ _____ _____
A4(i) (ii) (iii) (iv)	Name of sub-station or switchyard executed under the Contract Voltage level of sub-station or switchyard No. of bays in the sub-station or switchyard (a) No. of CB in the bay (b) No. of single phase CTs or Bushing CTs in the bay (c) No. of disconnectors in the bay	_____ _____ _____ _____ ___
A5(i) (ii)	Date of successful execution of the Contract No. of years the above referred substation is in successful operation as on the date of bid opening	_____ _____ years
A6.	Scope of work executed under the above contract	
A7.	Capacity in which the Contract was undertaken (Check One)	○ Prime Contractor ○ Sub Contractor ○ Partner of JV (Tick whichever is applicable)
A8.	Details/documentary evidence submitted in support of stated experience/Contract	

Name of the Bidder [Single Firm / Lead Partner of a JV / Partner of a JV	

A. Annual Turnover details:		
Sl. No.	**Financial year**	**Annual turnover in Rs. Million**
1.0		
2.0		
3.0		
4.0		
5.0		
Average annual turnover for best three years is:		
B. Liquid Assets		
Details of evidence of access to or availability of credit facilities		_____ _____

4.3 In accordance with the above, in case of JV bidders, it should be ensured that necessary details including those pertaining to each JV partner are furnished and the documents are submitted alongwith the bid. Further, the JV bidders should also ensure that other requirements are complied with. The lists of documents furnished are to be indicated below:

i) ……..
ii) ……..
iii) ……..
iv) ……..
v) ……..

5.0 ***The Bidder shall also furnish following documents/details with its bid. {Reference ITB clause 9.3 (c)}***

5.1 The complete annual reports together with Audited statement of accounts of the company for last five years of its own (separate) immediately preceding the date of submission of bid.
Note:

I. In the event the bidder is not able to furnish the information of its own (i.e separate), being a subsidiary company and its accounts are being consolidated with its group/holding/parent company, the bidder should submit the audited balance sheets, income statements, other information pertaining to it only (not of its group/Holding/Parent Company) duly certified by any one of the authority [(i) Statutory Auditor of the bidder /(ii) Company Secretary of the bidder or (iii) A certified Public Accountant] certifying that such information/documents are based on the audited accounts as the case may be.

II. *Similarly, if the bidder happens to be a Group/Holding/Parent Company, the bidder should submit the above documents/information of its own (i.e. exclusive of its subsidiaries) duly certified by any one of the authority mentioned in Note-I above certifying that these information/documents are based on the audited accounts, as the case may be.*

5.2 The Bidder should accordingly also provide the following information /documents (**In case of JV bidders, information should be provided separately for all the Partners of JV in the given format**):

Audited balance sheet and income statements for the last five years as per the following:

Years preceding to the bid opening	**Audited Balance Sheet and Income Statements enclosed**	
1st Year	○ Yes	○ No
2nd Year	○ Yes	○ No
3rd Year	○ Yes	○ No
4th Year	○ Yes	○ No
5th Year	○ Yes	○ No

Date:..... (Signature) …….....

Place:..... (Printed Name) .....

(Designation) .....

Tender Package "Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15"

(Manufacturer's Authorization Form)

(On Manufacturer's Letterhead, see Clause 9.3(c) of the ITB)

To: [Insert: name of Employer]

Dear Ladies and/or Gentlemen,

WE *[insert: **name of Manufacturer**]* who are established and reputable manufacturers of *[insert: **name and/or description of the plant & equipment**]* having production facilities at *[insert: **address of factory**]* do hereby authorize *[insert: **name & address of Bidder**]* (hereinafter, the "Bidder") to submit a bid, and subsequently negotiate and sign the Contract with you against IFB *[insert**: title and reference number of Invitation for Bids**]* including the above plant & equipment or other goods produced by us.

We hereby extend our full guarantee and warranty for the above specified plant & equipment materials or other goods offered supporting the supply, installation and achieving of Operational Acceptance of the plant by the Bidder against these Bidding Documents, and duly authorize said Bidder to act on our behalf in fulfilling these guarantee and warranty obligations. We also hereby declare that we and…… , *[insert: **name of the Bidder**]* have entered into a formal relationship in which, during the duration of the Contract (including warranty / defects liability) we, the Manufacturer or Producer, will make our technical and engineering staff fully available to the technical and engineering staff of the successful Bidder to assist that Bidder, on a reasonable and best effort basis, in the performance of all its obligations to the Purchaser under the Contract.

For and on behalf of the Manufacturer

Signed: _____

Date: _____

In the capacity of *[insert: **title of position or other appropriate designation**]* and this should be signed by a person having the power of attorney to legal bind the manufacturer.

Date:.....

Place:..... (Signature).....

(Printed Name).....

(Designation).....

(Common Seal).....

Note 1. The letter of Undertaking should be on the letterhead of the Manufacturer and should be signed by a person competent and having Power of Attorney to legally bind the Manufacturer. It shall be included by the bidder in its bid.

2. Above undertaking shall be registered or notarized so as to be legally enforceable.

LEGENDS

Service Unit Description		
S.No	**Legend**	**Description**
1	B50	BAG PER 50 KG OF CEMENT
2	CM	Centimeter
3	EA	each
4	JHR	Years
5	KG	Kilogram
6	KL	Kilolitre
7	KM	Kilometer
8	L	Liter
9	LOT	LOT
10	LS	LUMP SUM
11	M	Meter
12	M2	Square meter
13	M3	Cubic meter
14	MND	MAN DAYS
15	MNW	MAN WEEKS
16	MT	Metric Ton
17	PAA	Pair
18	QTL	QUINTAL
19	RM	RUN. MTR.
20	SET	SET
21	STD	Hours
22	TAG	Days
23	DAY	Days
24	YR	Years

Material Unit Description		
S.No	**Legend**	**Description**
1	EA	each
2	FT	Foot
3	FT2	Square foot
4	G	Gram
5	H	Hour
6	KG	Kilogram
7	KL	Kilolitre
8	KM	Kilometer
9	L	Liter
10	LOT	LOT
11	LS	LUMP SUM
12	M	Meter
13	M2	Square meter
14	ML	Milliliter
15	MON	Months
16	MT	Metric Ton
17	PAA	Pair
18	RM	RUN. MTR.
19	ROL	Role
20	SET	SET
21	PAK	Pack
22	CS	Case
23	TAG	Days

Second Envelope (Price Schedule)

General guidelines for filling up the Price Schedules, Sch-1 to Sch-7

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

1	**Fill up only green shaded cells in Sch 1, Sch 2, Sch 3, Sch 4 and Discount (Optional), Guarantee Declariation and Bid Form 2nd Envelope.**
2	**All the cells in Sch 5, Sch 6 & Sch 6 (After Discount) are auto filled, therefore no cell is required to be filled up there. Sch 7 is Not Applicable**
3	**Instructions / error messages, if any, will be displayed automatically after selecting the cell.**

Click for Detailed General Instructions | Click to skip Instructions & Proceed

REC Power Development and Consultancy Limited
(A wholly owned subsidiary of REC, a 'Navratna CPSE'
Under the Ministry of Power, Govt of India)
D- Block, REC Corporate Headquarter,
Plot No. I-4, Sector-29, Gurugram (Haryana)-122001,
Website: www.recpdcl.in

SUMMARY SHEET		
Name of participating bidder (To be filled by the bidder)		
Price Quoted (as per Schedule-6 (after discount))		
Value in INR	Total Evaluated Price	0.00

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

Click to Proceed

I While filling up the worksheets following may please be observed :

(i) Fill up only green shaded cells.

(ii) Certain data type entries have been restricted, such as Numeric values or limits of numeric values.

(iii) Select only the options provided in pull down menus.

(iv) Do not link any cell of this work book with any other work book.

(v) Do not use copy & paste or cut & paste options for filling up the data.

(vi) Do not reformat any of the cell of the work book.

II This Workbook consists of following worksheets :

Cover :

Opening page of the workbook.

Names of Bidder :

- Select Sole Bidder or JV (Joint Venture) from the pull down menu. Do not leave this cell blank.
- Select nos. of the JV Partners other than the Lead Partner from drop down
- In case of JV partners more than 2, enter details of 3rd & more partners along with details of 2nd partner.
- Fill up names and address of the Sole Bidder and /or Joint Venture.
- Fill up date in dd-mm-yyyy format from drop down menu.
- Click for Sch-1 given at the right top of the worksheet to go to Sch-1.

Sch-1 (Ex-works Prices) :

- Fill up unit rates for all the items in numeric values greater than 0 (zero). If unit rate is left blank, the corresponding item shall be deemed to be included in the total price.
- Total amount shall get calculated automatically.
- Type Test charges are Not Applicable

Sch-2 (Freight & Insurance Charges) :

- Fill up unit rates for all the items in numeric values greater than 0 (zero). If unit rate is left blank, the corresponding item shall be deemed to be included in the total price.
- Total amount shall get calculated automatically.

Sch-3 (Erection Charges) :

- Fill up unit rates for all the items in numeric values greater than 0 (zero). If unit rate is left blank, the corresponding item shall be deemed to be included in the total price.
- Total amount shall get calculated automatically.

Sch-4 (Training Charges) :

- Not applicable, hence no cell is required to be filled up.

Sch-5 (Summary of GST applicable on Supply of Goods

- Amount of GST shall be calculated autometically

Sch -6 :

- Summary of all the Schedules without considering discount (mentioned in the work sheet discount) shall be displayed automatically.
- No cell is required to be filled in by the bidder in this worksheet.

Sch-7 (Type Test Charges) :

- Fill up the rates & location where type tests are proposed.
- Total of this Sch-7 shall automatically appear in Sch-1.

Bid from 2nd Envelope :

- Fill up ref. no. as bidder's ref no. of this letter.
- This letter shall consider the net price as per Sch-6 (After Discount).
- Fill up names & Designation of the representatives of other JV partner(s) if the bidder is JV (Joint Venture) .
- Fill up additional information as required.

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15	
Enter following details of the bidder	
Specify type of Bidder [Select from drop down menu]	Sole Bidder
Name of the Sole Bidder	
Address of the Sole Bidder	
Name of Other Partner - 2	…….. …….. …….. …….. …….. ……..
Address of other Partner-2	…….. …….. …….. …….. …….. ……..
	…….. …….. …….. …….. …….. ……..
	…….. …….. …….. …….. …….. ……..
Printed Name	
Designation	
Date	___\01\2024
Place	

Click for Sch. 1

Tender NIT No. RECPDCL/PIA/JKPTCL/SS & LILO-I

Schedule - 1

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

Click to

(SCHEDULE OF RATES AND PRICES)

Bidder's Name and Address :

Name : 0

Address : 0

To:
REC Power Development and Consultancy Limited
(A wholly owned subsidiary of REC, a 'Navratna CPSE'
Under the Ministry of Power, Govt of India)
D- Block, REC Corporate Headquarter,
Plot No. I-4, Sector-29, Gurugram (Haryana)-122001,
Website: www.recpdcl.in

PLANT AND EQUIPMENT (INCLUDING MANDATORY SPARES PARTS) TO BE SUPPLIED:

All Prices are in Indian Rupees.

Sl. No.	HSN Code	Whether HSN Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable	Item Description	Unit	Qty.	Unit Ex-works price(excluding GST)	Total Ex-works Price (excluding GST)	GST Tax as confirmed by Bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	
I					**220/33KV NAGROTA SUBSTATION**					
A-1					**TRANSFORMER**					
1.1	85042330		18%		50MVA, 220/33KV three-phase transformer without transformer oil	No.	2.00		-	-
1.2	85049010		18%		Insulating oil for 50MVA, 220/33 KV, 3-phase transformer (* 1Lot = Oil for 1 number transformer)	Lot	2.00		-	-
1.3	84248990		18%		Nitrogen Injection Fire Protection for 50MVA, 220/33 KV, 3-phase transformer	No.	2.00		-	-
1.4	85049010		18%		On line Insulating oil drying system	No.	2.00		-	-
A-2					**LT TRANSFORMER**					-
1.1	85042100		18%		315KVA, 33/0.433KV LT transformer	No.	2.00		-	-
A-3					**VOTAGE STABLIZER**					
1.1	85044040		18%		315KVA, 3 Phase, Automatic Voltage Stablizer	No.	1.00		-	-
B-1					**220 kV EQUIPMENT**					
1.0					**Circuit Breakers (3 Ph.)**					
					2500 A, 40 kA, SF6 Circuit Breakers (3-Phase) with support structure (make: Siemens)					
i	85352911		18%		SF6 Circuit Breaker Poles (make: Siemens, Breaker Type 3AP1FI, Year of Mfg: 2022, 3150 A, 50 kA)	Nos.	2.00		-	-
2.0					**Isolators (3 Ph.)**					
i)	85353090		18%		1600A, 40 kA with One earth Switch (Double break Isolator)	Nos.	5.00		-	-
ii)	85353090		18%		1600A, 40 kA without earth Switch (Double break Isolator) (Tandem)	Nos.	9.00		-	-
iii)	85353090		18%		1600A, 40kA with two earth Switch (Double break Isolator)	Nos.	5.00		-	-
iv)	85353090		18%		2500A, 40kA with two earth Switch (Double break Isolator)	Nos.	2.00		-	-
3.0	85354010		18%		216 kV, 10KA Surge Arrester (1-ph) along with surge counter	Nos.	12.00		-	-
B-II										
1.1					**ERECTION HARDWARE (WITHOUT BPI)**					
					Insulator strings and hardware, Spacers, conductor(s), bus-bar material, cable trays, Bay MB, clamps, connectors including equipment connectors, Junction Box, earth wire, earthing material, risers, auxiliary earth mat (excluding main earth mat), buried cable trenches/ PVC pipes for equipment & lighting, all accessories etc. for the following :				-	-
					220kV ' Double Main & Transfer' type					
i)	72169990		18%		Line Bay	Set	2.00		-	-
ii)	72169990		18%		Transformer Bay	Set	2.00		-	-

Sl. No.	HSN Code	Whether HSN Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable	Item Description	Unit	Qty.	Unit Ex-works price(excluding GST)	Total Ex-works Price (excluding GST)	GST Tax as confirmed by Bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	
iii)	72169990		18%		Bus Coupler Bay	Set	1.00		-	-
iv)	72169990		18%		Bus transfer Bay	Set	1.00		-	-
iv)	72169990		18%		Bus (For three bays)	Set	2.00		-	-
1.2	85462040		18%		220 kV Bus Post Insulators for the erection hardware	Nos.	46.00		-	-
C-I					**33 kV EQUIPMENT**					
1.0					**Circuit Breakers (3 Ph.)**					
i)	85352911		18%		36 kV, 1250A, 25 kA,3-Phase CircuitBreaker with support structure	Nos.	7.00		-	-
2.0					**Isolators (3 Ph.)**					
i)	85353090		18%		36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITH ONE E/S	Nos.	7.00		-	-
ii)	85353090		18%		36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITHOUT E/S	Nos.	9.00		-	-
iii)	85353090		18%		36 kV, 1250A, 25 KA, 3-Phase HDB Isolator with two E/s	Nos.	7.00		-	-
iv)	85353090		18%		36 kV, 2500A, 25 KA, 3-Phase HDB Isolator with two E/s	Nos.	2.00		-	-
v)	85353090		18%		36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITHOUT E/S (TANDEM)	Nos.	7.00		-	-
2.1	85353090		18%		36kV,400A Horn gap fuse (1-Ph.)	Nos.	6.00		-	-
3.0	85354010		18%		**Surge Arrestors 30kV, 1-ph along with surge arrestor**	Nos.	21.00		-	-
C-II										
1.1					**ERECTION HARDWARE (WITHOUT BPI)**					
					Insulator strings & Hardware, Spacers, conductor(s), bus-bar material, cable trays, Bay MB, clamps, connectors including equipment connectors, Junction Box, earthwire, earthing material, risers, auxiliary earthmat (excluding main earthmat), buried cable trenches/ PVC pipes for equipment & lighting, all accessories etc. for the following :					
					33 kV Double main with Bypass Isolator type					
i)	72169990		18%		Line Bay	Set	4.00		-	-
ii)	72169990		18%		Transformer Bay	Set	2.00		-	-
iii)	72169990		18%		BC Bay	Set	1.00		-	-
iv)	72169990		18%		Auxilary Transformer Bay	Set	1.00		-	-
v)	72169990		18%		Bus (For Four bays + Three bays) (2+1)	Set	3.00		-	-
1.2	85462040		18%		**33kV Bus Post Insulators for the above**	Nos.	16.00		-	-
2.0	85462090		18%		Conductor, clamps, connectors including equipment connectors, earthing material including risers, etc. (excluding main earthmat) required for connection of aux. LT transformer	Set	2.00		-	-
D					**LT SWITCHGEAR**					
1.1	85371000		28%		415V Main switchboard	Set	1.00		-	-
1.2	85371000		28%		415V ACDB	Set	1.00		-	-
1.3	85371000		28%		415V MLDB	Set	1.00		-	-
1.4	85371000		28%		415V Emergency LDB	Set	1.00		-	-
1.5	85371000		28%		220V DCDB	Set	2.00		-	-
1.6	85371000		28%		48V DCDB	Set	2.00		-	-
E1					**RELAY PANELS (WITH AUTOMATION)**					
1.0					**220 kV (Swing Type Front Door Glass Simplex type)**					
a					Circuit Breaker Relay Panel					
i	85371000		28%		With Auto Reclose	Set	3.00		-	-
ii	85371000		28%		With out Auto Reclose	Set	3.00		-	-
b	85371000		28%		Line Protection Panel	Set	2.00		-	-
c	85371000		28%		Transformer Protection Panel (For both HV & MV side)	Set	2.00		-	-

Sl. No.	HSN Code	Whether HSN Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable	Item Description	Unit	Qty.	Unit Ex-works price(excluding GST)	Total Ex-works Price (excluding GST)	GST Tax as confirmed by Bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	
d	85371000		28%		Bus Bar Protection Panel	Set	1.00		-	-
E2					**Teleprotection Equipments**					
a)	85371000		28%		Digital protection coupler including cabling etc.	Set	2.00		-	-
b)	85371000		28%		Digital protection coupler including cabling etc. for other end	Set	2.00		-	-
c)	85371000		28%		Shifting and re-erection of existing panel of Barn/Kishenpur or Gladni/Udhampur as per Technical specification	LS	1.00		-	-
2.0					**33KV Panels(Swing Type Front Door Glass Simplex Panels)**					
a	85371000		28%		Circuit Breaker Relay Panel With out Auto Reclose	Set	8.00		-	-
b	85371000		28%		Line Protection Panel	Set	4.00		-	-
F					**SUBSTATION AUTOMATION SYSTEM (SAS)**					
					Complete Substation Automation System (SAS) for 220/33 kV Substation including hardware and software for the substation & remote control stations along with associated equipments for the following bays as per TS:-					
a)	85371000		28%		220 kV System	Bay	6.00		-	-
b)	85371000		28%		33 kV System	Bay	7.00		-	-
c)	85371000		28%		BCU for Controlling and monitoring of Auxiliary System	Set	1.00		-	-
G					**Tele Communication System**					
1.0					**SDH EQUIPMENTS(STM-4 MADM upto 5MSP Protected directions)**					
(i)					**Nagrota**					
a)	85176270		18%		Base equipments(Common cards,Cross connect/control cards, power supply cards, power cabling, other hardware and accessories including sub rascks, patch cord, DDF etc fully equipped excluding (ii) & (iii) below	Nos.	1.00		-	-
					Gladni					
b	85176270		18%		Base equipments(Common cards,Cross connect/control cards, power supply cards, power cabling, other hardware and accessories including sub rascks, patch cord, DDF etc fully equipped excluding (ii) & (iii) below	Nos.	1.00		-	-
(ii)					**Optical Interface Cards/SFP**					
					Nagrota					
a					S4.1 SFP	Nos.	-		-	-
b	85176270		18%		L4.1 SFP	Nos.	4.00		-	-
					Gladni					
a	85176270		18%		S4.1 SFP	Nos.	4.00		-	-
b	85176270		18%		L4.1 SFP	Nos.	2.00		-	-
					Udhampur					
a	85176270				S4.1 SFP	Nos.	-		-	-
b	85176270		18%		L4.1 SFP	Nos.	2.00		-	-
(iii)					**Tributary cards**					
					Nagrota					
a	85176270		18%		E1 Interface card(Min. 16 Interfaces per card)	Nos.	2.00		-	-
b	85176270		18%		Ethernet interface 10/100 Base T with Layer-2 switching (Min 8 Interfaces per card)	Nos.	2.00		-	-
					Gladni					
a	85176270		18%		E1 Interface card(Min. 16 Interfaces per card)	Nos.	2.00		-	-
b	85176270		18%		Ethernet interface 10/100 Base T with Layer-2 switching (Min 8 Interfaces per card)	Nos.	2.00		-	-
(iv)	83040000		18%		**Equipment Cabinet**	Nos.	2.00		-	-
2.0					**Network Manager System(NMS)**					
					Nagrota					
(I)					**Craft terminal**					
a	84715000		18%		Hardware	Set	1.00		-	-
b	85238020		18%		Software	Set	1.00		-	-

Sl. No.	HSN Code	Whether HSN Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable	Item Description	Unit	Qty.	Unit Ex-works price(excluding GST)	Total Ex-works Price (excluding GST)	GST Tax as confirmed by Bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	
					Gladni					
(II)					**Craft terminal**					
a	84715000		18%		Hardware	Set	-		-	-
b	85238020		18%		Software	Set	-		-	-
3.0					**VOIP telephone instrument with one common switch(min. 8 port)**					
a	85171890		18%		**Nagrota**	No.s	2.00		-	-
b					**Gladni**	No.s	-		-	-
4.0					**Approach Cable (24 fibres)**					
					Nagrota					
a	85447090		18%		24 Fibre(DWSM)	Kms	1.00		-	-
b	39269079		28%		Installation hardware set for above 24 Fibre, Fibre Optic Approach Cable	Set	1.00		-	-
					Gladni					
a	85447090		18%		24 Fibre(DWSM)	kms	1.00		-	-
b	39269079		28%		Installation hardware set for above 24 Fibre, Fibre Optic Approach Cable	Set	1.00		-	-
					Udhampur					
a	85447090		18%		24 Fibre(DWSM)	kms	1.00		-	-
b	39269079		28%		Installation hardware set for above 24 Fibre, Fibre Optic Approach Cable	Set	1.00		-	-
5.0					**FODP**					
					Nagrota					
a	85447090		18%		**48 Fibre**:Indoor Type,Rack Mounted with FCPC Coupling & Pigtails(5mtrs)	No.s	1.00		-	-
					Gladni					
a	85447090		18%		**48 Fibre**:Indoor Type,Rack Mounted with FCPC Coupling & Pigtails(5mtrs)	No.s	1.00		-	-
					Udhampur					
a	85447090		18%		**48 Fibre**:Indoor Type,Rack Mounted with FCPC Coupling & Pigtails(5mtrs)	No.s	1.00		-	-
H-(i)					**BATTERIES (VRLA type)**					
1.1					220 V					
a)	85072000		28%		500 AH	Set	2.00		-	-
1.2					48V					
a)	85072000		28%		300 AH	Set	2.00		-	-
H-(ii)					**BATTERY CHARGER System**					
1.1	85044030		18%		220V, 80A/50 A Float Cum Boost	Nos.	2.00		-	-
1.2	85044030		18%		48V, 50A/30 A Float Cum Boost	Nos.	2.00		-	-
I	85021200		18%		**Diesel Generator Set along with control panel (100 kVA)**	Set	1.00		-	-
J	84158210		28%		**High wall type Split Air Conditioner Units of 2 TR capacity**	Nos.	21.00		-	-
K					**Fire Protection System**					
1.1					Wheel/trolley mounted fire extinguishers :					
a	84241000		28%		22.5 Kg DCP type	Nos.	4.00		-	-
b	84241000		28%		22.5 Kg CO_2 type	Nos.	4.00		-	-
1.2					Portable fire extinguishers:					
a	84241000		28%		4.5 Kg DCP type	Nos.	6.00		-	-
b	84241000		28%		4.5 Kg CO_2 type	Nos.	10.00		-	-
1.3	84818090		18%		Complete Pumping arrangement for Hydrant complete with all piping and valves, fitting etc. inside pump house	LS	1.00		-	-

Sl. No.	HSN Code	Whether HSN Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable	Item Description	Unit	Qty.	Unit Ex-works price(excluding GST)	Total Ex-works Price (excluding GST)	GST Tax as confirmed by Bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	
1.4	84818090		18%		Hydrant system with complete O/G and U/G piping and accessories etc.(all items) outside the pump house. The hydrant system shall cover the switchyard area, Transformers, Control Room, Stores, etc. as per tender specification.	LS	1.00		-	-
1.5	85319000		18%		Smoke detection and Alarm system with all accessories and fittings for CRB & FFPH	Set	1.00		-	-
L					**ILLUMINATION SYSTEM**					
L.1	94059900		5%		Control Room Building (including indoor Lighting panel, Fixtures, Conduits, wire, indoor receptacles, Fans, etc.)	LS	1.00		-	-
L.2	94059900		5%		Fire Fighting Pump House Building (including Fixtures, Conduits, wire, indoor receptacles, Fans, etc.)	LS	1.00		-	-
L.3	94059900		5%		Security Room (including, Fixtures, Conduits, wire, indoor receptacles, Fans, etc.)	LS	1.00		-	-
L.4	94059900		5%		Storage room	LS	1.00		-	-
L.5					**Outdoor Lighting (Switchyard and street lighting)**					
1					**Lighting Panel**					
a)	85371000		5%		Lighting Panel (Outdoor) Type ACP-2	Nos.	4.00		-	-
b)	94059900		5%		Lighting Panel (Outdoor) Type ACP-3	Nos.	1.00		-	-
c)	85371000		5%		Sub Lighting Panel (Outdoor) - SLP	Nos.	3.00		-	-
2					Lighting fixtures and Receptacles including junction box, lighting wires & flexible conduit (if required) from junction box to lighting fixture, mounting arrangement, and other accessories/materials, etc. as required for complete installation and commissioning of lighting fixture as per technical specifications:					
a)	94054090		18%		Lighting Fixture **Type-SF1**	Nos.	14.00		-	-
b)	94054090		18%		Lighting Fixture **Type-SF2**	Nos.	14.00		-	-
c)	94054090		18%		Lighting Fixture **Type-SF3**	Nos.	-		-	-
d)	94054090		18%		Lighting Fixture **Type-SF4**	Nos.	-		-	-
e)	94054090		18%		Lighting Fixture **Type-SF5**	Nos.	20.00		-	-
f)	94054090		18%		Lighting Fixture **Type-SC**	Nos.	10.00		-	-
g)	94054090		18%		Lighting Fixture **Type-S-LED**	Nos.	-		-	-
h)	94054090		18%		15A, 240V: Outdoor Receptacle 2 pole, 3-pin type **(Type RO)**	Nos.	5.00		-	-
i)	94054090		18%		125A, 415V : Interlocked switch socket outdoor Receptacle **(Type RP)**	Nos.	2.00		-	-
3	94055040		18%		Lighting Poles Type A1	Nos.	10.00		-	-
4	94055040		18%		Lighting Poles Type E1	Nos.	16.00		-	-
5	76169990		18%		Cartwheel mounted aluminium ladder as per technical specification	No.	1.00		-	-
M					**1.1kV grade cable along with associated accessories like clamps,glands, lugs and straight joints etc.**					
1.1	85446090		28%		Power Cables(XLPE) (1.1 kV) Aluminium Conductor armoured	LS	1.00		-	-
1.2	85446020		28%		Power Cables(PVC) (1.1 kV) Aluminium Conductor armoured	LS	1.00		-	-
1.3	85446020		28%		Control Cables(PVC) (1.1 kV) Copper Conductor armoured	LS	1.00		-	-
N	72159090		18%		**40 mm MS rod for Main Earthmat**	kM	2.12		-	-
O					**Lattice Structure**					
i)	73082011		18%		Non-standard gantry structures including all Bolts & Nuts (Towers, Beam)	MT	50.00		-	-
ii)	73082011		18%		Non-standard Lightening Mast structures including all Bolts & Nuts	MT	50.00		-	-

Sl. No.	HSN Code	Whether HSN Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable	Item Description	Unit	Qty.	Unit Ex-works price(excluding GST)	Total Ex-works Price (excluding GST)	GST Tax as confirmed by Bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	
iii)	73082011		18%		Non-standard equipment support structures including all Bolts & Nuts	MT	90.00		-	-
P					**Visual Monitoring System**	LS	1.00		-	-
R					**MANDATORY SPARES *(Break-up of Lumpsum quantity shall be as per Annexure-1 of Sec-Project of Technical specifications**					
1.0	85042330		18%		220/33kV, 50MVA, 3Phase Transformer	LS	1.00		-	-
2.0	85353090		18%		245kV ISOLATORS	LS	1.00		-	-
3.0	85354010		18%		216kV SURGE ARRESTOR	LS	1.00		-	-
4.0	85352912		18%		Auxiliary Switch suitable for 36kV CIRCUIT BREAKER (2500A) of make M/s ABB and Model No. OVB-VBF 36.20.32	No	1.00		-	-
5.0	85352912		18%		36kV CIRCUIT BREAKER (1250A)	LS	1.00		-	-
6.0	85353090		18%		36kV ISOLATOR	LS	1.00		-	-
7.0	85354010		18%		30kV SURGE ARRESTOR	LS	1.00		-	-
8.0	85371000		28%		RELAY PROTECTION PANEL	LS	1.00		-	-
9.0	85371000		28%		SUBSTATION AUTOMATION SYSTEM	LS	1.00		-	-
10.0	85044030		18%		BATTERY CHARGER (220V and 48V)	LS	1.00		-	-
11.0	85030010		18%		DG Set	LS	1.00		-	-
12.0	85042100		18%		LT Transformer (315kVA)	LS	1.00		-	-
13.0	85042100		18%		LT Transformer (160kVA)	LS	1.00		-	-
14.0	94059900		5%		Illumination system	LS	1.00		-	-
15.0	98010019		18%		Erection Hardware Items	LS	1.00		-	-
16.0	98010019		18%		Tele Communication	LS	1.00		-	-
17.0	85371000		28%		LT Switchgear	LS	1.00		-	-
R					**Maintenance & Testing equipments :**					
1	84212900		18%		BDV Test Kit	No.	1.00		-	-
2	90303390		18%		Meggar 5 KV	No.	1.00		-	-
3	90303100		18%		Digital multimeter	No.	1.00		-	-
4	85389000		18%		Portable SF6 gas refilling device	No.	1.00		-	-
5	85389000		18%		SF6 Gas leak detector	No.	1.00		-	-
6	85389000		18%		SF6 Dew Point Meter	No.	1.00		-	-
7	90303900		18%		Circuit Breaker Analyzer with DCRM including transducer	No.	1.00		-	-
8	90308990		18%		Digital Micro-Ohm meter for contact resistance measurement	No.	1.00		-	-
9	90308990		18%		Primary Current Injection Kit	No.	1.00		-	-
10	90308990		18%		Secondary relay injection Kit - Relay Test Kit	No.	1.00		-	-
11	90308990		18%		Earth resistance Tester	No.	1.00		-	-
12	90308990		18%		3-ph Variac 440-480 Volts	No.	1.00		-	-
13	90308990		18%		3-Phase Sequence meter	No.	1.00		-	-
14	90308990		18%		Portable Dissolved Gas analysis (DGA) kit for Transformer Oil	No.	1.00		-	-
15	73090090		18%		Oil Filteration Plant (Capacity - 6000 LPH)	No.	1.00		-	-
16	73090090		18%		Oil Storage Tank - 10kL	No.	1.00		-	-
17	90303900		18%		Transformer Turn Ratio Meter	No.	1.00		-	-
18	90303900		18%		Capacitance & Ten Delta Measurement Kit	No.	1.00		-	-
19	90303900		18%		Winding Resistance Measurement Instrument	No.	1.00		-	-
20	73239990		18%		Oil Sampling Bottle	Nos.	3.00		-	-
21	85389000		18%		SF6 GAS FILTERING, EVACUATING AND DRYING PLANT	No	1.00		-	-
								TOTAL (I)	-	-
II					**LILO of 220kV Udhampur-Gladni**					
1.0					**TOWERS**					
1.1					Fabrication, galvanizing & supply of various types of tower & Gantry structures, tower parts, and tower extensions (complete) excluding bolts & nuts, step bolts and stubs but including hangers, D-Shackles, pack washers, etc.					

Sl. No.	HSN Code	Whether HSN Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable	Item Description	Unit	Qty.	Unit Ex-works price(excluding GST)	Total Ex-works Price (excluding GST)	GST Tax as confirmed by Bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	
					Normal Towers					
i	73082011		18%		**Mild Steel**	MT	130.00		-	-
ii	73082011		18%		**HT Steel**	MT	80.00		-	-
1.2					Fabrication, galvanizing & supply of stubs & cleats of various types of towers, and tower extensions (complete) excluding bolts & nuts					
i	73082011		18%		**Mild Steel**	MT	1.00		-	-
ii	73082011		18%		**HT Steel**	MT	1.00		-	-
1.3					**Supply of bolts and nuts including step bolts and spring washers**					
i					For Towers & tower extns.					
a	73181500		18%		Hexagonal Bolts & Nuts including Step Bolts	MT	10.00		-	-
ii	73181500		18%		For stubs	MT	0.50		-	-
2.0					**Supply of earthing of towers**					
i	73082011		18%		Pipe type earthing	Nos.	40.00		-	-
ii	73082011		18%		Counterpoise type (120 m length)	Nos.	2.00		-	-
iii					Shielding Earthwire including PG clamps, downlead clamps and earthwire bits					
a	73082011		18%		Pipe type earthing	Nos.	2.00		-	-
b	73082011		18%		Counterpoise type	Nos.	1.00		-	-
iv					River crossing locations	Kgs.	-		-	-
3.0					**Supply of following tower accessories**					
i	73082011		18%		Danger plate	Nos.	24.00		-	-
ii	73082011		18%		Number plate	Nos.	24.00		-	-
iii	73082011		18%		Phase Plate (Set of three)	Sets.	48.00		-	-
iv	73082011		18%		Circuit Plate (Set of two)	Sets	23.00		-	-
v	73082011		18%		Anticlimbing device	Nos.	25.00		-	-
vi	73082011		18%		Bird Guards (Set of three)	Sets.	-		-	-
vii	73082011		18%		Solar Power LED Lighting System marking for Obstruction Marking 0f 220 KV Transmission Line comprising one medium intensity and 2 low-intensity lights, solar panels, maintenance-free battery, astronomical time switch, control panel, solar charger, Complete with interconnecting cables, mounting hardware, cover fort battery, charger and all allied accessories.	Nos	13.00		-	-
viii)	73082011		18%		Aircraft Warning sphere span marker 600 mm dia colour (Full/half), White/Orange	Nos	37.00		-	-
ix)	73082011		18%		Primer for Tower upper - two stories including cross arms to be applied before painting for daytime aviation obstruction structure marking.	Nos	13.00		-	-
x)	73082011		18%		Grade A aviation marker paint (Red/Orange/White) for tower upper two stories including cross arm fo daytime aviation obstruction marking	Nos	13.00		-	-
4.0					**Design, manufacture and supply of the following line materials**					
4.1	76141000		18%		**ACSR "ZEBRA" Conductor**	Kms.	31.00		-	-
4.2	85447090		18%		**Optical Fiber Ground Wire (24 fibre DWSM)**	Kms.	0.10		-	-
4.3	85447090		18%		**Optical Fiber Ground Wire (48 fibre DWSM)**	Kms.	5.20		-	-
4.4					**COMPOSITE LONG ROD INSULATORS**					
i	85469090		18%		70KN	Nos.	54.00		-	-

Sl. No.	HSN Code	Whether HSN Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable	Item Description	Unit	Qty.	Unit Ex-works price(excluding GST)	Total Ex-works Price (excluding GST)	GST Tax as confirmed by Bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	
ii	85469090		18%		120KN	Nos.	420.00		-	-
4.5					**Hardware fittings**					
a	73082011		18%		Single `I' Suspension Insulator string for ACSR "ZEBRA"	Sets	-		-	-
b	73082011		18%		Single suspension string (Pilot) for ACSR "ZEBRA"	Sets	54.00		-	-
c	73082011		18%		Single tension string for ACSR "ZEBRA"	Sets	240.00		-	-
d)	73082011		18%		Double Tension String for ACSR 'ZEBRA"	Sets	60.00		-	-
4.6					**Accessories for Conductor & OPGW**					
i)	76169990		18%		Midspan Compression Joint for ACSR 'ZEBRA' Conductor	Nos.	17.00		-	-
ii)	76169990		18%		Repair Sleeves for ACSR ZEBRA Conductor	Nos.	6.00		-	-
iii)	73082011		18%		Flexible Copper bonds	Nos.	52.00		-	-
iv)	73082011		18%		Vibration Damper for ACSR `ZEBRA' Conductor	Nos.	600.00		-	-
v)	73082011		18%		Vibration Damper for OPGW	Nos.	100.00		-	-
vi)	82057000		18%		Tension assembly set for OPGW	Nos.	10.00		-	-
a	82057000		18%		Dead end Assembly	Set	2.00		-	-
b	82057000		18%		Double Tension Assembly at Joint Location	Set	4.00		-	-
c	82057000		18%		Double Tension Pass Through Assembly	Set	22.00		-	-
vii)	82057000		18%		Suspension assembly for OPGW	Set	2.00		-	-
viii)	85353090		18%		Downlead Clamps for OPGW	Nos.	20.00		-	-
ix)	85353090		18%		Terminal Box for OPGW	Nos.	2.00		-	-
x)	85353090		18%		Joint Box for OPGW	Nos.	4.00		-	-
5.0					**Test Equipment**					
a)	90275090		18%		**Optical time Domain Reflectometer for 1310/1550nm with laser source (Equivalent toi Anritsu MW 9076B1 or better**	No.	1.00		-	-
b)	90275090		18%		**Optical Attenuators (Variable 1310/1550nm) Equivalent to JDSU OLA55 or better**	No.	1.00		-	-
c)	90275090		18%		**Optical Power meter (1310/1550nm) Equivalent to JDSU OLP55 or better**	No.	1.00		-	-
d)	90275090		18%		**Laser Light Source (Equivalent to EXFO FLS300-23BL or better**	No.	1.00		-	-
e)	90275090		18%		**Optical Talk Set - Equivalent to JDSU OTS55 or better**	No.	1.00		-	-
f)	90275090		18%		**Optical Fiber Fusion Splicer incl. Fibre cleaver (Equivalent to SumitomoT-39-SE or better**	No.	1.00		-	-
g)	90328990		18%		**Calibrated Fibre**	No.	1.00		-	-
h)	90328990		18%		**Connectorization kit (FIS - FI - 0053- FC - INST or equivalent)**	No.	1.00		-	-
i)	90328990		18%		**Splice Kit (FIS - F1 - 0053 -FF or equivalent)**	No.	1.00		-	-
j)	90275090		18%		**Optical test accessory kit including all necessary connectors, adaptors, cables, terminations and other items required for testing**	No.	1.00		-	-
								TOTAL (II)	-	-
								TOTAL EX-WORKS PRICE (I+II)	-	-
								TOTAL TYPE TEST CHARGES As Per Schedule- 7 (NOT APPLICABLE)	-	
								TOTAL EX-WORKS PRICE Including Type Test Charges	-	
								TOTAL GST Tax as confirmed by Bidder	-	

Note: Specify amount of GST on the transaction between the contractor and Employer

* In case the bidder leaves the cell for confirmation of HSN code and/or GST Rate "Blank", the HSN code and corresponding GST Rate indicated by the Employer shall be deemed to be the one confirmed by the bidder.

Those Buildings/Structures (including all) have been partially completed (up to Raft, Column, Plinth Beam, Super structure etc.). Bidders may visit the site and assess the quantum of work to be carried out to complete the balance work.

Date : __\01\2024 Printed Name : 0

Place : 0 Designation: 0

Tender NIT No. RECPDCL/PIA/JKPTCL/SS & LILO-I		Schedule - 2

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

Click to Sch. 3

(SCHEDULE OF RATES AND PRICES)

Bidder's Name and Address :		To: REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC, a 'Navratna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001, Website: www.recpdcl.in
Name :	0	
Address :	0	

LOCAL TRANSPORTATION, INSURANCE AND OTHER INCIDENTAL SERVICES

All Prices are in Indian Rupees.

Sl. No.	Description	Unit	Quantity	Unit Freight, In-transit, Insurance, Loading & Unloading Charges	Total Freight, In-transit, Insurance, Loading & Unloading Charges
1	4	6	7	9.00	10 = 7 x 9
I	**220/33KV NAGROTA SUBSTATION**				
A-1	**TRANSFORMER**				
1.1	50MVA, 220/33KV three phase transformer without transformer oil	No.	2.00		-
1.2	Insulating oil for 50MVA , 220/33 KV, 3-phase transformer(* 1Lot = Oil for 1 number transformer)	Lot	2.00		-
1.3	Nitrogen Injection Fire Protection for for 50MVA , 220/33 KV, 3-phase transformer	No.	2.00		-
1.4	On line Insulating oil drying system	No.	2.00		-
A-2	**LT TRANSFORMER**				
1.1	315KVA, 33/0.433KV LT transformer	No.	2.00		-
A-3	**VOTAGE STABLIZER**				
1.1	315KVA, 3 Phase, Automatic Voltage Stablizer	No.	1.00		-
B-1	**220 kV EQUIPMENT**				
1.0	**Circuit Breakers (3 Ph.)**				
	2500 A, 40 kA, SF6 Circuit Breakers (3-Phase) with support structure (make: Siemens)				
i)	SF6 Circuit Breaker Poles (make: Siemens, Breaker Type 3AP1FI, Year of Mfg: 2022, 3150 A, 50 kA)	Nos.	2.00		-
2.0	**Isolators (3 Ph.)**				
i)	1600A, 40 kA with One earth Switch (Double break Isolator)	Nos.	5.00		-
ii)	1600A, 40 kA without earth Switch (Double break Isolator) (Tandem)	Nos.	9.00		-
iii)	1600A, 40kA with two earth Switch (Double break Isolator)	Nos.	5.00		-
iv)	2500A, 40kA with two earth Switch (Double break Isolator)	Nos.	2.00		-
3.0	**216 kV, 10KA Surge Arrester (1-ph) along with surge counter**	Nos.	12.00		-
B-II					
1.1	**ERECTION HARDWARE (WITHOUT BPI)**				
	Insulator strings & Hardware, Spacers, conductor(s), bus-bar material, cable trays , Bay MB, clamps, connectors including equipment connectors, Junction Box, earthwire, earthing material, risers, auxiliary earthmat (excluding main earthmat), buried cable trenches/ PVC pipes for equipment & lighting, all accessories etc. for the following :				
	220kV ' Double Main & Transfer' type				
i)	Line Bay	Set	2.00		-
ii)	Transformer Bay	Set	2.00		-
iii)	Bus Coupler Bay	Set	1.00		-
iv)	Bus transfer Bay	Set	1.00		-
iv)	Bus (For three bays)	Set	2.00		-

Sl. No.	Description	Unit	Quantity	Unit Freight, In-transit, Insurance, Loading & Unloading Charges	Total Freight, In-transit, Insurance, Loading & Unloading Charges
1	4	6	7	9.00	10 = 7 x 9
1.2	**220 kV Bus Post Insulators for the erection hardware**	Nos.	46.00		-
C-I	**33 kV EQUIPMENT**				
1.0	**Circuit Breakers (3 Ph.)**				
i)	36 kV, 1250A, 25 kA,3-Phase Circuit Breaker with support structure	Nos.	7.00		-
2.0	**Isolators (3 Ph.)**				
i)	36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITH ONE E/S	Nos.	7.00		-
ii)	36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITHOUT E/S	Nos.	9.00		-
iii)	36 kV, 1250A, 25 KA, 3-Phase HDB Isolator with two E/s	Nos.	7.00		-
iv)	36 kV, 2500A, 25 KA, 3-Phase HDB Isolator with two E/s	Nos.	2.00		-
v)	36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITHOUT E/S (TANDEM)	Nos.	7.00		-
2.1	36kV,400A Horn gap fuse (1-Ph.)	Nos.	6.00		-
3.0	**Surge Arrestors 30kV, 1-ph along with surge arrestor**	Nos.	21.00		-
C-II					
1.1	**ERECTION HARDWARE (WITHOUT BPI)**				
	Insulator strings & Hardware, Spacers, conductor(s), bus-bar material, cable trays, Bay MB, clamps, connectors including equipment connectors, Junction Box, earthwire, earthing material, risers, auxiliary earthmat (excluding main earthmat), buried cable trenches/ PVC pipes for equipment & lighting, all accessories etc. for the following :				
	33 kV Double main with Bypass Isolator type				
i)	Line Bay	Set	4.00		-
ii)	Transformer Bay	Set	2.00		-
iii)	BC Bay	Set	1.00		-
iv)	Auxilary Transformer Bay	Set	1.00		-
v)	Bus (For Four Bays + Three bays) (2+1)	Set	3.00		-
1.2	33kV Bus Post Insulators for the above	Nos.	16.00		-
2.0	Conductor, clamps, connectors including equipment connectors, earthing material including risers, etc. (excluding main earthmat) required for connection of aux. LT transformer	Set	2.00		-
D	**LT SWITCHGEAR**				
1.1	415V Main switchboard	Set	1.00		-
1.2	415V ACDB	Set	1.00		-
1.3	415V MLDB	Set	1.00		-
1.4	415V Emergency LDB	Set	1.00		-
1.5	220V DCDB	Set	2.00		-
1.6	48V DCDB	Set	2.00		-
E1	**RELAY PANELS (WITH AUTOMATION)**				
1.0	**220 kV (Swing Type Front Door Glass Simplex type)**				
a	Circuit Breaker Relay Panel				
i	With Auto Reclose	Set	3.00		-
ii	With out Auto Reclose	Set	3.00		-
b	Line Protection Panel	Set	2.00		-
d	Transformer Protection Panel (For both HV & MV side)	Set	2.00		-
e	Bus Bar Protection Panel	Set	1.00		-
E2	**Teleprotection Equipments**				
a)	Digital protection coupler including cabling etc.	Set	2.00		-
b)	Digital protection coupler including cabling etc. for other end	Set	2.00		-

Sl. No.	Description	Unit	Quantity	Unit Freight, In-transit, Insurance, Loading & Unloading Charges	Total Freight, In-transit, Insurance, Loading & Unloading Charges
1	4	6	7	9.00	10 = 7 x 9
c)	Shifting and re-erection of an existing panel of Gladni/Udhampur as per Technical specification	LS	1.00		-
2.0	**33KV Panels(Swing Type Front Door Glass Simplex Panels)**				
a	Circuit Breaker Relay Panel With out Auto Reclose	Set	8.00		-
b	Line Protection Panel	Set	4.00		-
F	**SUBSTATION AUTOMATION SYSTEM (SAS)**				
	Complete Substation Automation System (SAS) for 220/33 kV Substation including hardware and software for the substation & remote control stations along with associated equipments for the following bays as per TS:-				
a)	220 kV System	Bay	6.00		-
b)	33 kV System	Bay	7.00		-
c)	BCU for Controlling and monitoring of Auxiliary System	Set	1.00		-
G	**Tele Communication System**				
A-1	**SDH EQUIPMENTS(STM-4 MADM upto 5MSP Protected directions)**				
(I)	**Nagrota**				
a	Base equipments(Common cards,Cross connect/control cards, power supply cards, power cabling, other hardware and accessories including sub rascks, patch cord, DDF etc fully equipped excluding (ii) & (iii) below	Nos.	1.00		-
	Gladni				
b	Base equipments(Common cards,Cross connect/control cards, power supply cards, power cabling, other hardware and accessories including sub rascks, patch cord, DDF etc fully equipped excluding (ii) & (iii) below	Nos.	1.00		-
(ii)	**Optical Interface Cards/SFP#**				
	Nagrota				
a	S4.1 SFP	Nos.	-		-
b	L4.1 SFP	Nos.	4.00		-
	Gladni				
a	S4.1 SFP	Nos.	4.00		-
b	L4.1 SFP	Nos.	2.00		-
	Udhampur				
a	S4.1 SFP	Nos.	-		-
b	L4.1 SFP	Nos.	2.00		-
(iii)	**Tributary cards**				
	Nagrota				
a	E1 Interface card(Min. 16 Interfaces per card)	Nos.	2.00		-
b	Ethernet interface 10/100 Base T with Layer-2 switching (Min 8 Interfaces per card)	Nos.	2.00		-
	Gladni				
a	E1 Interface card(Min. 16 Interfaces per card)	Nos.	2.00		-
b	Ethernet interface 10/100 Base T with Layer-2 switching (Min 8 Interfaces per card)	Nos.	2.00		-
(iv)	**Equipment Cabinet**	Nos.	2.00		-
2.0	**Network Manager System(NMS)**				
	Nagrota				
(I)	**Craft terminal**				
a	Hardware	Set	1.00		-
b	Software	Set	1.00		-
	Gladni				
(I)	**Craft terminal**				
a	Hardware	Set	-		-
b	Software	Set	-		-

Sl. No.	Description	Unit	Quantity	Unit Freight, In-transit, Insurance, Loading & Unloading Charges	Total Freight, In-transit, Insurance, Loading & Unloading Charges
1	4	6	7	9.00	10 = 7 x 9
3.0	**VOIP telephone instrument with one common switch(min. 8 port)**				
	Nagrota	Nos.	2.00		-
	Gladni	Nos.	-		-
4.0	**Approach Cable (24 fibres)**				
	Nagrota				
a	24 Fibre(DWSM)	Kms	1.00		-
b	Installation hardware set for above 24 Fibre, Fibre Optic Approach Cable	Set	1.00		-
	Gladni				
a	24 Fibre(DWSM)	kms	1.00		-
b	Installation hardware set for above 24 Fibre, Fibre Optic Approach Cable	Set	1.00		-
	Udhampur				
a	24 Fibre(DWSM)	kms	1.00		-
b	Installation hardware set for above 24 Fibre, Fibre Optic Approach Cable	Set	1.00		-
5.0	**FODP**				
	Nagrota				
a	**48 Fibre**:Indoor Type,Rack Mounted with FCPC Coupling & Pigtails(5mtrs)	No.s	1.00		-
	Gladni				
a	**48 Fibre**:Indoor Type,Rack Mounted with FCPC Coupling & Pigtails(5mtrs)	No.s	1.00		-
	Udhampur				
a	**48 Fibre**:Indoor Type,Rack Mounted with FCPC Coupling & Pigtails(5mtrs)	No.s	1.00		-
H-(i)	**BATTERIES (VRLA type)**				
1.1	220V				
a)	500 AH	Set	2.00		-
1.2	48V				
a)	300 AH	Set	2.00		-
H-(ii)	**BATTERY CHARGER System**				
1.1	220V, 80A/50 A Float Cum Boost	Nos.	2.00		-
1.2	48V, 50A/30 A Float Cum Boost	Nos.	2.00		-
I	**Diesel Generator Set along with control panel (100 kVA)**	Set	1.00		-
J	**High wall type Split Air Conditioner Units of 2 TR capacity**	Nos.	21.00		-
K	**Fire Protection System**				
1.1	Wheel/trolley mounted fire extinguishers :				
a	22.5 Kg DCP type	Nos.	4.00		-
b	22.5 Kg CO_2 type	Nos.	4.00		-
1.2	Portable fire extinguishers:				
a	4.5 Kg DCP type	Nos.	6.00		-
b	4.5 Kg CO_2 type	Nos.	10.00		-
1.3	Complete Pumping arrangement for Hydrant complete with all piping and valves, fitting etc. inside pump house	LS	1.00		-
1.4	Hydrant system with complete O/G and U/G piping and accessories etc.(all items) outside the pump house. The hydrant system shall cover the switchyard area, Transformers, Control Room, Stores, etc. as per tender specification.	LS	1.00		-
1.5	Smoke detection and Alarm system with all accessories and fittings for CRB & FFPH	Set	1.00		-
L	**ILLUMINATION SYSTEM**				
L.1	Control Room Building (including indoor Lighting panel, Fixtures, Conduits, wire, indoor receptacles, Fans, etc.)	LS	1.00		-

Sl. No.	Description	Unit	Quantity	Unit Freight, In-transit, Insurance, Loading & Unloading Charges	Total Freight, In-transit, Insurance, Loading & Unloading Charges
1	4	6	7	9.00	10 = 7 x 9
L.2	Fire Fighting Pump House Building (including Fixtures, Conduits, wire, indoor receptacles, Fans, etc.)	LS	1.00		-
L.3	Security Room (including, Fixtures, Coduits, wire, indoor receptacles, Fans, etc.)	LS	1.00		-
L.4	Storage room	LS	1.00		-
L.5	**Outdoor Lighting (Switchyard and street lighting)**				
1	Lighting Panel				
a)	Lighting Panel (Outdoor) Type ACP-2	Nos.	4.00		-
b)	Lighting Panel (Outdoor) Type ACP-3	Nos.	1.00		-
c)	Sub Lighting Panel (Outdoor) - SLP	Nos.	3.00		-
2	Lighting fixtures and Receptacles including junction box, lighting wires& flexible conduit (if required) from junction box to lighting fixture, mounting arrangement, and other accessories/materials, etc. as required for complete installation and commissioning of lighting fixture.				
a)	Lighting Fixture **Type-SF1**	Nos.	14.00		-
b)	Lighting Fixture **Type-SF2**	Nos.	14.00		-
c)	Lighting Fixture **Type-SF3**	Nos.	-		-
d)	Lighting Fixture **Type-SF4**	Nos.	-		-
e)	Lighting Fixture **Type-SF5**	Nos.	20.00		-
f)	Lighting Fixture **Type-SC**	Nos.	10.00		-
g)	Lighting Fixture **Type-S-LED**	Nos.	-		-
h)	15A, 240V: Outdoor Receptacle 2 pole, 3-pin type **(Type RO)**	Nos.	5.00		-
i)	125A, 415V : Interlocked switch socket outdoor Receptacle **(Type RP)**	Nos.	2.00		-
3	Lighting Poles Type A1	Nos.	10.00		-
4	Lighting Poles Type E1	Nos.	16.00		-
5	Cartwheel mounted aluminium ladder as per technical specification	No.	1.00		-
M	**1.1kV grade cable along with associated accessories like clamps,glands, lugs and straight joints etc.**				
1.1	Power Cables(XLPE) (1.1 kV) Aluminium Conductor armoured	LS	1.00		-
1.2	Power Cables(PVC) (1.1 kV) Aluminium Conductor armoured	LS	1.00		-
1.3	Control Cables(PVC) (1.1 kV) Copper Conductor armoured	LS	1.00		-
N	**40 mm MS rod for Main Earthmat**	kM	2.12		-
O	**Lattice Structure**				
i	Non-standard gantry structures including all Bolts & Nuts (Towers, Beam)	MT	50.00		-
ii	Non-standard Lighting Mast structures including all Bolts & Nuts	MT	50.00		-
iii	Non-standard equipment support structures including all Bolts & Nuts	MT	90.00		-
P	**Visual Monitoring System**	LS	1.00		-
R	**MANDATORY SPARES *(Break-up of Lumpsum quantity shall be as per Annexure-1 of Sec-Project of Technical specifications**				
1	220/33kV, 50MVA, 3Phase Transformer	LS	1.00		-
2	245kV ISOLATORS	LS	1.00		-
3	216kV SURGE ARRESTOR	LS	1.00		-

Sl. No.	Description	Unit	Quantity	Unit Freight, In-transit, Insurance, Loading & Unloading Charges	Total Freight, In-transit, Insurance, Loading & Unloading Charges
1	4	6	7	9.00	10 = 7 x 9
4	Auxilliary Switch suitable for 36kV CIRCUIT BREAKER (2500A) of make M/s ABB and Model No. OVB-VBF 36.20.32	No.	1.00		-
5	36kV CIRCUIT BREAKER (1250A)	LS	1.00		-
6	36kV ISOLATOR	LS	1.00		-
7	30kV SURGE ARRESTOR	LS	1.00		-
8	RELAY PROTECTION PANEL	LS	1.00		-
9	SUBSTATION AUTOMATION SYSTEM	LS	1.00		-
10	BATTERY CHARGER (220 V and 48 V)	LS	1.00		-
11	DG Set	LS	1.00		-
12	LT Transformer (315kVA)	LS	1.00		-
13	LT Transformer (160kVA)	LS	1.00		-
14	Illumination system	LS	1.00		-
15	Erection Hardware Items	LS	1.00		-
16	Tele Communication	LS	1.00		-
17	LT Switchgear	LS	1.00		-
R	**Maintenance & Testing equipments :**				
1	BDV Test Kit	No.	1.00		-
2	Meggar 5 KV	No.	1.00		-
3	Digital multimeter	No.	1.00		-
4	Portable SF6 gas refilling device	No.	1.00		-
5	SF6 Gas leak detector	No.	1.00		-
6	SF6 Dew Point Meter	No.	1.00		-
7	Circuit Breaker Analyzer with DCRM including transducer	No.	1.00		-
8	Digital Micro-Ohm meter for contact resistance measurement	No.	1.00		-
9	Primary Current Injection Kit	No.	1.00		-
10	Secondary relay injection Kit - Relay Test Kit	No.	1.00		-
11	Earth resistance Tester	No.	1.00		-
12	3-ph Variac 440-480 Volts	No.	1.00		-
13	3-Phase Sequence meter	No.	1.00		-
14	Portable Dissolved Gas analysis (DGA) kit for Transformer Oil	No.	1.00		-
15	Oil Filteration Plant (Capacity - 6000 LPH)	No.	1.00		-
16	Oil Storage Tank - 10kL	No.	1.00		-
17	Transformer Turn Ratio Meter	No.	1.00		-
18	Capacitance & Ten Delta Measurement Kit	No.	1.00		-
19	Winding Resistance Measurement Instrument	No.	1.00		-
20	Oil Sampling Bottle	Nos.	3.00		-
21.0	SF6 GAS FILTERING, EVACUATING AND DRYING PLANT	No	1.00		-
	TOTAL (I)				-
II	**LILO of 220kV Kishenpur-Barn/Gladni-Udhampur**				
1.0	**TOWERS**				
1.1	Fabrication, galvanizing & supply of various types of tower & Gantry structures, tower parts, and tower extensions (complete) excluding bolts & nuts, step bolts and stubs but including hangers, D-Shackles, pack washers, etc.				
	Normal Towers				
i	**Mild Steel**	MT	130.00		-
ii	**HT Steel**	MT	80.00		-
1.2	Fabrication, galvanizing & supply of stubs & cleats of various type of towers, tower extensions (complete) excluding bolts & nuts				
i	**Mild Steel**	MT	1.00		-
ii	**HT Steel**	MT	1.00		-
1.3	**Supply of bolts and nuts including step bolts and spring washers**				
i	For Towers & tower extns.				
a	Hexagonal Bolts & Nuts including Step Bolts	MT	10.00		-
ii	For stubs	MT	0.50		-
2.0	**Supply of earthing of towers**				

Sl. No.	Description	Unit	Quantity	Unit Freight, In-transit, Insurance, Loading & Unloading Charges	Total Freight, In-transit, Insurance, Loading & Unloading Charges
1	4	6	7	9.00	10 = 7 x 9
a	Pipe type earthing	Nos.	40.00		-
b	Counterpoise type (120 m length)	Nos.	2.00		-
c	Shielding Earthwire including PG clamps, downlead clamps and earthwire bits				
i	Pipe type earthing	Nos.	2.00		-
ii	Counterpoise type	Nos.	1.00		-
d	River crossing locations	Kgs.	-		-
3.0	**Supply of following tower accessories**				
a	Danger plate	Nos.	24.00		-
b	Number plate	Nos.	24.00		-
c	Phase Plate (Set of three)	Sets.	48.00		-
d	Circuit Plate (Set of two)	Sets	23.00		-
e	Anticlimbing device	Nos.	25.00		-
f	Bird Guards (Set of three)	Sets.	-		-
g	Solar Power LED Lighting System marking for Obstruction Marking 0f 220 KV Transmission Line comprising one medium intensity and 2 low-intensity lights, solar panels, maintenance-free battery, astronomical time switch, control panel, solar charger, Complete with interconnecting cables, mounting hardware, cover fort battery, charger and all allied accessories.	Nos	13.00		-
h	Aircraft Warning sphere span marker 600 mm dia colour (Full/half), White/Orange	Nos	37.00		-
i	Primer for Tower upper - two stories including cross arms to be applied before painting for daytime aviation obstruction structure marking.	Nos	13.00		-
j	Grade A aviation marker paint (Red/Orange/White) for tower upper two stories including cross arm fo day time aviation obstruction marking	Nos	13.00		-
4.0	**Design, manufacture and supply of the following line materials**				
4.1	**ACSR "ZEBRA" Conductor**	Kms.	31.00		-
4.2	**Optical Fiber Ground Wire (24 fibre DWSM)**	Kms.	0.10		-
4.3	**Optical Fiber Ground Wire (48 fibre DWSM)**	Kms.	5.20		-
4.4	**COMPOSITE LONG ROD INSULATORS**				
i	70KN	Nos.	54.00		-
ii	120KN	Nos.	420.00		-
4.5	**Hardware fittings**				
a	Single `I' Suspension Insulator string for ACSR "ZEBRA"	Sets	-		-
b	Single suspension string (Pilot) for ACSR "ZEBRA"	Sets	54.00		-
c	Single tension string for ACSR "ZEBRA"	Sets	240.00		-
d	Double Tension String for ACSR 'ZEBRA"	Sets	60.00		-
4.6	**Accessories for Conductor & OPGW**				
i)	Midspan Compression Joint for ACSR 'ZEBRA' Conductor	Nos.	17.00		-
ii)	Repair Sleeves for ACSR ZEBRA Conductor	Nos.	6.00		-
iii)	Flexible Copper bonds	Nos.	52.00		-
iv)	Vibration Damper for ACSR `ZEBRA' Conductor	Nos.	600.00		-
v)	Vibration Damper for OPGW	Nos.	100.00		-
vi)	Tension assembly set for OPGW	Nos.	10.00		-
a	Dead end Assembly	Set	2.00		-
b	Double Tension Assembly at Joint Location	Set	4.00		-
c	Double Tension Pass Through Assembly	Set	22.00		-
vii)	Suspension assembly for OPGW	Set	2.00		-

Sl. No.	Description	Unit	Quantity	Unit Freight, In-transit, Insurance, Loading & Unloading Charges	Total Freight, In-transit, Insurance, Loading & Unloading Charges
1	4	6	7	9.00	10 = 7 x 9
viii)	Downlead Clamps for OPGW	Nos.	20.00		-
ix)	Terminal Box for OPGW	Nos.	2.00		-
x)	Joint Box for OPGW	Nos.	4.00		-
5.0	**Test Equipment**				
a)	**Optical time Domain Reflectometer for 1310/1550nm with laser source (Equivalent toi Anritsu MW 9076B1 or better**	No.	1.00		-
b)	**Optical Attenuators (Variable 1310/1550nm) Equivalent to JDSU OLA55 or better**	No.	1.00		-
c)	**Optical Power meter (1310/1550nm) Equivalent to JDSU OLP55 or better**	No.	1.00		-
d)	**Laser Light Source (Equivalent to EXFO FLS300-23BL or better**	No.	1.00		-
e)	**Optical Talk Set - Equivalent to JDSU OTS55 or better**	No.	1.00		-
f)	**Optical Fiber Fusion Splicer incl. Fibre cleaver (Equivalent to SumitomoT-39-SE or better**	No.	1.00		-
g)	**Calibrated Fibre**	No.	1.00		-
h)	**Connectorization kit (FIS - FI - 0053- FC - INST or equivalent)**	No.	1.00		-
i)	**Splice Kit (FIS - F1 - 0053 -FF or equivalent)**	No.	1.00		-
j)	**Optical test accessory kit including all necessary connectors, adaptors, cables, terminations and other items require3d for testing**	No.	1.00		-
TOTAL (II)					-
Grand Total of Schedule-2 (I+II)					-
Date :	\01\2024			Printed Name :	-
Place :	0			Designation:	-

Tender NIT No. RECPDCL/PIA/JKPTCL/SS & LILO-I	Schedule - 3

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

Click to Sch. 4

(SCHEDULE OF RATES AND PRICES)

Bidder's Name and Address :		To:
Name :	0	REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC, a 'Navratna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001, Website: www.recpdcl.in
Address :	0	

INSTALLATION CHARGES

All Prices are in Indian Rupees.

Sl. No.	(SAC) Service Acounting Code	Whether SAC Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable rate of GST	Description	Unit	Quantity	Unit Erection Charges	Total Erection Charges	Total GST as confirmed by the bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
I					220/33KV NAGROTA SUBSTATION					
A-1					TRANSFORMER					
1.1	998736		18%		50MVA, 220/33KV three phase transformer without transformer oil	No.	2.00		-	-
1.2	998736		18%		Insulating oil for 50MVA , 220/33 KV, 3-phase transformer(* 1Lot = Oil for 1 number transformer)	Lot	2.00		-	-
1.3	998736		18%		Nitrogen Injection Fire Protection for for 50MVA , 220/33 KV, 3-phase transformer	No.	2.00		-	-
1.4	998736		18%		On line Insulating oil drying system	No.	2.00		-	-
A-2					LT TRANSFORMER					
1.1	998736		18%		315KVA, 33/0.433KV LT transformer	No.	2.00		-	-
A-3					VOTAGE STABLIZER					
1.1			18%		315KVA, 3 Phase, Automatic Voltage Stablizer	No.	1.00		-	-
B-1					220 kV EQUIPMENT					
1.0					Circuit Breakers (3 Ph.)					
i)	998736		18%		2500 A, 40 kA, SF6 Circuit Breakers (3-Phase) with support structure	Nos.	6.00		-	-
2.0					Isolators (3 Ph.)					
i)	998736		18%		1600A, 40 kA with One earth Switch (Double break Isolator)	Nos.	5.00		-	-
ii)	998736		18%		1600A, 40 kA without earth Switch (Double break Isolator) (Tandem)	Nos.	9.00		-	-
iii)	998736		18%		1600A, 40kA with two earth Switch (Double break Isolator)	Nos.	5.00		-	-
iv)	998736		18%		2500A, 40kA with two earth Switch (Double break Isolator)	Nos.	2.00		-	-
3.0					Current Transformers (1-Ph.)					
i)	998736		18%		800A, 40kA, 5 core CT with 120% extended current rating	Nos.	15.00		-	-
ii)	998736		18%		1600A, 40kA, 5 core CT with 150% extended current rating	Nos.	3.00		-	-
4.0					245 kV Capacitive Voltage Transformer (1- Phase)					
i)	998736		18%		4400 pF	Nos.	12.00		-	-
5.0	998736		18%		216 kV, 10KA Surge Arrester (1-ph) along with surge counter	Nos.	12.00		-	-

Sl. No.	(SAC) Service Acounting Code	Whether SAC Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable rate of GST	Description	Unit	Quantity	Unit Erection Charges	Total Erection Charges	Total GST as confirmed by the bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
B-II										
1.1					**ERECTION HARDWARE (WITHOUT BPI)**					
					Insulator strings & Hardware, Spacers, conductor(s), bus-bar material, cable trays, Bay MB, clamps, connectors including equipment connectors, Junction Box, earthwire, earthing material, risers, auxiliary earthmat (excluding main earthmat), buried cable trenches/ PVC pipes for equipment & lighting, all accessories etc. for the following :					
					220kV ' Double Main & Transfer' type					
i)	998731		18%		Line Bay	Set	2.00		-	-
ii)	998731		18%		Transformer Bay	Set	2.00		-	-
iii)	998731		18%		Bus Coupler Bay	Set	1.00		-	-
iv)	998731		18%		Bus transfer Bay	Set	1.00		-	-
iv)	998731		18%		Bus (For three bays)	Set	2.00		-	-
1.2	998736		18%		220 kV Bus Post Insulators for the erection hardware	Nos.	46.00		-	-
C-I					**33 kV EQUIPMENT**					
1.0					**Circuit Breakers (3 Ph.)**					
i)	998736		18%		36 kV, 1250A, 25 kA,3-Phase CircuitBreaker with support structure	Nos.	7.00		-	-
i)	998736		18%		36 kV, 2500A, 25 kA,3-Phase CircuitBreaker with support structure	Nos.	1.00		-	-
2.0					**Isolators (3 Ph.)**					
i)	998736		18%		36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITH ONE E/S	Nos.	7.00		-	-
ii)	998736		18%		36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITHOUT E/S	Nos.	9.00		-	-
iii)	998736		18%		36 kV, 1250A, 25 KA, 3-Phase HDB Isolator with two E/s	Nos.	7.00		-	-
iv)	998736		18%		36 kV, 2500A, 25 KA, 3-Phase HDB Isolator with two E/s	Nos.	2.00		-	-
ii)	998736		18%		36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITHOUT E/S (TANDEM)	Nos.	7.00		-	-
2.1	998736		18%		36kV,400A Horn gap fuse (1-Ph.)	Nos.	6.00		-	-
3.0					**Current Transformers (1 Ph.)**					
i)	998736		18%		36kV,1200A,25kA,1-Ph Current Transformer-120% rating	Nos.	21.00		-	-
ii)	998736		18%		36 KV, 2000A, 25 KA, 1-PHASE CURRENT TRANSFORMER WITH 150% EXTENDEDRATING	Nos.	3.00		-	-
4.0	998736		18%		**Potential Transformer (1 Ph.) 33kV/√3/110/√3/110/√3/110/√3**	Nos.	6.00		-	-
5.0	98736		18%		**Surge Arrestors 30kV, 1-ph along with surge arrestor**	Nos.	21.00		-	-
C-II										
1.1					**ERECTION HARDWARE (WITHOUT BPI)**					

Sl. No.	(SAC) Service Acounting Code	Whether SAC Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable rate of GST	Description	Unit	Quantity	Unit Erection Charges	Total Erection Charges	Total GST as confirmed by the bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
					Insulator strings & Hardware, Spacers, conductor(s), bus-bar material, cable trays, Bay MB, clamps, connectors including equipment connectors, Junction Box, earthwire, earthing material, risers, auxiliary earthmat (excluding main earthmat), buried cable trenches/ PVC pipes for equipment & lighting, all accessories etc. for the following :					
					33 kV Double main with Bypass Isolator type					
i)	998731		18%		Line Bay	Set	4.00		-	-
ii)	998731		18%		Transformer Bay	Set	2.00		-	-
iii)	998731		18%		BC Bay	Set	1.00		-	-
iv)	998731		18%		Auxilary Transformer Bay	Set	1.00		-	-
v)	998731		18%		Bus (For Four Bays+ Three Bays) (2+1)	Set	3.00		-	-
1.2	998736		18%		33kV Bus Post Insulators for the above	Nos.	16.00		-	-
2.0	998736		18%		Conductor, clamps, connectors including equipment connectors, earthing material including risers, etc. (excluding main earthmat) required for connection of aux. LT transformer	Set	2.00		-	-
D					**LT SWITCHGEAR**					
1.1	998736		18%		415V Main switchboard	Set	1.00		-	-
1.2	998736		18%		415V ACDB	Set	1.00		-	-
1.3	998731		18%		415V MLDB	Set	1.00		-	-
1.4	998736		18%		415V Emergency LDB	Set	1.00		-	-
1.5	998736		18%		220V DCDB	Set	2.00		-	-
1.6	998736		18%		48V DCDB	Set	2.00		-	-
E1					**RELAY PANELS (WITH AUTOMATION)**					
1.0					**220 kV ((Swing Type Front Door Glass Simplex type)**					
a					Circuit Breaker Relay Panel					
i	998736		18%		With Auto Reclose	Set	3.00		-	-
ii	998736		18%		With out Auto Reclose	Set	3.00		-	-
b	998736		18%		Line Protection Panel	Set	2.00		-	-
d	998736		18%		Transformer Protection Panel (For both HV & MV side)	Set	2.00		-	-
e	998736		18%		Bus Bar Protection Panel	Set	1.00		-	-
E2					**Teleprotection Equipments**					
a)	998734		18%		Digital protection coupler including cabling etc.	Set	2.00		-	-
b)	998734		18%		Digital protection coupler including cabling etc. for other end	Set	2.00		-	-
c)	998734		18%		Shifting and re-erection of existing panel of Gladni/Udhampur as per Technical specification	LS	1.00		-	-
2.0					**33KV Panels (Swing Type Front Door Glass Simplex type)**					
a	998736		18%		Circuit Breaker Relay Panel With out Auto Reclose	Set	8.00		-	-
b	998736		18%		Line Protection Panel	Set	4.00		-	-

Sl. No.	(SAC) Service Acounting Code	Whether SAC Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable rate of GST	Description	Unit	Quantity	Unit Erection Charges	Total Erection Charges	Total GST as confirmed by the bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
F					**SUBSTATION AUTOMATION SYSTEM (SAS)**					
					Complete Substation Automation System (SAS) for 220/33 kV Substation including hardware and software for the substation & remote control stations along with associated equipments for the following bays as per TS:-					
a)	998736		18%		220 kV System	Bay	6.00		-	-
b)	998736		18%		33 kV System	Bay	7.00		-	-
c)	998736		18%		BCU for Controlling and monitoring of Auxiliary System	Set	1.00		-	-
G					**Tele Communication System**					
A-1					**SDH EQUIPMENTS(STM-4 MADM upto 5MSP Protected directions)**					
(I)					**Nagrota**					
a	998336		18%		Base equipments(Common cards,Cross connect/control cards, power supply cards, power cabling, other hardware and accessories including sub rascks, patch cord, DDF etc fully equipped excluding (ii) & (iii) below	Nos.	1.00		-	-
					Gladni					
a	998336		18%		Base equipments(Common cards,Cross connect/control cards, power supply cards, power cabling, other hardware and accessories including sub rascks, patch cord, DDF etc fully equipped excluding (ii) & (iii) below	Nos.	1.00		-	-
(ii)					**Optical Interface Cards/SFP**					
					Nagrota					
a					S4.1 SFP	Nos.	-		-	-
b	998734		18%		L4.1 SFP	Nos.	4.00		-	-
					Gladni					
a	998734		18%		S4.1 SFP	Nos.	4.00		-	-
b	998734		18%		L4.1 SFP	Nos.	2.00		-	-
					Udhampur					
a					S4.1 SFP	Nos.	-		-	-
b	998734		18%		L4.1 SFP	Nos.	2.00		-	-
(iii)					**Tributary cards**					
					Nagrota					
a	998734		18%		E1 Interface card(Min. 16 Interfaces per card)	Nos.	2.00		-	-
b	998336		18%		Ethernet interface 10/100 Base T with Layer-2 switching (Min 8 Interfaces per card)	Nos.	2.00		-	-
					Gladni					
a	998734		18%		E1 Interface card (Min. 16 Interfaces per card)	Nos.	2.00		-	-
b	998336		18%		Ethernet interface 10/100 Base T with Layer-2 switching (Min 8 Interfaces per card)	Nos.	2.00		-	-
(iv)	998734		18%		**Equipment Cabinet**	Nos.	2.00		-	-
2.0					**Network Manager System(NMS)**					

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1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
					Nagrota					
(I)					**Craft terminal**					
a	998734		18%		Hardware	Set	1.00		-	-
b	998734		18%		Software	Set	1.00		-	-
					Gladni					
(I)					**Craft terminal**					
a					Hardware	Set	-		-	-
b					Software	Set	-		-	-
3.0					**VOIP telephone instrument with one common switch(min. 8 port)**					
	998336		18%		**Nagrota**	No.s	2.00		-	-
					Gladni	No.s	-		-	-
4.0					**Approach Cable (24 fibres)**					
					Nagrota					
a	998336		18%		24 Fibre(DWSM)	Kms	1.00		-	-
a	998336		18%		Installation hardware set for above 24 Fibre, Fibre Optic Approach Cable	Set	1.00		-	-
					Gladni					
a	998336		18%		24 Fibre(DWSM)	kms	1.00		-	-
a	998336		18%		Installation hardware set for above 24 Fibre, Fibre Optic Approach Cable	Set	1.00		-	-
					Udhampur					
a	998336		18%		24 Fibre(DWSM)	kms	1.00		-	-
a	998336		18%		Installation hardware set for above 24 Fibre, Fibre Optic Approach Cable	Set	1.00		-	-
5.0					**FODP**					
					Nagrota					
a	998716		18%		**48 Fibre**:Indoor Type,Rack Mounted with FCPC Coupling & Pigtails(5mtrs)	No.s	1.00		-	-
					Gladni					
a	998716		18%		**48 Fibre**:Indoor Type,Rack Mounted with FCPC Coupling & Pigtails(5mtrs)	No.s	1.00		-	-
					Udhampur					
a	998716		18%		**48 Fibre**:Indoor Type,Rack Mounted with FCPC Coupling & Pigtails(5mtrs)	No.s	1.00		-	-
H-(i)					**BATTERIES (VRLA type)**					
1.1					220 V					
a)	998736		18%		500 AH	Set	2.00		-	-
1.2					48V					
a)	998736		18%		300 AH	Set	2.00		-	-
H-(ii)					**BATTERY CHARGER System**					
1.1	998736		18%		220V, 80 A/50 A Float Cum Boost	Nos.	2.00		-	-
1.2	998736		18%		48V, 50A/30 A Float Cum Boost	Nos.	2.00		-	-
I	998731		18%		**Diesel Generator Set along with control panel (100 kVA)**	Set	1.00		-	-
J	995463		18%		**High wall type Split Air Conditioner Units of 2 TR capacity**	Nos.	21.00		-	-
K					**Fire Protection System**					
1.1					Wheel/trolley mounted fire extinguishers :				-	
a	998736		18%		22.5 Kg DCP type	Nos.	4.00		-	-
b	998736		18%		22.5 Kg CO_2 type	Nos.	4.00		-	-
1.2					Portable fire extinguishers:					
a	995461		18%		4.5 Kg DCP type	Nos.	6.00		-	-
b	995461		18%		4.5 Kg CO_2 type	Nos.	10.00		-	-

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1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
1.3	995461		18%		Complete Pumping arrangement for Hydrant complete with all piping and valves, fitting, etc. inside the pump house	LS	1.00		-	-
1.4	995461		18%		Hydrant system with complete O/G and U/G piping and accessories etc.(all items) outside the pump house. The hydrant system shall cover the Switchyard area, Transformers, Control Room, Stores, etc. as per tender specification.	LS	1.00		-	-
1.5	995461		18%		Smoke detection and Alarm system with all accessories and fittings for CRB & FFPH	Set	1.00		-	-
L					**ILLUMINATION SYSTEM**					
L.1	998739		18%		Control Room Building (including indoor Lighting panel, Fixtures, Conduits, wire, indoor receptacles, Fans, etc.)	LS	1.00		-	-
L.2	998739		18%		Fire Fighting Pump House Building (including Fixtures, Conduits, wire, indoor receptacles, Fans, etc.)	LS	1.00		-	-
L.3	998739		18%		Security Room (including, Fixtures, Coduits, wire, indoor receptacles, Fans, etc.)	LS	1.00		-	-
L.4	998739		18%		Storage room	LS	1.00		-	-
L.5					**Outdoor Lighting (Switchyard and street lighting)**					
1					Lighting Panel					
a)	995461		18%		Lighting Panel (Outdoor) Type ACP-2	Nos.	4.00		-	-
b)	998731		18%		Lighting Panel (Outdoor) Type ACP-3	Nos.	1.00		-	-
c)	998731		18%		Sub Lighting Panel (Outdoor) - SLP	Nos.	3.00		-	-
2					Lighting fixtures and Receptacles including junction box, lighting wires& flexible conduit (if required) from the junction box to lighting fixture, mounting arrangement and other accessories/materials, etc. as required for complete installation and commissoning of lighting fixture					
a)	998731		18%		Lighting Fixture **Type-SF1**	Nos.	14.00		-	-
b)	998731		18%		Lighting Fixture **Type-SF2**	Nos.	14.00		-	-
c)	998731		18%		Lighting Fixture **Type-SF3**	Nos.	-		-	-
d)	998731		18%		Lighting Fixture **Type-SF4**	Nos.	-		-	-
e)	998731		18%		Lighting Fixture **Type-SF5**	Nos.	20.00		-	-
f)	998731		18%		Lighting Fixture **Type-SC**	Nos.	10.00		-	-
g)	998731		18%		Lighting Fixture **Type-S-LED**	Nos.	-		-	-
h)	998731		18%		15A, 240V: Outdoor Receptacle 2 pole, 3-pin type **(Type RO)**	Nos.	5.00		-	-
i)	998731		18%		125A, 415V : Interlocked switch socket outdoor Receptacle **(Type RP)**	Nos.	2.00		-	-
3	998731		18%		Lighting Poles Type A1	Nos.	10.00		-	-
4	998731		18%		Lighting Poles Type E1	Nos.	16.00		-	-
5	998731		18%		Cartwheel-mounted aluminium ladder as per technical specification	No.	1.00		-	-

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1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
M					**1.1kV grade cable along with associated accessories like clamps, glands, lugs and straight joints, etc.**					
1.1	998736		18%		Power Cables(XLPE) (1.1 kV) Aluminium Conductor armoured	LS	1.00		-	-
1.2	998736		18%		Power Cables(PVC) (1.1 kV) Aluminium Conductor armoured	LS	1.00		-	-
1.3	998736		18%		Control Cables(PVC) (1.1 kV) Copper Conductor armoured	LS	1.00		-	-
N	998731		18%		**40 mm MS rod for Main Earthmat**	kM	2.12		-	-
O					**Lattice Structure**					
i	730820		18%		Non-standard gantry structures including all Bolts & Nuts (Towers, Beam)	MT	50.00		-	-
ii	730820		18%		Non-standard Lighting Mast structures including all Bolts & Nuts	MT	50.00		-	-
iii	730820		18%		Non-standard equipment support structures including all Bolts & Nuts	MT	100.00		-	-
P	998731		18%		**Visual Monitoring System**	LS	1.00		-	-
R					**CIVIL WORKS**					
3.0					**Levelling of Area (Cutting & Filling of Soil & Backfilling with same excavated soil)**					
3.1	995433		18%		Soft Rock	Cu. M	3,500.00		-	-
3.2	995433		18%		Normal Soil	Cu. M	9,000.00		-	-
4.0					**Design, Engineering (as per requirements) and Construction of foundation for following Equipments/Structures. All civil works including earthwork excavation for all types of soils, PCC Shuttering/Scaffolding, curing, Steel grating for Transformer oil pits, Rail tracks, other miscellaneous steel, backfill and disposable of excess earth, excluding RCC M25 and Reinforcement Steel to be paid separately all complete as per TS and approved drawing.**					
4.1					**50MVA, Power Transformer (Main body, rail fixing, walls, rail-cum road, soak pit, sump pit, and peripheral walls completed)**					
a	998736		18%		Balance civil works and finishing works required to be completed in all respects as per approved drawing, TS and site requirements. The contractor has to assess the balance of work as per site condition. (Refer Note)	Nos.	2.00		-	-
4.2	998736		18%		**315 KVA L.T. Transformer (as per approved design and drawing to be provided by Contractor)**	Nos.	2.00		-	-

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1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
4.3					**220kV Tower Structure : (Excavation, PCC, RCC and bolt fixing Completed)**					
a	998736		18%		Balance civil works and finishing works required to be completed in all respects as per approved drawing, TS and site requirements. (Refer Notes)	Nos.	23.00		-	-
4.4	998736		18%		**Lightning Mast Structure**	Nos.	3.00		-	-
4.5					**33kV Tower Structure (Excavation, PCC, RCC and bolt fixing Completed)**					
a	998731		18%		Balance civil works and finishing works required to be completed in all respects as per approved drawing, TS and site requirements.(Refer Note)	Nos.	27.00		-	-
4.6					**220kV & 33kV Equipment Structure (Foundation works required to be completed in all respect as per approved drawing, TS and site requirements). (Refer Note)**					
c	998731		18%		220kV CT (1Ph) High Support	Nos.	3.00		-	-
e	998731		18%		220kV Isolator (3Ph)	Nos.	1.00		-	-
f	998731		18%		220kV Isolator (3Ph) Tandem	Nos.	1.00		-	-
g	998731		18%		220kV LA (1Ph)	Nos.	6.00		-	-
h	998731		18%		220kV BPI (1Ph)	Nos.	11.00		-	-
i	998731		18%		220kV HBPI (1Ph)	Nos.	15.00		-	-
j	998731		18%		33kV CB (2500A) (3 Ph)	Nos.	1.00		-	-
k	998731		18%		33kV CB (1250A) (3Ph)	Nos.	7.00		-	-
l	998731		18%		33kV CT (1Ph)	Nos.	3.00		-	-
o	998731		18%		33kV Isolator (3ph) Tandem	Nos.	4.00		-	-
q	998731		18%		33kV Horn Gap (1ph)	Nos.	6.00		-	-
r	998731		18%		33kV BPI (1Ph)	Nos.	9.00		-	-
s(i)	998731		18%		Backfilling work required to be completed in all respects (as per requirements) for all Towers and Equipments. (Refer Note)	CuM	9,500.00		-	-
s(ii)	998731		18%		Finishing work (including grouting) required to be completed in all respects (as per requirements) for all Towers & Equipments. (Refer Note)	Nos.	228.00		-	-
4.7					**100 KVA D.G. Set: (Excavation, PCC and RCC work completed)**					
a	998731		18%		Balance civil works and finishing works required to be completed in all respects as per approved drawing, TS and site requirements.(Refer Note)	Nos.	1.00		-	-

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1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
5.0					**Design, Engineering and construction of Cable Trench of various sizes and crossings as per drg. given in specification including all civil works, earthwork excavation for all types of soils, concreting (PCC & RCC M25), curing, reinforcement steel, Mild Steel (angles, flats & plates including all, etc.), edge protection angles, backfill and disposable of excess earth, Cable trench covers all complete in all respect as per TS and approved drawing.**					
5.1	995462		18%		Section 1-1	R. Mt	40.00		-	-
5.2	995462		18%		Section 2-2	R. Mt	135.00		-	-
5.3	995462		18%		Section 3-3	R. Mt	155.00		-	-
5.4	995462		18%		Section 4-4	R. Mt	300.00		-	-
6					**Design, Engineering (as per requirement) and Construction of the following buildings inclusive of Excavation in all kinds of soils, PCC, brick masonry, plastering, Shuttering/Scaffolding, curing, internal cable trench, internal and external finishing (including all types of finishing work as per TS & approved drawings), internal water supply, internal and external sanitation, septic tank and soak pit, plinth protection etc. excluding RCC M25 and Reinforcement Steel to be paid separately. complete in all respects as per TS and approved drawing**					
6.1					**Control Room Building (Double Storey): Super structure completed**					
a	995414		18%		Balance civil works and finishing works required to be completed in all respects as per approved drawing, TS and site requirements.(Refer Note)	Nos.	1.00		-	-
6.2					**Fire Fighting Pump House Building (Super Structure completed)**					
a	995414		18%		Balance civil works and finishing works required to be completed in all respects as per approved drawing, TS and site requirements.(Refer Note)	Nos.	1.00		-	-
6.3	995414		18%		**Security Room**	Nos.	1.00		-	-
6.4					**Store Room (Completed up to Plinth level)**				-	-

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1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
a	995414		18%		Balance civil works and finishing works required to be completed in all respects as per approved drawing, TS and site requirements. (Refer Note)	Nos.	1.00		-	-
6.5	995414		18%		Parking shed RCC for 5 Nos. Vehicle	LS	1.00		-	-
7	995414		18%		**Design, Engineering (as per requirements) and Construction of Fire Fighting Water Tank including excavation of all kinds of soil, PCC, Brick masonry (as per requirement), Plastering (as per requirement), Shuttering/Scaffolding, curing, Roof, Pipe Fittings and fixtures, Steel (ISMC, Plates, Purline, Nuts & Bolts and Roofing sheet, etc.) internal and external finishes, etc. excluding, RCC M25 and Reinforcement Steel to be paid separately, complete in all respects as per TS and approved drawing.**	LS	1.00		-	-
8					**Construction of Concrete (RCC M25) road including approach road. All civil works for roads including earthwork excavation, WBM, grading, backfill, disposable of excess earth, concreting (Including PCC & RCC), curing, reinforcement steel, Shoulders as per approved drawing and TS, RCC hume pipe crossings (NP3 Pipe for culverts wherever required as per Drawing, TS and site requirements), etc. all complete in all respect as per TS and approved drawings.**					
8.1	995421		18%		Road 3.75m wide	R. Mtrs	700.00		-	-
8.2	995421		18%		Road 5.5m wide	R. Mtrs	300.00		-	-
9.0					**Design, Engineering (as per requirements) & Construction of Boundary wall including excavation, PCC, Shuttering/Scaffolding, Structural steel, Brick masonary, plastering, curing, painting, barbed wire and concertina coil, etc all complete as per approved drawing & technical specification (2.5 m high R.C.C frame wall as per Drawing and 0.5 m high angle support on top) *including, RCC M25 and Reinforcement Steel* complete in all respects as per TS and approved drawing.**					

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1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
a	995454		18%		Balance work: Fixing of Y angles, Painting and finishing work to be completed in all respects. (**Note.- Excavation, PCC, Plinth Beam, Column, Brickwork and Plasterwork completed**). (Refer Notes)	R. Mtr.	580.00		-	-
b	995454		18%		Excavation, PCC, Plinth Beam, Column, Brick masonry, Plastering work (all civil works), Fixing of Y angles, Painting and finishing works required to be completed in all respects as per drawing, TS and site requirements.	R. Mtr.	320.00		-	-
10.0	995454		18%		**Main boundary wall Gate (Steel):** including all works required to be completed in all respects as per drawings & technical specifications.	No.	1.00		-	-
11 (a)	995477		18%		**Yard chain link fencing:** including excavation, PCC, shuttering, brick masonry work, plastering and finishing work required to be completed in all respects as per drawings & technical specifications.	R.Mts	550.00		-	-
11 (b)	995477		18%		**Fencing Gate:** including all works required to be completed in all respects as per drawings & technical specifications.	No.	1.00		-	-
12.0					**Design and construction of Drainage system including culverts as per approved drawing & TS.**					
a	995462		18%		Section A-A	R.Mtr.	1,300.00		-	-
b	995462		18%		Section B-B	R.Mtr.	410.00		-	-
13.0	995424		18%		**Antiweed treatment**	Sq.mt	12,000.00		-	-
14.0	995454		18%		**75mm thick P.C.C (1:5:10) in Switchyard area**	Sq.mt	12,000.00		-	-
15.0	995433		18%		**Gravel Filling (100 mm Thick)**	Sq. mt	12,000.00		-	-
16.0					**Supplying & laying RCC hume pipe of grade (NP-3) for culverts and cable trench crossings of following dia.**					
a	995421		18%		200mm	R.Mts	10.00		-	-
b	995421		18%		300mm	R.Mts	30.00		-	-
c	995421		18%		450mm	R.Mts	52.00		-	-
17.0					**Supplying and erecting dewatering pumps**					
a	841370		18%		5 HP	No.	2.00		-	-
b	841370		18%		1.0 HP	No.	2.00		-	-
18.0					**Water Supply**				-	
					Providing and Laying GI Pipe (medium duty) for water supply to Control Room, Security Room and Fire fighting Tank as per design & drawing.					
18.1	995462		18%		200mm Dia	Mts.	50.00		-	-
18.2	995462		18%		50mm Dia	Mts.	25.00		-	-

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1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
18.3	995462		18%		40mm Dia	Mts.	40.00		-	-
18.4	995462		18%		25mm Dia	Mts.	50.00		-	-
19.0					**Random rubble Masonary Retaining Wall:**					
a	680221		18%		Construction of Random rubble Masonry Retaining Wall with a hard stone in foundation and plinth including Excavation for a foundation for all types of soils, PCC, Scaffolding, Shuttering (if required), curing, backfill and disposing of excess earth and coping coarse leveling up with cement concrete 1:6:12(1 cement: 6 coarse sand and 12 graded stone aggregate 20mm nominal size) upto plinth level with cement mortar 1:6 (1 cement: 6 coarse sand) as per approved drawing and CPWD Specifications.	CuM	500.00		-	-
b					**Slope Protection:** Design, Engineering & Construction of Slope Protection with Stone Pitching as per CPWD specifications, including Bottom Toe Wall, Top edge protection with Random Rubble Masonary in cement sand mix of 1:6, PCC (1:2:4 or 1:4:8) as per requirement/design ; Drains on slope as per requirement /design					
i	680221		18%		Excavation	CuM	170.00		-	-
ii	680221		18%		PCC 1:2:4	CuM	70.00		-	-
iii	680221		18%		PCC 1:4:8	CuM	530.00		-	-
c	680221		18%		Stone Pitching with Random Rubble Masonary in cement sand mix of 1:6	CuM	1,770.00		-	-
d	680221		18%		Toe Wall with Random Rubble Masonary in cement sand mix of 1:6	CuM	130.00		-	-
20.0					**RCC Retaining Wall:** Design, Engineering (as per requirements) & Construction of RCC Retaining Wall including Excavation for the foundation for all types of soils, PCC, Shuttering/Scaffolding, laying cement concrete in retaining walls, return walls, walls (any thickness) including attached pilasters, columns, piers, abutments, pillars, posts, struts, buttresses, string or lacing courses, parapets, coping, bed blocks, anchor blocks, the cost of cantering, shuttering, and finishing, etc. excluding RCC M25 and Reinforcement Steel to be paid separately, complete in all respects as per TS, approved drawings and site requirements. (Refer Note)					

Sl. No.	(SAC) Service Acounting Code	Whether SAC Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable rate of GST	Description	Unit	Quantity	Unit Erection Charges	Total Erection Charges	Total GST as confirmed by the bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
a	995475		18%		Construction of RCC Retaining Wall -up to 3 mtr high, required to be completed in all respect as per approved drawings, TS and site requirements.	CuM	748.97		-	-
b	995475		18%		Construction of RCC Retaining Wall - above 3 Mtr & up to 5 mtr high, required to be completed in all respect as per approved drawings, TS and site requirements.	CuM	100.00		-	-
21.0	995454		18%		**Rain Water Harvesting**	LS	1.00		-	-
22.0	995454		18%		**Miscellaneous Steel (MS Steel Work with painting)-as per approved drawing, if required**	MT	20.00		-	-
					TOTAL (I)				-	-
II	**LILO of 220kV Udhampur-Gladni**									
1.0					**Survey**					
a	998344		18%		Check Survey	Kms.	5.11		-	-
2.0					**Soil Investigation**					
2.1					Detailed Soil Investigation					
i	998342		18%		All kinds of soil except fissured rock & hard rock	Loc.	4.00		-	-
ii	998342		18%		Fissured Rock	Loc.	3.00		-	-
iii					Hard Rock	Loc.	-		-	-
iv)					River Crossing Location	Loc.	-		-	-
3.0					Erection of various types of towers, tower & Gantry Structures, parts and tower extensions (complete) with bolts and nuts, including tack welding and supply and application of zinc-rich primer and two coats of enamel paint					
a	998342		18%		Normal Tower	MT	220.00		-	-
b					River Crossing Tower	MT	-		-	-
4.0	998342		18%		Erection of Solar Power LED Lighting System marking for Obstruction Marking 0f 220 KV Transmission Line compromising one medium intensity and 2 low-intensity lights, solar panels, maintenance-free battery, astronomical time switch, control panel, solar charger, Complete with interconnecting cables, mounting hardware, cover fort battery, charger and all allied accessories.	Nos.	13.00		-	-
5.0	998342		18%		Erection Aircraft Warning sphere span marker 600 mm dia colour (Full/half) , White/Orange	Nos.	37.00		-	-
6.0	998342		18%		Providing/Applying Primer for Tower upper - two stories including cross arms to be applied before painting for daytime aviation obstruction structure marking.	Nos.	13.00		-	-

Sl. No.	(SAC) Service Acounting Code	Whether SAC Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable rate of GST	Description	Unit	Quantity	Unit Erection Charges	Total Erection Charges	Total GST as confirmed by the bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
7.0	998342		18%		Providing /Applying Grade A aviation marker paint (Red/Orange/White)for tower's upper two stories including cross arm for daytime aviation obstruction marking	Nos.	13.00		-	-
8.0					**Benching**					
i	995432		18%		All kinds of soil except fissured rock & hard rock	CUM	2,000.00		-	-
ii	995432		18%		Fissured Rock	CUM	500.00		-	-
iii	995433		18%		Hard Rock	CUM	100.00		-	-
9.0					**Work associated with tower foundations (excluding river crossing foundations)**					
9.1					**Excavation in various type of Soils**					
i	995433		18%		Dry Soil	CUM	1,500.00		-	-
ii	995433		18%		Wet Soil	CUM	500.00		-	-
iii	995433		18%		Dry fissured Rock	CUM	500.00		-	-
9.2					**Concreting (including all associated works related to foundation not covered in 5.1 & 5.3)**					
i	995454		18%		Nominal Concrete mix 1:1.5:3	CUM	260.00		-	-
ii	995454		18%		Nominal Concrete mix 1:3:6	CUM	60.00		-	-
9.3	995454		18%		**Supply and placement of reinforcement steel**	MT	25.00		-	-
9.4	995455		18%		**Installation of stub including bolts & nuts**	MT	11.00		-	-
10.0	995456				**Protection of tower Footings (supply and installation)**					
a	995456		18%		Random rubble stone masonry including excavation (1:5 cement mortar), PCC 1:2:4 at top of RR walls and foundations, backfilling and gap leveling complete as per approved drawing.	CUM	750.00		-	-
b	995456		18%		Revetment of pack 6" & above stone/boulders in heavily coated GI 4mm dia performed wire mesh size 100 mmx100mm as per approved drawing	CUM	50.00		-	-
11.0					**installation of Earthing for towers**					
a	995468		18%		Pipe type earthing	Nos	40.00		-	-
b	995468		18%		Counterpoise type earthing	Nos	2.00		-	-
c					Shielding Earthwire including PG clamps, downlead clamps and earthwire bits					
i	995468		18%		Pipe type earthing	Nos.	2.00		-	-
ii	995468		18%		Counterpoise type	Nos.	1.00		-	-
d					River crossing tower	Kgs.	-		-	-
12.0					**Installation of tower accessories**					
i	995444		18%		Danger plate	Nos.	24.00		-	-
ii	995444		18%		Number plate	Nos.	24.00		-	-
iii	995444		18%		Phase Plate (Set of three)	Sets.	48.00		-	-
iv	995444		18%		Circuit Plate (Set of two)	Sets	23.00		-	-
v	995444		18%		Anticlimbing device	Nos.	25.00		-	-
vi	995444		18%		Bird Guards (Set of three)	Sets.	-		-	-

Sl. No.	(SAC) Service Acounting Code	Whether SAC Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable rate of GST	Description	Unit	Quantity	Unit Erection Charges	Total Erection Charges	Total GST as confirmed by the bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
13.0					Installation of insulator strings complete with arcing horns and necessary hardware, installing and stringing of conductor including fixing of conductor accessories, installing and stringing of earthwire/OPGW including fixing of earthwire/OPGW accessories for the line.					
					Normal Strech					
a)	995444		18%		Single circuit	Kms.	0.50		-	-
b)	995444		18%		Double circuit	Kms.	5.50		-	-
c)					River Crossing stretch(Double Circuit)	Kms	-		-	-
					TOTAL (II)				-	-
III)	**Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at 220/33 kV Substation Nagrota (Jammu)**									
1					**Civil Works- Architecture, Design, Engineering (As per requirements), including procurement and subcontracting (if any), delivery, Contouring and site leveling (as per requirements), Excavation, PCC, brick masonry, plastering, plinth protection, internal and external finishing (including all types of finishing work as per TS & approved drawings), installation and completion of all facilities, excluding RCC M25 and Reinforcement Steel to be paid separately for following residential staff quarters, complete in all respects as per TS and approved drawing.**					
1.1	995414		18%		**JEs Quarter -4 nos.** (1 Unit of 2 GF+2FF with common stairs)	Nos.	1.00		-	-
1.2	995414		18%		**SBA's Quarter - 8 Nos.** (2 Units of 2 GF + 2 FF each with Common Stairs)	Nos.	2.00		-	-
1.3					**AE/AEE Quarter-1 No.** (1 Nos.. Single Storey): **Super structure completed.**					
a	995414		18%		Balance civil works and finishing works required to be completed in all respects as per approved drawing, TS, and site requirements. (Refer Note)	Nos.	1.00		-	-
1.4	995414		18%		Santry/Security Post	Nos.	1.00		-	-

Sl. No.	(SAC) Service Acounting Code	Whether SAC Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable rate of GST	Description	Unit	Quantity	Unit Erection Charges	Total Erection Charges	Total GST as confirmed by the bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
2	995414		18%		**Septic tank and soakpit for a township :** (Design, Engineering and Construction of Structures. All civil works including earthwork excavation for all types of soils, PCC, Shuttering/Scaffolding, curing, other miscellaneous steel work, backfill and disposable of excess earth, all complete in all respects **including RCC M25 and Reinforcement Steel** as per TS and approved drawing.)	LS	1.00		-	-
3	995414		18%		Providing and laying of SW pipes for external sewerage system as per technical specification & approved design in all sizes 100 mm, 200 mm, and 300 mm including construction of inspection chambers as per approved design, drawings, TS and as per site requirements.	LS	1.00		-	-
4	995414		18%		External water supply arrangement (including all as per site requirements i.e.pipes, fittings, chambers, etc.) as per approved design, drawings and TS for colony & other buildings, etc.	LS	1.00		-	-
5	995414		18%		Underground water storage tank of approved size and capacity, Civil Works-Architecture, Design, Engineering, including procurement and subcontracting (if any), delivery, Excavation, PCC, installation and completion of the facilities and **including RCC M25 and Reinforcement Steel** for colony & other buildings.	LS	1.00		-	-
6					**Providing and laying in position plain cement concrete of specified grade excluding the cost of centering and shuttering- All work up to plinth level: as per drawing and TS** (only applicable for other miscellaneous work as per requirements).**(for both substation and residential quarters)**					
a	995414		18%		Providing and laying of Plain Cement Concete 1:2:4	CuM	105.00		-	-
b	995414		18%		Providing and laying of Plain Cement Concete 1:4:8	CuM	100.00		-	-
c	995414		18%		Providing and laying of Plain Cement Concete 1:5:10	CuM	50.00		-	-

Sl. No.	(SAC) Service Acounting Code	Whether SAC Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable rate of GST	Description	Unit	Quantity	Unit Erection Charges	Total Erection Charges	Total GST as confirmed by the bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
7	995414		18%		**Providing and laying of Reinforcement Cement Concrete M25 mix including pre-cast, including shuttering, Grouting of Pockets, & underpinning but excluding steel reinforcement as per drawing and TS** (also applicable for other miscellaneous works, as per requirements): **(for both substation and residential quarters)**	CuM	2,235.00		-	-
8					**Steel Reinforcement for RCC work including straightening, cutting, bending, placing in position and binding all complete up to floor V level as per drawings and TS** (also applicable for other miscellaneous work as per requirements). **(for both substation and residential quarters)**					
a	721420		18%		(Thermo-Mechanically Treated bars of Grade Fe-500D or more)	MT	251.00		-	-
9	995431		18%		Demolishing RCC work including stacking of steel bars and disposal of unserviceable material **(for both substation and residential quarters)**	CuM	30.00		-	-
10	995431		18%		Dismantling of existing boundary wall, stacking of steel, barbed wire, bricks and other usable materials including disposal of unserviceable material. **(for both substation and residential quarters)**	R. Mtr.	50.00		-	-
11	995431		18%		Disposal of excess and unserviceable soil as per site requirement (anywhere at site). **(for both substation and residential quarters)**	CuM	3,000.00		-	-
12	995414		18%		RCC Culverts including supply and laying hume pipe 450 mm dia of grade (NP-3) excluding concrete as per drawing & TS.	R. Mtr.	50.00		-	-
13	995414		18%		Bore well (any location at the site) for water supply in a water tank and all substation buildings including all complete work in all respects as per design, drawing, TS and site requirements. ***(The said borewell is for the supply of water for daily use after completion of a project and not for construction purposes)***	LS	1.00		-	-
14	0602 20		18%		Ornamental Works such as development of lawns and landscaping	LS	1.00		-	-

Sl. No.	(SAC) Service Acounting Code	Whether SAC Code in Column '2' is confirmed. If not indicate applicable	Rate of GST Applicable (%)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable rate of GST	Description	Unit	Quantity	Unit Erection Charges	Total Erection Charges	Total GST as confirmed by the bidder
1	2	3	4	5	6	7	8	9.00	10=8x9	11.00
15					**Electrical Works- Design, Engineering, procurement, delivery, erection, testing and commissioning of the facilities for following job works:-**					
15.1	995414		18%		Construction of 1 x **160** KVA, 11/0.433 kV Distribution transformer along with 11kV isolator, horn gap fuse, Bus Post Insulator and Surge arrestors for LT Station along with 415 V, 400A Township DB, etc in complete as required.	LS	1.00		-	-
15.2	853720		18%		Electrical Panel/Sub- Panel as per the works requirement in complete.	LS	1.00		-	-
15.3	853720		18%		Internal & External Wiring for Power & light points including DB, switchboard, etc in complete with proper earthing as per works requirement.	LS	1.00		-	-
15.4	853720		18%		Ceiling Fan, 1400 mm sweep in complete.	LS	1.00		-	-
15.5	853720		18%		Lighting Fixture LED Luminaires type as per illumination level required for the indoor building lightening etc in complete.	LS	1.00		-	-
15.6	853720		18%		LED Street Light Luminaire as per illumination level required for the street in complete as required.	LS	1.00		-	-
16	853720		18%		**Power & Control cable/wiring including earthing, DB, timer, Street lighting Pole, etc for street light as required all complete in all respects as per drawing.**	LS	1.00		-	-
TOTAL (III)									-	-
Grand Total of Schedule-3(I+II+III)									-	-
TOTAL GST Tax as confirmed by Bidder										-
Note :	*Those Buildings/Structures (including all) have been partially completed (up to Raft, Column, Plinth Beam, Super structure, etc.). Bidders may visit the site and assess the quantum of work to be carried out to complete the balance work.*									
Date :	__\01\2024						Printed Name :	-		
Place :	0						Designation:	-		

Tender NIT No. RECPDCL/PIA/JKPTCL/SS & LILO-I	Schedule - 4

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

Click to Sch. 5

(SCHEDULE OF RATES AND PRICES: TRAINING CHARGES)

Bidder's Name and Address :		To:
Name :	0	REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC, a 'Navratna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001, Website: www.recpdcl.in
Address :	0	

TRAINING CHARGES

PRICE COMPONENT OF TRAINING TO BE IMPARTED TO OWNER'S PERSONNEL BY BIDDER'S INSTRUCTOR

All Prices are in Indian Rupees.

Sl. No.	SAC (Service Accounting Codes)	Whether SAC Code in Column '2' is confirmed. If not indicate applicable	Rate of GST applicable (in %)	Whether Rate of Interest in Column '4' is confirmed. If not indicate applicable rate of GST	Description	Unit	Quantity	Unit Charges	Total Training Charges excluding GST	Total GST as confirmed by the bidder
1	2	3	4	5	6	7	8	9	10=8x9	11
I					220/33KV NAGROTA SUBSTATION					
1			18%		Training of employers personnel as per clause 10 of section project	LS	1		-	-
2			18%		Design Operation Maintenance including procedures for fault attending for the Power Transformer, Circuit Breaker, Isolators, Instrument Transformers, Relay & Protection system at manufacturer's/suppliers work for 20 personnel of Owner for 5 days.	MND	100		-	-
3			18%		FO-based communication equipment at manufacturers/suppliers work for 10 personnel of Owner for 5 days.	MND	50		-	-
II					LILO of 220kV Gladni-Udhampur					
1			18%		Training to staff of the Company and certification to its trained personnel for carrying out each activity of the Transmission Line Project for 20 personnel of Owner for 5 days.	MND	100		-	-
	Total Training Charges (I+II)								-	-
	Total GST as confirmed by bidder (I+II)									-

1 All reasonable expenses for trainees including the round trip airfare up to the manufacturer's plant, the food & hotel accommodation charges and local travel during their stay for the training period, accommodation for the Instructor(Trainer) and Training material for the Trainees shall be included in the prices quoted by the bidder

2 * In case the bidder leaves the cell for confirmation of the HSN code and/or GST rate "blank", the HSN code and corresponding GST rate indicated by the Employer shall be deemed to be the one confirmed by the Bidder.

3 For training at site, the bidder shall considered the expenses of the instructor (Trainer) only

Date __\01\2024 **Printed Name:** 0

Place 0 **Designation :** 0

Tender NIT No. RECPDCL/PIA/JKPTCL/SS & LILO-I	Schedule-5

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

Click to Sch. 7

SUMMARY OF TAXES & DUTIES APPLICABLE ON PLANT & EQUIPMENT

Bidder's Name and Address :		To: REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC, a 'Navratna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001, Website: www.recpdcl.in
Name :	0	
Address :	0	

All Prices are in Indian Rupees.

Sl. No.	Item Nos.	Total Price (INR)
1	**TOTAL GST ON GOODS**	
	Total GST for Supply of Goods (inter-alia including Type Test Charges) between the Contractor and the Employer (identified in Schedule 1') which are not included in the Ex-works price as per the provision of the Bidding Documents, as applicable.	0
2	**TOTAL GST ON SERVICES**	
	Total GST on Installation Services (Schedule-3) and Training to be imparted in India (Schedule-4)	0
	GRAND TOTAL [1+2]	-

Date : __\01\2024 **Printed Name:** **0**

Place : **0** **Designation :** **0**

Tender NIT No. RECPDCL/PIA/JKPTCL/SS & LILO-I	Schedule-6

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

(GRAND SUMMARY)

Bidder's Name and Address :		To: REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC, a 'Navratna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001, Website: www.recpdcl.in
Name :	0	
Address :	0	

Sl. No.	**Description**	**Total Price (INR)**
1	**TOTAL SCHEDULE NO. 1**	**0.00**
	Ex-works price of Plant and Equipment including Type Test Charges	
2	**TOTAL SCHEDULE NO. 2**	**0.00**
	Local Transportation, In-transit Insurance, loading and unloading	
3	**TOTAL SCHEDULE NO. 3**	**0.00**
	Installation Charges	
4	**TOTAL SCHEDULE NO. 4**	**0.00**
	Training Charges	
5	**TOTAL SCHEDULE NO. 5**	**0.00**
	Taxes and Duties	
6	**TOTAL SCHEDULE NO. 7**	**0.00**
	Type Test Charges: **NOT APPLICABLE** [Total of this Schedule is included in Schedule - 1 above.]	
	GRAND TOTAL [1+2+3+4+5]	**0.00**

Date : __\01\2024 **Printed Name :** 0

Place : 0 **Designation :** 0

Tender NIT No. RECPDCL/PIA/JKPTCL/SS & LILO-I	Schedule-6(After Discount)

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

(GRAND SUMMARY: AFTER DISCOUNT)

Bidder's Name and Address :		To: REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC, a 'Navratna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001, Website: www.recpdcl.in
Name :	0	
Address :	0	

Sl. No.	Description	Total Price (INR)
1	**TOTAL SCHEDULE NO. 1**	**0.00**
	Ex-works price of Plant and Equipment including Type Test Charges	
2	**TOTAL SCHEDULE NO. 2**	**0.00**
	Local Transportation, In-transit Insurance, loading and unloading	
3	**TOTAL SCHEDULE NO. 3**	**0.00**
	Installation Charges	
4	**TOTAL SCHEDULE NO. 4**	**0.00**
	Training Charges	
5	**TOTAL SCHEDULE NO. 5**	**0.00**
	Taxes and Duties	
6	**TOTAL SCHEDULE NO. 7**	**0.00**
	Type Test Charges: **NOT APPLICABLE** [Total of this Schedule is included in Schedule - 1 above.]	
	GRAND TOTAL [1+2+3+4+5]	**0.00**

Date :	__\01\2024	**Printed Name :**	0
Place :	0	**Designation :**	0

Tender NIT No. RECPDCL/PIA/JKPTCL/SS & LILO-1			Schedule-7

Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15

(SCHEDULE OF RATES AND PRICES)

Bidder's Name and Address :		To: REC Power Development and Consultancy Limited (A wholly owned subsidiary of REC, a 'Navratna CPSE' Under the Ministry of Power, Govt of India) D- Block, REC Corporate Headquarter, Plot No. I-4, Sector-29, Gurugram (Haryana)-122001, Website: www.recpdcl.in
Name :	0	
Address :	0	

TYPE TESTS CHARGES

All Prices are in Indian Rupees.

Sl. No.	HSN Code	Rate of GST Applicable (%)	Item Description	Unit	Qty.	Unit Ex-works price(excluding GST)	Total Ex-works price(excluding GST)
1	2	3	4	5	6	7	8= 6x7
NOT APPLICABLE							

Date:	__\01\2024		**Printed Name :**	0			
Place :	0		**Designation :**	0			

LETTER OF DISCOUNT

To:
REC Power Development and Consultancy Limited
(A wholly owned subsidiary of REC, a 'Navratna CPSE'
Under the Ministry of Power, Govt of India)
D- Block, REC Corporate Headquarter,
Plot No. I-4, Sector-29, Gurugram (Haryana)-122001,
Website: www.recpdcl.in

Subject: **Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15**

Dear Sir

With reference to the subject tender, we hereby offer unconditional discount on the prices quoted by us as per details given here below :

	4	Discount on lum-sum basis on the Schedules as given below : [The discount shall be proportionately applicable on all the relevent items of the respective Schdules.] In Percent (%)		
		Schedule-1: Ex Works prices	In Percent %	10.00%
		Schedule-2 : Freight & Insurance	In Percent %	10.00%
		Schedule-3 : Erection Charges	In Percent %	10.00%
		Schedule-4 : Training Charges	In Percent %	10.00%
		Schedule-7 : Type Test Charges	In Percent %	**Not Applicable**
Please consider this letter of discount as the integral part of our price bid.				
			Yours faithfully,	
			For and on behalf of	
Date :		__\01\2024	**Printed Name :**	0
Place :		0	**Designation :**	0

Bid Form 2nd Envelope

BID FORM (Second Envelope)

Bid Proposal Ref. No.	_____/RECPDCL/2023-24/____
Date :	

To,
Chief Executive Officer,
REC Power Development and Consultancy Limited
(A wholly owned subsidiary of REC, a 'Navratna CPSE'
Under the Ministry of Power, Govt of India)
D- Block, REC Corporate Headquarter,
Plot No. I-4, Sector-29, Gurugram (Haryana)-122001,
Website: www.recpdcl.in

Name of Contract :	**Balance construction work of 2X50 MVA, 220/33 kV Nagrota (New) substation including LILO of 220kV Udhampur-Gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP Scheme-15**

Dear Ladies and/or Gentlemen,

1.0	In continuation of First Envelope of our bid, we hereby submit the Second Envelope of the Bid, both of which shall be read together and in conjuction with each other, and shall be construed as an integral part of our Bid. Accordingly, we the undersigned, offier to design, manufacture, test, delier, install and commission (including carrying out Trial Operation, Performance & Guarantee Test as per provision of Technical Specification) under the above named package in full conformity with the said Bidding Documents for the sum of Rs (in the below mentioned cells) or such othersums as may be determined in accordance with the terms and conditions of the Bidding Documents. The above amounts are in accordance with the price schedules attached herewith and are made part of this bid.		
	0.00	**Fill the amount in words**	
2.0	**Price Schedules**		
2.1	In line with the requirements of the Bidding documents, we enclose herewith the following Price Schedules, duly filled - in as per your proforma:		
	Schedule 1	Plant and Equipment (Including Mandatory Spare Parts) to be supplied.	
	Schedule 2	Local Transportation, In-transit Insurance, loading and unloading	
	Schedule 3	Installation Charges.	
	Schedule 4	Training charges for training to be imparted.	
	Schedule 5	GST not included in Schedule 1 & 3	
	Schedule 6	Grand Summary [Schedule 1 to 5]	
	Schedule 7	Break-up of Type Test Charges for Type Tests to be conducted (NOT APPLICABLE)	
2.2	We are aware that the Price Schedules do not generally give a full description of the Work to be performed under each item and we shall be deemed to have read the Technical Specifications and other sections of the Bidding Documents and Drawings to ascertain the full scope of Work included in each item while filling-in the rates and prices. We agree that the entered rates and prices shall be deemed to include for the full scope as aforesaid, including overheads and profit.		
2.3	We declare that as specified in Clause 11.5, Section –II:ITB, Vol.-I of the Bidding Documents, prices quoted by us in the Price Schedules shall be subject to Price Adjustment during the execution of Contract in accordance with Appendix-2 (Price Adjustment) to the Contract Agreement.		

2.4	We understand that in the price schedules, where there are errors between the total of the amounts given under the column for the price Breakdown and the amount given under the Total Price, the former shall prevail and the latter will be corrected accordingly. We further understand that where there are discrepancies between amounts stated in figures and amounts stated in words, the amount stated in words shall prevail. Similarly, any discrepancy in the total bid price and that of the summation of Schedule price (price indicated in a Schedule indicating the total of that schedule), the total bid price shall be corrected to reflect the actual summation of the Schedule prices.
2.5	We declare that items left blank in the Schedules will be deemed to have been included in other items. The TOTAL for each Schedule and the TOTAL of Grand Summary shall be deemed to be the total price for executing the Facilities and sections thereof in complete accordance with the Contract, whether or not each individual item has been priced.
3.0	We confirm that except as otherwise specifically provided our Bid Prices in this Second Envelope include all GST and charges as may be assessed on us/our Associate (applicable for Foreign Bidder), our Sub-Contractor/Sub-Vendor or their employees by all municipal, state or national government authorities in connection with the Facilities, in and outside of India.
3.1	100% of applicable GST which are payable by the Employer under the Contract, shall be reimbursed by the Employer on production of satisfactory documentary evidence by the Contractor in accordance with the provisions of the Bidding Documents.
3.2	We further understand that notwithstanding 3.0 above, in case of award on us, you shall also bear and pay/reimburse to us, GST applicable on supplies by us to you, imposed on the Plant & Equipment including Mandatory Spare Parts to be incorporated into the Facilities including Type Test charges for Type test to be conducted specified in Schedule No. 1, Installation Services specified in Schedule No. 3 and Charges for Training to be imparted specified in Schedule No. 4 of the Price Schedule in this Second Envelope by the Indian Laws.
3.3	We confirm that we have also registered/we shall also get registered in the GST Network with a GSTIN, in all the states where the project is located and the states from which we shall make our supply of goods.
4.0	# (For Joint Venture only) We, the partners of Joint Venture submitting this bid, do agree and confirm that in case of Award of Contract on the Joint Venture, we shall be jointly and severally liable and responsible for the execution of the Contract in accordance with Contract terms and conditions.
5.0	We, hereby, declare that only the persons or firms interested in this proposal as principals are named here and that no other persons or firms other than those mentioned herein have any interest in this proposal or in the Contract to be entered into, if the award is made on us, that this proposal is made without any connection with any other person, firm or party likewise submitting a proposal is in all respects for and in good faith, without collusion or fraud.

Thanking you, we remain,				
			Yours faithfully,	
			For and on behalf of	
			Signature :	
Date :	**___\01\2**		**Printed Name :**	0
Place :	0		**Designation :**	0

In case of bid from a Joint Venture, name & designation of representative of JV partner is to be provided and Bid Form

Printed Name :		
Designation :		

Please provide additional information of the Bidder

Business Address :	
Country of Incorporation :	
State/Province to be indicated :	
Name of Principal Officer :	
Address of Principal Officer :	

Design & Engineering by:-AUPTC

GENERAL ARRANGEMENT LAYOUT PLAN OF 2X50 MVA, 220/33 kV NAGROTA NEW AIS GRID SUB-STATION

LINE Direction

220KV Dead End Tower

Catagories
Approved/ Issued/ for Fabrication/Construction/Manufacturing.
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing subject to comortion that statements and comments are included.
Please submit the revised documents for approval.
III. For Information and record.
V. Not approved.

(Signature)
(Designation)
(Date)

ZONE-1
ZONE-2
ZONE-3
ZONE-4

LINE-1
LINE-2
ICT-1
TBC
ICT-2
BC
FUTURE

P1
P2
P3
P4
P1'
P4'

R35174
R29411
R51357
R39672
R28411
R38130
R50000
R43942
R13000

FGL: 370
FGL: 363
FGL: 361
FGL: 352
FGL: 349
FGL: 348

LM-1
LM-2
LM-3

PARK AREA
AREA FOR STORE
5 PARKING
SECURITY ROOM
BORE WELL
Main Gate
PEER BABA
Fence Gate
TOE WALL
NATURAL SLOPE
Up to 6m slope Protection 1:1
upto 10m slope Protection 1:1
Up to 4.5m slope Protection 1:1
3.5m RCC RETAINING WALL
6m RRM RETAINING WALL

CONSTRUCTION LINE
BOUNDARY LINE

APPROACH ROAD

TBM
RL. 350.396

NH 44
<<< UDHAMPUR
JAMMU >>>
JAMMU

227264
174556
186070
55000
80000
29966
2669
17883
22955
13874
13582
11594
8647
8877
9473
12167
53069
33254
14056
11228
9930
8019
6329

PEC Power Development And Consultancy Ltd. * Gurugram-122001 *

CN-1503708

LEGENDS

220kV
HEIGHTS FROM FGL NEED TO BE PROTECTED
220KV BUSBAR HEIGHT:-12m
220KV JACK BUS/LIVE CONDUCTOR HEIGHT:-16.6m
220KV EQUIPMENT HEIGHT:-6.2m

33kV
HEIGHTS FROM FGL NEED TO BE PROTECTED
33kV BUSBAR HEIGHT:-5.8m
33kV JACK BUS/LIVE CONDUCTOR HEIGHT:-7.6m
33kV EQUIPMENT HEIGHT:-4.3m

- ZONE OF PROTECTION AT HEIGHT OF 80M (220kV BUS BAR) ABOVE REF. GROUND LEVEL BY LM-1. CONSIDER LM-1 HEIGHT BY ADDING FGL DIFFERENCE(7M) WITH ACTUAL HEIGHT(50.3M). (TOTAL LM-1 HEIGHT=50.3M+7M=57.3M) FROM REFERENCE FGL +363M AND 220kV BUS BAR HEIGHT BY ADDING FGL DIFFERENCE OF 7M WITH ACTUAL HEIGHT (12M) FROM REFERENCE FGL +363M.
- ZONE OF PROTECTION AT HEIGHT OF 20M (220kV BUS BAR) ABOVE REF. GROUND LEVEL BY LM-2 AND FACTIOUS POINT P1. CONSIDER LM-2 AND P1 HEIGHT 50.3 FROM REFERENCE FGL +363M AND 220kV BUS BAR HEIGHT BY ADDING FGL DIFFERENCE OF 7M WITH ACTUAL HEIGHT (12M) FROM REFERENCE FGL +363M.
- ZONE OF PROTECTION AT HEIGHT OF 14M (220kV BUS BAR) ABOVE REF. GROUND LEVEL BY LM-2. CONSIDER LM-2 HEIGHT BY ADDING FGL DIFFERENCE(2M) WITH ACTUAL HEIGHT(50.3M). (TOTAL LM-2 HEIGHT=50.3M+2M=52.3M) FROM REFERENCE FGL +361M AND 220kV BUS BAR HEIGHT BY ADDING FGL DIFFERENCE OF 2M WITH ACTUAL HEIGHT (12M) FROM REFERENCE FGL +361M.
- ZONE OF PROTECTION AT HEIGHT OF 14M (220kV BUS BAR) ABOVE REF. GROUND LEVEL BY LM-3 AND FACTIOUS POINT P2. CONSIDER LM-3 AND P1 HEIGHT 50.3 FROM REFERENCE FGL +361M AND 220kV BUS BAR HEIGHT BY ADDING FGL DIFFERENCE OF 2M WITH ACTUAL HEIGHT (12M) FROM REFERENCE FGL +361M.
- ZONE OF PROTECTION AT HEIGHT OF 5.8M (33kV BUS BAR) ABOVE REF. GROUND LEVEL BY LM-2. CONSIDER LM-2 HEIGHT BY ADDING FGL DIFFERENCE(2M) WITH ACTUAL HEIGHT(50.3M). (TOTAL LM-1 HEIGHT=50.3M+2M=52.3M) FROM REFERENCE FGL +361M AND 33kV BUS BAR HEIGHT IS 12M FROM REFERENCE FGL +361M.
- ZONE OF PROTECTION AT HEIGHT OF 5.8M (33kV BUS BAR) ABOVE REF. GROUND LEVEL BY LM-3 AND FACTIOUS POINT P3. CONSIDER LM-3 AND P3 HEIGHT 50.3 FROM REFERENCE FGL +361M AND 33kV BUS BAR HEIGHT IS 12M FROM REFERENCE FGL +361M.
- ZONE OF PROTECTION AT HEIGHT OF 10M (33kV DP STR) ABOVE GROUND LEVEL BY LM-3(50.3M) FROM REFERENCE FGL +361M.
- ZONE OF PROTECTION AT HEIGHT OF 16.6M (220kV JACK BUS/LIVE CONDUCTOR) ABOVE GROUND LEVEL BY SHIELD WIRE.
- ZONE OF PROTECTION AT HEIGHT OF 7.6M (33kV JACK BUS/LIVE CONDUCTOR) ABOVE GROUND LEVEL BY SHIELD WIRE.

NOTE

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. REFER DRAWING No.:- KDBIL/250 PJ/20-21/D1/03 FOR ELECTRICAL LAYOUT(GA) DRAWING FOR DETAIL DIMENSION.
3. REFER DRAWING No.:- KDBIL/250 PJ/20-21/D1/16C FOR DESIGN CALCULATION OF DSLP.
4. HEIGHT OF LIGHTNING MASTS SHALL BE (0.3M+60M).
5. DOWN CONDUCTOR SHALL BE CLEATED AT EVERY 2000MM INTERVAL.
6. LIGHTNING PROTECTION OF BUILDINGS(FFTH, TOWNSHIP/BUILDING, CONTROL ROOM BUILDING, CAR PARKING SHADE WILL BE SUBMITTED SEPARATELY.
7. POINT P1,P2 AND P3 ARE FICTITIOUS POINT DERIVE FROM TWO LM METHOD WITH DIFFERENT HEIGHT.

SCHEDULE OF TBM MARKING

TBM MARK	EASTING	NORTHING	LEVEL
TBM	5059.38	2226.51	350.396

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited (RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	DSLP DRAWING OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/16	REV- 01	
SCALE	As shown in Drawing	SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM		

	NAME	DATE	SIGN
PREPARED BY	MANOJ	04.02.2022	
CHECKED BY	G.H	04.02.2022	
SUBMITTED BY	KDBIL	04.02.2022	Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....

Kailash Devbuild (India) Pvt. Ltd. * Jabalpur *

Design & Engineering by:-AUPTC

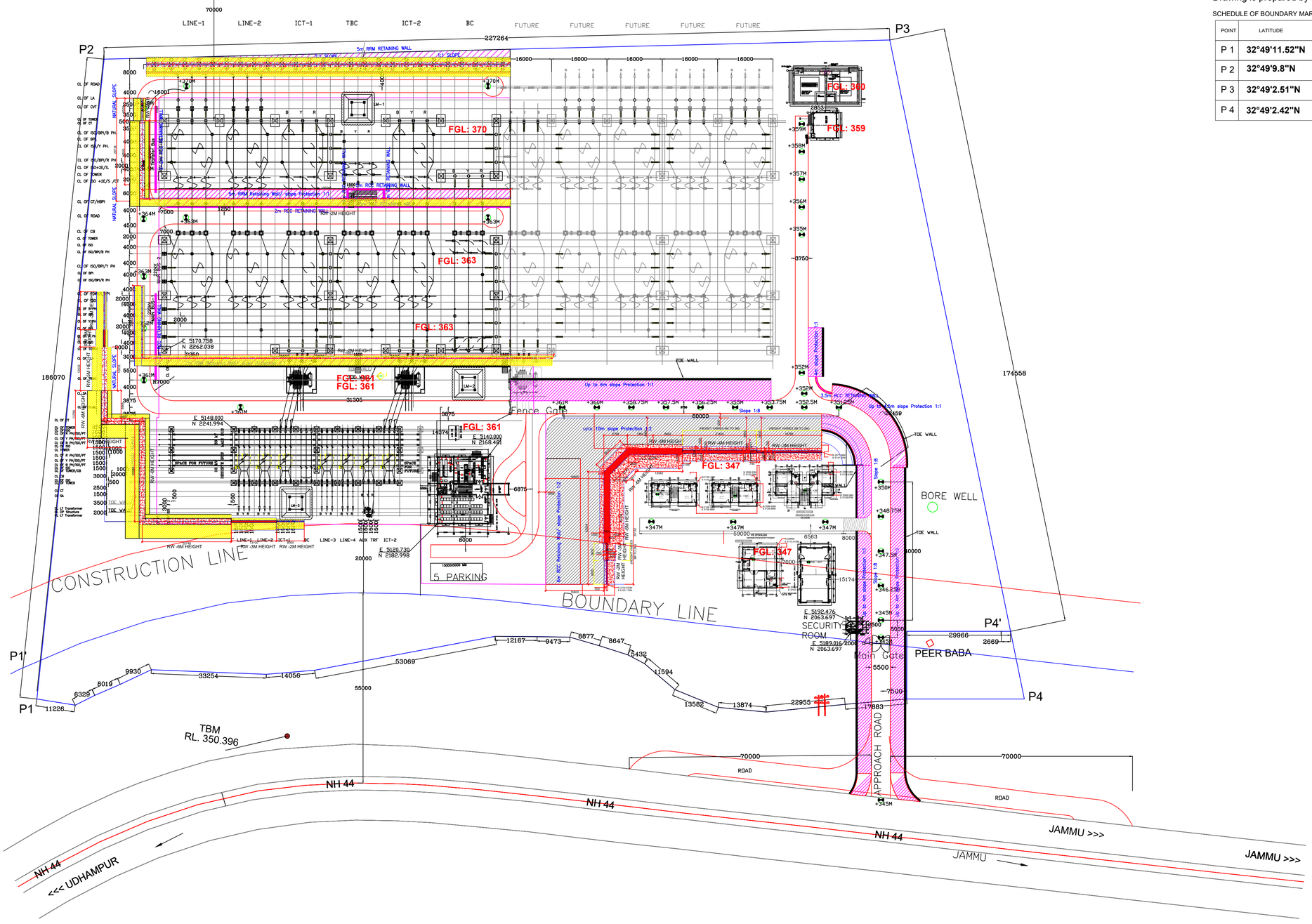
Design & Engineering by:- AUPTC

GENERAL ARRANGEMENT LAYOUT PLAN OF 2X50 MVA, 220/33 kV NAGROTA NEW AIS GRID SUB-STATION

LINE Direction

220KV Dead End Tower

SITE / CONTOUR PLAN OF 2 X 50 MVA, 220 / 33 KV, AIS GRID SUB-STATION NAGROTA, JAMMU



Drawing is prepared by Local Co-ordinates

SCHEDULE OF BOUNDARY MARKING

POINT	LATITUDE	LONGITUDE	EASTING	NORTHING	LEVEL
P 1	**32°49'11.52"N**	**74°53'56.94"E**	5069.98	2298.89	348.08
P 2	**32°49'9.8"N**	**74°54'3.8"E**	5255.04	2279.45	374.32
P 3	**32°49'2.51"N**	**74°54'2.18"E**	5260.58	2052.25	354.23
P 4	**32°49'2.42"N**	**74°53'55.46"E**	5088.88	2017.67	343.00

SCHEDULE OF TBM MARKING

TBM MARK	EASTING	NORTHING	LEVEL
TBM	5059.38	2226.51	350.396

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-jiadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NDA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	CONTOUR GA SUPERIMPOSE OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/02 — REV- 09
SCALE	As shown in Drawing
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN	
PREPARED BY	MANOJ	09.09.2021		R C BANSAL
CHECKED BY	G.H	09.09.2021		
SUBMITTED BY	Mr.JITENDRA	09.09.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

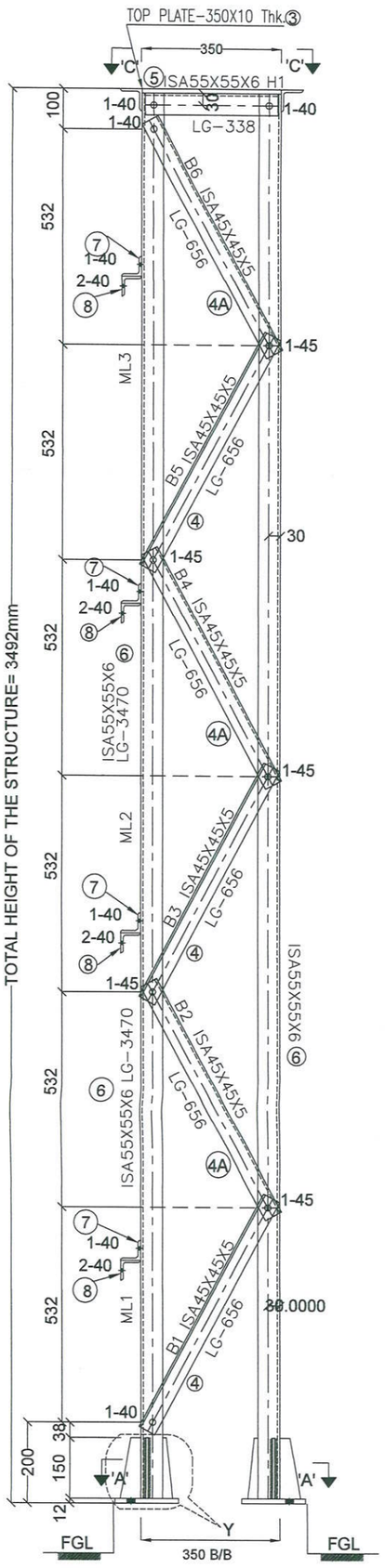
☐ More Information Date.....

Design & Engineering by:- AUPTC

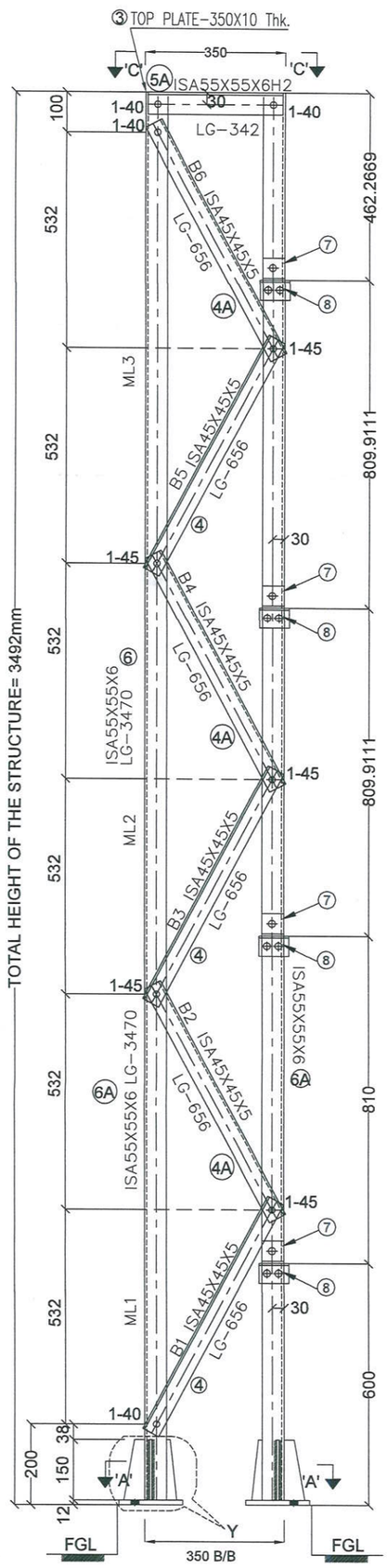
BILL OF MATERIAL

SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 160X12	160	160	94.20	2.412	4	9.646
2	2	PL 52X6	150	52	47.10	0.367	16	5.878
3	3	PL 350x10	350	350	78.50	9.616	1	9.616
4	4	L45X45X5	656		3.40	2.23	12	26.765
5	4A	L45X45X5	656		3.40	2.230	12	26.765
6	5	L55X55X6	338		4.90	1.656	2	3.312
7	5A	L55X55X6	342		4.90	1.676	2	3.352
8	6	L55X55X6	3470		4.90	17.003	2	34.006
9	6A	L55X55X6	3470		4.90	17.003	2	34.006
10	7	L55X55X6	55		4.90	0.270	8	2.156
11	8	L55X55X6	75		4.90	0.368	8	2.940
					WT. OF STRUCTURE (kg.) =			158.44

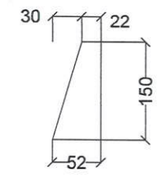
TOTAL LIST OF BOLTS & NUTS						
12		M16x40 mm Bolts & Nuts		0.125	44	5.50
13		M16x45 mm Bolts & Nuts		0.132	20	2.64
14		M-16-3.5 THK SPRING WASHER		0.009	64	0.58
15		M12X100 LG. FOR EQPT. MOUNTING		0.118	4	0.472
16		M-12-3.5 THK SPRING WASHER		0.003	4	0.012
				TOTAL WEIGHT OF HARDWARE (kg)=		9.20
				TOTAL WEIGHT OF STRUCTURE WITH HARDWARE (kg) =		167.64



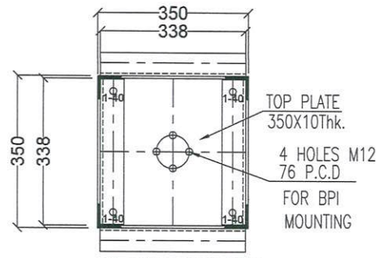
FRONT ELEVATION



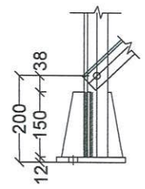
FRONT ELEVATION



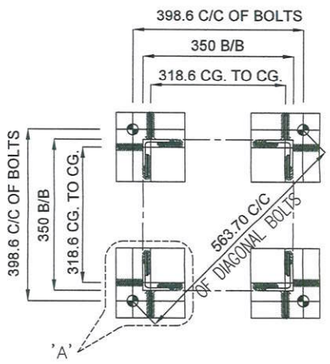
PL 6Thk.x52x150Lg.

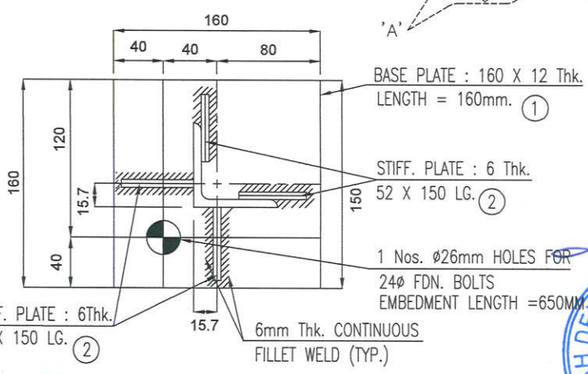


CL OF TOP PLATE
SECTION C-C FOR BPI

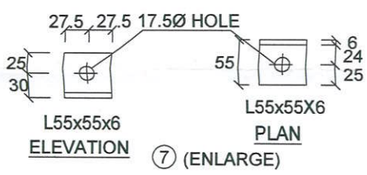


② DETAIL 'Y'
(ENLARGE)

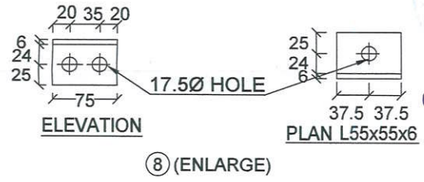




DETAIL–'A'



⑦ (ENLARGE)



⑧ (ENLARGE)

CN-22118
14/11/22

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS SHALL BE AS PER IS:12427 (PROPERTY CLASS 5.6).
4. GALVANIZING TO BE AS PER TECHNICAL SPECIFICATION.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER I.S:816
7. ALL STRUCTURAL MEMEBERS SHALL BE HOT DIP GALVANIZED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
8. ALL UNNOTED BRACING ARE L45X45X5 WITH 23mm BACKMARK.
9. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
10. EQUIPMENT MOUNTING DETAILS, & STRUCTURE HEIGTH ARE INDICATIVE ONLY, WHICH MAY CHANGE AS PER EQUIPMENT DRG.
11. ALL WELD SHALL BE 6MM THICK FILLET WELD.

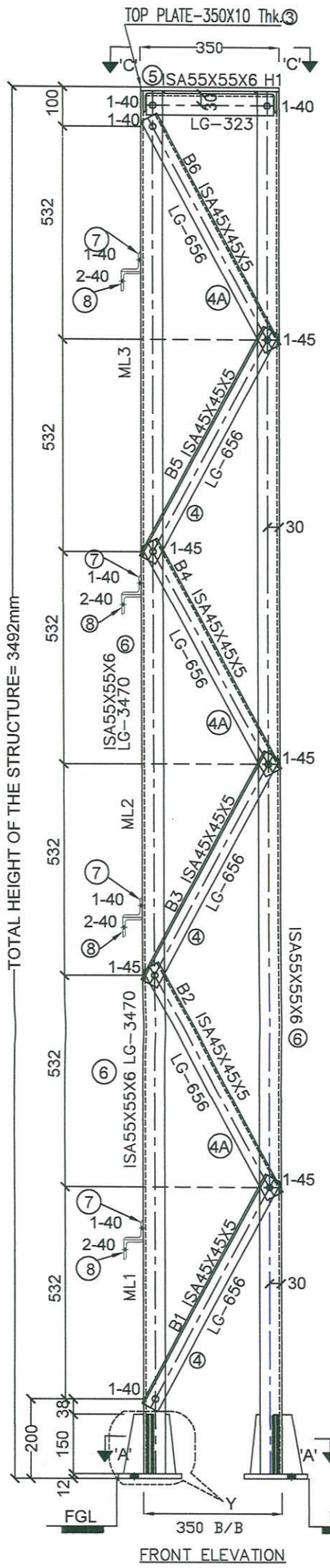
Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing
स्वीकृत/जारी/विनिर्माण/निर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
स्वीकृत/जारी/विनिर्माण/निर्माण हेतु अनुमोदित/जारी, बशर्ते कि इन टिप्पणियों को शामिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature)
(हस्ताक्षर)
Manager
(Designation)
(पदनाम)
(Date)
(तिथि)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	STRUCTURE DRAWING OF33KV BPI FOR 2x50 MVA, 220/33 kV Nagrota (New) S/S,Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/102		REV- 01
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1
	NAME	DATE	SIGN
PREPARED BY	PURNIMA	04.11.2022	
CHECKED BY	G.H	04.11.2022	KDBIL
SUBMITTED BY	Mr.ANURAG	04.11.2022	Signature/Stamp...

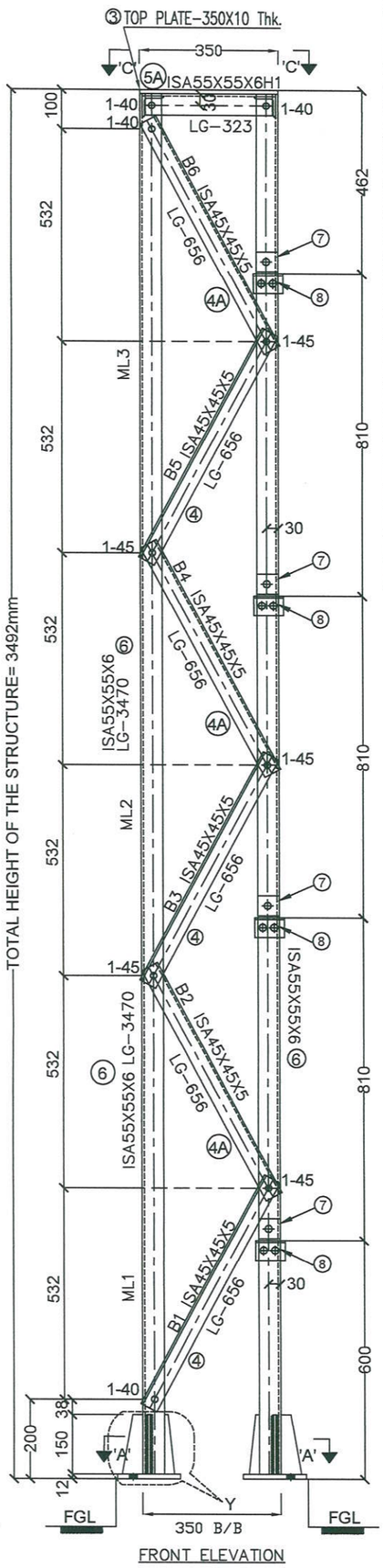
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

KAILASH DEVBUILD (INDIA) PVT. LTD. ★ JABALPUR



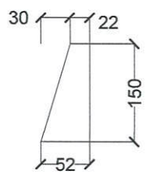
FRONT ELEVATION



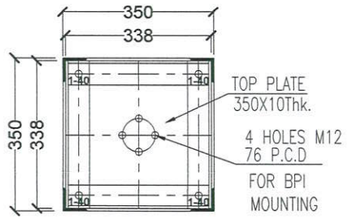
FRONT ELEVATION

BILL OF MATERIAL

SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 160X12	160	160	94.20	2.412	4	9.646
2	2	PL 52X6	150	52	47.10	0.367	16	5.878
3	3	PL 350X10	350	350	78.50	9.616	1	9.616
4	4	L45X45X5	656		3.40	2.230	12	26.765
5	4A	L45X45X5	656		3.40	2.230	12	26.765
6	5	L55X55X6	323		4.90	1.583	2	3.165
7	5A	L55X55X6	323		4.90	1.583	2	3.165
8	6	L55X55X6	3470		4.90	17.003	4	68.012
9	7	L55X55X6	55		4.90	0.270	8	2.156
10	8	L55X55X6	75		4.90	0.368	8	2.940
					WT. OF STRUCTURE =			**158.11**
		LIST OF 12MM & 16MM Ø BOLTS, NUTS, WASHER :						
11		16-Ø X 40 LG.				0.125	44	5.50
12		16-Ø X 45 LG.				0.132	20	2.64
		12-Ø X 100 LG. FOR EQPT. MOUNTING				0.118	4	0.47
		SPRING WASHER SUITABLE FOR M16				0.009	64	0.58
		SPRING WASHER SUITABLE FOR M12				0.003	4	0.01
		TOTAL WEIGTH OF HARDWARE =						9.20
		TOTAL WEIGTH OF STRUCTURE WITH HARDWARE =						**167.31**

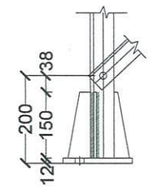


PL 6Thk.x52x150Lg.

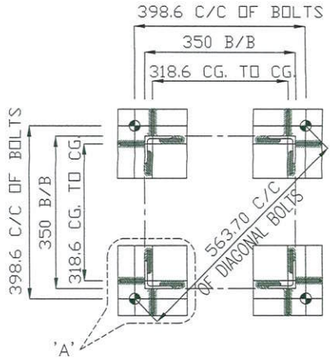


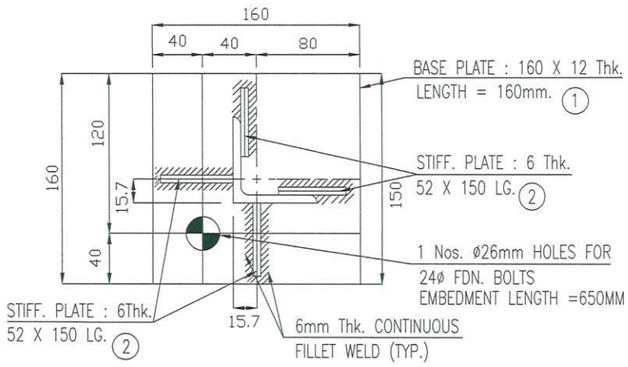
CL OF TOP PLATE

SECTION C-C FOR BPI

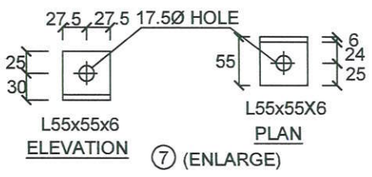


② DETAIL 'Y' (ENLARGE)

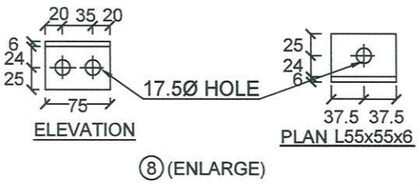




DETAIL–'A'



⑦ (ENLARGE)



⑧ (ENLARGE)

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802
3. BOLTS, NUTS SHALL BE AS PER IS:12427 (PROPERTY CLASS 5.6).
4. GALVANIZING TO BE AS PER TECHNICAL SPECIFICATION.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER I.S:816
7. ALL STRUCTURAL MEMEBERS SHALL BE HOT DIP GALVANIZED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
8. ALL UNNOTED BRACING ARE L45X45X5 WITH 23mm BACKMARK.
9. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
10. EQUIPMENT MOUNTING DETAILS, & STRUCTURE HEIGTH ARE INDICATIVE ONLY, WHICH MAY CHANGE AS PER EQUIPMENT DRG.
11. ALL WELD SHALL BE 6MM THICK FILLET WELD.

REC Power Development & Consultancy Ltd. Gurugram-122001

GM-17502 dt 15/6/2022

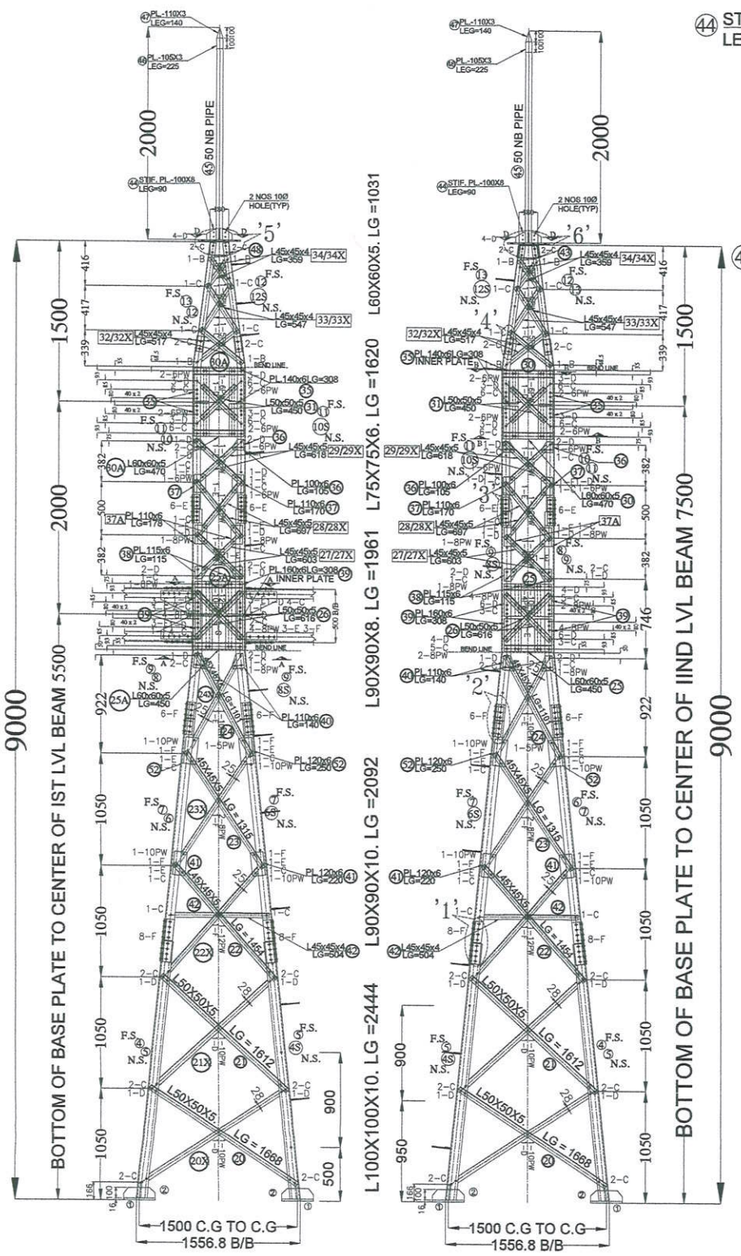
Approved/ Issued for Fabrication/Construction/Manufacturing.
Approved/ Issued for Fabrication/Construction/Manufacturing subject to condition that statements and comments are included.
Please submit the revised documents for approval.
III. Not in accordance with the contract documents. Please correct and submit again for approval.
IV. For information and record.
V. Not approved.
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

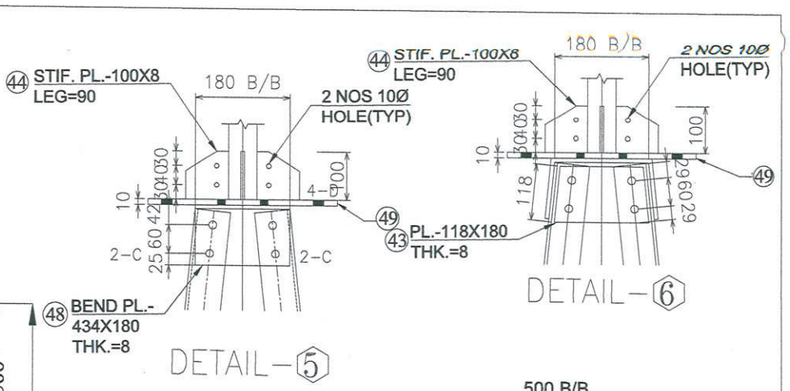
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	CD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 CD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	FABRICATION DRAWING OF 33KV BPI STR DWG , NAGROTA		
DRG. NO.	KDBIL/250 PJ/20-21/D1/102A	REV- 0	
SCALE	As shown in Drawing	SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		
	NAME	DATE	SIGN
PREPARED BY	PURNIMA	01.06.2022	
CHECKED BY	G.H	01.06.2022	
SUBMITTED BY	MR. JITENDRA	01.06.2022	

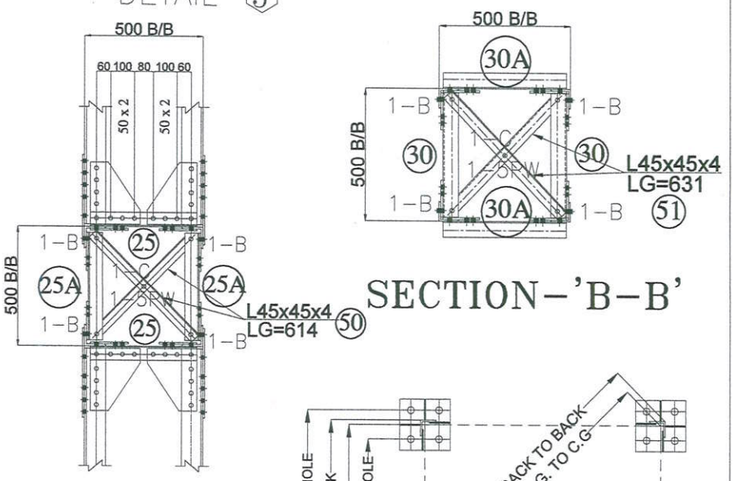
☐ Approved ☐ Approved with comments ☐ Not Approved

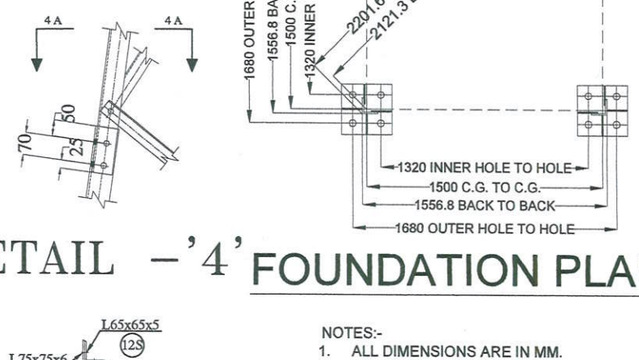
☐ More Information Date.....

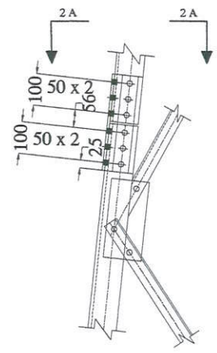
Kailash Devbuild (India) Pvt. Ltd. Authorised Signatory

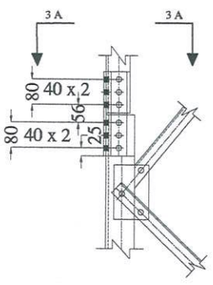


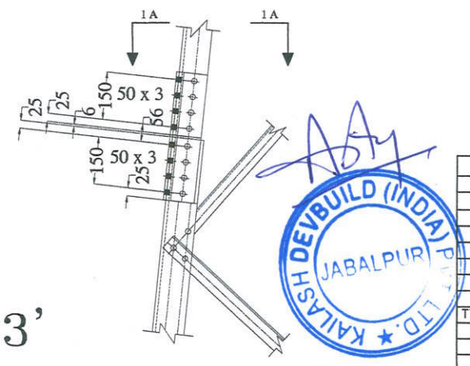


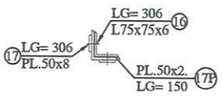


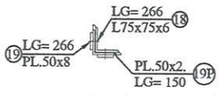


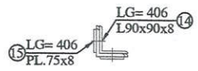


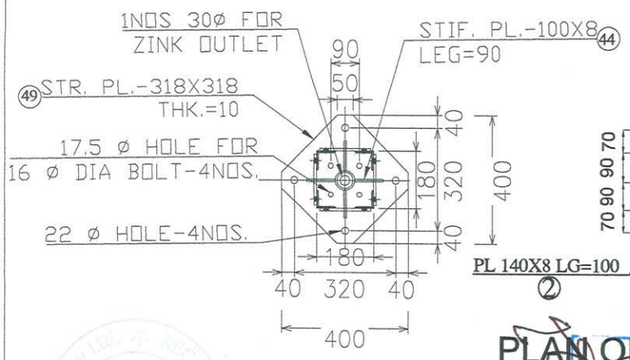


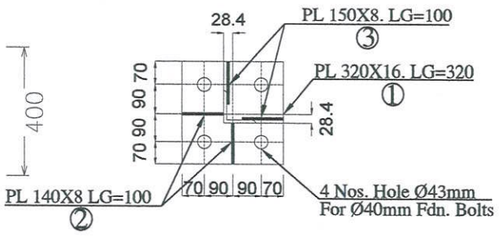












NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639(PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'CB' THAT IS CB-1,CB-2,SO ON.
8. SECTIONS NOT INDICATED ARE L45X45X5 WITH 25MM BACKMARK.

BOLTS/NUT STATEMENT			
	SPRING. WASHER	860	
12	30 ØDX12 THK PACK. WASHER	14	
10	30 ØDX10 THK PACK. WASHER	34	
8	30 ØDX8 THK PACK. WASHER	64	
6	30 ØDX6 THK PACK. WASHER	48	
5	30 ØDX5 THK PACK. WASHER	24	
3	30 ØDX4 THK PACK. WASHER	6	
	STEP BOLT Ø16X175	19	DIAGONALLY
TYPE	SIZE	QTY	REMARK
B	DIA 16X35 Lg.	48	
C	DIA 16X40 Lg.	344	
D	DIA 16X45 Lg.	192	
E	DIA 16X50 Lg.	122	
F	DIA 16X55 Lg.	152	
G	DIA 16X60 Lg.	2	

REV.	REV. DATE	MODIFICATION
01	01.11.2022	REVISED AS PER CLIENT COMMENT
00	04.06.2022	FIRST SUBMISSION

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	ERECTION DRAWING OF 33KV TOWER 3TAP Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/104
SCALE	As shown in Drawing
AREA	91.6 KANAL 46336.5 SQM
REV-01	SHEET SIZE - A2

	NAME	DATE	SIGN	
PREPARED BY	RASHID	01.11.2022	MR	KDBIL
CHECKED BY	G.H	01.11.2022		
SUBMITTED BY	Er. ANURAG	01.11.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

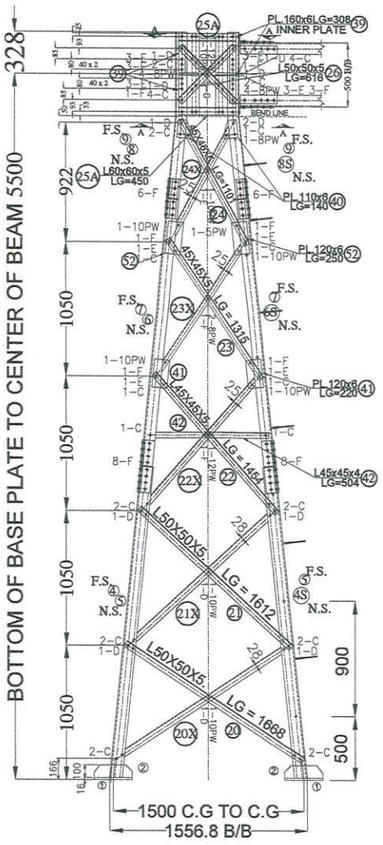
☐ More Information Date.....

KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR

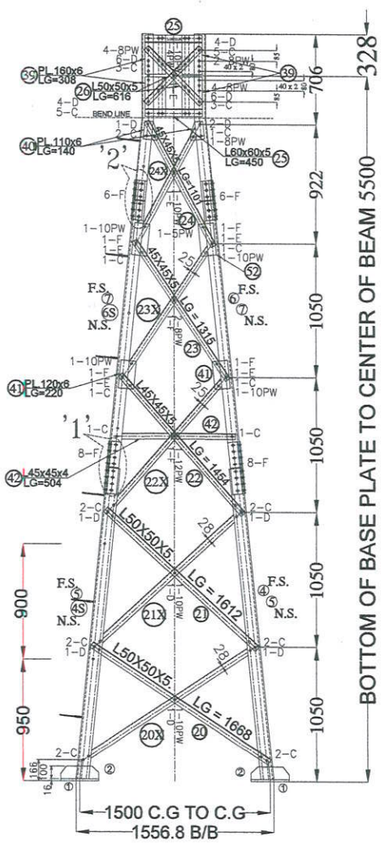
CN-22128
17/11/22

Manager

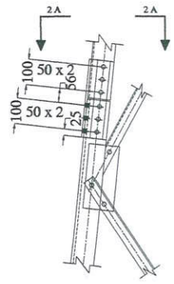
MR



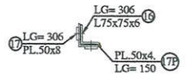
LONGITUDINAL FACE



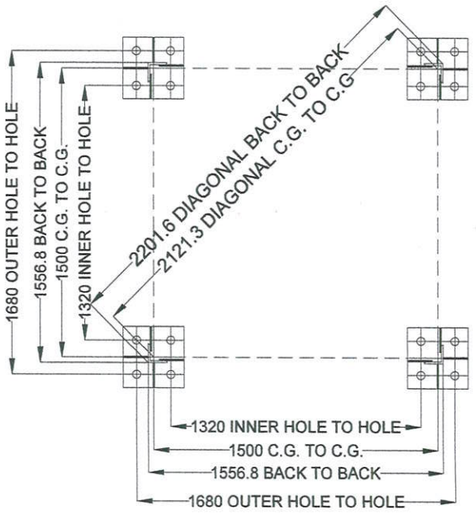
TRANSVERSE FACE



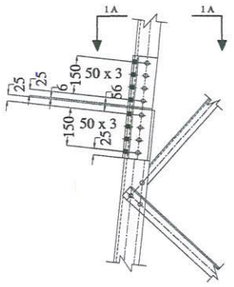
DETAIL –'2'



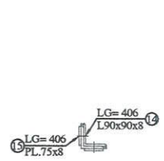
SECTION–'2A–2A'

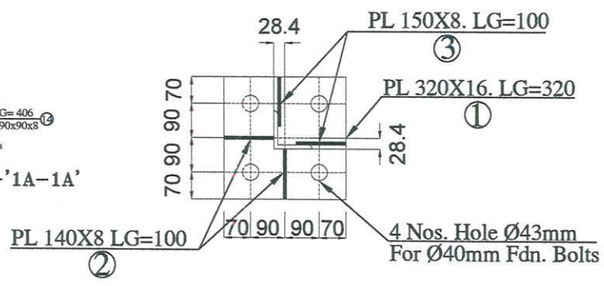


FOUNDATION PLAN



SECTION–'1A–1A'

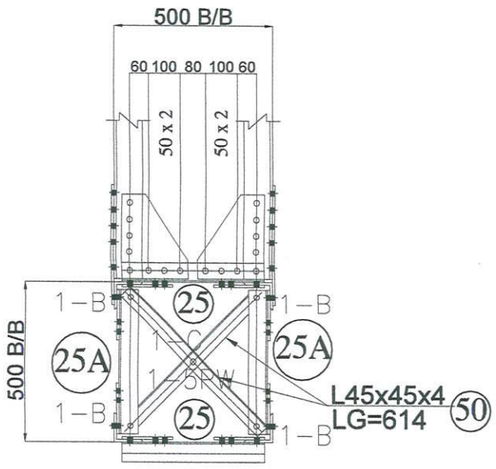




DETAIL –'1'

BOLTS/NUT STATEMENT			
	SPRING. WASHER	418	
12	30 ODX12 THK PACK. WASHER	6	
10	30 ODX10 THK PACK. WASHER	32	
8	30 ODX8 THK PACK. WASHER	26	
6	30 ODX6 THK PACK. WASHER	0	
5	30 ODX5 THK PACK. WASHER	6	
3	30 ODX4 THK PACK. WASHER	0	
	STEP BOLT ø16X175	13	DIAGONALLY
TYPE	SIZE	QTY	REMARK
B	DIA 16X35 Lg.	0	
C	DIA 16X40 Lg.	140	
D	DIA 16X45 Lg.	86	
E	DIA 16X50 Lg.	46	
F	DIA 16X55 Lg.	144	
G	DIA 16X60 Lg.	2	

PLAN OF BASE PLATE



SECTION–'A–A'

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639(PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'CB' THAT IS CB-1,CB-2,SO ON.
8. SECTIONS NOT INDICATED ARE L45X45X5 WITH 25MM BACKMARK.

01	01.11.2022	REVISED AS PER CLIENT COMMENT	
00	08.06.2022	FIRST SUBMISSION	
REV.	REV. DATE	MODIFICATION	
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	ERECTION DRAWING OF 33KV TOWER 3TE Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/111		
SCALE	As shown in Drawing	REV-01	
AREA	91.6 KANAL 46336.5 SQM	SHEET SIZE - A2	

	NAME	DATE	SIGN	
PREPARED BY	RASHID	01.11.2022	MR	KDBIL
CHECKED BY	G.H	01.11.2022		
SUBMITTED BY	Er. ANURAG	01.11.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

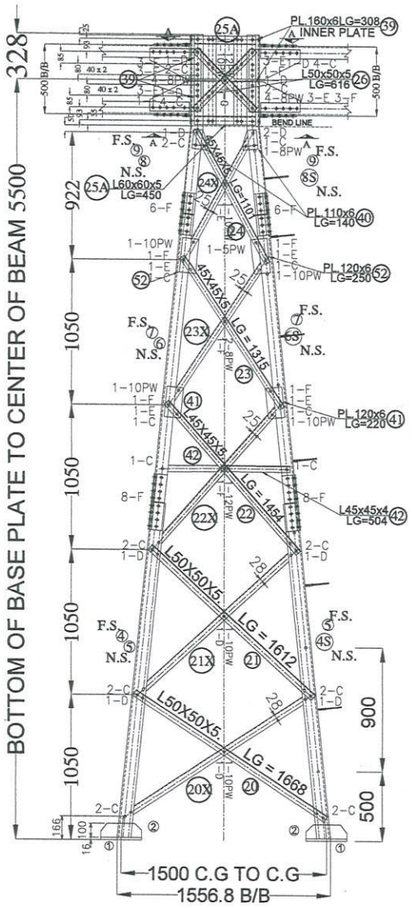
KAILASH DEVBUILD (INDIA) PVT. LTD. ★ JABALPUR

~~17/11/22~~ 17/11/22
CN-22128

Categories
(a) Approved/ Issued/ for Fabrication/Construction/Manufacturing.
(b) Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included. Please submit the revised documents for approval.
(c) Insert comments and submit again for approval.
(d) For Information and record.
(e) Not approved.

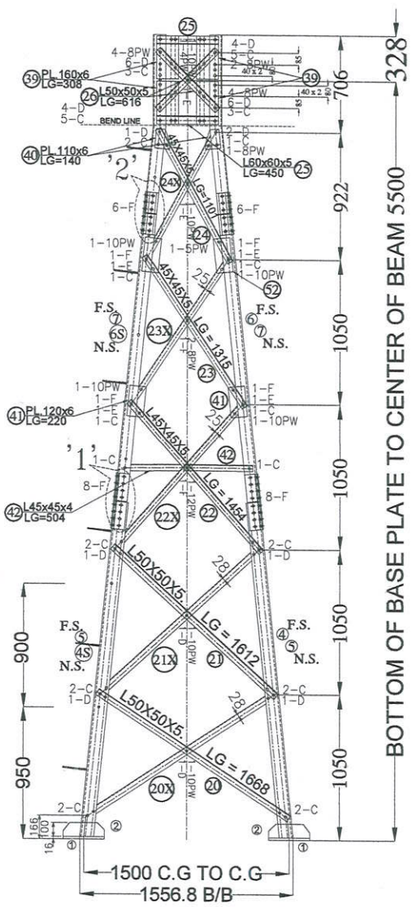
(Signature) Manager (Designation) (Date)

MR

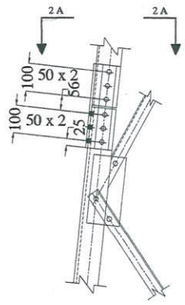


LONGITUDINAL FACE

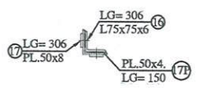
L100X100X10. LG =2444 L90X90X10. LG =2092 L90X90X6. LG =1291



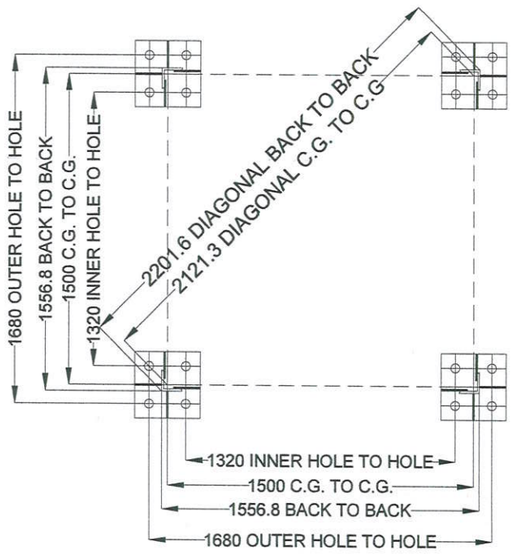
TRANSVERSE FACE



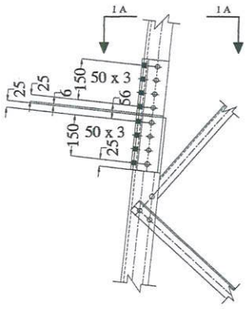
DETAIL –'2'

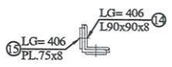


SECTION–'2A–2A'

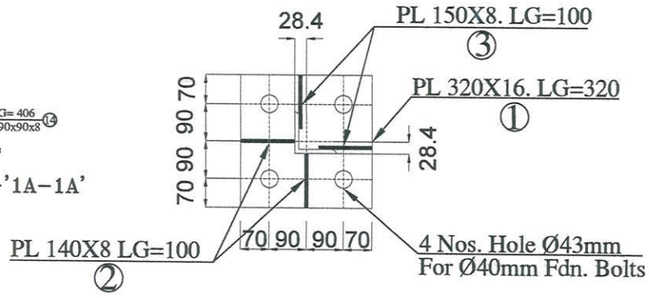


FOUNDATION PLAN





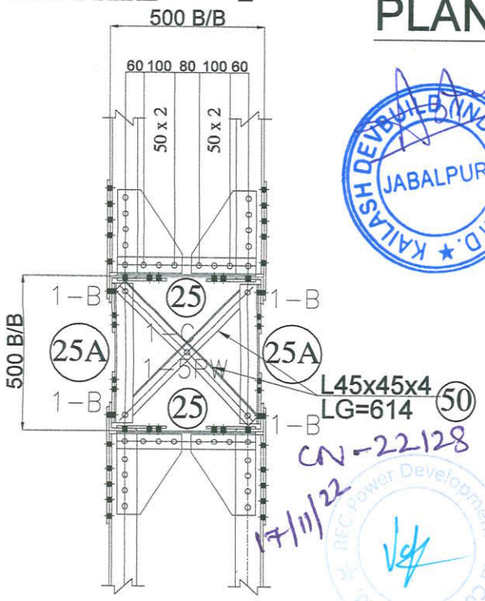
SECTION–'1A–1A'



DETAIL –'1'

BOLTS/NUT STATEMENT			
	SPRING. WASHER	418	
12	30 ODX12 THK PACK. WASHER	6	
10	30 ODX10 THK PACK. WASHER	32	
8	30 ODX8 THK PACK. WASHER	26	
6	30 ODX6 THK PACK. WASHER	0	
5	30 ODX5 THK PACK. WASHER	6	
3	30 ODX4 THK PACK. WASHER	0	
	STEP BOLT ø16X175	13	DIAGONALLY
TYPE	SIZE	QTY	REMARK
B	DIA 16X35 Lg.	0	
C	DIA 16X40 Lg.	140	
D	DIA 16X45 Lg.	86	
E	DIA 16X50 Lg.	46	
F	DIA 16X55 Lg.	144	
G	DIA 16X60 Lg.	2	

PLAN OF BASE PLATE



SECTION–'A–A'

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639(PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'CB' THAT IS CB-1,CB-2,SO ON.
8. SECTIONS NOT INDICATED ARE L45X45X5 WITH 25MM BACKMARK.

KAILASH DEVBUILD (INDIA) PVT. LTD. ★ JABALPUR

CN-22128
17/11/22

01	01.11.2022	REVISED AS PER CLIENT COMMENT
00	08.06.2022	FIRST SUBMISSION
REV.	REV. DATE	MODIFICATION
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.	
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020	
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)	
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)	
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)	
CONSULTANT	Advanced Ultra Power Transmission Consultancy	
TITLE	ERECTION DRAWING OF 33KV TOWER 3TD Nagrota (New) S/S, Jammu	
DRG. NO.	KDBIL/250 PJ/20-21/D1/113	
SCALE	As shown in Drawing	REV-01
AREA	91.6 KANAL 46336.5 SQM	SHEET SIZE - A2

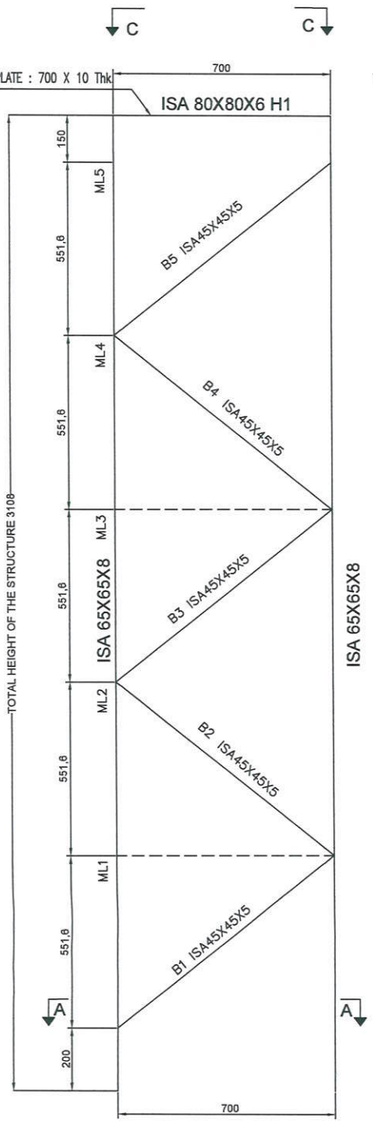
	NAME	DATE	SIGN	
PREPARED BY	RASHID	01.11.2022	MR	KDBIL
CHECKED BY	G.H	01.11.2022		
SUBMITTED BY	Er. ANURAG	01.11.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

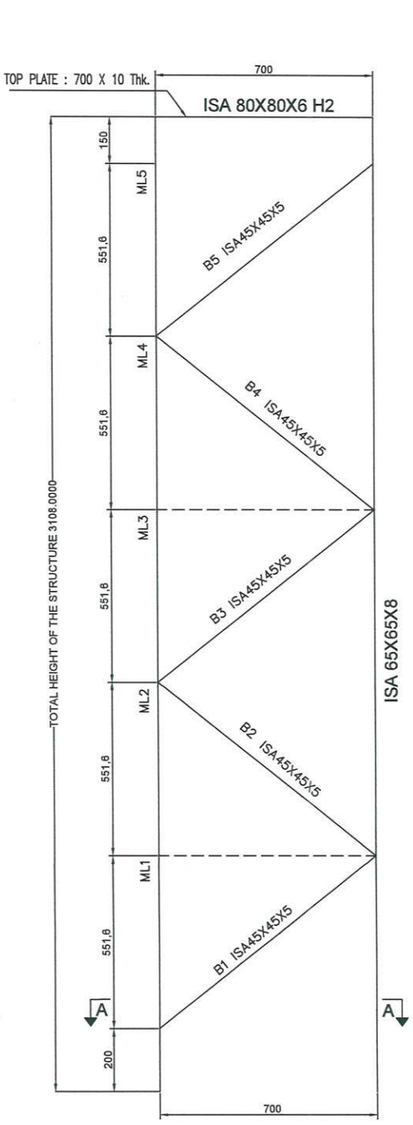
☐ More Information Date.....

Categories
श्रेणीयां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
स्वीकृत/जारी/निर्माण/निर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval
स्वीकृत/जारी/निर्माण हेतु अनुमोदित/जारी, बशर्ते कि ये
टिप्पणियों को शामिल किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
(Signature) (हस्ताक्षर)
Manager
(Designation) (पदनाम)
(Date)

MR



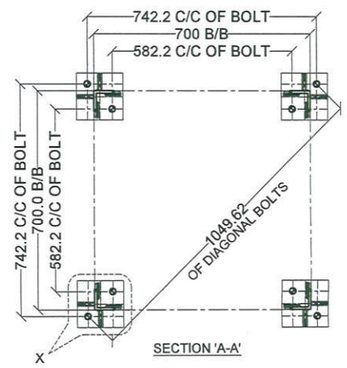
FRONT ELEVATION



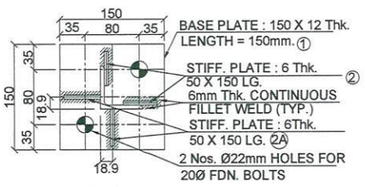
SIDE ELEVATION

SR. NO.	MEMBER ID	ANGLE SIZE		
1	ML1	65	x 65 x	8
2	ML2	65	x 65 x	8
3	ML3	65	x 65 x	8
4	ML4	65	x 65 x	8
5	ML5	65	x 65 x	8
6	B1	45	x 45 x	5
7	B2	45	x 45 x	5
8	B3	45	x 45 x	5
9	B4	45	x 45 x	5
10	B5	45	x 45 x	5
11	H1	80	x 80 x	6
12	H2	80	x 80 x	6

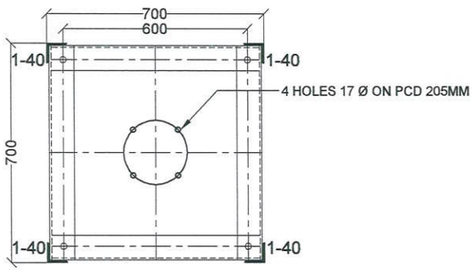
MEMBER	LENGTH	WIDTH	THK.
TOP PLATE	700	X700X	10
BASE PLATE	150	X150X	12
STIFF. PLATE	150	x 50 x	6



SECTION 'A-A'



DETAIL-'X'
(ENLARGE)



SECTION C-C

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	220KV LA STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/116		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1
	NAME	DATE	SIGN
PREPARED BY	PURNIMA	11.06.2022	
CHECKED BY	G.H	11.06.2022	
SUBMITTED BY	Mr. ANURAG	11.06.2022	Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

KDBIL Jabalpur

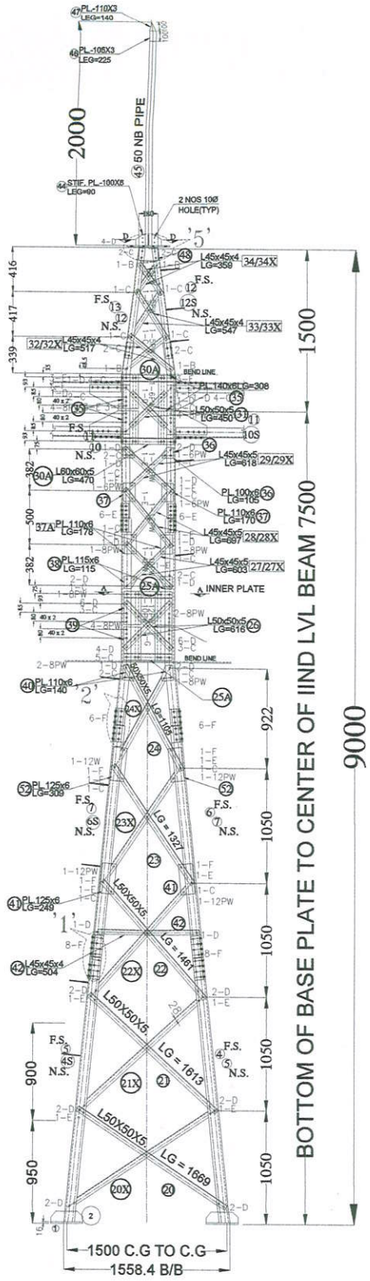
Kailash Devbuild (India) Pvt. Ltd.

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
स्वीकृत/जारी/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.- Please submit the revised documents for approval.
निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते की गई टिप्पणियों का अनुपालन किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Reject, comments and submit again for approval.
टिप्पणियों को अस्वीकृत, कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

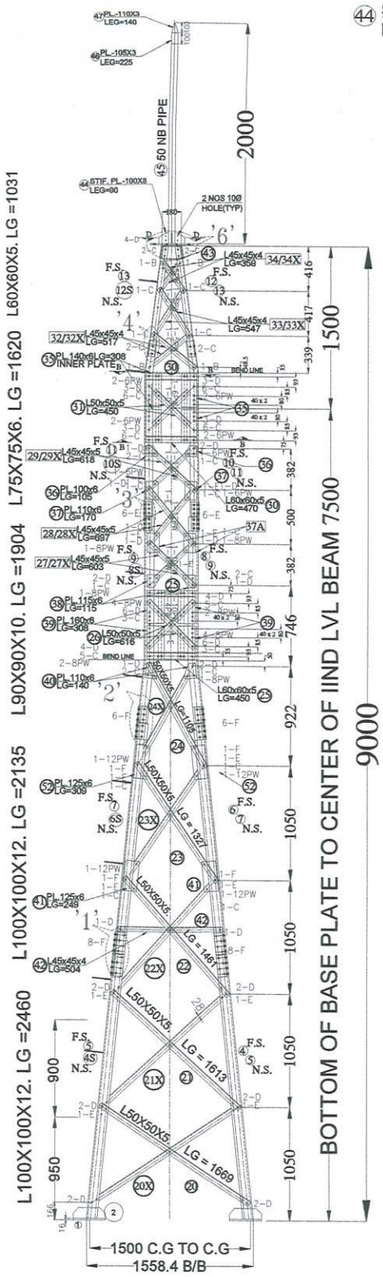
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

REC Power Development And Consultancy Ltd. Gurugram-122001

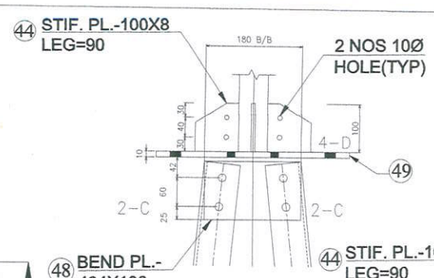
CW-17906 dt 12/7/2022



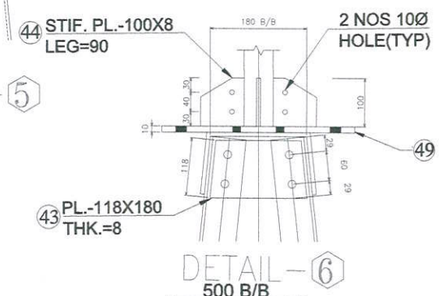
LONGITUDINAL FACE



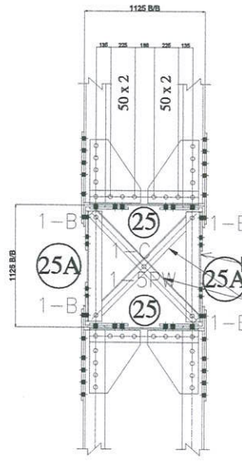
TRANSVERSE FACE



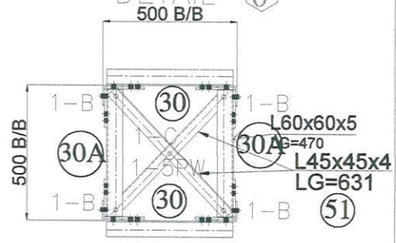
DETAIL – 5



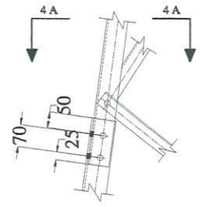
DETAIL – 6

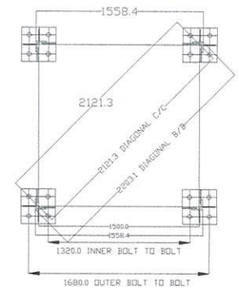


SECTION – 'A – A'

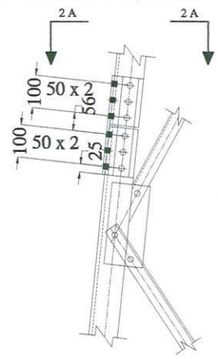


SECTION – 'B – B'

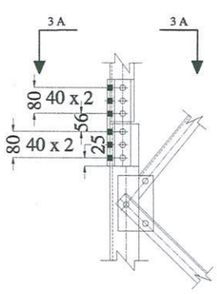




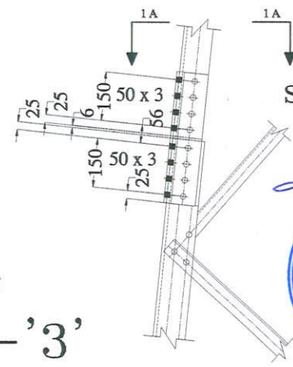
FOUNDATION PLAN



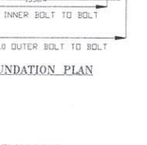
DETAIL – '2



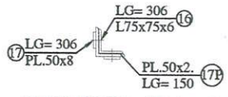
DETAIL – '3



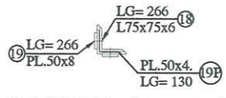
DETAIL – '1



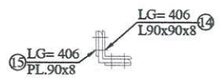
SECTION – '4A – 4A'



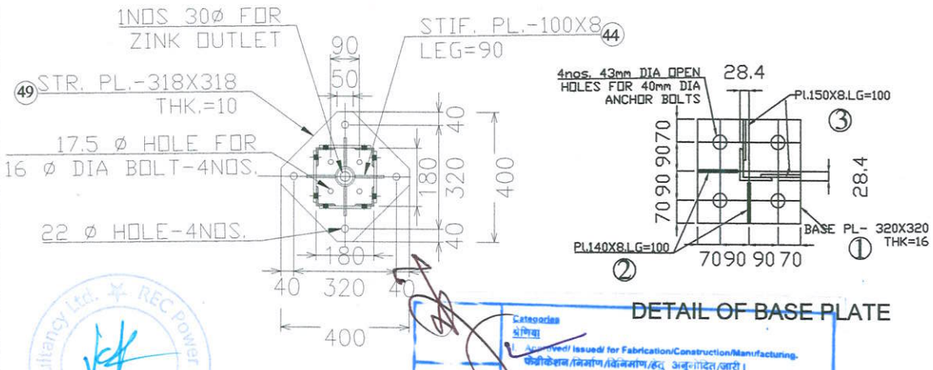
SECTION – '2A – 2A'



SECTION – '3A – 3A'



SECTION – '1A – 1A'



DETAIL OF BASE PLATE

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639(PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'CB' THAT IS CB-1,CB-2,SO ON.
8. SECTIONS NOT INDICATED ARE L45X45X5 WITH 25MM BACKMARK.

BOLTS/NUT STATEMENT

	SPRING. WASHER	860	
12	30 ⌀X12 THK PACK. WASHER	18	
10	30 ⌀X10 THK PACK. WASHER	30	
8	30 ⌀X8 THK PACK. WASHER	64	
6	30 ⌀X6 THK PACK. WASHER	48	
5	30 ⌀X5 THK PACK. WASHER	24	
3	30 ⌀X4 THK PACK. WASHER	6	
	STEP BOLT ⌀16X175	19	DIAGONALLY
TYPE	SIZE	QTY	REMARK
B	DIA 16X35 Lg.	48	
C	DIA 16X40 Lg.	332	
D	DIA 16X45 Lg.	200	
E	DIA 16X50 Lg.	126	
F	DIA 16X55 Lg.	152	
G	DIA 16X60 Lg.	2	

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED(RECPDCL)
EPC COMPANY	Kallash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	ERECTION DRAWING OF 33KV TOWER 3TGP Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/117 — REV- 02
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN	
PREPARED BY	RASHID	01.11.2022		KDBIL
CHECKED BY	G.H	01.11.2022		
SUBMITTED BY	ANURAG	01.11.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

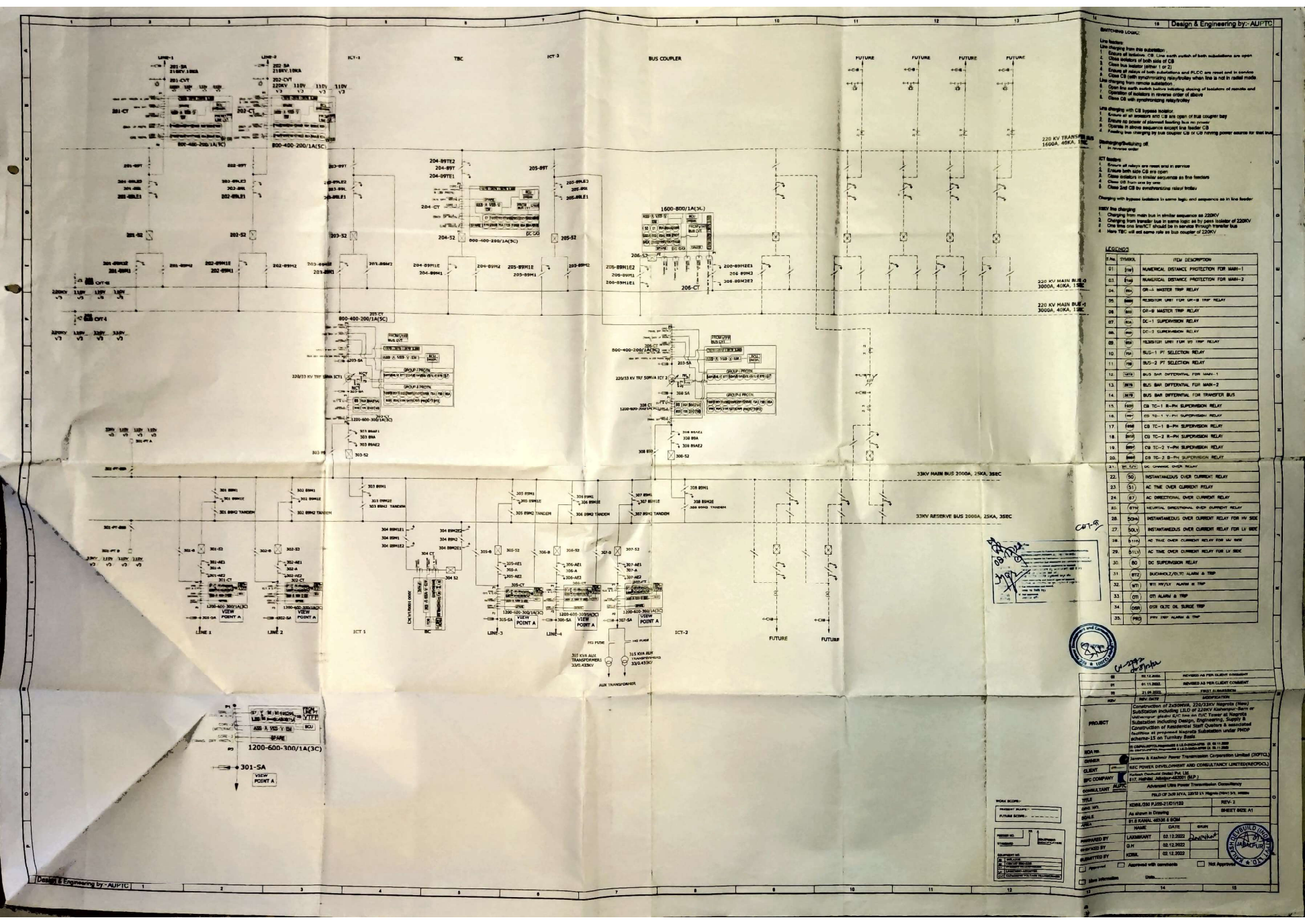
KALLASH DEVBUILD (INDIA) PVT. LTD. ★ JABALPUR

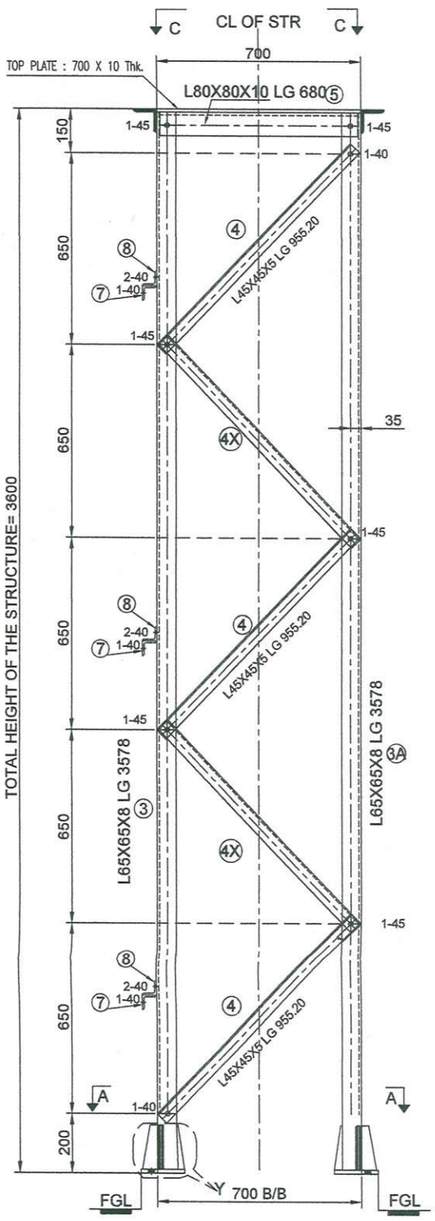
REC Power Development & Consultancy Ltd.

CN-22128
17/11/22

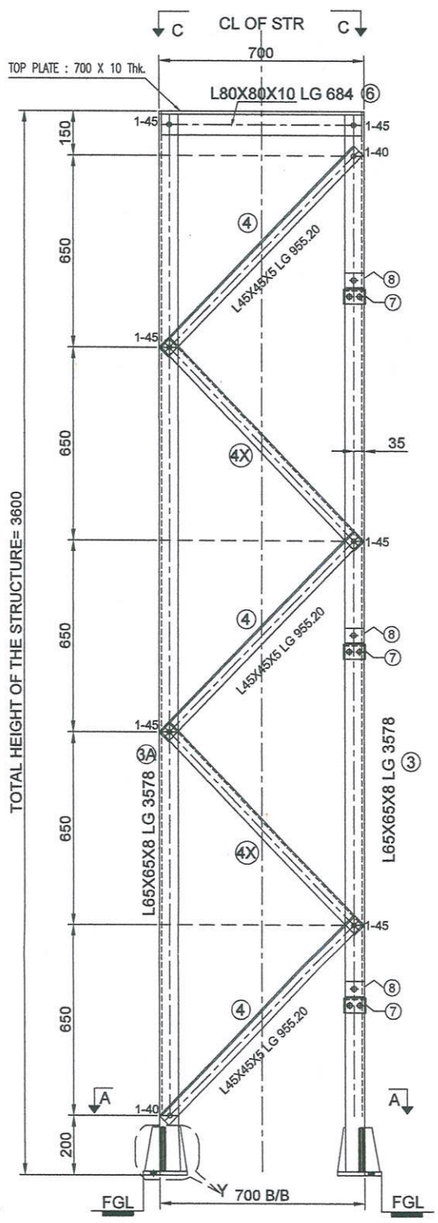
Manager

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
डिजाईनिंग/निर्माण/विनिर्माण/हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included. Please submit the revised documents for approval.
टिप्पणियों को शामिल करते हुए अनुमोदित/जारी। संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

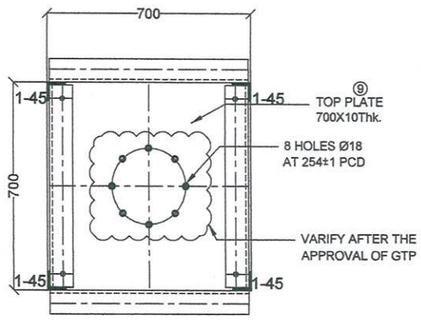

Design & Engineering by:- AUPTC
SWITCHING LOGIC:
Line feeders:
Line charging from bus substation:
1. Ensure all isolators, CB, Line earth switch of both substations are open
2. Close isolators of both side of CB
3. Close bus isolator (either 1 or 2)
4. Ensure all relays of both substations and PLCC are reset and in service
5. Close CB (with synchronising relay/trolley when line is not in radial mode
Line charging from remote substation
6. Open line earth switch before initiating closing of isolators of remote end
7. Operation of isolators in reverse order of above
8. Close CB with synchronising relay/trolley
Line charging with CB bypass isolator:
1. Ensure all air breakers and CB are open of bus coupler bay
2. Ensure no power of planned feeding bus no power
3. Operate in above sequence except line feeder CB
4. Feeding line charging by bus coupler CB or CB having power source for that bus
Discharging/Switching off:
In reverse order
ICT feeders:
1. Ensure all relays are reset and in service
2. Ensure both side CB are open
3. Close isolators in similar sequences as line feeders
4. Close CB from one by one
5. Close 2nd CB by synchronizing relay/ trolley
Charging with bypass isolators is same logic and sequence as in line feeder
33KV line charging:
1. Charging from main bus in similar sequence as 220KV
2. Changing from transfer bus in same logic as by pass isolator of 220KV
3. One time one line/ICT should be in service through transfer bus
4. Here TBC will act same role as bus coupler of 220KV
LEGENDS
Sl.No. SYMBOL ITEM DESCRIPTION
01. (21G) NUMERICAL DISTANCE PROTECTION FOR MAIN-1
03. (21G) NUMERICAL DISTANCE PROTECTION FOR MAIN-2
04. (86A) GR-A MASTER TRIP RELAY
05. (86BB) MASTER TRIP RELAY FOR GR-B TRIP RELAY
06. (86B) GR-B MASTER TRIP RELAY
07. (86A) DC-1 SUPERVISION RELAY
08. (86B) DC-2 SUPERVISION RELAY
09. (96B) MASTER TRIP RELAY FOR STB TRIP RELAY
10. (76T) BUS-1 PT SELECTION RELAY
11. (76B) BUS-2 PT SELECTION RELAY
12. (387A) BUS BAR DIFFERENTIAL FOR MAIN-1
13. (387B) BUS BAR DIFFERENTIAL FOR MAIN-2
14. (387B) BUS BAR DIFFERENTIAL FOR TRANSFER BUS
15. (52CC) CB TC-1 R-PH SUPERVISION RELAY
16. (74CY) CB TC-1 Y-PH SUPERVISION RELAY
17. (74CB) CB TC-1 B-PH SUPERVISION RELAY
18. (52CC) CB TC-2 R-PH SUPERVISION RELAY
19. (52CY) CB TC-2 Y-PH SUPERVISION RELAY
20. (52CB) CB TC-2 B-PH SUPERVISION RELAY
21. (DC G/O) DC GROUND OVER RELAY
22. (50) INSTANTANEOUS OVER CURRENT RELAY
23. (51) AC TIME OVER CURRENT RELAY
24. (67) AC DIRECTIONAL OVER CURRENT RELAY
25. (67N) NEUTRAL DIRECTIONAL OVER CURRENT RELAY
26. (50HV) INSTANTANEOUS OVER CURRENT RELAY FOR HV SIDE
27. (50LV) INSTANTANEOUS OVER CURRENT RELAY FOR LV SIDE
28. (51HV) AC TIME OVER CURRENT RELAY FOR HV SIDE
29. (51LV) AC TIME OVER CURRENT RELAY FOR LV SIDE
30. (80) DC SUPERVISION RELAY
31. (BTZ) BUCHHOLZ/OLTC ALARM & TRIP
32. (WTI) WTI HV/LV ALARM & TRIP
33. (OTI) OTI ALARM & TRIP
34. (OSR) OSR OLTC OIL SURGE TRIP
35. (PRD) PRV TRIP ALARM & TRIP
LINE-1
LINE-2
ICT-1
TBC
ICT-2
BUS COUPLER
FUTURE
220 KV TRANSFER BUS 1600A, 40KA, 1SEC
220 KV MAIN BUS-2 3000A, 40KA, 1SEC
220 KV MAIN BUS-1 3000A, 40KA, 1SEC
33KV MAIN BUS 2000A, 25KA, 3SEC
33KV RESERVE BUS 2000A, 25KA, 3SEC
800-400-200/1A(5C)
1600-800/1A(5C)
1200-600-300/1A(3C)
315 KVA AUX TRANSFORMER1 33/0.433KV
AUX TRANSFORMER
VIEW POINT A
301-SA
REVISED AS PER CLIENT COMMENT
REVISED AS PER CLIENT COMMENT
FIRST SUBMISSION
PROJECT: Construction of 2x500MVA, 220/33KV Nagrota (New) Substation including LILO of 220KV Kishenpur-Barn or Udhampur-pladi D/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis
NOA NO.
OWNER: Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT: REC POWER DEVELOPMENT AND CONSULTANCY LIMITED(RECPDCL)
BPC COMPANY: Kailash Chemicals (India) Pvt. Ltd. 617, Rathlai Jabalpur-482001 (M.P.)
CONSULTANT: AUPTC Advanced Ultra Power Transmission Consultancy
FIELD OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
TITLE: KDIRL/250 PJ/05-21/01/120 REV- 2
DRG. NO.
SCALE: As shown in Drawing SHEET SIZE A1
AREA: 91.8 KANAL 46535 S SQM
NAME DATE SIGN
PREPARED BY: LAXMIKANT 03.12.2022
CHECKED BY: G.H 03.12.2022
SUBMITTED BY: KDIRL 03.12.2022
Approved Approved with comments Not Approved
Other information: Date:
WORK SCOPE:
PRESENT SCOPE:
FUTURE SCOPE:
EQUIPMENT NO.
A. 400 KV GIS
B. 1.5 MVAR REACTOR
C. 220 KV GIS
D. 220/33KV 160 MVA ICT
E. 33 KV GIS
F. 33/0.433KV AUX TRANSFORMER
G. 33/0.433KV GROUNDING TRANSFORMER
H. 33KV CAPACITOR VOLTAGE TRANSFORMER
Design & Engineering by:- AUPTC



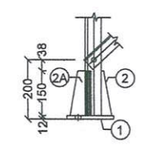
ELEVATION



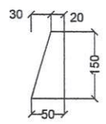
SECTION B–B



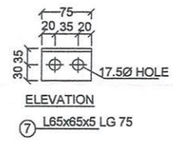
SECTION C–C



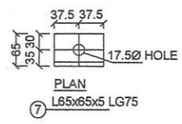
DETAIL 'Y'
(ENLARGE)



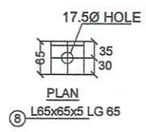
② PL 6Thk.x50x150Lg.



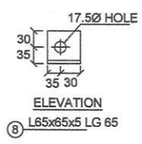
ELEVATION
⑦ L65x65x5 LG 75



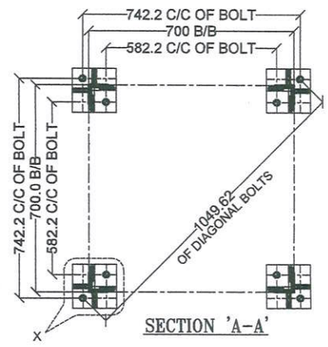
PLAN
⑦ L65x65x5 LG75



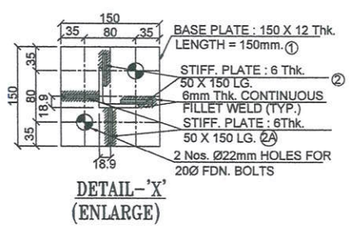
PLAN
⑧ L65x65x5 LG 65



ELEVATION
⑧ L65x65x5 LG 65



SECTION 'A–A'



DETAIL–'X'
(ENLARGE)

BILL OF MATERIAL

SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 150X12	150	150	94.20	2.120	4	8.478
2	2	PL 50X6	150	50	47.10	0.353	8	2.826
3	2A	PL 50X6	150	50	47.10	0.353	8	2.826
4	3	L65x65x8	3578		7.70	27.55	2	55.101
5	3A	L65x65x8	3578		7.70	27.55	2	55.101
6	4	L45X45X5	955.2		3.40	3.248	12	38.972
7	4X	L45X45X5	955.2		3.40	3.248	8	25.981
8	5	L80X80X10	680		11.80	8.024	2	16.048
9	6	L80X80X10	684		11.80	8.071	2	16.142
10	7	L65X65X5	75		4.90	0.368	6	2.205
11	8	L65X65X5	65		4.90	0.319	6	1.911
12	9	PL700X10	700	700	78.50	38.465	1	38.465
				WT. OF STRUCTURE (kg.) =				**264.06**
			TOTAL LIST OF BOLTS & NUTS					
13		M16x40 mm Bolts & Nuts				0.126	26	3.28
14		M16x45 mm Bolts & Nuts				0.134	28	3.75
15		M-16-3.5 THK SPRING WASHER				0.009	54	0.49
16		M16X100 LG. FOR EQPT. MOUNTING (FULL THREADED)				0.218	8	1.744
					TOTAL WEIGHT OF HARDWARE (kg)=			**9.26**
		TOTAL WEIGHT OF STRUCTURE WITH HARDWARE (kg)						**273.32**

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802
3. BOLTS, NUTS SHALL BE AS PER IS:12427 (PROPERTY CLASS 5.6).
4. GALVANIZING TO BE AS PER TECHNICAL SPECIFICATION.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER I.S:816
7. ALL STRUCTURAL MEMEBERS SHALL BE HOT DIP GALVANIZED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
8. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
9. EQUIPMENT MOUNTING DETAILS, & STRUCTURE HEIGTH ARE INDICATIVE ONLY, WHICH MAY CHANGE AS PER EQUIPMENT DRAWING.
10. ALL WELD SHALL BE 6MM THICK FILLET WELD.

REVISION	REV. DATE	MODIFICATION
01	09.11.2022	REVISED AS PER CLIENT COMMENT
00	03.11.2022	FIRST SUBMISSION

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	220KV BPI STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/121
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 1

	NAME	DATE	SIGN	
PREPARED BY	PURNIMA	09.11.2022	Purnima	KDBIL
CHECKED BY	G.H	09.11.2022		
SUBMITTED BY	Mr.ANURAG	09.11.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

KAILASH DEVBUILD (INDIA) PVT. LTD. ★ JABALPUR

Categories
(श्रेणियां)
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
(स्वीकृतिकरण/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।)
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
(स्वीकृतिकरण/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते कि इन टिप्पणियों को शामिलत किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को शामिलत कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

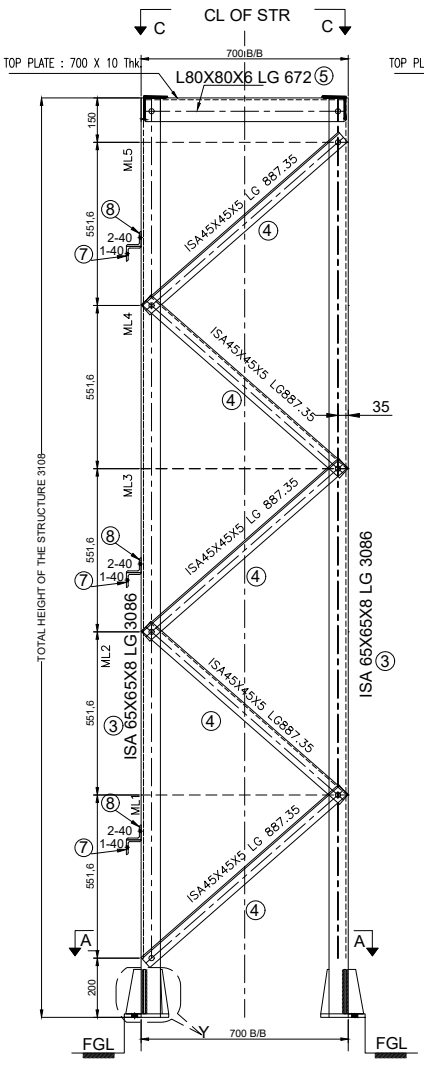
(Signature)
(हस्ताक्षर)
Manager
(Designation)
(पदनाम)
(Date)
(दिनांक)

CN-22118
14/11/22

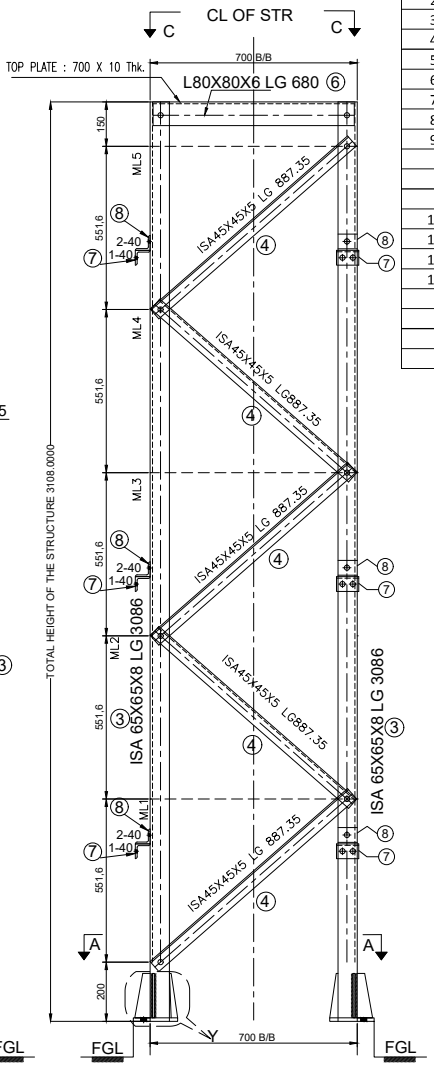
REC Power Development & Consultancy Ltd.

BILL OF MATERIAL

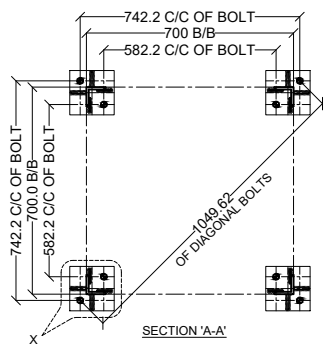
SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 150X12	150	150	94.20	2.120	4	8.478
2	2	PL 50X6	150	50	47.10	0.353	8	2.826
3	2A	PL 50X6	150	50	47.10	0.353	8	2.826
4	3	L65x65x8	3086		7.70	23.76	4	95.049
5	4	L45X45X5	887.35		3.40	3.017	20	60.340
6	5	L80X80X6	672		7.30	4.906	2	9.811
7	6	L80X80X6	680		7.30	4.964	2	9.928
8	7	L65X65X5	65		4.90	0.319	6	1.911
9	8	L65X65X5	65		4.90	0.319	6	1.911
				WT. OF STRUCTURE (kg.) =				**193.08**
TOTAL LIST OF BOLTS & NUTS								
10		M16x40 mm Bolts & Nuts			0.126	38	4.79	
11		M16x45 mm Bolts & Nuts			0.134	16	2.14	
12		M-16-3.5 THK SPRING WASHER			0.009	54	0.49	
13		M16X100 LG. FOR EQPT.			0.218	4	0.872	
				TOTAL WEIGHT OF HARDWARE (kg)=				**8.29**
		TOTAL WEIGHT OF STRUCTURE WITH HARDWARE (kg						**201.37**



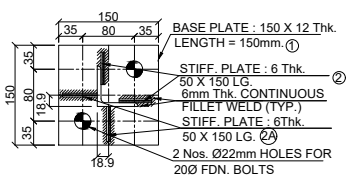
FRONT ELEVATION



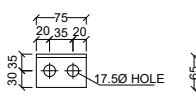
SIDE ELEVATION



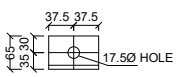
SECTION 'A-A'



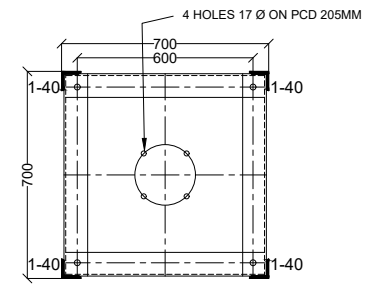
DETAIL-'X'
(ENLARGE)



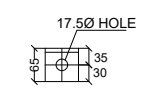
ELEVATION
⑦ L65x65x5 LG 75



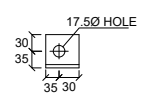
PLAN
⑦ L65x65x5 LG75



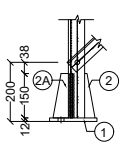
SECTION C-C



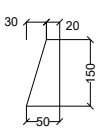
PLAN
⑧ L65x65x5 LG 65



ELEVATION
⑧ L65x65x5 LG 65



DETAIL 'Y'
(ENLARGE)



② PL 6Thk.x50x150Lg.

NOTES:

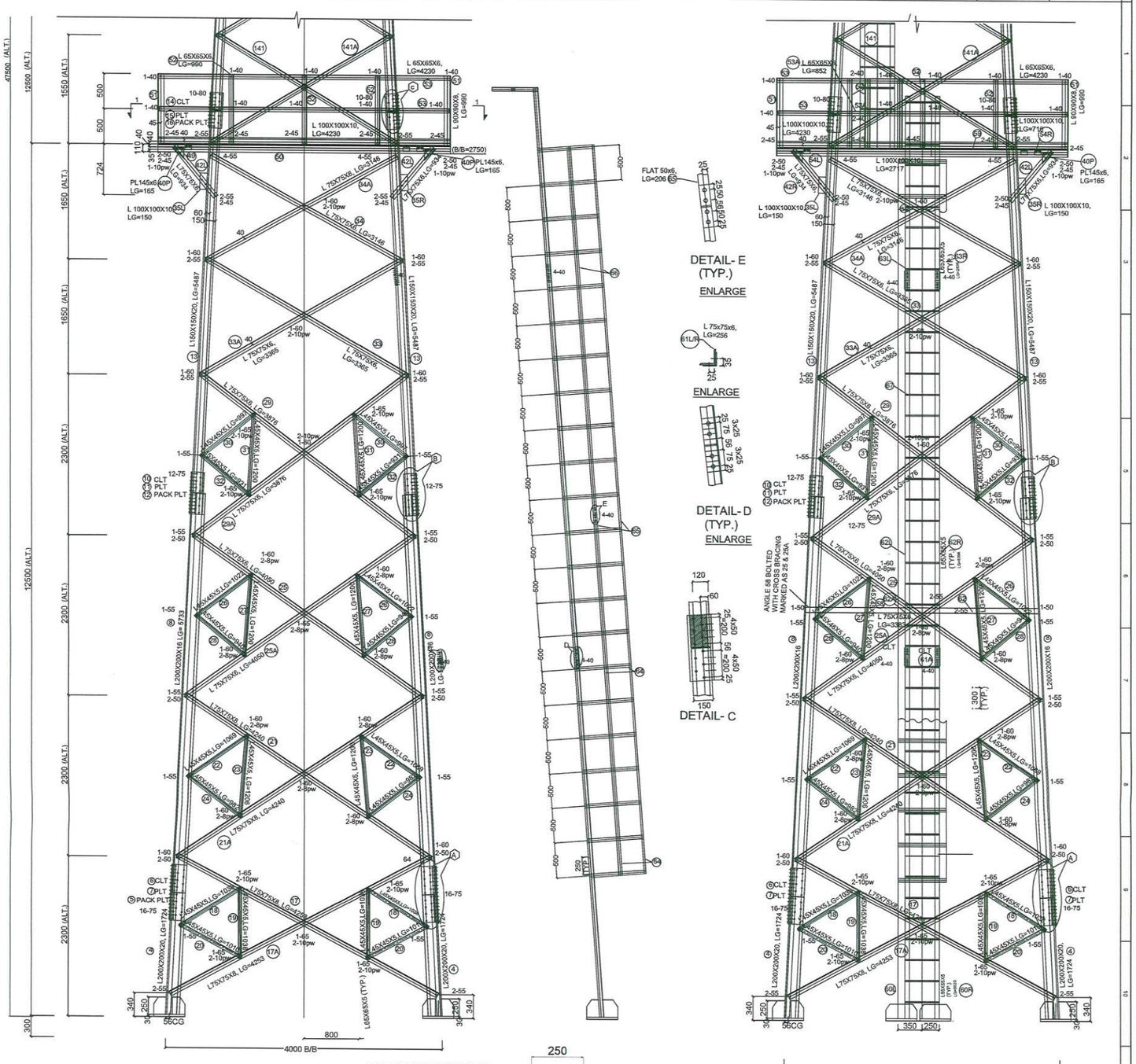
1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802
3. BOLTS, NUTS SHALL BE AS PER IS:12427 (PROPERTY CLASS 5.6).
4. GALVANIZING TO BE AS PER TECHNICAL SPECIFICATION.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER I.S:816
7. ALL STRUCTURAL MEMEBERS SHALL BE HOT DIP GALVANIZED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
8. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
9. EQUIPMENT MOUNTING DETAILS, & STRUCTURE HEIGTH ARE INDICATIVE ONLY, WHICH MAY CHANGE AS PER EQUIPMENT DRAWING.
10. ALL WELD SHALL BE 6MM THICK FILLET WELD.

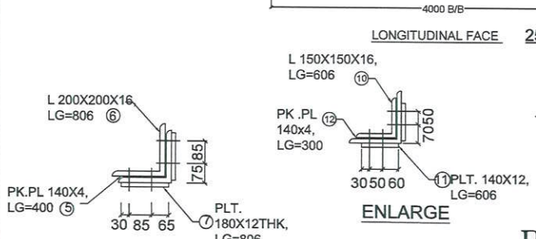
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development Company Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	220KV LA STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/127 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 1

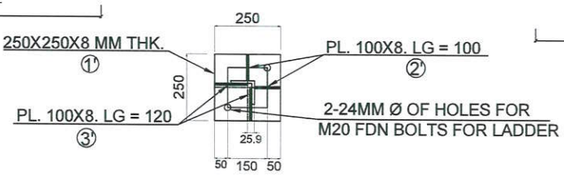
	NAME	DATE	SIGN	
PREPARED BY	SHIVAM	05.07.2022		KDBIL
CHECKED BY	G.H	05.07.2022		
SUBMITTED BY	Mr. ANURAG	05.07.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

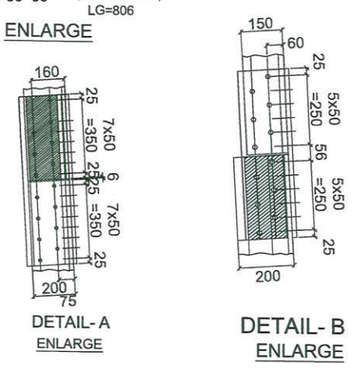
☐ More Information Date.....

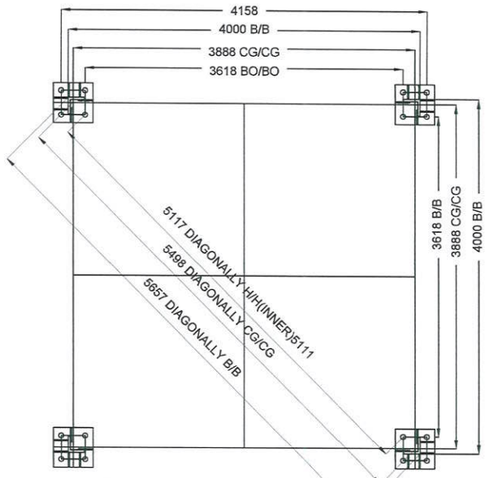






PLAN OF BASE PLATE OF LADDER





NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER.
2. ALL STEEL AS PER IS-2062 & FABRICATION SHALL BE AS PER IS 802.
3. BOLT NUTS AS PER IS-6639 (PROPERTY CLASS 5.6)
4. ALL HOLES 17.5 MM DIA FOR 16 MM DIA BOLT IF NOT STATED OTHERWISE.
5. WELDING SHALL BE DONE AS PER IS- 816.
6. ALL MEMBERS, BOLTS, NUTS, WASHERS SHALL BE HOT DIP GALVANISED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
7. GALVANISING SHALL BE 610 GM/MT. SQ.
8. ALL UN NOTED GUSSETS ARE 6MM THK.
9. ALL UN NOTED BRACING ARE 45x45x5 WITH 23mm BACKMARK.
10. 5% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
11. ALL ITEMS NOS TO BE PRE-FIXED WITH 'LM'.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	ERECTION DRAWING OF 50-M LIGHTENING MAST MKD. 'LM', FOR 220kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/128		REV- 01
SCALE	As shown in Drawing		SHEET NO.- 1 OF 4
AREA	91.6 KANAL 46336.5 SQM		SHEET SIZE - A4
	NAME	DATE	SIGN
PREPARED BY	BHARAT	15.07.2022	KDBIL
CHECKED BY	G.H	15.07.2022	
SUBMITTED BY	Er. ANURAG	15.07.2022	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

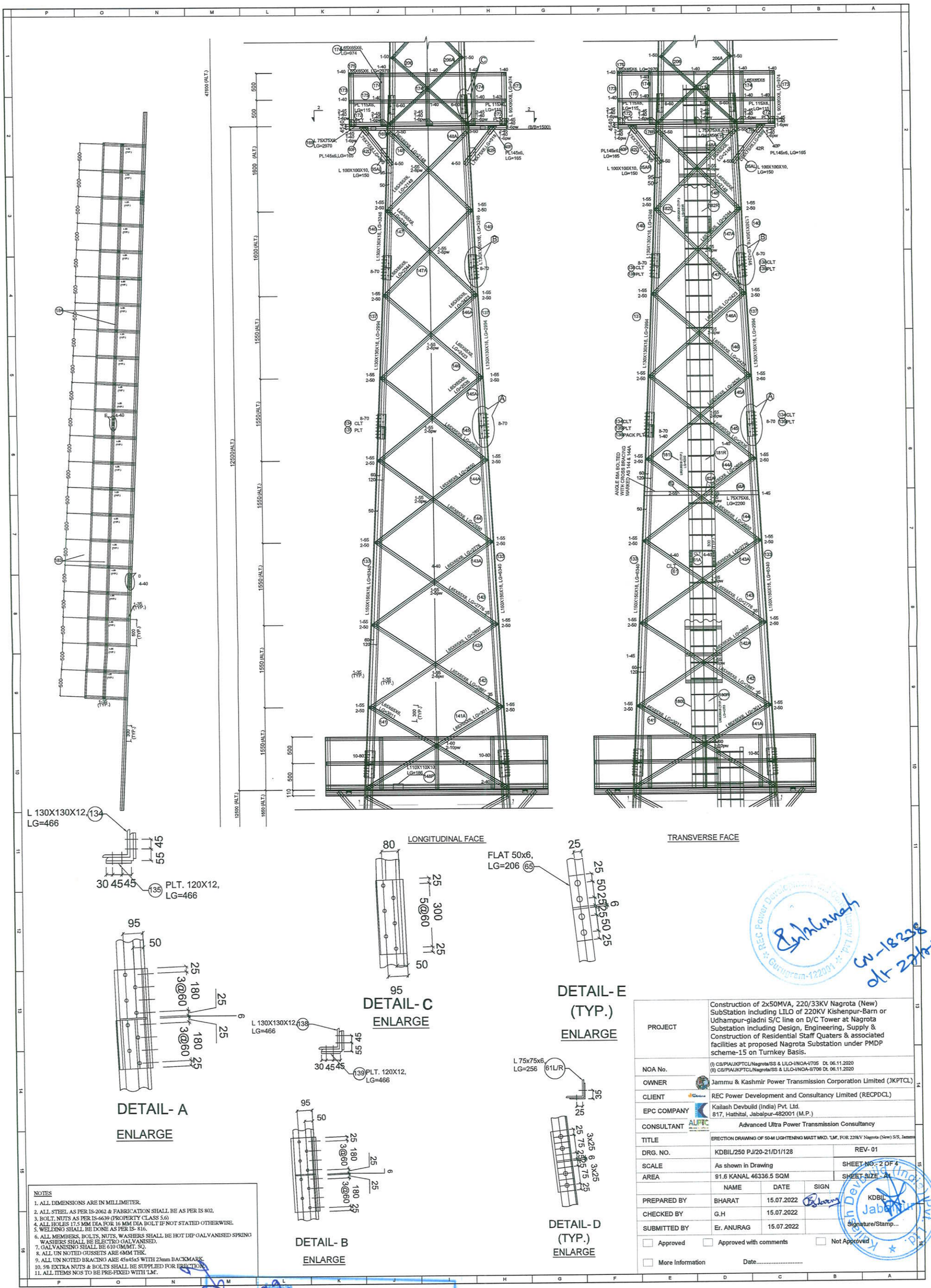
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

Approved/ Issued for Fabrication/Construction/Manufacturing.
Approved/ Issued for Fabrication/Construction/Manufacturing Subject to condition that statements and comments are included.
Please re-submit revised documents for approval.
Insert comments and submit again for approval.
For Information and record.
Not approved.

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

REC Power Development and Consultancy Ltd. Gurugram-122001

Cr-1833 P dt 27/9/2022



NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER.
2. ALL STEEL AS PER IS-2062 & FABRICATION SHALL BE AS PER IS 802.
3. BOLT, NUTS AS PER IS-6639 (PROPERTY CLASS 5.6)
4. ALL HOLES 17.5 MM DIA FOR 16 MM DIA BOLT IF NOT STATED OTHERWISE.
5. WELDING SHALL BE DONE AS PER IS- 816.
6. ALL MEMBERS, BOLTS, NUTS, WASHERS SHALL BE HOT DIP GALVANISED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
7. GALVANISING SHALL BE 610 GM/MT. SQ.
8. ALL UN NOTED GUSSETS ARE 6MM THK.
9. ALL UN NOTED BRACING ARE 45x45x5 WITH 23mm BACKMARK.
10. 5% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
11. ALL ITEMS NOS TO BE PRE-FIXED WITH 'LM'.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathitai, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	ERECTION DRAWING OF 50-M LIGHTENING MAST MKD. 'LM', FOR 220kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/128			REV- 01
SCALE	As shown in Drawing			SHEET NO.- 2 OF 4
AREA	91.6 KANAL 46336.5 SQM			SHEET SIZE - A4
	NAME	DATE	SIGN	
PREPARED BY	BHARAT	15.07.2022		KDBIL
CHECKED BY	G.H	15.07.2022		Signature/Stamp...
SUBMITTED BY	Er. ANURAG	15.07.2022		

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

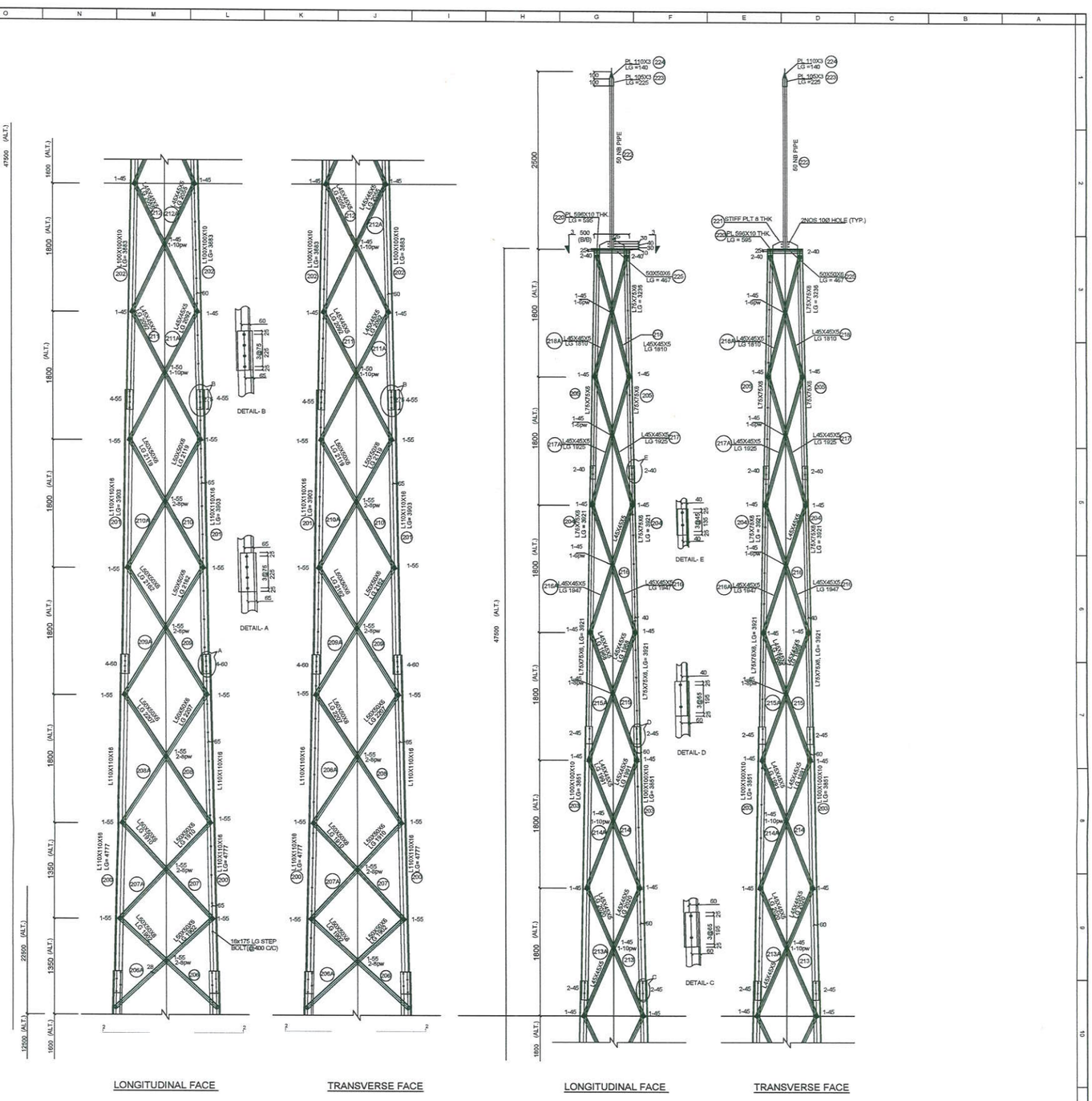
REC Power Development and Consultancy Ltd. Gurugram-122001

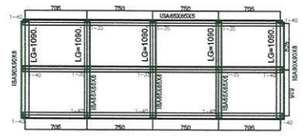
CN-18338
dt 27/7/2022

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

Approved/ Issued/ for Fabrication/Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित जारी। बशर्ते दी गई टिप्पणियों का संकलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date)





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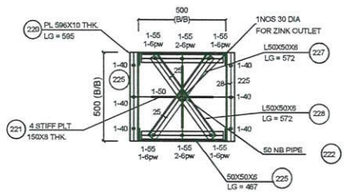


SECTION 3-3

Approval
Signature (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing. फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.- Please submit the revised documents for approval. फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते टी गई टिप्पणियों को अंकलित किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval. टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record. सूचना एवं रिकॉर्ड हेतु।
V. Not approved. अनुमोदित नहीं।

REC Power Development and Consultancy Ltd. Gurugram-122001

CV-18338 dt 23/12/2022

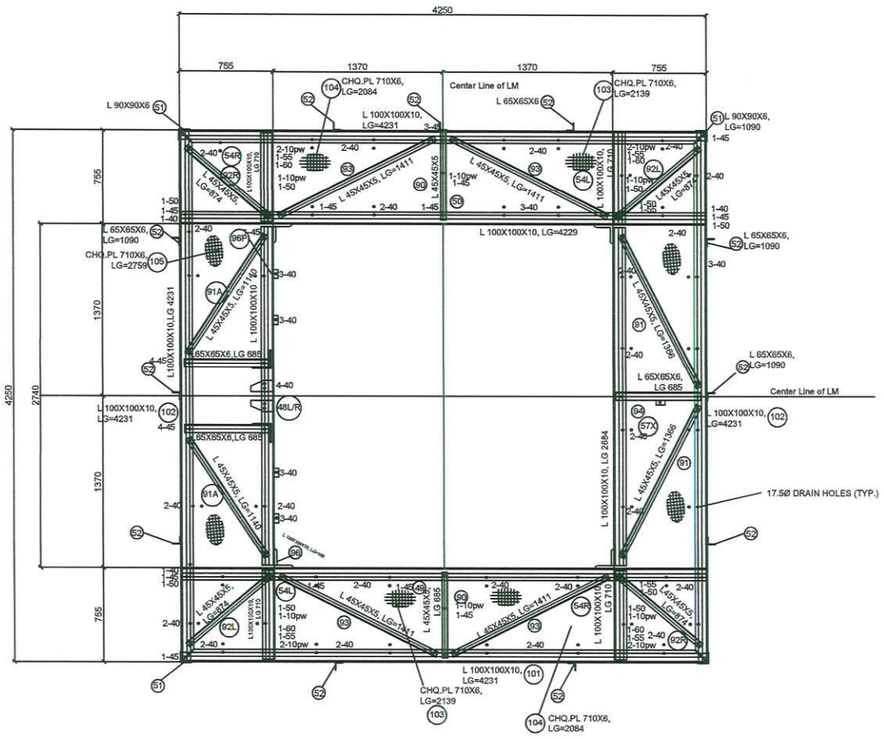
LIST OF 16mm Ø BOLTS (5.6 GRADE), NUTS & WASHERS.		
	SIZE (length in mm)	TOTAL QTY.
A	DIA 16X35 Lg.	-
B	DIA 16X40 Lg.	340
C	DIA 16X45 Lg.	292
D	DIA 16X50 Lg.	298
E	DIA 16X55 Lg.	369
F	DIA 16X60 Lg.	156
G	DIA 16X65 Lg.	32
H	DIA 16X70 Lg.	128
I	DIA 16X75 Lg.	224
J	DIA 16X80 Lg.	80
K	DIA 16X85 Lg.	-
SPRING WASHER	3.5 THK - 16 Ø	1919
PACK WASHER	5 mm	-
PACK WASHER	6 mm	56
PACK WASHER	8 mm	180
PACK WASHER	10 mm	95
PACK WASHER	12 mm	-
STEP BOLTS	^16x175 LG.	65

NOTES
1. ALL DIMENSIONS ARE IN MILLIMETER.
2. ALL STEEL AS PER IS-2062 & FABRICATION SHALL BE AS PER IS 802.
3. BOLT, NUTS AS PER IS-6639 (PROPERTY CLASS 5.6)
4. ALL HOLES 17.5 MM DIA FOR 16 MM DIA BOLT IF NOT STATED OTHERWISE.
5. WELDING SHALL BE DONE AS PER IS- 816.
6. ALL MEMBERS, BOLTS, NUTS, WASHERS SHALL EE HOT DIP GALVANISED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
7. GALVANISING SHALL BE 610 GM/MT. SQ.
8. ALL UN NOTED GUSSETS ARE 6MM THK.
9. ALL UN NOTED BRACING ARE 45x45x5 WITH 23mm BACKMARK.
10. 5% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
11. ALL ITEMS NOS TO BE PRE-FIXED WITH 'LM'.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	ERECTION DRAWING OF 50-M LIGHTENING MAST MKD. 'LM', FOR 220kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/128		REV- 01
SCALE	As shown in Drawing		SHEET NO.- 3 OF 4
AREA	91.6 KANAL 46336.5 SQM		SHEET SIZE - A1
	NAME	DATE	SIGN
PREPARED BY	BHARAT	15.07.2022	
CHECKED BY	G.H	15.07.2022	
SUBMITTED BY	Er. ANURAG	15.07.2022	KDBIL Signature/Stamp

Approved | Approved with comments | Not Approved | More information | Date.....

Kailash Devbuild (India) Pvt. Ltd. Jabalpur


4250
755
1370
1370
755
Center Line of LM
L 100X100X10, LG=4229
17.5Ø DRAIN HOLES (TYP.)
CHQ.PL 710X6, LG=2084
CHQ.PL 710X6, LG=2139
L 90X90X6
L 65X65X6, LG=1090
CHQ.PL 710X6, LG=2759
L 100X100X10, LG=4231
L 65X65X6, LG 685
L 45X45X5, LG=1411
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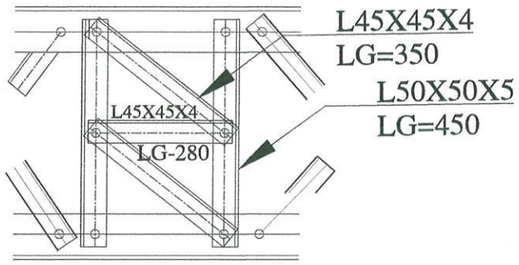
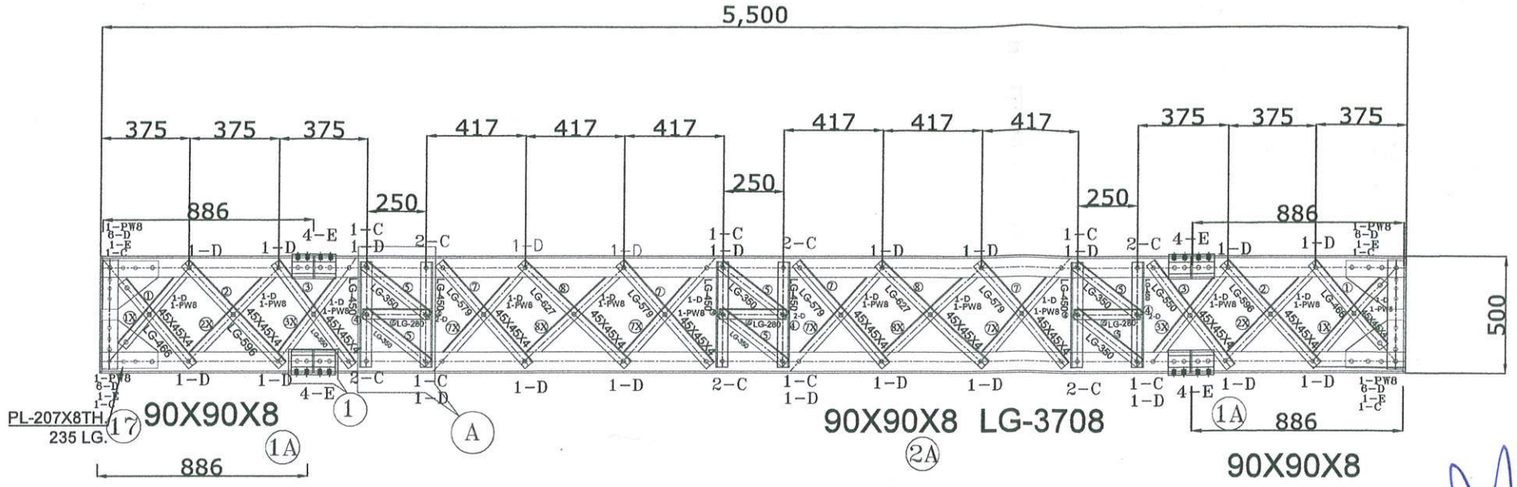
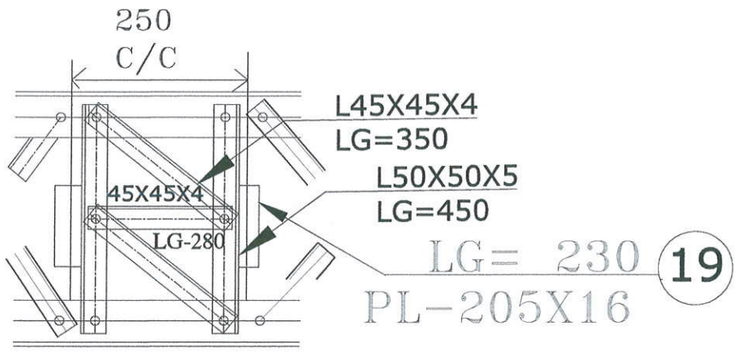


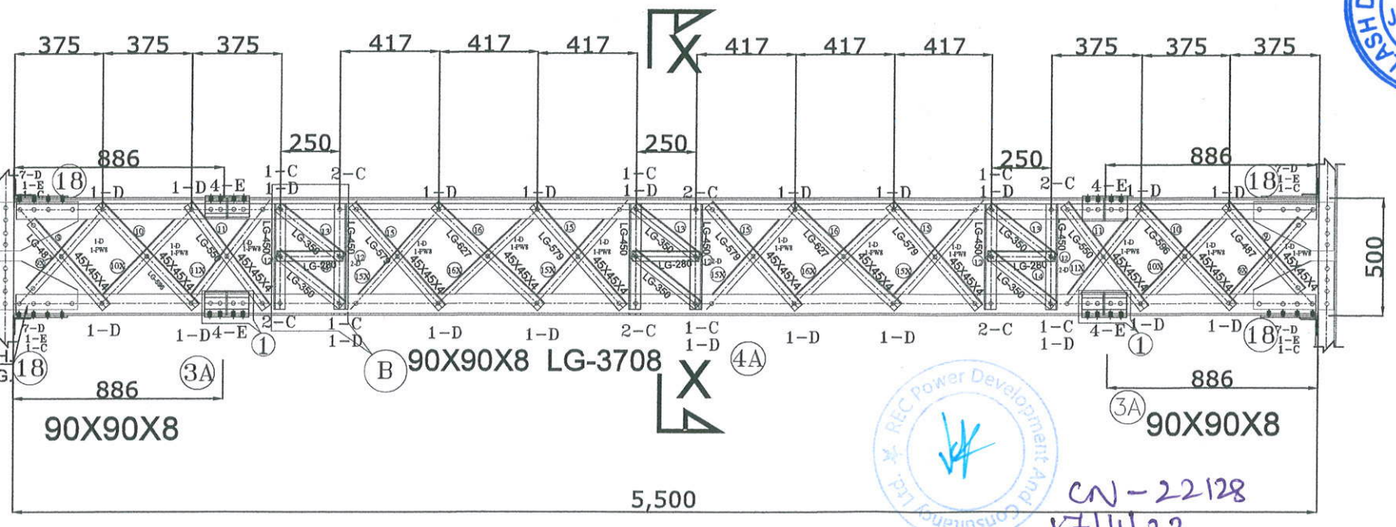
DETAIL-A

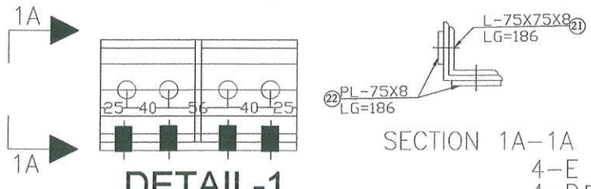


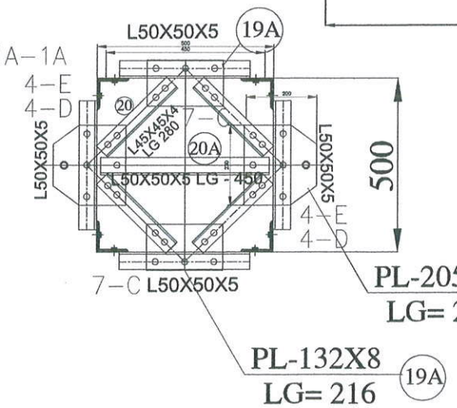
TOP & BOTTOM PLAN VIEW



DETAIL-B







FRONT REAR ELEVATION VIEW

Approved/ Issued/ for Fabrication/Construction/Manufacturing.
स्वीकृत/जारी/निर्माण/संरचना/हेतु अनुमोदित/जारी।
Approved/ Issued/ for Fabrication/ Construction/Manufacturing subject to condition that statements and comments are included.
Please submit the revised documents for approval.
शर्तों के अधीन स्वीकृत/जारी/निर्माण/संरचना हेतु अनुमोदित/जारी। टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
Manager

BOLTS/NUT STATEMENT			
	3.5mm THK SPRING. WASHER	612	
6	30 DX6 THK PACK. WASHER	–	
8	30 DX8 THK PACK. WASHER	48	
10	30 DX10 THK PACK. WASHER	–	
12	30 DX12 THK PACK. WASHER	–	
TYPE	SIZE	QTY	REMARK
B	DIA 16X35 Lg.	0	
C	DIA 16X40 Lg.	172	
D	DIA 16X45 Lg.	312	
E	DIA 16X50 Lg.	128	

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639(PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FABRICATION OF 33KV BEAM (3BA,3BB,3BC,3BD,3BE,3BF,3BG,3BH) Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/133 — REV- 01
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — PAGE NO.- 01

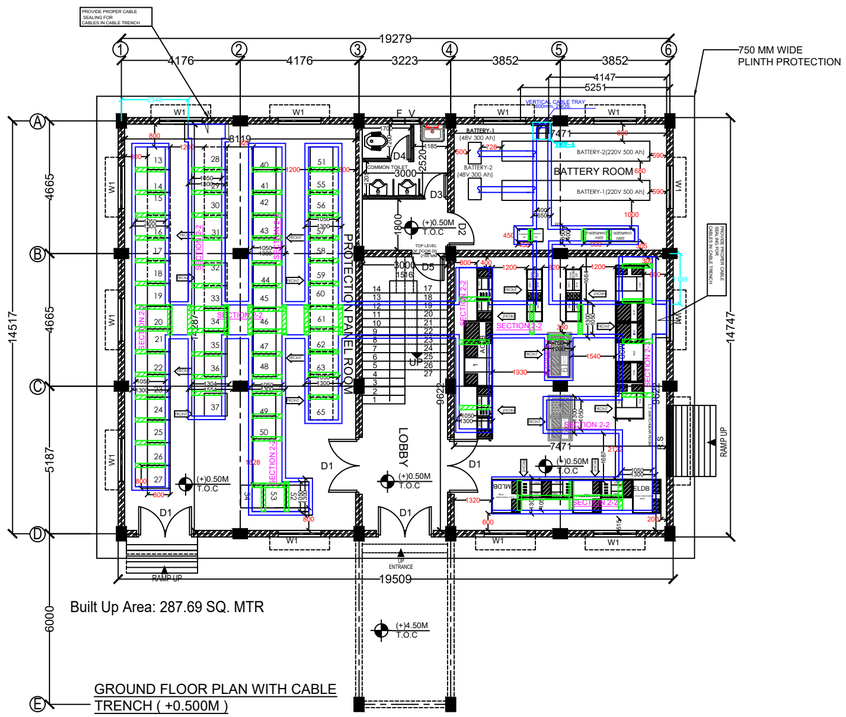
	NAME	DATE	SIGN	
PREPARED BY	BHARAT	04.11.2022		KDBIL
CHECKED BY	G.H	04.11.2022		
SUBMITTED BY	ANURAG	04.11.2022		Signature/Stamp...

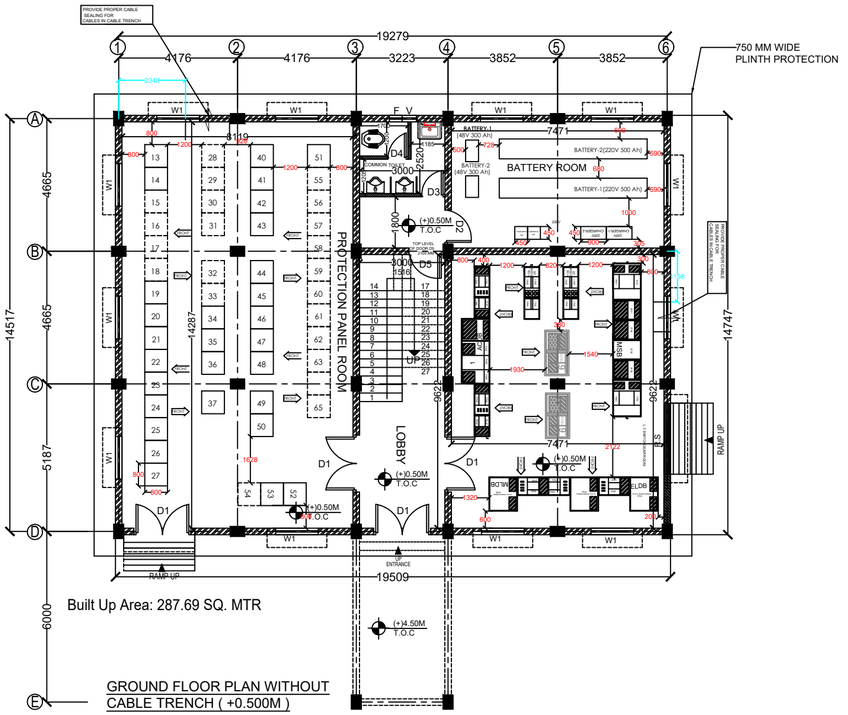
☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....

KAILASH DEVBUILD (INDIA) PVT. LTD. ★ JABALPUR

REC Power Development and Consultancy Ltd.

CN – 22128
17/11/22





PANEL DETAILS

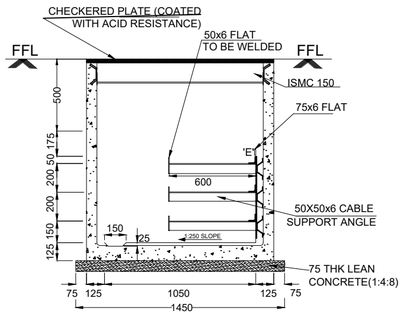
PANEL NO.	DESCRIPTION	SIZE
1	ACDB	6000X1000X2375
2	MSB	5400X1000X2375
3	MLDB	3850X1200X2375
4	ELDB	1200X2100X2375
5	DCDB-1(220V)	1850X550X2375
6	DCDB-2(220V)	1850X550X2375
7	DCDB-1(48V)	1600X850X1800
8	DCDB-2(48V)	1600X850X1800
9	220V BATTERY CHARGER-1	900X450
10	220V BATTERY CHARGER-2	900X450
11	48V BATTERY CHARGER-1	450X450
12	48V BATTERY CHARGER-2	1200X800
13	220 KV LINE PROTECTION-1	800X900X2315
14	220 KV LINE PROTECTION-2	800X900X2315
15	220 KV LINE PROTECTION-1(F)	800X900X2315
16	220 KV LINE PROTECTION-2(F)	800X900X2315
17	220 KV LINE PROTECTION-3(F)	800X900X2315
18	220 KV LINE PROTECTION-4(F)	800X900X2315
19	220KV TRF-1 (HV & LV)	800X800X2315
20	220KV TRF-2 (HV & LV)	800X800X2315
21	220KV BUSBAR PROTECTION	800X800X2315
22	220 KV CB RELAY LINE-1	800X800X2315
23	220 KV CB RELAY LINE-2	800X800X2315
24	220 KV CB RELAY ICT-1	800X800X2315
25	220 KV CB RELAY ICT-2	800X800X2315
26	220 KV CB RELAY TBC	800X800X2315
27	220 KV CB RELAY BC	800X800X2315
28	220 KV CB RELAY LINE-3 (F)	800X800X2315
29	220 KV CB RELAY LINE-4 (F)	800X800X2315
30	220 KV CB RELAY LINE-5 (F)	800X800X2315
31	220 KV CB RELAY LINE-6 (F)	800X800X2315
32	220 KV CB RELAY ICT-3 (F)	800X800X2315

PANEL DETAILS

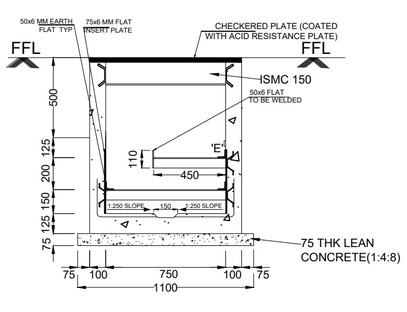
33	220KV TRF-3 (HV & LV) (F)	800X800X2315
34	DPC PANEL -1	800X800X2315
35	DPC PANEL -2	800X800X2315
36	FOTE-1	800X800X2315
37	SDH PANEL	800X800X2315
38	SAS PANEL-1	800X800X2315
39	SAS PANEL-2	800X800X2315
40	33KV LINE PROTECTION-1	800X800X2315
41	33KV LINE PROTECTION-1	800X800X2315
42	33KV LINE PROTECTION-1	800X800X2315
43	33KV LINE PROTECTION-1	800X800X2315
44	33 KV CB RELAY LINE-1	800X800X2315
45	33 KV CB RELAY LINE-2	800X800X2315
46	33 KV CB RELAY LINE-3	800X800X2315
47	33 KV CB RELAY LINE-4	800X800X2315
48	33 KV CB RELAY ICT-1	800X800X2315
49	33 KV CB RELAY ICT-2	800X800X2315
50	33 KV CB RELAY BC	800X800X2315
51	33 KV CB RELAY LT TRF	800X800X2315
52	RTCC-1	800X800X2315
53	RTCC-2	800X800X2315
54	RTCC-3 (F)	800X800X2315
55	33KV LINE PROTECTION-5 (F)	800X800X2315
56	33KV LINE PROTECTION-6 (F)	800X800X2315
57	33KV LINE PROTECTION-7 (F)	800X800X2315
58	33KV LINE PROTECTION-8 (F)	800X800X2315
59	33KV LINE PROTECTION-9 (F)	800X800X2315
60	33 KV CB RELAY LINE-5 (F)	800X800X2315
61	33 KV CB RELAY LINE-6 (F)	800X800X2315
62	33 KV CB RELAY LINE-7 (F)	800X800X2315
63	33 KV CB RELAY LINE-8(F)	800X800X2315
64	33 KV CB RELAY LINE-9 (F)	800X800X2315
65	33 KV CB RELAY ICT-3 (F)	800X800X2315

NOTES:

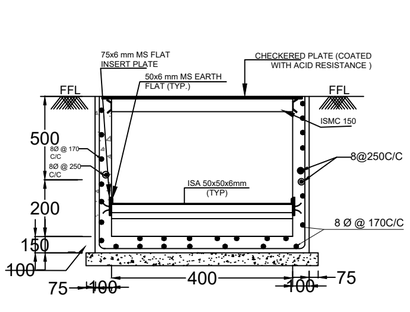
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. UNUSED OPENING/SPARE CONDUITS ETC. SHALL BE SEALED PROPERLY & MADE WATER PROOF.
3. INDOOR INVERT LEVEL SHALL BE GOES TO OUTSIDE.



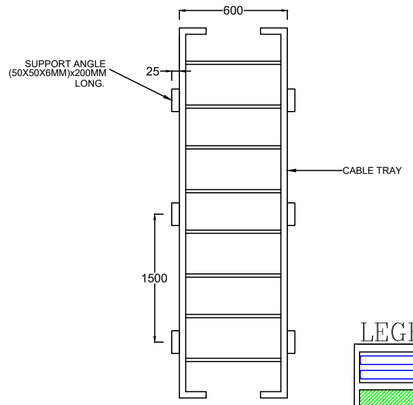
SECTION 2–2



SECTION 3–3



SECTION 4–4



VIEW–A
FRONT VIEW

LEGENDS:

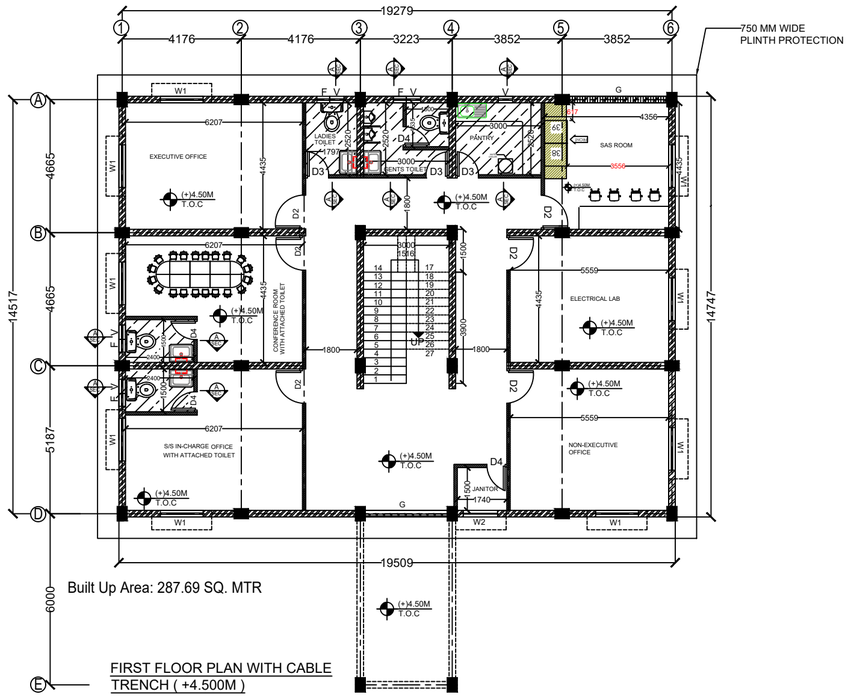
- 100MM ø PIPE
- ISMC150MM
- 75*75*6MM ANGLE

01	05.12.2022	REVISED AS PER COMMENT	
0 0	25.11.2022	FIRST RIVISON	
RIVISON	RIVISON DATE	MODIFICATION	
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	CRB PANEL ARRANGEMENT AND INDOOR CABLE TRENCH 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/144		
SCALE	As shown in Drawing	SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM	SH. NO.:- 1OF2	

	NAME	DATE	SIGN	
PREPARED BY	SHWETA	05.12.2022		
CHECKED BY	GH	05.12.2022		
SUBMITTED BY	KDBIL	05.12.2022		Signature/Stamp...

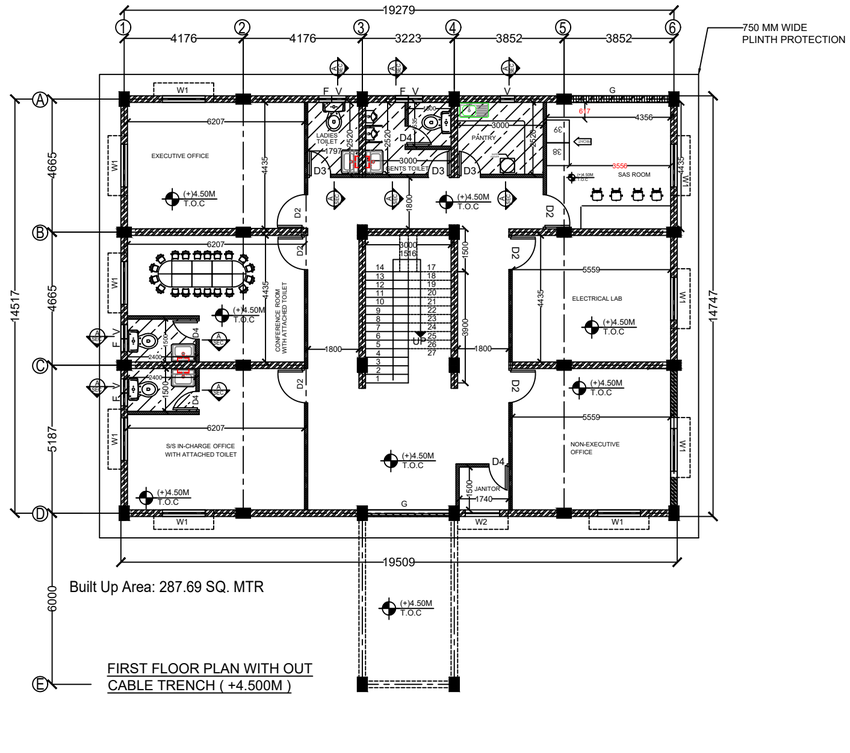
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



Built Up Area: 287.69 SQ. MTR

FIRST FLOOR PLAN WITH CABLE TRENCH (+4.500M)



Built Up Area: 287.69 SQ. MTR

FIRST FLOOR PLAN WITH OUT CABLE TRENCH (+4.500M)

PANEL DETAILS

PANEL NO	DESCRIPTION	SIZE
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PANEL DETAILS

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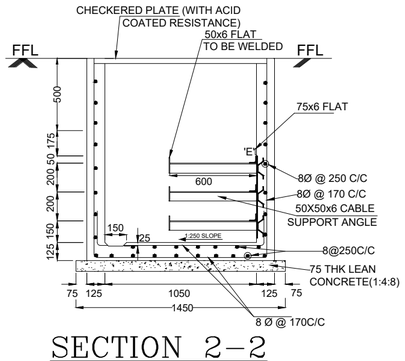
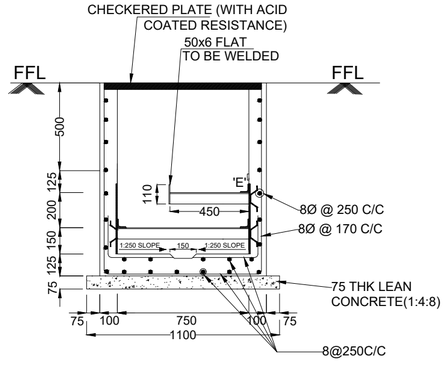
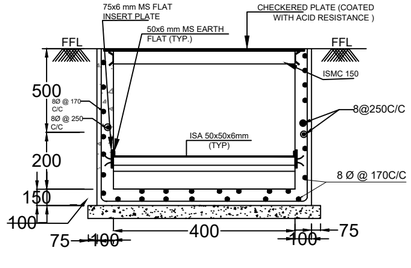


SECTION 2–2



SECTION 3–3



SECTION 4–4

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. UNUSED OPENING/SPARE CONDUITS ETC. SHALL BE SEALED PROPERLY & MADE WATER PROOF.
3. INDOOR INVERT LEVEL SHALL BE GOES TO OUTSIDE.

LEGENDS:

CHECKERED PLATE 500MM

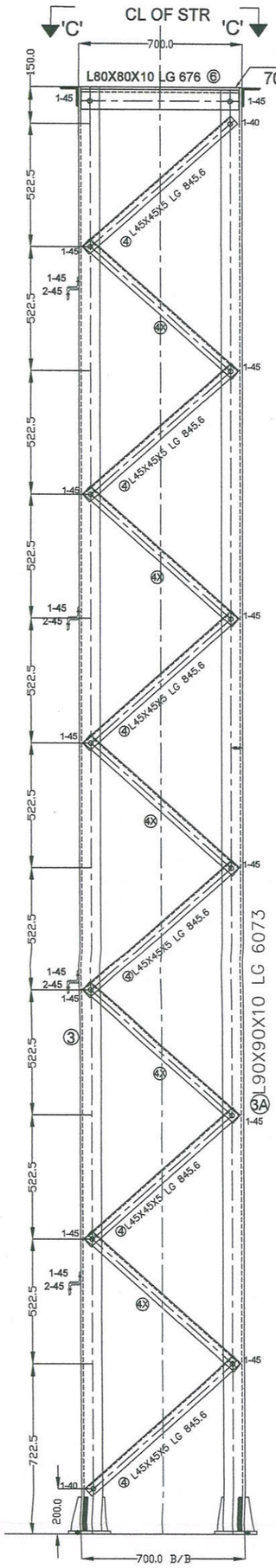
01	05.12.2022	REVISED AS PER COMMENT
0 0	25.11.2022	FIRST RIVISON
RIVISON	RIVISON DATE	MODIFICATION

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	CRB PANEL ARRANGEMENT AND INDOOR CABLE TRENCH 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/144
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM — SH. NO.:- 2OF2

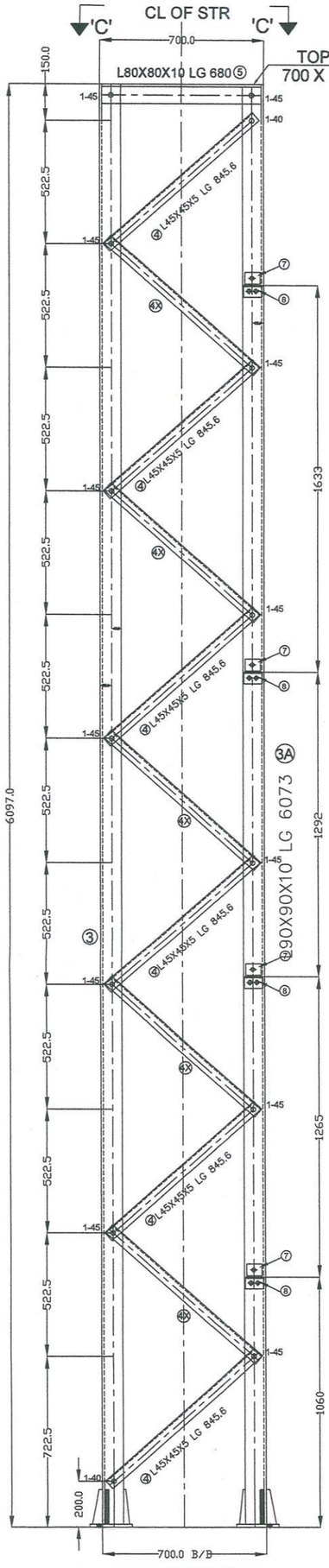
	NAME	DATE	SIGN	
PREPARED BY	SHWETA	05.12.2022		
CHECKED BY	GH	05.12.2022		
SUBMITTED BY	KDBIL	05.12.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

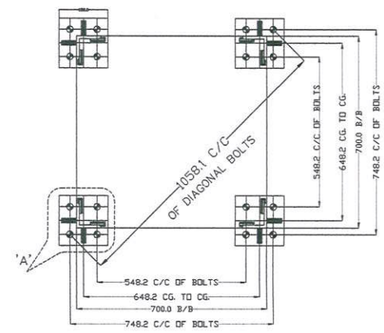


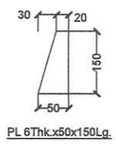
FRONT ELEVATION



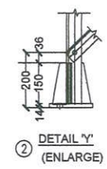
SIDE ELEVATION

BILL OF MATERIAL								
SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 180X14	180	180	109.90	3.561	4	14.243
2	2	PL 50X6	150	50	47.10	0.353	8	2.826
3	2A	PL 50X6	150	50	47.10	0.353	8	2.826
4	3	L90X90X10	6073		13.40	81.38	2	162.756
5	3A	L90X90X10	6073		13.40	81.38	2	162.756
6	4	L45X45X5	845.6		3.40	2.875	12	34.500
7	4X	L45X45X5	845.6		3.40	2.875	10	28.750
8	5	L80X80X10	680		11.80	8.024	2	16.048
9	6	L80X80X10	676		11.80	7.977	2	15.954
10	7	L65X65X10	65		9.40	0.611	8	4.888
11	8	L65X65X10	75		9.40	0.705	8	5.640
12	9	PL700X10	700	700	78.50	38.465	1	38.465
				WT. OF STRUCTURE (kg.) =				489.65
TOTAL LIST OF BOLTS & NUTS								
13		M16x40 mm Bolts & Nuts				0.126	8	1.01
14		M16x45 mm Bolts & Nuts				0.134	76	10.18
15		M-16-3.5 THK SPRING WASHER				0.009	84	0.76
16		M16X100 LG. FOR EQPT. MOUNTING (FULL THREADED)				0.218	8	1.744
					TOTAL WEIGHT OF HARDWARE (kg)=			13.69
					TOTAL WEIGHT OF STRUCTURE WITH HARDWARE (kg)			503.35

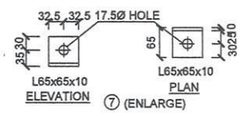




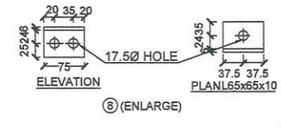
PL 6Thk.x50x150Lg.



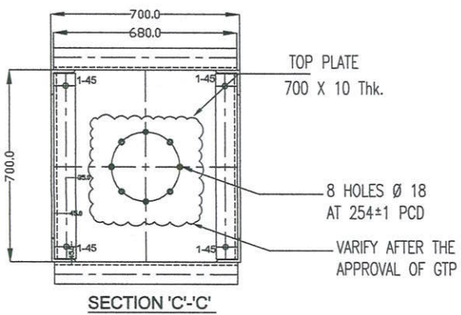
② DETAIL 'Y' (ENLARGE)



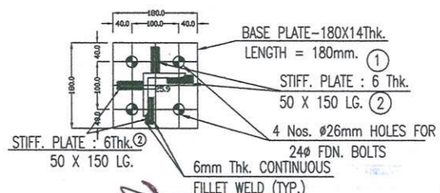
⑦ (ENLARGE)



⑧ (ENLARGE)



SECTION 'C'-'C'



00	26.11.2022	FIRST SUBMISSION
REVISION	REV. DATE	MODIFICATION
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.	
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OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)	
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)	
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)	
CONSULTANT	ed Ultra Power Transmission Consultancy	
TITLE	220KV HBPI STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu	
DRG. NO.	KDBIL/250 PJ/20-21/D1/145	
SCALE	As shown in Drawing	SHEET SIZE - A3
AREA	91.6 KANAL 46336.5 SQM	SHEET OF

	NAME	DATE	SIGN
PREPARED BY	PURNIMA	26.11.2022	Purnima
CHECKED BY	G.H	26.11.2022	
SUBMITTED BY	Mr.ANURAG	26.11.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR

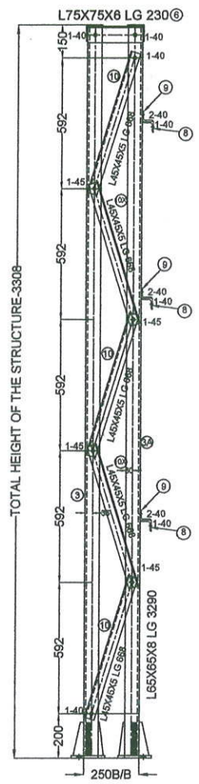
Signature/Stamp

Issued/ for Fabrication/Construction
submit the revised documents for approval
comments and submit again for approval
information and record.
not approved.

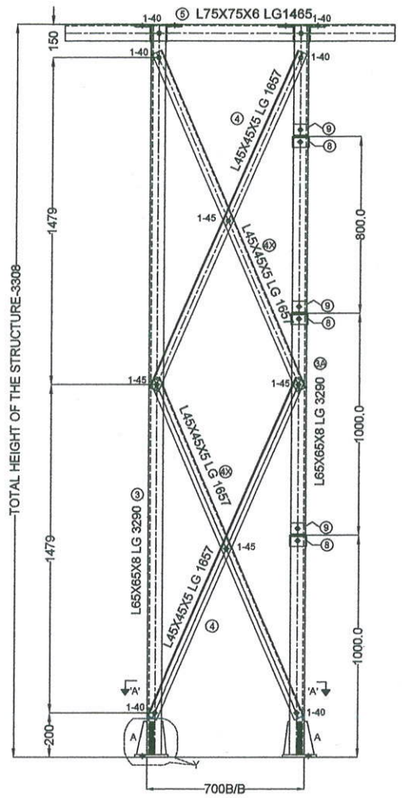
Manager

REC Power Development and Consultancy Limited Gurugram

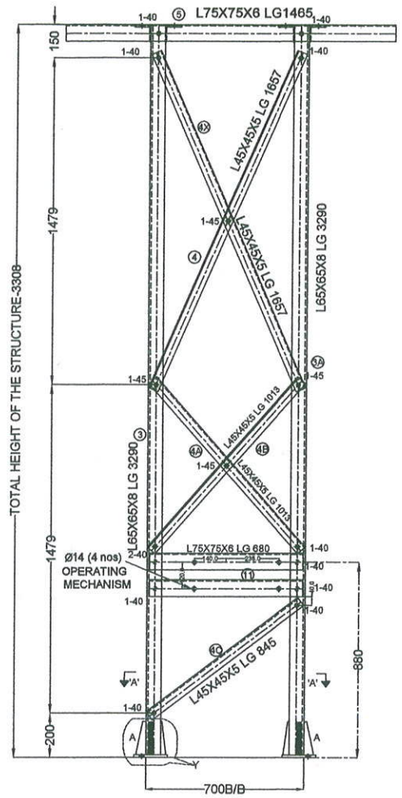
CN-22601
~~30/11/22~~
01/12/22



SIDE ELEVATION



BACK ELEVATION



FRONT ELEVATION

BILL OF MATERIAL FOR THREE PHASE TANDEM ISOLATOR

SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 160X12	160	160	94.20	2.412	12	28.938
2	2	PL 50X6	150	50	47.10	0.353	24	8.478
3	2A	PL 50X6	150	50	47.10	0.353	24	8.478
4	3	L65x65x8	3290		7.70	25.33	6	151.998
5	3A	L65x65x8	3290		7.70	25.33	6	151.998
6	4	L45X45X5	1657		3.40	5.634	9	50.704
7	4X	L45X45X5	1657		3.40	5.634	9	50.704
8	4A	L45X45X5	1013		3.40	3.444	3	10.333
9	4B	L45X45X5	1013		3.40	3.444	3	10.333
10	4C	L45X45X5	845		3.40	2.873	3	8.619
11	5	L75X75X6	1465		6.80	9.962	6	59.772
12	6	L75X75X6	230		6.80	1.564	6	9.384
13	7	L75X75X6	230		6.80	1.564	6	9.384
14	8	L75X75X5	75		5.70	0.428	36	15.390
15	9	L75X75X5	65		5.70	0.371	36	13.338
16	10	L45X45X5	668		3.40	2.271	18	40.882
17	10X	L45X45X5	668		3.40	2.271	12	27.254
18	11	L75X75X6	680		6.80	4.624	6	27.744
				WT. OF STRUCTURE (kg.) =				655.99
TOTAL LIST OF BOLTS & NUTS								
19		M16x40 mm Bolts & Nuts				0.126	162	20.41
20		M16x45 mm Bolts & Nuts				0.134	48	6.43
21		M-16-3.5 THK SPRING WASHER				0.009	210	1.89
22		M16X100 LG. FOR EQPT. MOUNTING (FULL THREADED)				0.218	6	1.308
23		M12X45 LG. FOR OPERATING BOX				0.071	4	0.284
TOTAL WEIGHT OF HARDWARE (kg)=								30.33

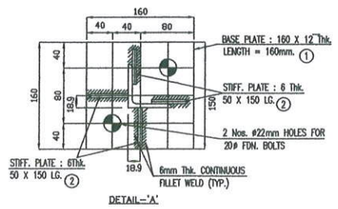
NOTES

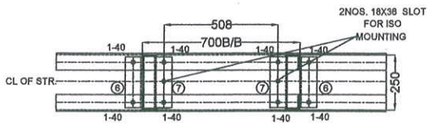
1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802
3. BOLTS, NUTS SHALL BE AS PER IS:12427 (PROPERTY CLASS 5.6).
4. GALVANIZING TO BE AS PER TECHNICAL SPECIFICATION.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER I.S:816
7. ALL STRUCTURAL MEMEBERS SHALL BE HOT DIP GALVANIZED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
8. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
9. EQUIPMENT MOUNTING DETAILS, & STRUCTURE HEIGTH ARE INDICATIVE ONLY, WHICH MAY CHANGE AS PER EQUIPMENT DRAWING.
10. ALL WELD SHALL BE 6MM THICK FILLET WELD.

CV-24461 06/02/23

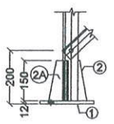
REC PDCL GURUGRAM

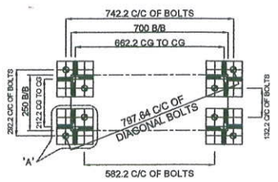
KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR

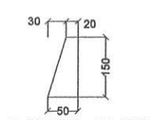




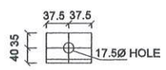
SECTION C-C FOR ISO



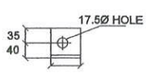




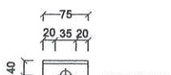
② PL 6Thk.x50x150Lg.



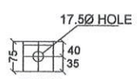
PLAN
⑧ L75x75x5 LG75



ELEVATION
⑨ L75x75x5 LG 65



ELEVATION
⑧ L75x75x5 LG 75



PLAN
⑨ L75x75x5 LG 65

00	20.01.2023	FIRST SUBMISSION
REVISION	REV.DATE	MODIFICATION
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.	
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020	
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)	
CLIENT	REC Power Development & Consultancy Limited (RECPDCL) Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)	
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)	
CONSULTANT	Advanced Ultra Power Transmission Consultancy	
TITLE	33KV TANDEM ISO STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu	
DRG. NO.	KDBIL/250 PJ/20-21/D1/147	
SCALE	As shown in Drawing	SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 1 OF 1

	NAME	DATE	SIGN	
PREPARED BY	PURNIMA	20.01.2023		Signature/Stamp...
CHECKED BY	G.H	20.01.2023		
SUBMITTED BY	ANURAG	20.01.2023		

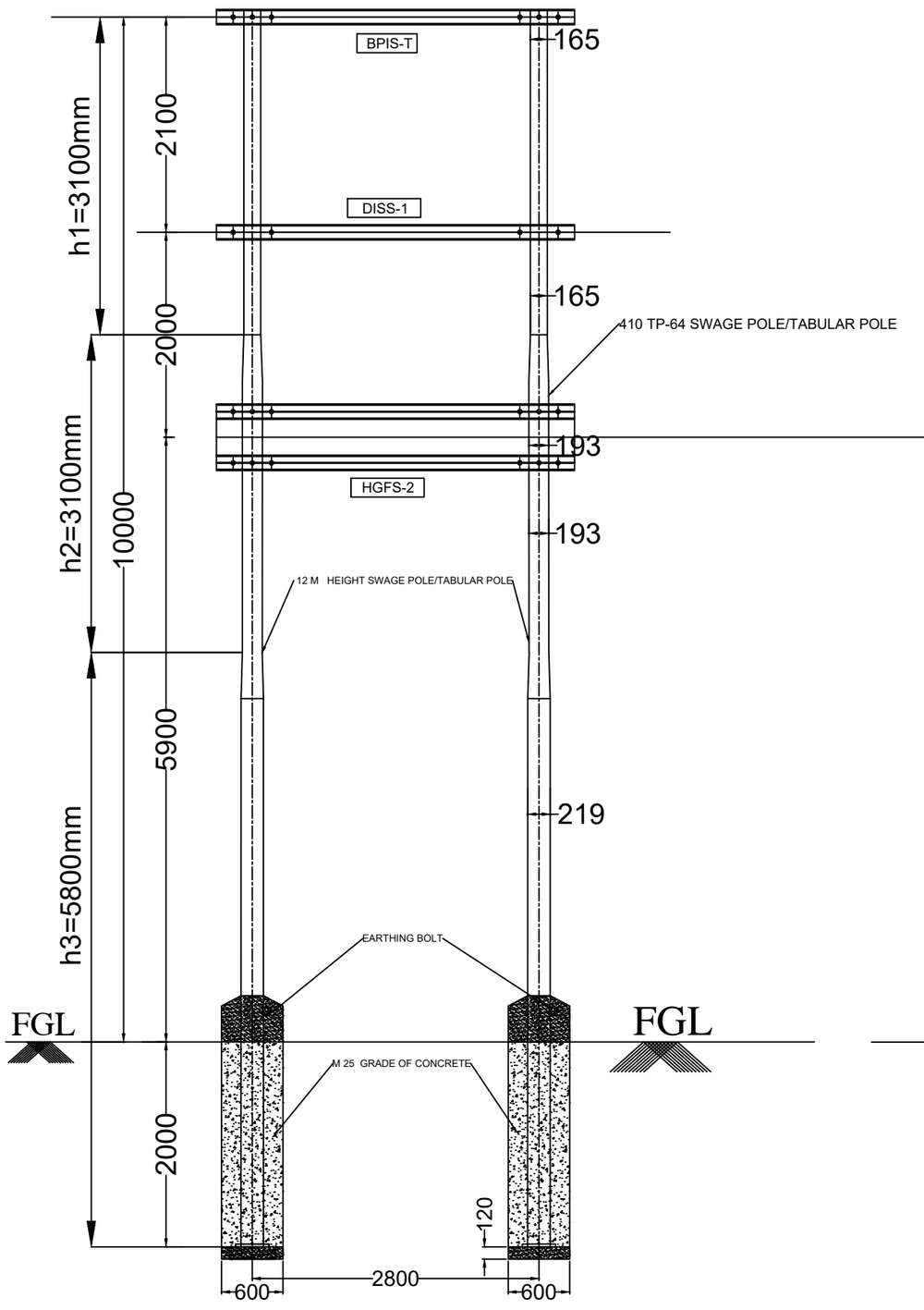
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

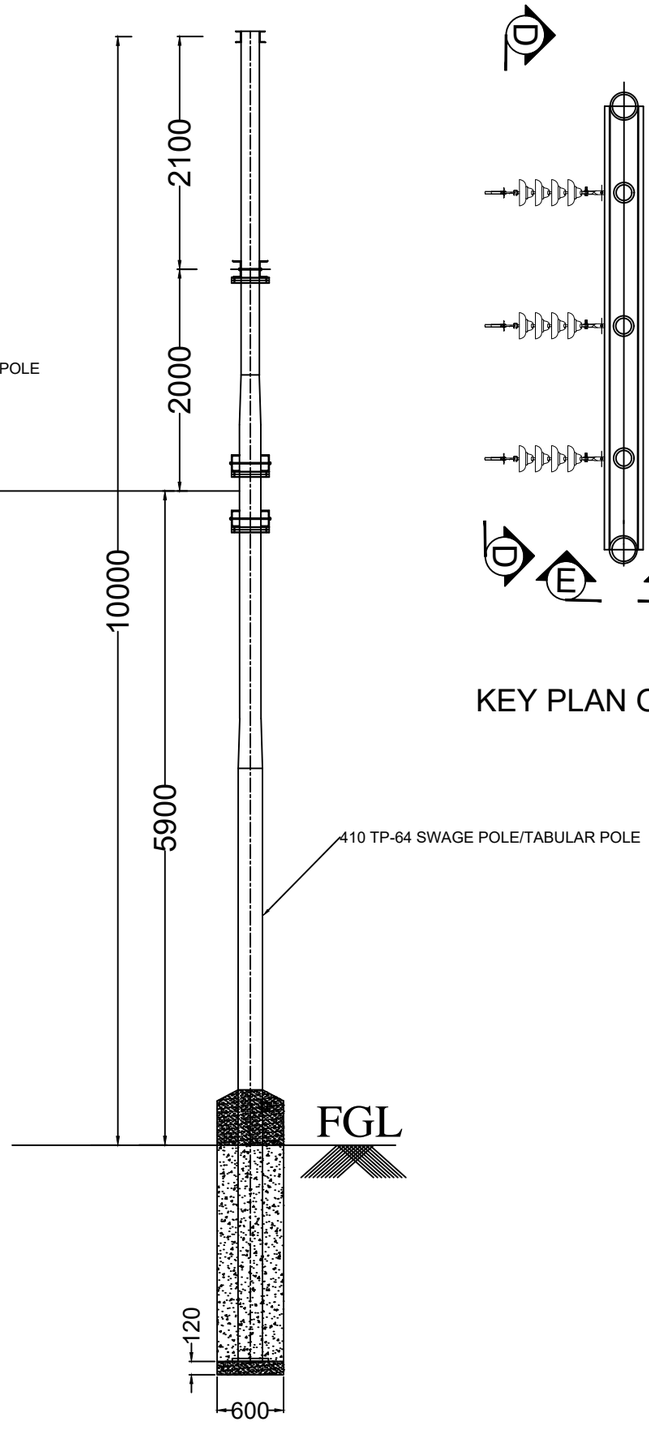
(Signature) (Manager) (Designation) 06/02/23 (Date)

Comments :
I Approved issued for Fabrication/Construction/Manufacturing
II Approved issued for Fabrication/Construction/Manufacturing. Subject to condition that comments and comments are included. Please submit the re-liked documents for approval
III Insert comments and submit again for approval
IV For information and record
V Not approved

DESIGNATION	OVERALL LENGTH OF POLE	PLANTING DEPTH	HEIGHT ABOVE GROUND	STEPS h3xh2xh1 (mm)	APPROX WEIGHT OF SINGLE POLE
410 TP-64	12 METER	2 METER	10 METER	219.1x193.7x165.1	279 KG



33KV O/G LINE DOUBLE POLE
(FRONT VIEW)
SECTION D-D



33KV O/G LINE DOUBLE POLE
(SIDE VIEW)
SECTION E-E

KEY PLAN OF DP STR

NOTES:-
1. ALL DIMENSIONS ARE IN MM. AND LEVEL IN METRE UNLESS OTHERWISE NOTED.
2. ALL STRUCTURAL STEELS SHALL CONFORM TO GRADE E250A (Fe410W) OF IS:2062.
3. ALL WELDS ARE 6MM FILLET UNLESS OTHERWISE NOTED.
4. ALL FABRICATION AND ERECTION SHALL CONFORM TO PROVISIONS OF IS:800.
5. ALL HOLES SHALL BE 17.5 DIA. FOR 16 DIA. BOLT UNLESS OTHERWISE NOTED.
6. ALL WELDS SHALL CONFORM TO IS:816, IS:9595.
7. PAINTING OF STRUCTURAL STEEL MEMBERS SHALL BE AS PER SPECIFICATION.
8. ALL STRUCTURAL STEEL ,BOLTS & NUT SHALL BE GALVANISED.
9. FOR LAYOUT AND LOCATIONS OF FOUNDATION REF.DRAWING NO.
10. TOTAL HEIGHT OF POLE STRUCTRE IS 12 M CONSIDERED AS PER SECTION LAYOUT.
11. WE CONSIDER POLE IS CIRCULAR SHAPE (TOP DIA IS 165 MM, MID DIA 193MM& BOTTOM DIA IS 220 MM)
12. FOR SWAGE POLE/TABULAR POLE STANDARD SPECIFICATION REFER TO IS CODE 2713.

LEGEND	
HGFS	HORN GAP FUSE
FGL	FINISH GROUND LEVEL
PISS	PIN INSULATOR SUPPORT
DISS	DIS INSULATOR SUPPORT
C	COLUMN

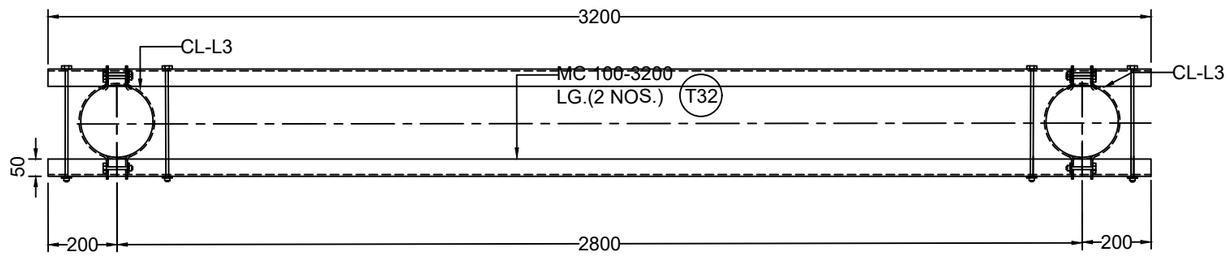
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	DOUBLE POLE STRUCTURE DRAWING WITH CONNECTED HGFS&BPI OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/148		REV- 2	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 4	
	NAME	DATE	SIGN	
PREPARED BY	SHIVAM	25.03.2023		Signature/Stamp...
CHECKED BY	G.H	25.03.2023		
SUBMITTED BY	ANURAG	25.03.2023		

☐ Approved ☐ Approved with comments ☐ Not Approved

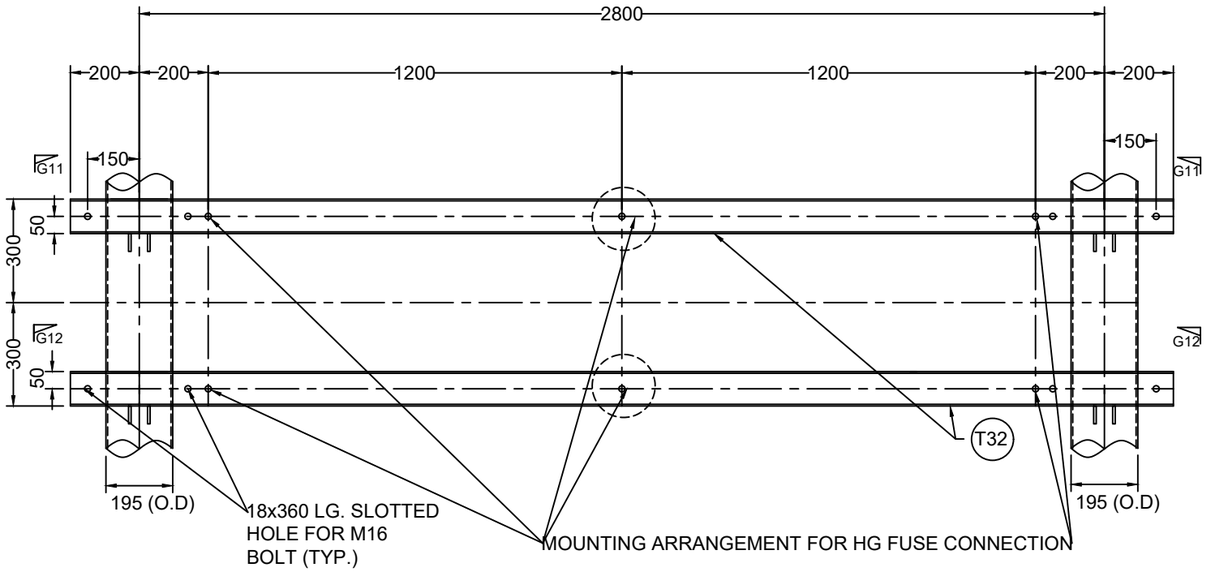
☐ More Information Date.....

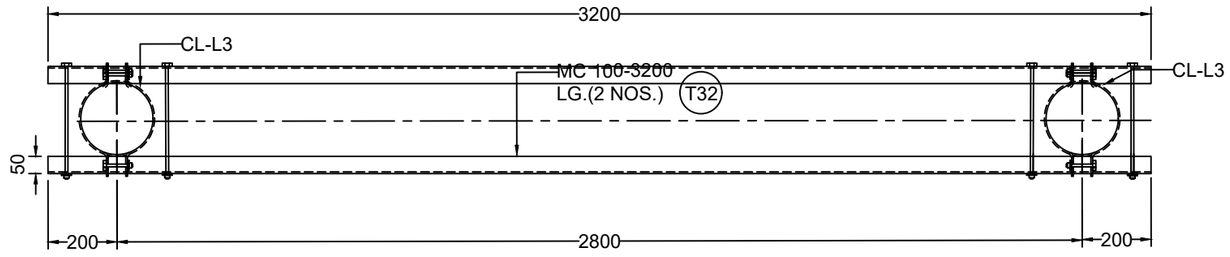
HG FUSE FOR 33KV

EQUIPMENTS MKD. NO. :HGFS-2

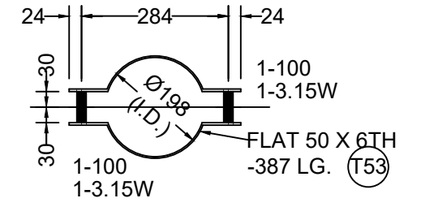


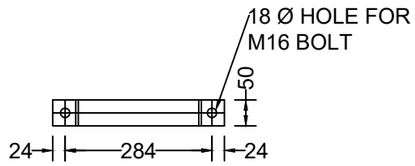
PLAN G11-G11





PLAN G12-G12





DETAIL OF CLAMP MKD.
CL-M FOR 195(O.D)

NOTES:-

1. ALL DIMENSIONS ARE IN MM. AND LEVEL IN METRE UNLESS OTHERWISE NOTED.
2. ALL BOLTS,NUTS & WASHER SHALL CONFORM IS:6639 & AS PER SPECIFICATION & PROPERTY CLASS 4.6.

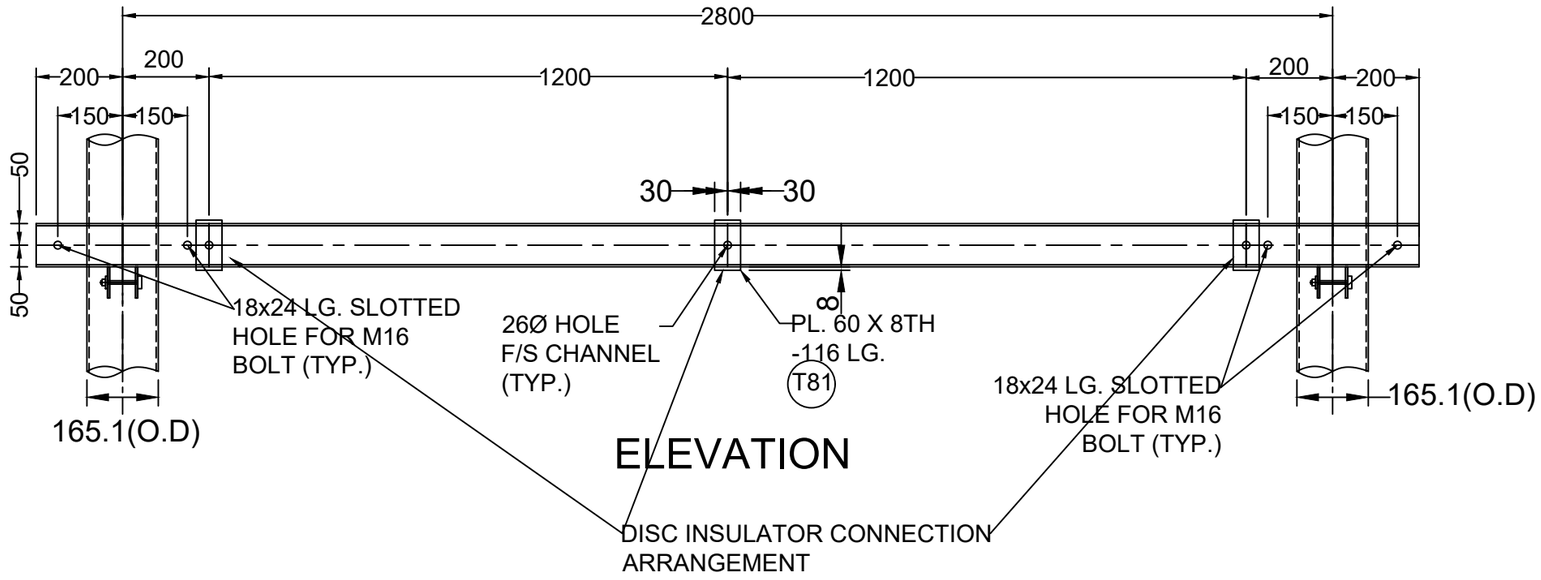
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	TYP.DETAIL OF HG FUSE FOR 33KV SUBSTATION. EQUIPMENTS MKD.NO.:HGFS-2 NAGROTA (NEW) S/S			
DRG. NO.	KDBIL/250 PJ/20-21/D1/148		REV- 2	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 2 OF 4	
	NAME	DATE	SIGN	
PREPARED BY	SHIVAM	25.03.2023		Signature/Stamp...
CHECKED BY	G.H	25.03.2023		
SUBMITTED BY	ANURAG	25.03.2023		

☐ Approved ☐ Approved with comments ☐ Not Approved

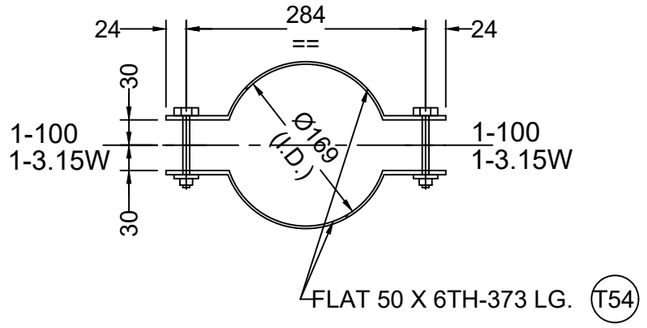
☐ More Information Date.....

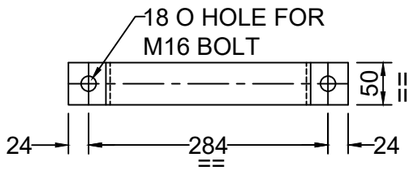
PIN INSULATOR WITH DISC INSULATOR FOR 33KV

EQUIPMENTS MKD. NO. :DISS-1

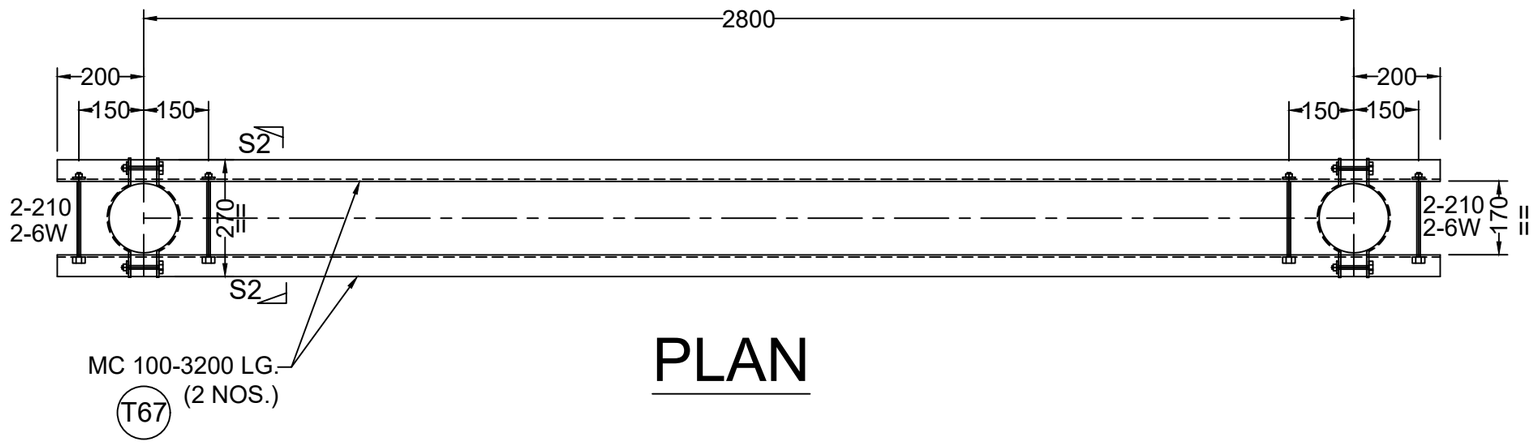


ELEVATION

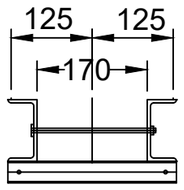




DETAIL OF CLAMP MKD.
CL-T FOR 165.1(O.D)



PLAN



VIEW S2-S2

NOTES:-

1. ALL DIMENSIONS ARE IN MM. AND LEVEL IN METRE UNLESS OTHERWISE NOTED.
2. ALL BOLTS,NUTS & WASHER SHALL CONFORM IS:6639 & AS PER SPECIFICATION & PROPERTY CLASS 4.6.

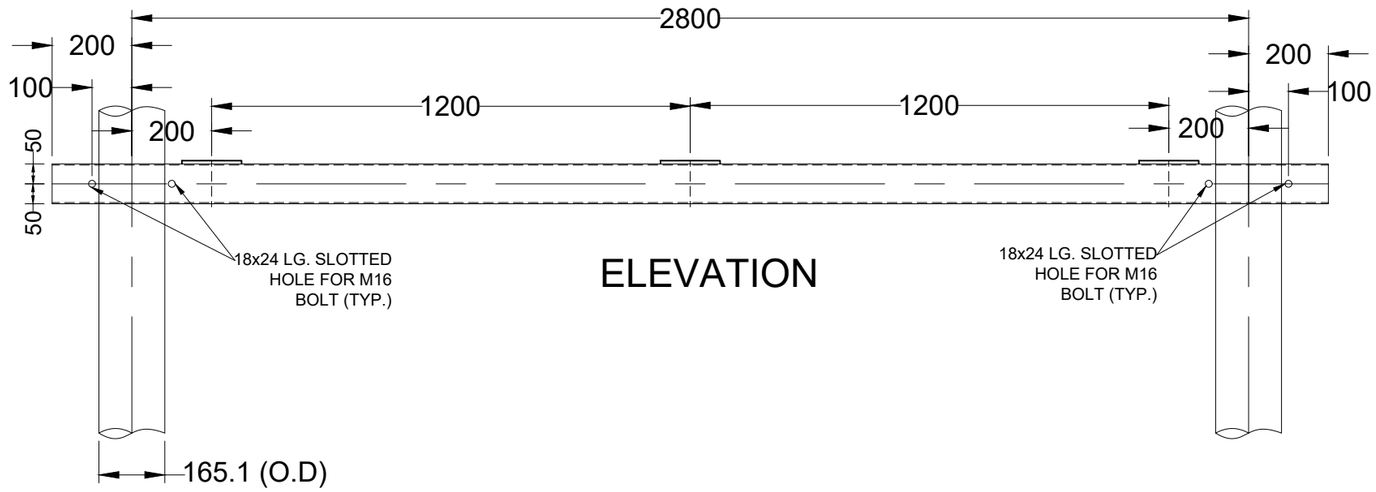
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	TYP. DETAIL OF PIN INSULATOR WITH DIS INSULATOR FOR 33KV SUB STATION EQUIPMENTS MKD.NO.:DISS–1			
DRG. NO.	KDBIL/250 PJ/20-21/D1/148		REV- 2	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 3 OF 4	
	NAME	DATE	SIGN	
PREPARED BY	SHIVAM	25.03.2023		Signature/Stamp...
CHECKED BY	G.H	25.03.2023		
SUBMITTED BY	ANURAG	25.03.2023		

☐ Approved ☐ Approved with comments ☐ Not Approved

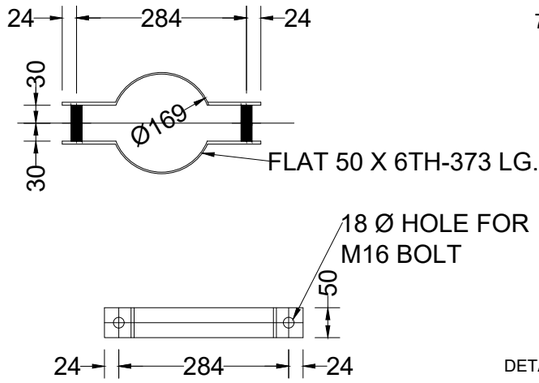
☐ More Information Date.....

BUS POST INSULATOR FOR 33KV

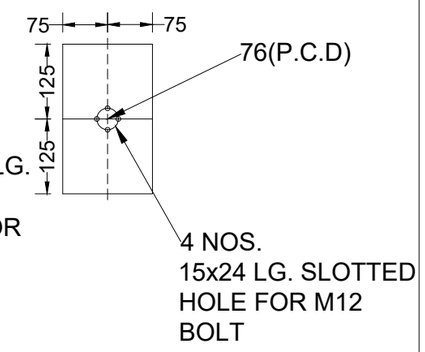
EQUIPMENTS MKD. NO. :BPIS-T



ELEVATION



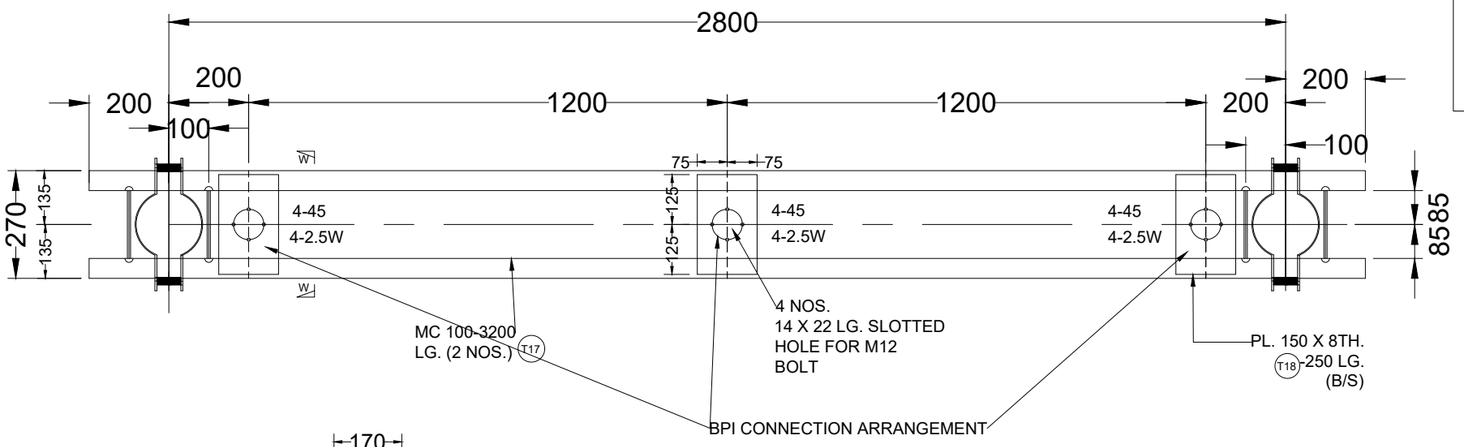
DETAIL OF CLAMP MKD. CL-T FOR 165.1(O.D)

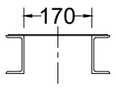


DETAIL OF ITEM NO.T-18

NOTES:-

1. ALL DIMENSIONS ARE IN MM. AND LEVEL IN METRE UNLESS OTHERWISE NOTED.
2. ALL BOLTS,NUTS & WASHER SHALL CONFORM IS:6639 & AS PER SPECIFICATION & PROPERTY CLASS 4.6.





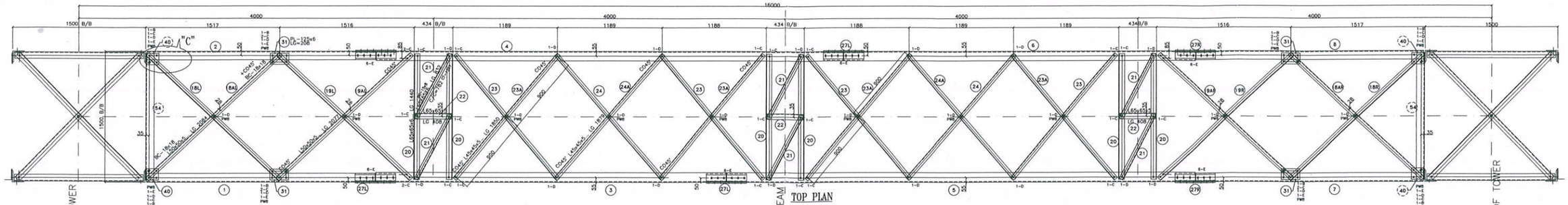
VIEW W-W
(SCALE 1:10)

BPIS BASE PL. 9MM THK. 12 MM DIA. HOLE 4 NOS. ON 76 P.C.D

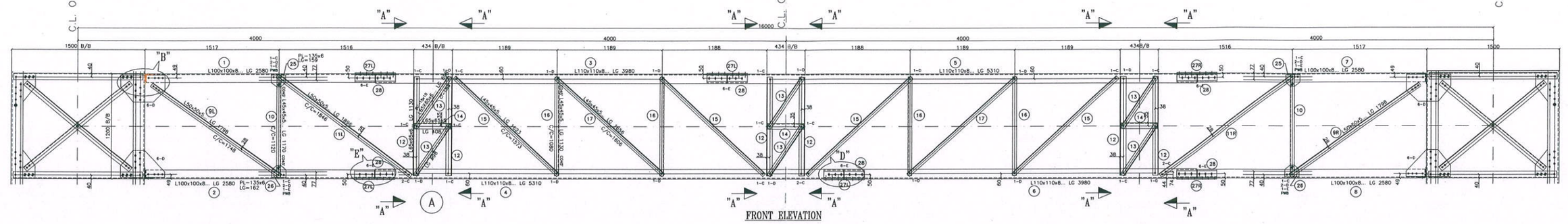
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	TYP.DETAIL OF BUS POST INSULATOR FOR 33KV SUBSTATION, EQUIPMENTS MKD.NO.:BPIS-T, NAGROTA S/S			
DRG. NO.	KDBIL/250 PJ/20-21/D1/148		REV- 2	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 4 OF 4	
	NAME	DATE	SIGN	
PREPARED BY	SHIVAM	25.03.2023		
CHECKED BY	G.H	25.03.2023		
SUBMITTED BY	ANURAG	25.03.2023		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

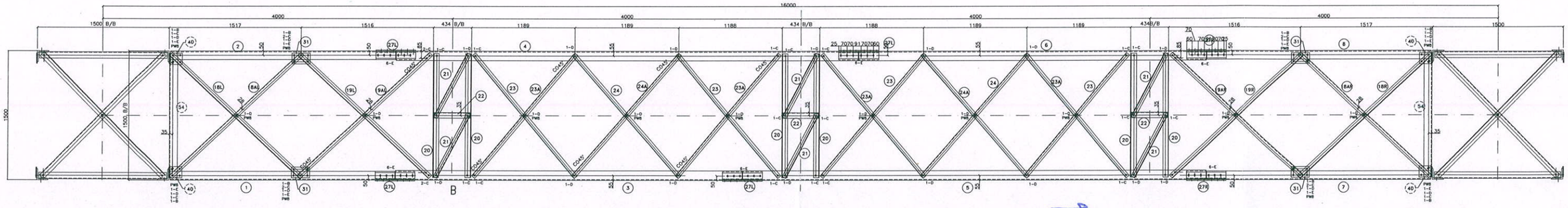
☐ More Information Date.....



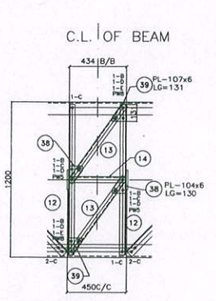
TOP PLAN

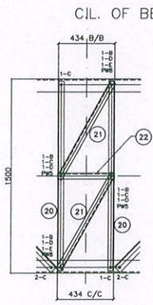


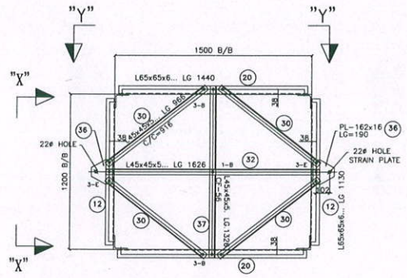
FRONT ELEVATION



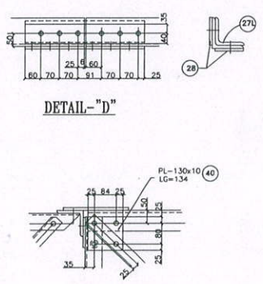
BOTTOM PLAN







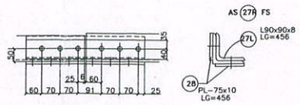
SECTION A-A



DETAIL - "B"

DETAIL-"D"

DETAIL - "C"



DETAIL-"E"

BEAM MKD. BG1

KEY PLAN

BOLTS/NUT STATEMENT

	SPRING WASHER	571	
B	30 ODX8 THK PACK. WASHER	47	
G	30 ODX6 THK PACK. WASHER	–	
	STEP BOLT ø16x175	–	
F	DIA 16X55 Lg.	–	
E	DIA 16X50 Lg.	215	
D	DIA 16X45 Lg.	165	
C	DIA 16X40 Lg.	130	
B	DIA 16X35 Lg.	61	
TYPE	SIZE.	QTY.	REMARK

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639 (PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 5% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'BG1' THAT IS BG1-1, BG1-2, SO ON.
8. UNNOTED BRACING ARE L45X45X5 WITH 23MM BACK MARK.
9. WELDING SHALL BE DONE AS PER IS:876 (LAEST REVISION) FOR ELECTRIC WELDING
10. ALL WELD ARE 6MM FILLET CONTIOUS WELD UNLESS OTHERWISE SPECFIED.

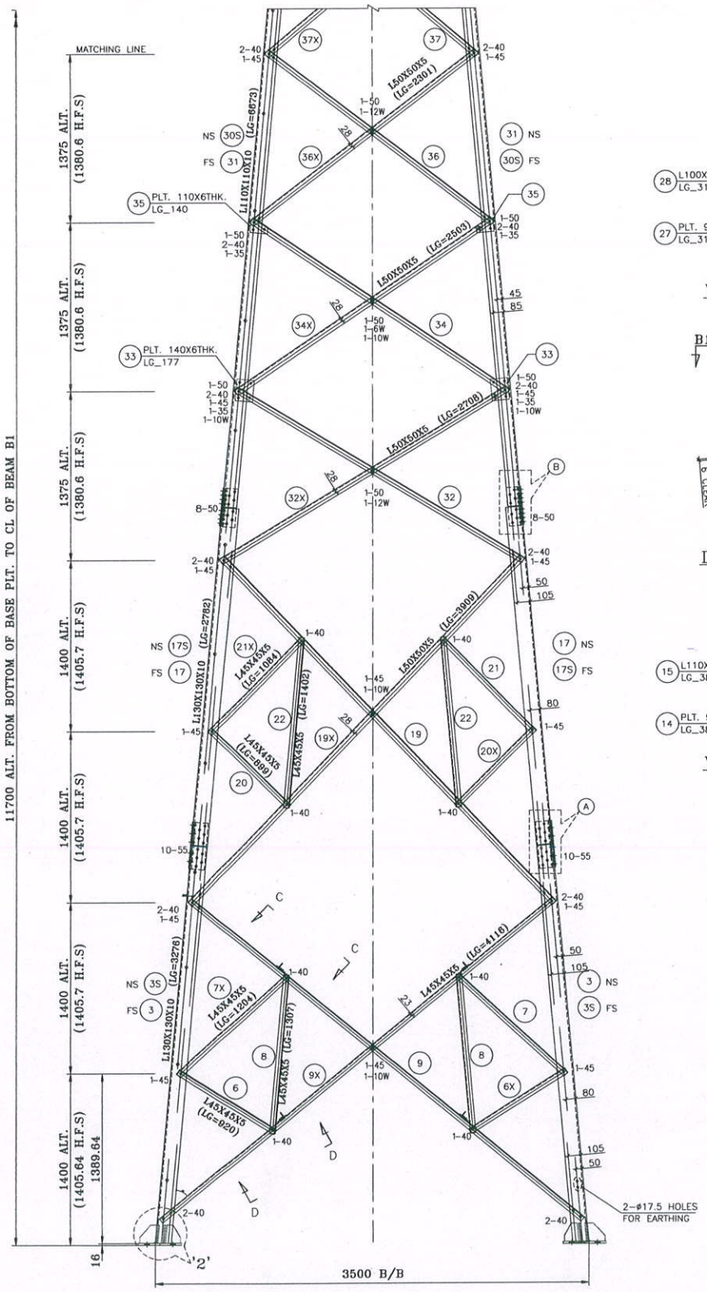
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

Approved / Approved subject to Fabrication / Approved subject to ... / Please submit revised ... / Insert comments and submit again for approval. / For Information and record. / Not approved.

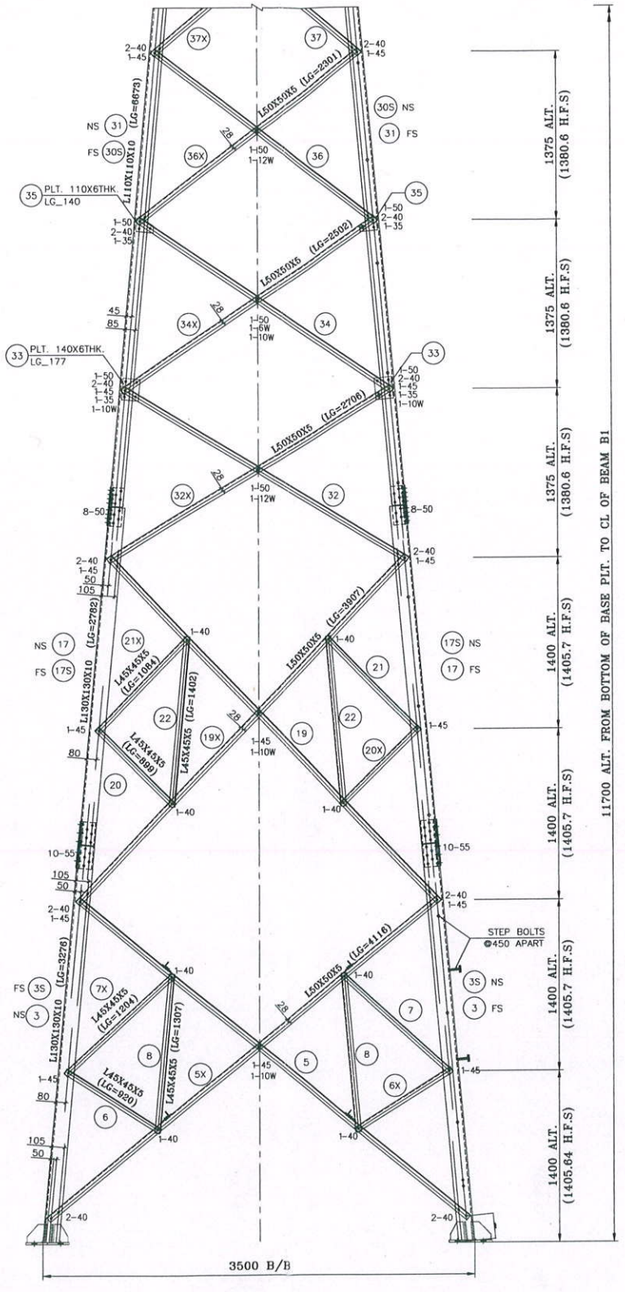
REFERENCE DWG. NO.= C-ENGG-STD-220-FAB-474042, REV.-00

NAME OF CLIENT	POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL), Gurugram, Haryana
EPC CONTRACTOR	KAILASH DEVBUILD INDIA PVT. LTD., JABALPUR, M.P.
NAME OF OWNER	Jammu & Kashmir Power Transmission Co. Ltd. (JKPTCL)
PROJECT	Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation, Jammu
P.O Reference No. :	CS/PIA/JKPTCL/SS&LILO-01/CA-I/811 Dated 21.11.2020
TITLE	FABRICATION DETAIL FOR 220KV BEAM –"BG1"

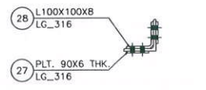
DRAWN BY.	T.K.K.	DATE	28/01/2022	DRAWING No.	
CHECKED BY.	TKK	SCALE	NTS	KDIPL/JK/NAG/220KV/BG1	
APP. BY.	---	SHEET NO.	1 OF 1	REV. NO.	0



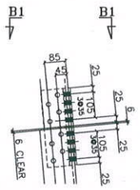
LONGITUDINAL FACE



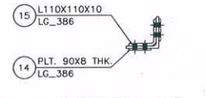
TRANSVERSE FACE



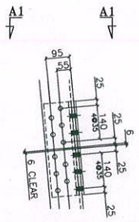
VIEW "B1–B1"



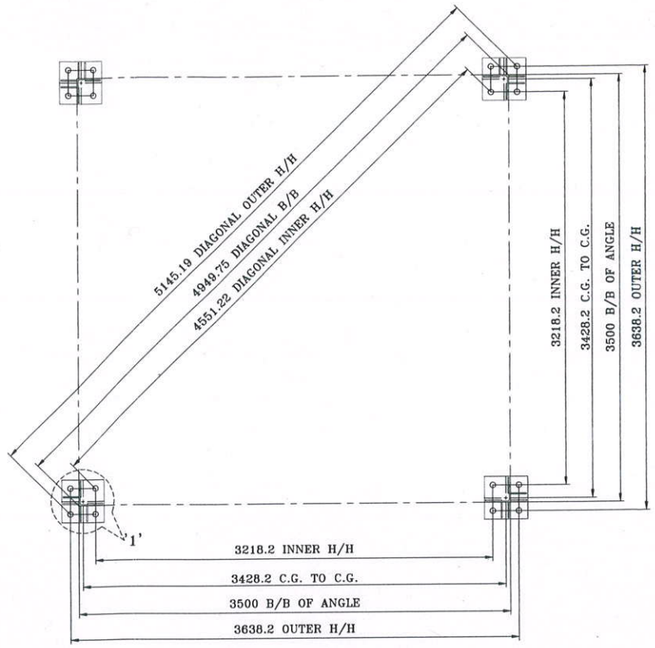
DETAIL–"B"



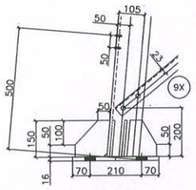
VIEW "A1–A1"



DETAIL–"A"



SECTION–"1–1"



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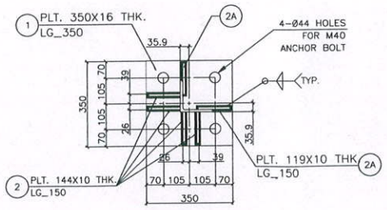
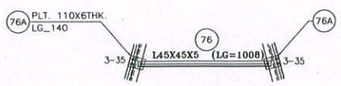
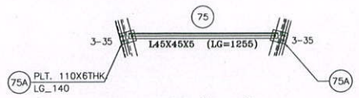


DETAIL–"1"



VIEW "C–C"



VIEW "D–D"

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. ALL STRUCTURAL STEEL ARE AS PER IS:2062/I.S.432.
3. ALL BOLTS SHALL BE AS PER IS:12427, CONFIRMING TO GRADE–5.6
3. ALL NUTS SHALL BE AS PER IS:1367, CONFIRMING TO CLASS–4.
4. ALL EXPOSED STRUCTURAL STEEL SHALL BE ZINC COATED AT 610 GMS/SQ. MT.
5. ALL HOLES 17.5MM DIA. FOR 16MM DIA. BOLT IF NOT STATED OTHERWISE
6. 5% EXTRA NUTS & BOLTS SHAAL BE SUPPLIED FOR ERECTION
7. ALL ERECTION MARKS TO BE PREFIXED WITH 'CD'
8. PLAIN WASHER SHALL BE CONFIRM TO IS:2016.
9. STEP BOLTS SHALL BE ON ONE LEG ONLY
10. ALL UNNOTTED MEMBERS ARE L45X45X5 WITH 23MM BACKMARK

BOLTS & NUTS STATEMENT		
	SIZE (Length in mm)	TOTAL QTY.
A	M16 X 35 mm	32
B	M16 X 40 mm	258
C	M16 X 45 mm	252
D	M16 X 50 mm	240
E	M16 X 55 mm	164
F	M16 X 60 mm	0
G	M16 X 65 mm	0
H	M16 X 70 mm	0
SPRING WASHER	3.5 X 16 ø	1007
STEP BOLTS	M16X150	41
PACK WASHER	5 mm	32
PACK WASHER	6 mm	44
PACK WASHER	8 mm	52
PACK WASHER	10 mm	88
PACK WASHER	12 mm	14

REC Power Development And Consultancy Ltd. Gurugram-122001

CN-18558 dt 7/9/22

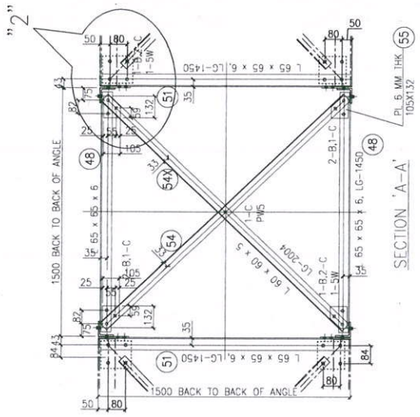
Approved/ Issued/ for Fabrication/Construction/Manufacturing.
निर्माण/विनिर्माण हेतु अनुमोदित/ जारी।
II. Approved/ Issued/ for Fabrication/ Construction/ Manufacturing
Subject to condition that abovementioned comments are included.
Please submit the revised documents for approval.
निर्माण/विनिर्माण हेतु अनुमोदित/ जारी किये गए
दिये गये टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें
IV For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

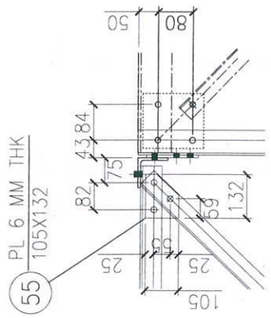
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

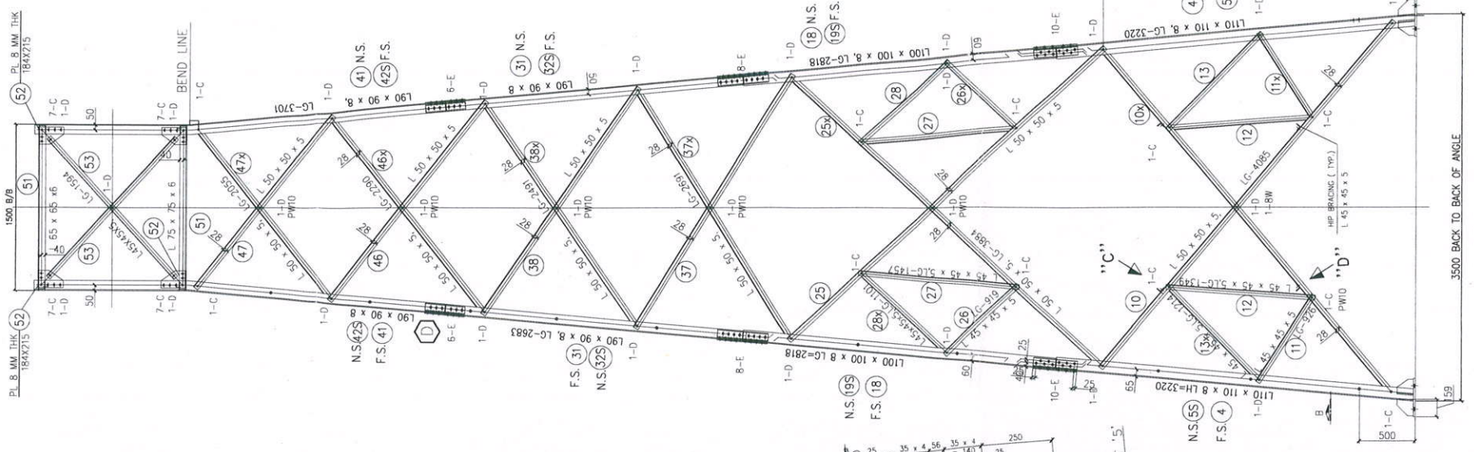
REFERENCE DWG. NO.= C–ENGG–STD–220–FAB–474046

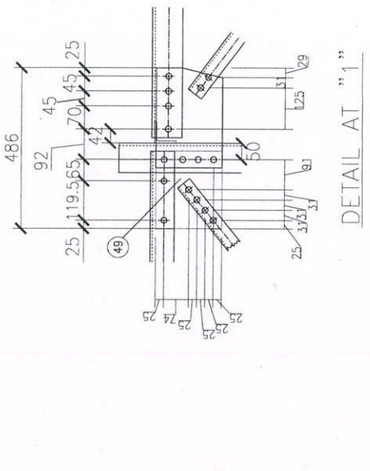
NAME OF CLIENT	POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL), Gurugram, Haryana			
EPC CONTRACTOR	KAILASH DEVBUILD INDIA PVT. LTD., JABALPUR, M.P.			
NAME OF OWNER	Jammu & Kashmir Power Transmission Co. Ltd. (JKPTCL)			
PROJECT	Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation, Jammu			
P.O Reference No. :	CS/PIA/JKPTCL/SS&LILO-01/CA-I/811 Dated 21.11.2020			
TITLE	FABRICATION DETAIL FOR 220KV COLUMN "CD"			
DRAWN BY.	T.K.K.	DATE	28/01/2022	DRAWING No. KDIPL/JK/NAG/220KV/CD
CHECKED BY.	TKK	SCALE	NTS	
APP. BY.	---	SHEET NO.	1 OF 2	REV. NO. 0

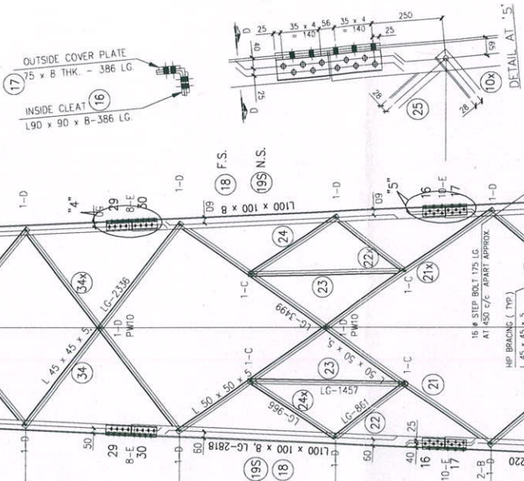
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

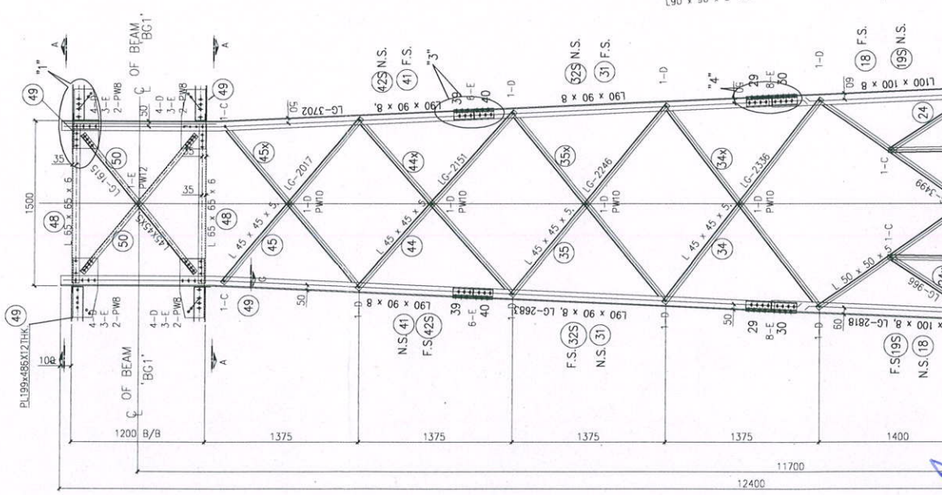


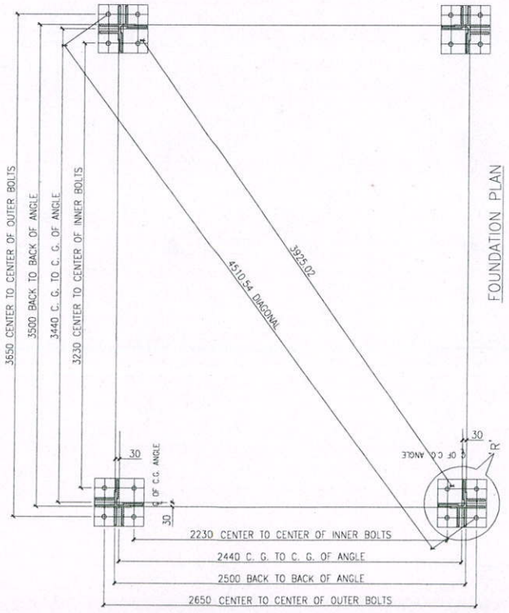


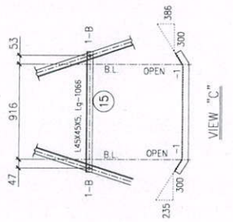


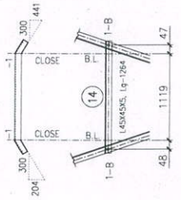


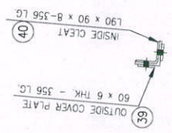


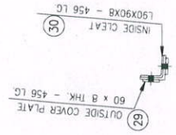


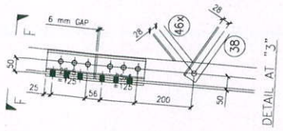


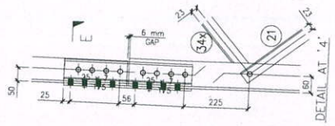












BOLTS/NUTS STATEMENT WITH 5% EXTRA		
	SIZE (Length in mm)	TOTAL QTY.
B	Dia 16X35 mm	34
C	Dia 16x40 mm	162
D	Dia 16x45 mm	144
E	Dia 16x50 mm	218
F	Dia 16x55 mm	–
G	Dia 16x60 mm	–
	STEP BOLT 16X175MM	52
SPRING WASHER	–	610
PACK WASHER	30mm OD X12 THK	2
PACK WASHER	30mm OD X10 THK	24
PACK WASHER	30mm OD X8 THK.	36
PACK WASHER	30mm OD X6 THK.	4

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639 (PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 5% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'CTG' THAT IS CTG-1, CTG-2, SO ON.
8. UNNOTED BRACING ARE L45X45X5 WITH 23MM BACK MARK.
9. WELDING SHALL BE DONE AS PER IS:816 (LAEST REVISION) FOR ELECTRIC WELDING
10. ALL WELD ARE 6MM FILLET CONTIOUS WELD UNLESS OTHERWISE SPECFIED.

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

CGM-18958 dt 21/9/22

07.09.22

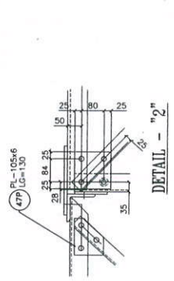
Consultant's Comments

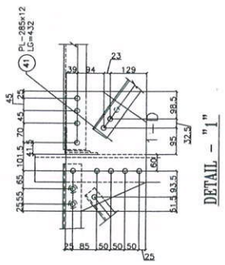
i. Approved/ issued for Fabrication/ Construction/Manufacturing.
स्वीकृत/जारी विनिर्माण हेतु
ii. Approved/ issued for Fabrication/ Construction/Manufacturing subject to condition that statement ... included.
Please submit the revised document for approval.
स्वीकृत/जारी विनिर्माण हेतु ... शामिल किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
iii. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित करें और अनुमोदन के लिए पुनः प्रस्तुत करें।
iv. For information and record.
सूचना एवं रिकॉर्ड हेतु।
v. Not approved.
अस्वीकृत, यहां।

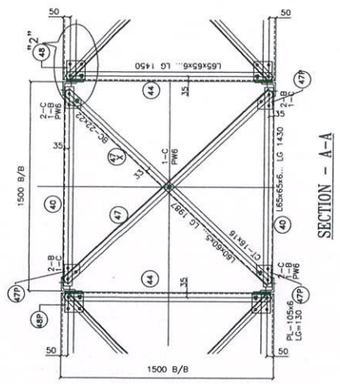
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

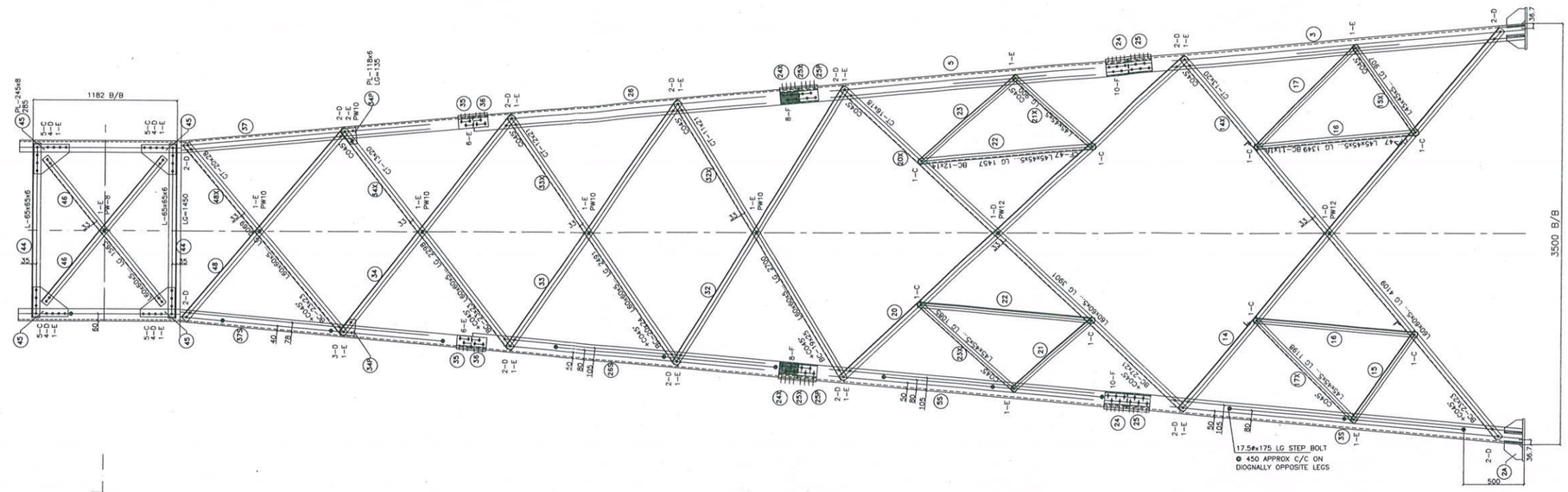
REFERENCE DWG. NO.= C-ENGG-STD-220-FAB-474054

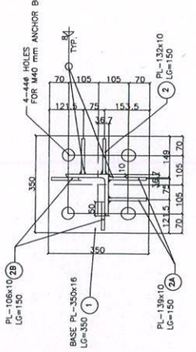
NAME OF CLIENT	POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL), Gurugram, Haryana				
EPC CONTRACTOR	KAILASH DEVBUILD INDIA PVT. LTD., JABALPUR, M.P.				
NAME OF OWNER	Jammu & Kashmir Power Transmission Co. Ltd. (JKPTCL)				
PROJECT	Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation, Jammu				
P.O Reference No. :	CS/PIA/JKPTCL/SS&LILO-01/CA-I/811 Dated 21.11.2020				
TITLE	FABRICATION DETAIL FOR 220KV COLUMN "CTG"				
DRAWN BY.	T.K.K.	DATE	28/01/2022	DRAWING No.	
CHECKED BY.	TKK	SCALE	NTS	KDIPL/JK/NAG/220KV/CTG	
APP. BY.	---	SHEET NO.	1 OF 1	REV. NO.	0

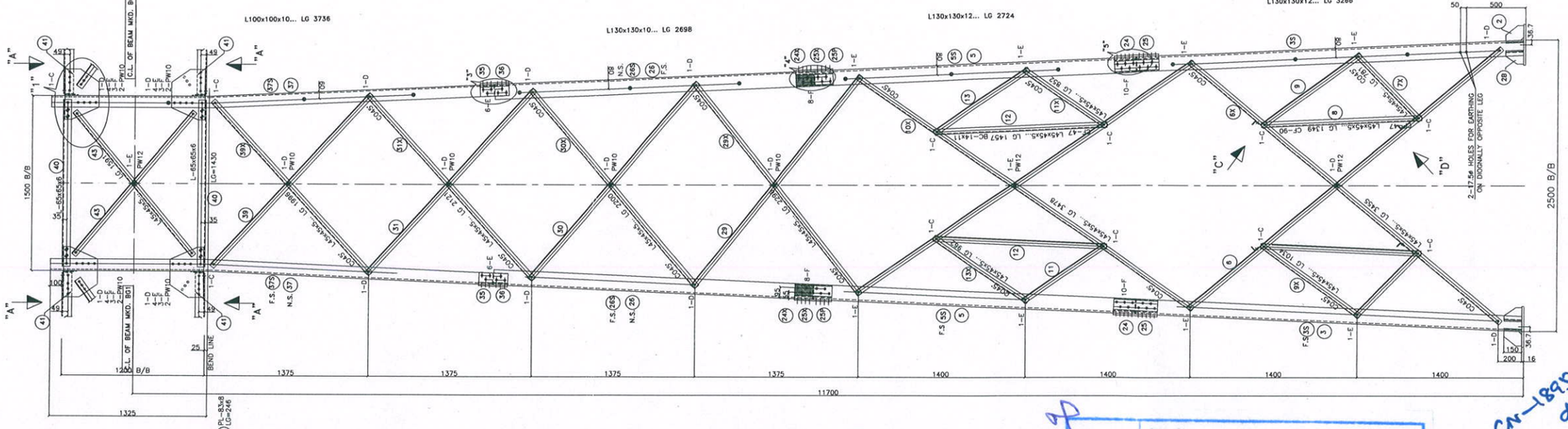


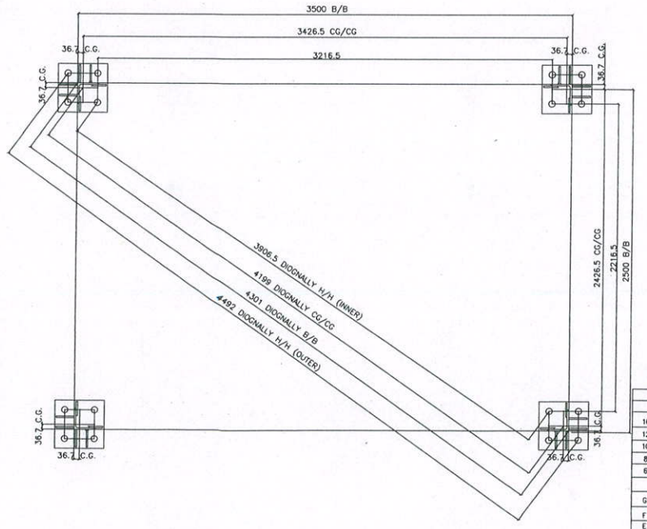


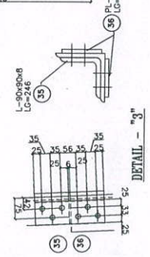


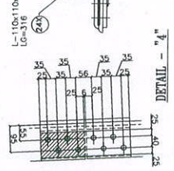


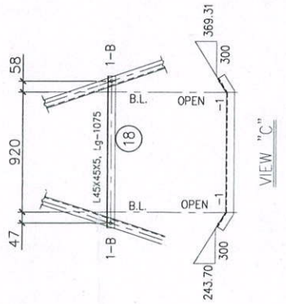


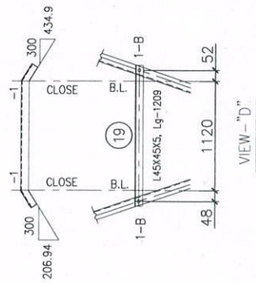


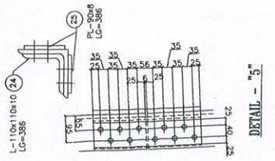












BOLTS/NUT STATEMENT WITH 5% EXTRA

	SPRING WASHER	556	
16	30 ODX16 THK PACK. WASHER	-	
12	30 ODX12 THK PACK. WASHER	10	
10	30 ODX10 THK PACK. WASHER	34	
8	30 ODX8 THK PACK. WASHER	2	
6	30 ODX6 THK PACK. WASHER	4	
	STEP BOLT ø16x175	52	
G	DIA 16X60 Lg.	-	
F	DIA 16X55 Lg.	168	
E	DIA 16X50 Lg.	146	
D	DIA 16X45 Lg.	124	
C	DIA 16X40 Lg.	90	
B	DIA 16X35 Lg.	28	
TYPE	SIZE.	QTY.	REMARK

NOTE :-

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639 (PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 5% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'CTH' THAT IS CTH-1, CTH-2, SO ON.
8. UNNOTED BRACING ARE L45X45X5 WITH 23MM BACK MARK.
9. WELDING SHALL BE DONE AS PER IS:876 (LAEST REVISION) FOR ELECTRIC WELDING
10. ALL WELD ARE 6MM FILLET CONTIOUS WELD UNLESS OTHERWISE SPECFIED.

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

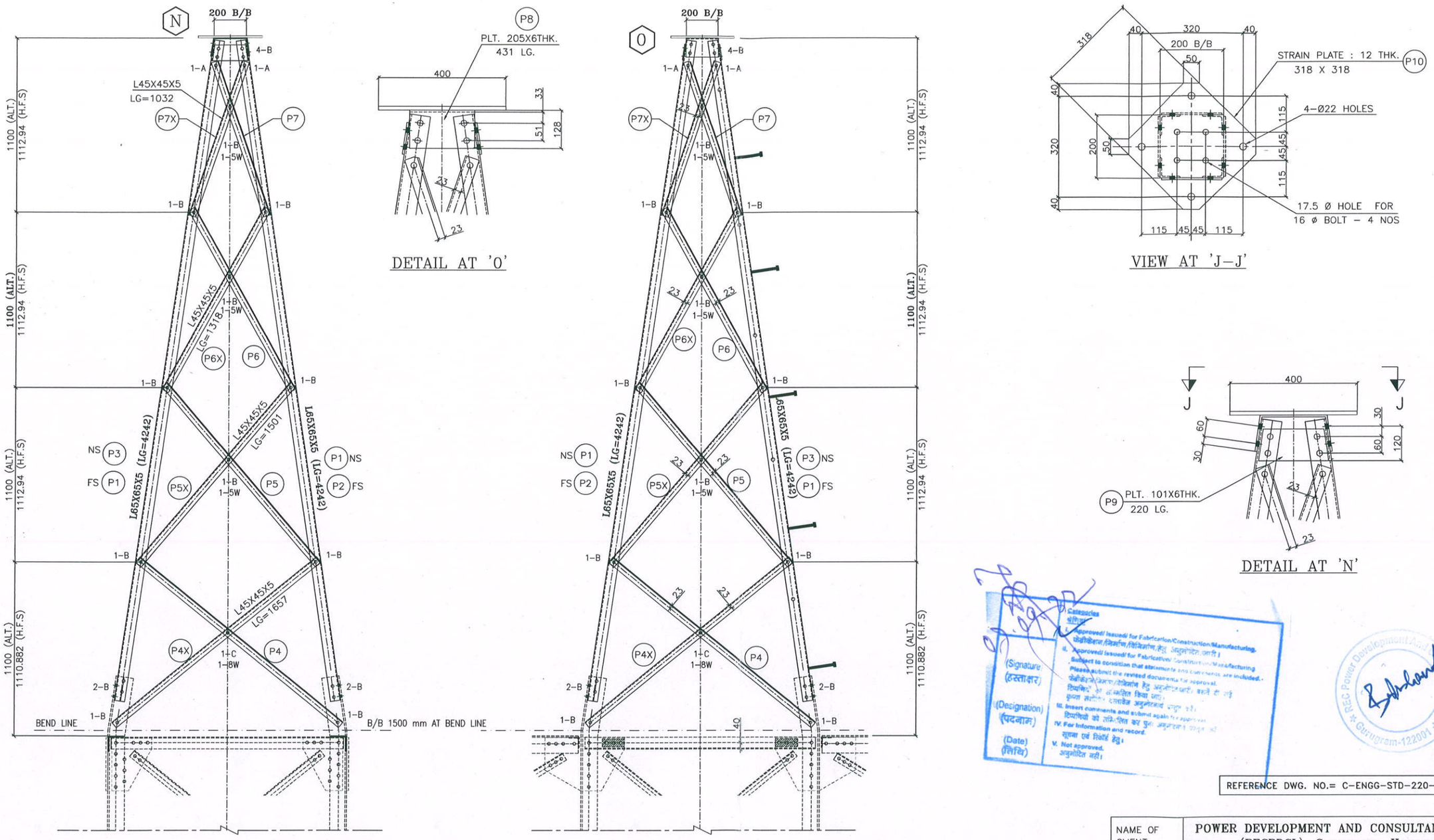
Category
I. Approved/ Issued for Fabrication / Construction / Manufacturing.
II. Approved/ Issued for Fabrication / Construction / Manufacturing Subject to condition that ex... Please submit the revised co... III. Inspect com ments and submit again for Approval. IV. For information and record. V. Not approved.
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

REFERENCE DWG. NO.= C-ENGG-STD-220-FAB-474055

CN-18958 dt 2/9/22

PEC Power Development And Consultancy Limited Gurugram 122001

NAME OF CLIENT	POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL), Gurugram, Haryana			
EPC CONTRACTOR	KAILASH DEVBUILD INDIA PVT. LTD., JABALPUR, M.P.			
NAME OF OWNER	Jammu & Kashmir Power Transmission Co. Ltd. (JKPTCL)			
PROJECT	Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation, Jammu			
P.O Reference No. :	CS/PIA/JKPTCL/SS&LILO-01/CA-I/811 Dated 21.11.2020			
TITLE	FABRICATION DETAIL FOR 220KV COLUMN "CTH"			
DRAWN BY.	T.K.K.	DATE	28/01/2022	DRAWING No.
CHECKED BY.	TKK	SCALE	NTS	KDIPL/JK/NAG/220KV/CTH
APP. BY.	---	SHEET NO.	1 OF 1	REV. NO. 0



BOLTS & NUTS STATEMENT WITH 5% EXTRA		
TYPE	SIZE (Length in mm)	TOTAL QTY.
B	M16 X 35 mm	16
C	M16 X 40 mm	40
STEP BOLTS	M16X175	10
30 OD WASHER	5 mm THK.	12
30 OD WASHER	6 mm THK.	4
SPRING WASHER	3.5 X 16 ø	70

NOTE :-

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639 (PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER IS : 816.
7. ALL MEMBERS, BOLTS, NUTS, WASHERS SHALL BE HOT DIP GALVANISED. SPRING WASHER SHALL BE ELECTRO GALVANISED.
8. ALL UNNOTED BRACINGS ARE L45X45X5 WITH 23MM BACKMARK
9. 5% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
10. ALL ITEMS TO BE PREFIXED WITH '2P1' THAT IS MARK 2P1-1, 2P1-2, SO ON.

Categories
श्रेणियाँ
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी। बशर्ते ही सभी टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

REC Power Development And Consultancy Ltd. Gurugram-122001

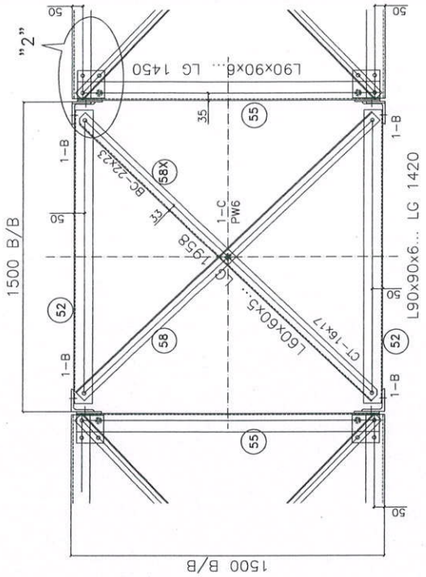
CW-18588
dt 2/9/22

REFERENCE DWG. NO.= C-ENGG-STD-220-FAB-474038

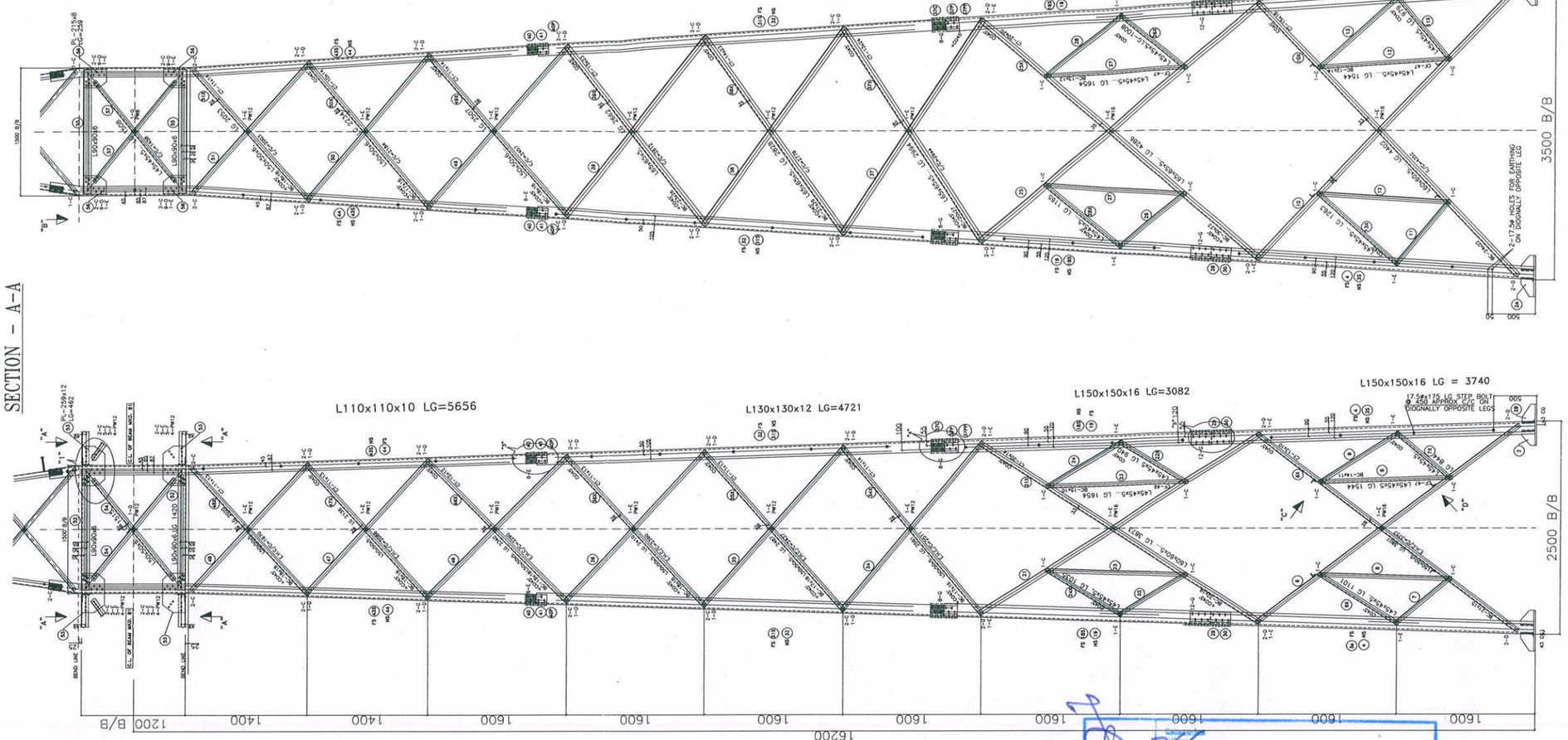
NAME OF CLIENT	POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL), Gurugram, Haryana
EPC CONTRACTOR	KAILASH DEVBUILD INDIA PVT. LTD., JABALPUR, M.P.
NAME OF OWNER	Jammu & Kashmir Power Transmission Co. Ltd. (JKPTCL)
PROJECT	Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation, Jammu
P.O Reference No. :	CS/PIA/JKPTCL/SS&LILO-01/CA-I/811 Dated 21.11.2020
TITLE	FABRICATION DETAIL FOR 220KV PEAK-"2PI"

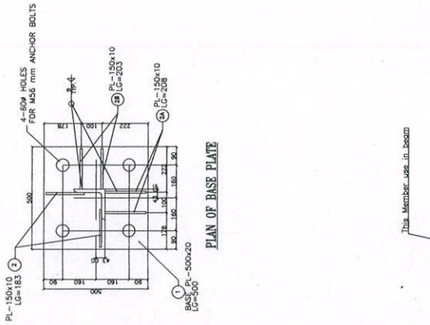
DRAWN BY.	T.K.K.	DATE	27/04/2022	DRAWING No.	
CHECKED BY.	TKK	SCALE	NTS	KDIPL/JK/NAG/220KV/P1	
APP. BY.	---	SHEET NO.	1 OF 1	REV. NO.	0

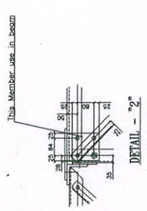
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

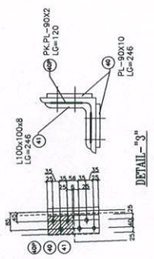


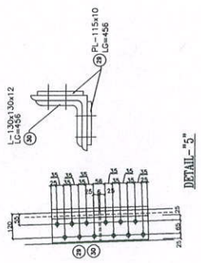
SECTION – A-A

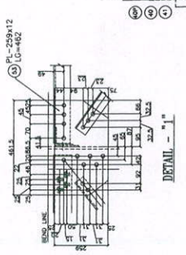


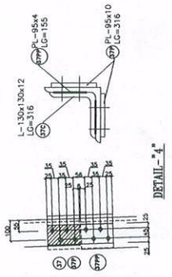


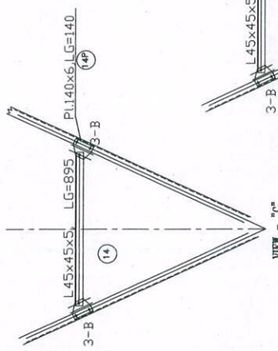


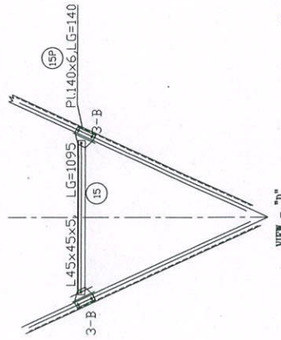


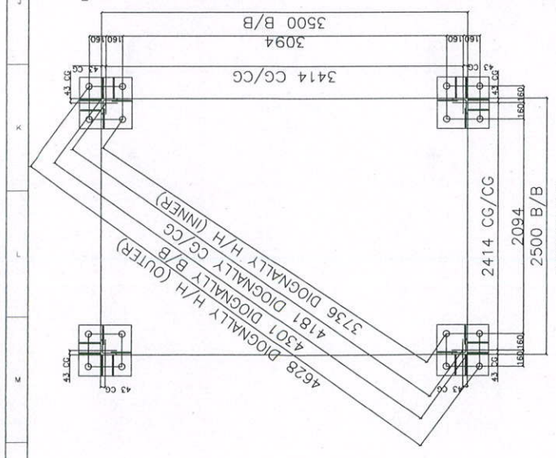




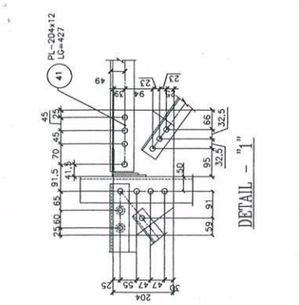


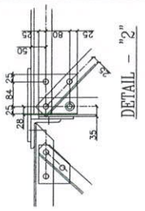


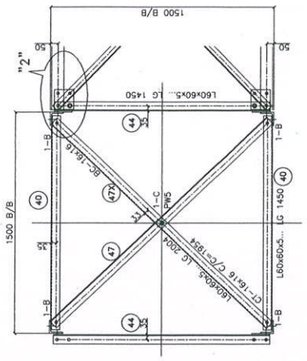


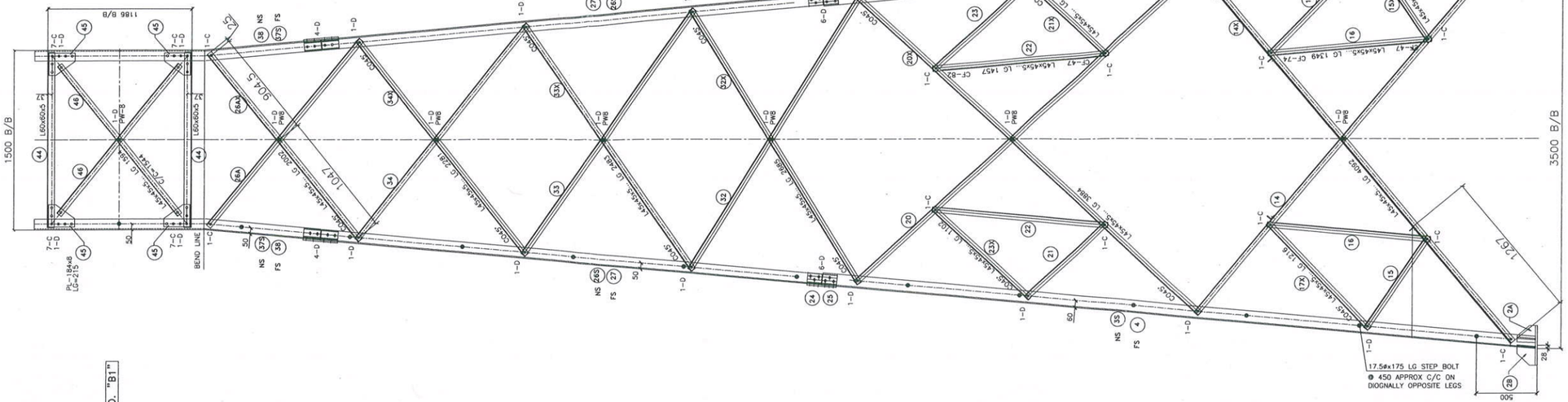


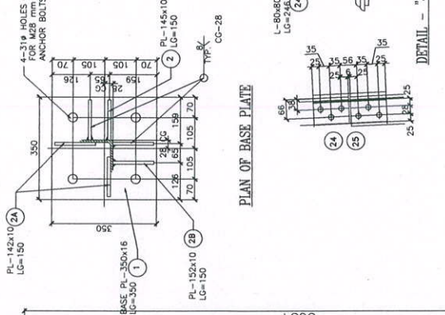
| BOLTS/NUT STATEMENT WITH 2% EXTRA | | |

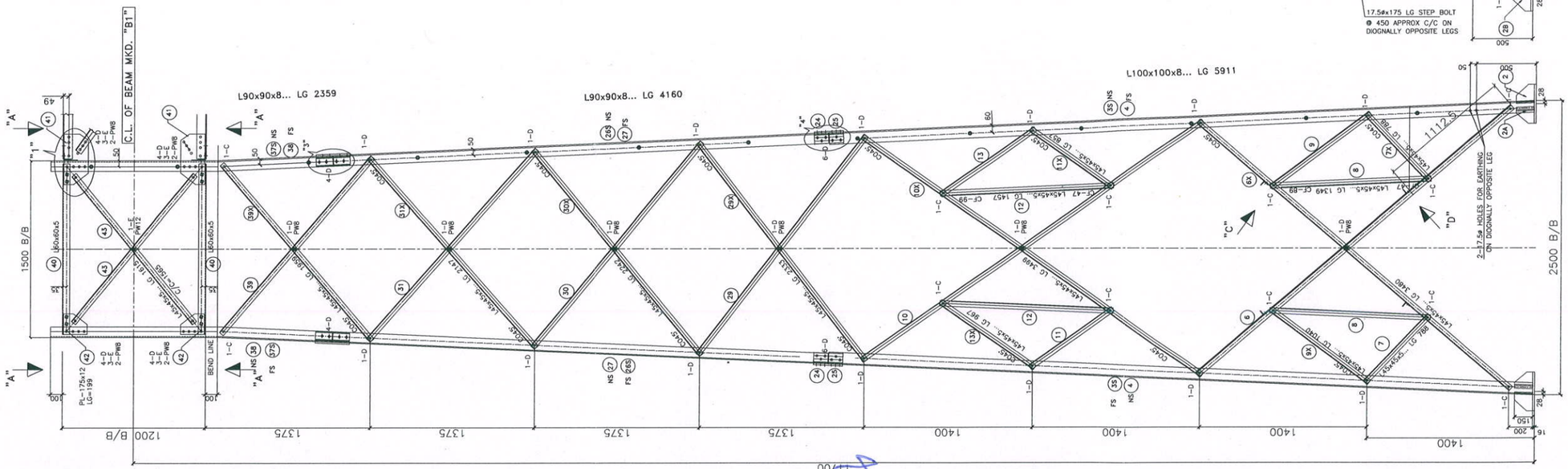


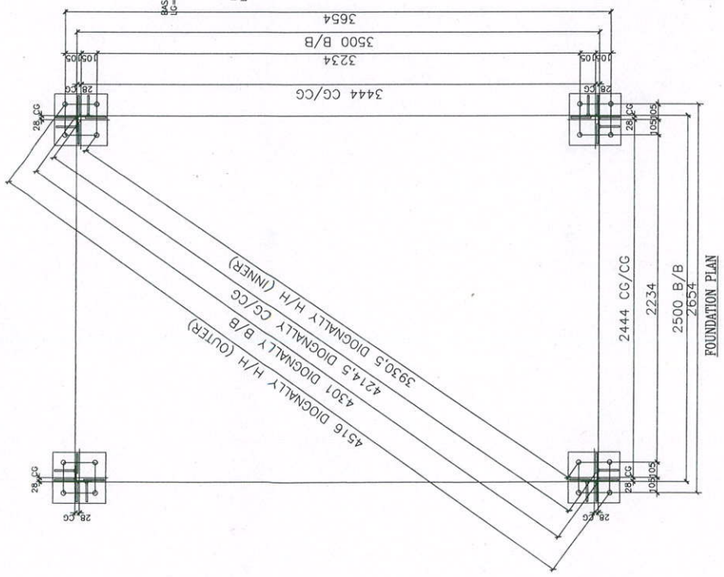






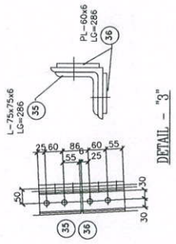






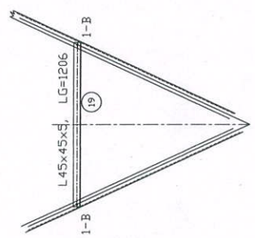
BOLTS/NUT STATEMENT WITH 2% EXTRA

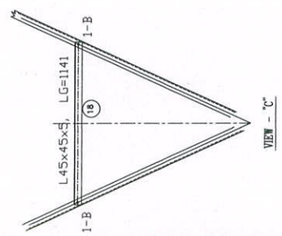
	SPRING. WASHER	332	
16	30 ODX16 THK PACK. WASHER	–	
12	30 ODX12 THK PACK. WASHER	2	
10	30 ODX10 THK PACK. WASHER	–	
8	30 ODX8 THK PACK. WASHER	42	
6	30 ODX6 THK PACK. WASHER	4	
	STEP BOLT ø16x175	52	DIOGNALLY
G	DIA 16X60 Lg.	–	
F	DIA 16X55 Lg.	–	
E	DIA 16X50 Lg.	24	
D	DIA 16X45 Lg.	202	
C	DIA 16X40 Lg.	82	
B	DIA 16X35 Lg.	24	
TYPE	SIZE,	QTY.	REMARK



NOTE :-
1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639 (PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'CC' THAT IS CC-1, CC-2, SO ON.
8. UNNOTED BRACING ARE L45X45X5 WITH 23MM BACK MARK.
9. WELDING SHALL BE DONE AS PER IS:876 (LAEST REVISION) FOR ELECTRIC WELDING
10. ALL WELD ARE 6MM FILLET CONTIOUS WELD UNLESS OTHERWISE SPECIFIED.

LEGEND





Approved
I. Approved/ issued for Fabrication/Construction/Manufacturing.
स्वीकृतिकरण/निर्माण/विनिर्माण हेतु अनुमोदित जारी।
II. Approved/ issued for Fabrication/ Construction/Manufacturing Subject to condition that stated/or's and comments are included. Please submit the revised documents for approval.
स्वीकृतिकरण/निर्माण/विनिर्माण हेतु अनुमोदित जारी, बशर्ते दी गई टिप्पणियों को शामिल किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

REC Power Development And Consultancy Ltd. Gurugram-122001

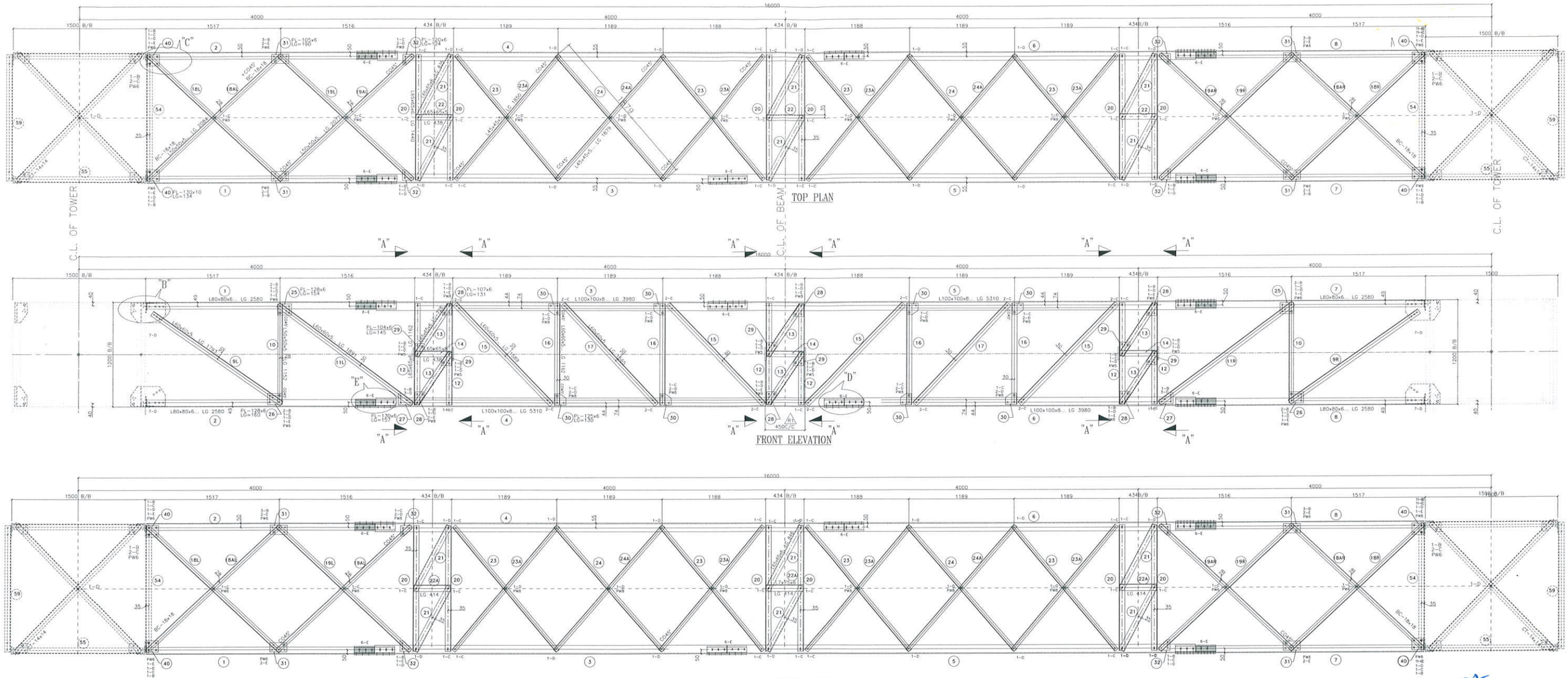
CW-19958 dt 7/5/22

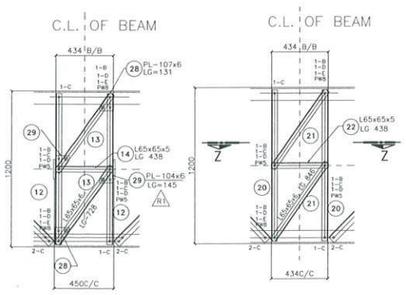
REFERENCE DWG. NO.= C-ENGG-STD-220-FAB-474045

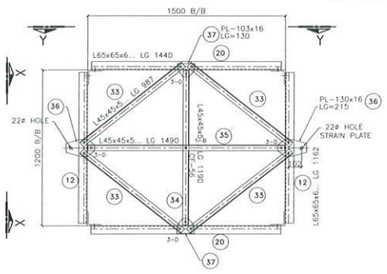
NAME OF CLIENT	POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL), Gurugram, Haryana
EPC CONTRACTOR	KAILASH DEVBUILD INDIA PVT. LTD., JABALPUR, M.P.
NAME OF OWNER	Jammu & Kashmir Power Transmission Co. Ltd. (JKPTCL)
PROJECT	Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation, Jammu
P.O Reference No. :	CS/PIA/JKPTCL/SS&LILO-01/CA-I/811 Dated 21.11.2020
,TITLE	FABRICATION DETAIL FOR 220KV TOWER TYPE "CC"

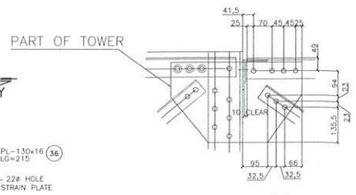
DRAWN BY.	T.K.K.	DATE	28/01/2022	DRAWING No.	
CHECKED BY.	TKK	SCALE	NTS	KDIPL/JK/NAG/220KV/CC	
APP. BY.	---	SHEET NO.	1 OF 1	REV. NO.	0

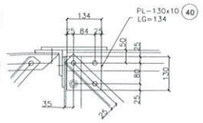
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

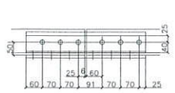


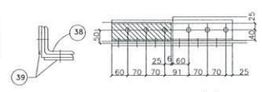


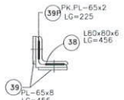


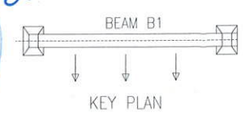












CV 17502
dt 15/1/2022

BOLTS/NUT STATEMENT WITH 2% EXTRA

TYPE	SIZE.	QTY.	REMARKS
	SPRING WASHER	668	
8	30 ODX8 THK PACK. WASHER	52	
6	30 ODX6 THK PACK. WASHER	32	
	STEP BOLT ø16x175	–	
F	DIA 16X55 Lg.	–	
E	DIA 16X50 Lg.	188	
D	DIA 16X45 Lg.	246	
C	DIA 16X40 Lg.	156	
B	DIA 16X35 Lg.	78	

NOTES:–

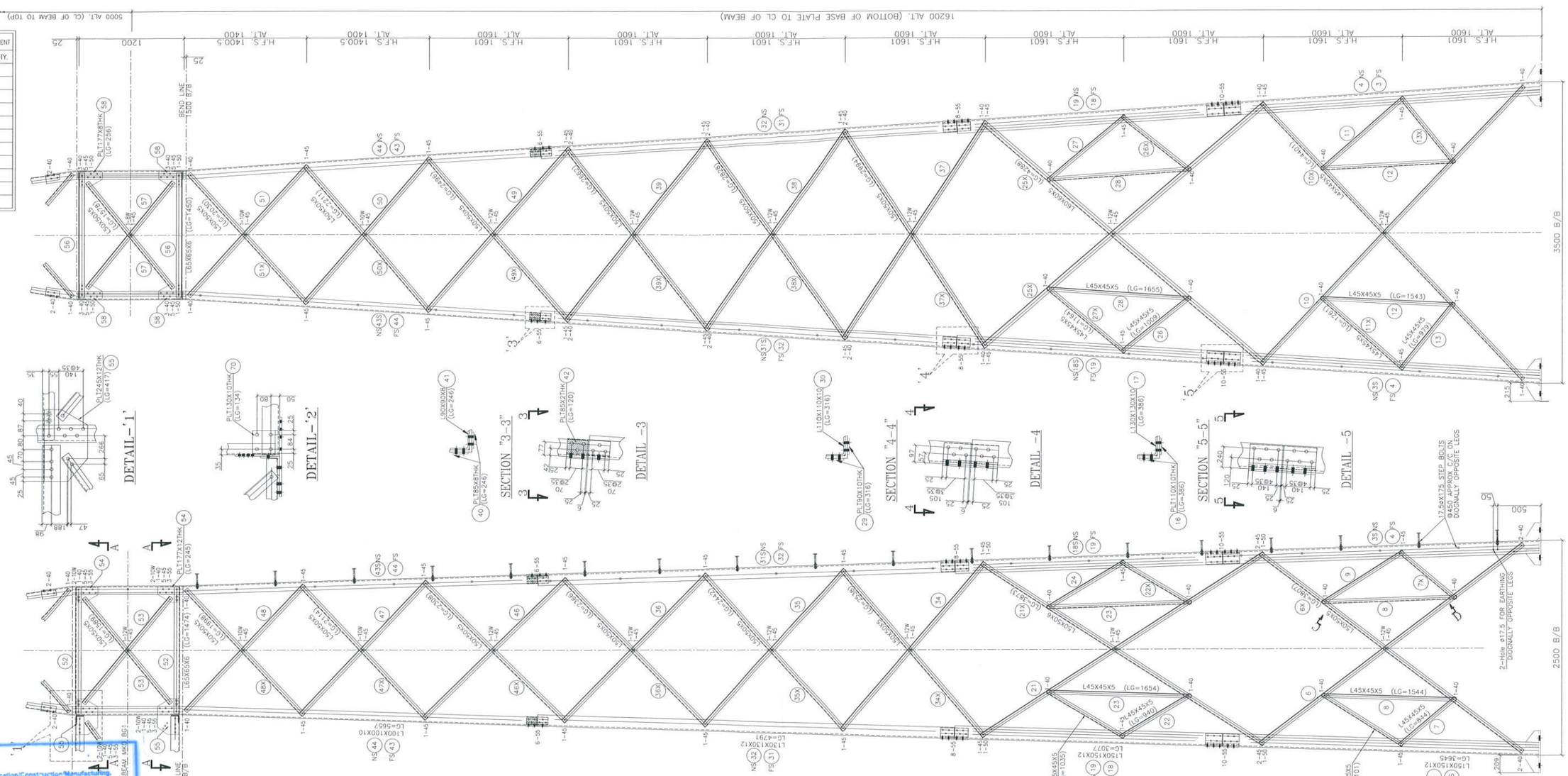
1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639 (PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'B1' THAT IS B1–1, B1–2, SO ON.
8. UNNOTED BRACING ARE L45X45X5 WITH 23MM BACK MARK.
9. WELDING SHALL BE DONE AS PER IS:876 (LAEST REVISION) FOR ELECTRIC WELDING
10. ALL WELD ARE 6MM FILLET CONTIOUS WELD UNLESS OTHERWISE SPECFIED.

REFERENCE DWG. NO.= C–ENGG–STD–220–FAB–474041 , REV.–00

NAME OF CLIENT	POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL), Gurugram, Haryana
EPC CONTRACTOR	KAILASH DEVBUILD INDIA PVT. LTD., JABALPUR, M.P.
NAME OF OWNER	Jammu & Kashmir Power Transmission Co. Ltd. (JKPTCL)
PROJECT	Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation, Jammu
P.O Reference No. :	CS/PIA/JKPTCL/SS&LILO–01/CA–I/811 Dated 21.11.2020
TITLE	FABRICATION DETAIL FOR 220KV BEAM MKD. "B1"

DRAWN BY.	T.K.K.	DATE	28/01/2022	DRAWING No.
CHECKED BY.	TKK	SCALE	NTS	KDIPL/JK/NAG/220KV/B1
APP. BY.	–––	SHEET NO.	1 OF 1	REV. NO. 0

	BOLTS & NUTS STATEMENT	
	SIZE (Length in mm)	TOTAL QTY.
	M16 X 35 mm	75
	M16 X 40 mm	0
	M16 X 45 mm	235
	M16 X 50 mm	51
	M16 X 55 mm	38
SPRING WASHER	3.5 X 16 ø	449
STEP BOLTS	M16X175	80
PACK WASHER	6 mm	60
PACK WASHER	8 mm	2
PACK WASHER	10 mm	0
PACK WASHER	12 mm	0



Categories
श्रेणियां
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
निर्माण/विनिर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued for Fabrication/ Construction/Manufacturing subject to condition that statements and comments are included. Please submit the revised documents for approval.
निर्माण/विनिर्माण/निर्माण हेतु अनुमोदित/जारी परन्तु शर्तों टिप्पणियों को सम्मिलित किया जाए।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

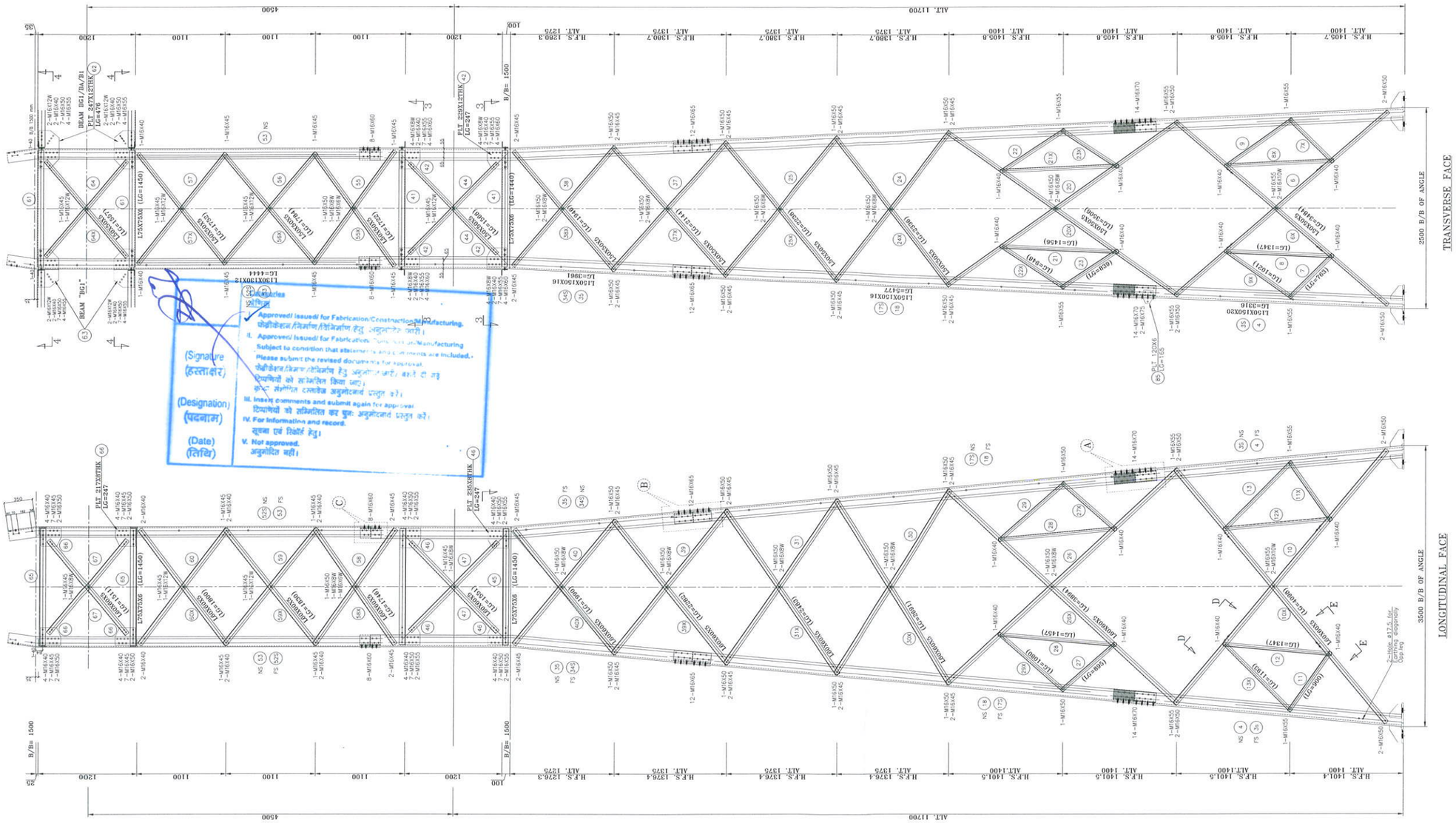
CW-17502 dt 15/6/2022

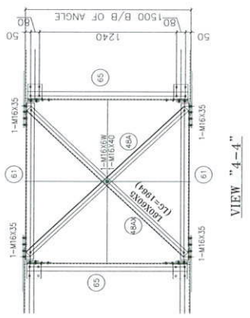
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

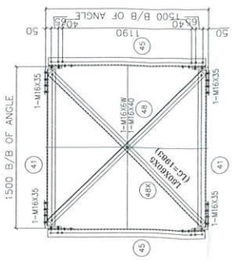
REFERENCE DWG. NO.= C-ENGG-STD-220-FAB-474048

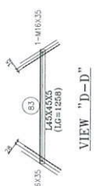
NOTES:-
1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AE PER I.S. 802
3. BOLTS, NUTS AS PER IS:6639 (PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE @ 610 gm/sq.
5. ALL HOLES SHALL BE 17.5 MM DIA FOR 16MM DIA BOLT IF NOT STATED OTHERWISE
6. WELDING SHALL BE DONE AS PER IS:816.
7. ALL MEMBERS, BOLTS, NUTS, WASHER SHALL BE HOT DIP GALVANISED SPRING WASHER SHALL BE ELECTRO GALVANISED.
8. ALL UNNOTED BRACINGS ARE L45X45X5 WITH 23MM BACKMARK
9. 5% EXTRA NUT & BOLTS SHALL BE SUPPLIED FOR ERECTION
10. ALL ITEMS TO BE PREFIXED WITH 'CTA' THAT IS CTA-1,CTA-2, SO ON

NAME OF CLIENT	POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL), Gurugram, Haryana			
EPC CONTRACTOR	KAILASH DEVBUILD INDIA PVT. LTD., JABALPUR, M.P.			
NAME OF OWNER	Jammu & Kashmir Power Transmission Co. Ltd. (JKPTCL)			
PROJECT	Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation, Jammu			
P.O Reference No. :	CS/PIA/JKPTCL/SS&LIL0-01/CA-I/811 Dated 21.11.2020			
TITLE	FABRICATION DETAIL FOR 220KV TOWER TYPE "CTA"			
DRAWN BY.	T.K.K.	DATE	28/01/2022	DRAWING No.
CHECKED BY.	TKK	SCALE	NTS	KDIPL/JK/NAG/220KV/CTA
APP. BY.	---	SHEET NO.	1 OF 1	REV. NO. 0

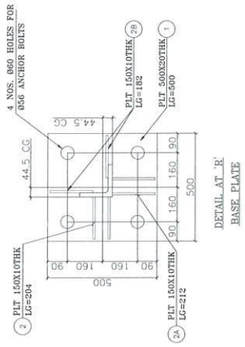


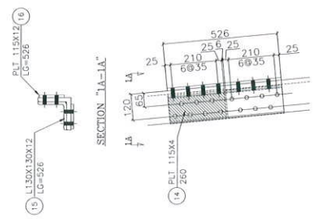












NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. BOLTS SYMBOL Ø16 ⊕ =Ø17.5 HOLES
   Ø16 ⊕ =Ø17.5 HOLES FOR STEP BOLTS
3. ALL STEEL MEMBERS SHALL CONFORM TO IS:2062-1999 GRADE "A"
4. ALL BOLTS, NUTS & LOCK NUT SHALL CONFIRM TO IS:1367 (LATEST) CLASS 5.6 FOR BOLTS & 5 FOR NUTS .
5. MINIMUM GALVANISATION THICKNESS IN STEEL SECTION SHALL BE 610 GMS/SQM.
6. MINIMUM EDGE SECURITY FOR 16ø BOLT SHALL BE 25mm FROM CUT EDGE & 20MM FROM ROLLED EDGE.
7. ALL ERECTION MARKS TO BE PREFIXED WITH 'CTB'
8. ALL UNNOTED BRACINGS AREL 45X45X5 WITH 23MM BACKMARK
9. FABRICATION SHALL BE CONFORM TO IS:802 PART-II (1972)
10. ALL WELDS ARE 6MM FILLET CONTINUOUS WELD UNLESS OTHERWISE SPECIFIED.
11. ALL UNNOTED GUSSETS PLATE ARE 6mm THICK UNLESS OTHERWISE SPECIFIED.

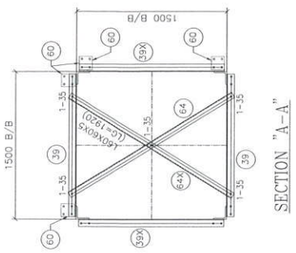
BOLTS & NUTS STATEMENT		
	SIZE (Length in mm)	TOTAL QTY.
A	M16 X 35 mm	16
B	M16 X 40 mm	120
C	M16 X 45 mm	148
D	M16 X 50 mm	294
E	M16 X 55 mm	220
F	M16 X 60 mm	16
G	M16 X 65 mm	160
H	M16 X 70 mm	112
SPRING WASHER	3.5 X 16 ø	1086
STEP BOLTS	M16X175	41
PACK WASHER	5 mm	28
PACK WASHER	6 mm	4
PACK WASHER	8 mm	48
PACK WASHER	10 mm	84
PACK WASHER	12 mm	28
PACK WASHER	16 mm	--

Rec Power Development And Consultancy Ltd. Gurugram-122001

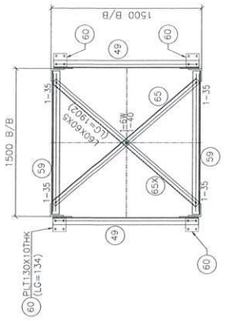
Cwr17502 dt 15/6/22

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

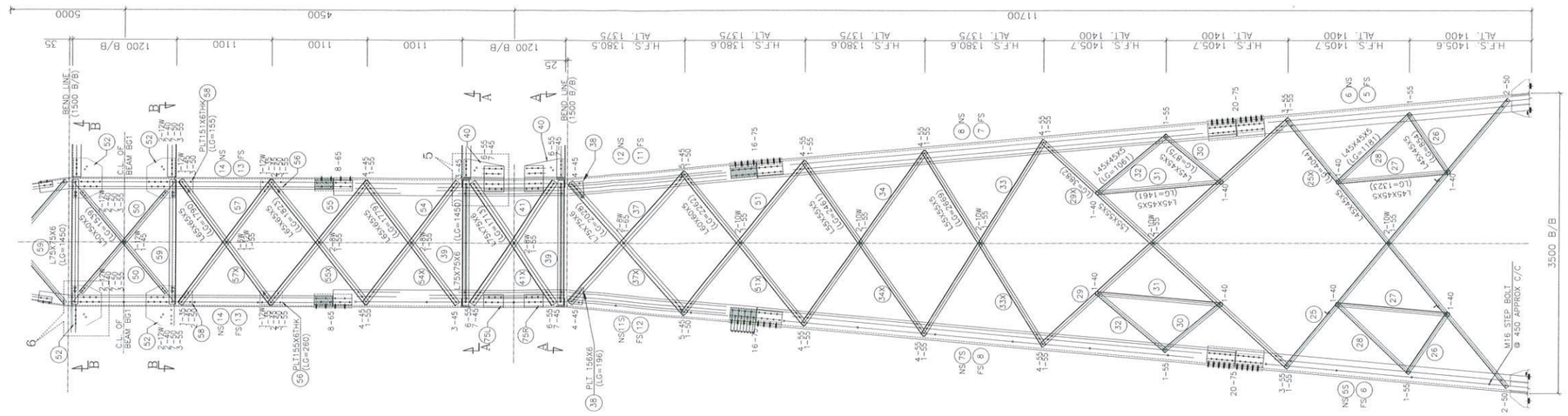
REFERENCE DWG. NO.= C-ENGG-STD-220-FAB-474049				
EPC CONTRACTOR	KAILASH DEVBUILD INDIA PVT. LTD., JABALPUR, M.P.			
NAME OF OWNER	Jammu & Kashmir Power Transmission Co. Ltd. (JKPTCL)			
NAME OF CLIENT	REC Power Distribution Company Limited (RECPDCL), Gurugram, Haryana			
PROJECT	Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation, Jammu			
P.O Reference No. :	CS/PIA/JKPTCL/SS&LILO-01/CA-I/811 Dated 21.11.2020			
TITLE	FABRICATION DETAIL FOR 220KV TOWER TYPE "CTB"			
DRAWN BY.	T.K.K.	DATE	28/01/2022	DRAWING No.
CHECKED BY.	TKK	SCALE	NTS	KDIPL/JK/NAG/220KV/CTB
APP. BY.	----	SHEET NO.	1 OF 1	REV. NO. 0

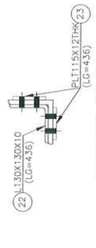


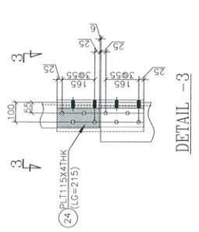


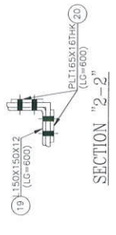


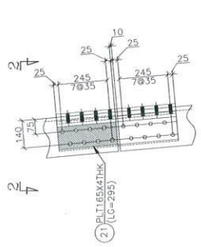


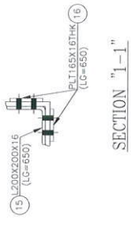


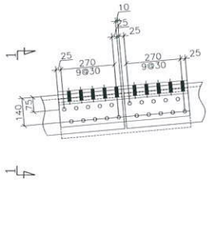


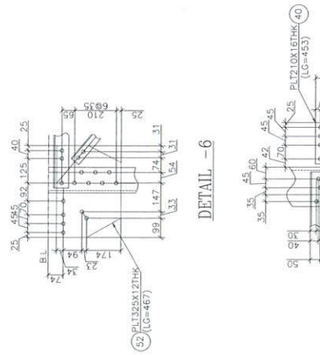


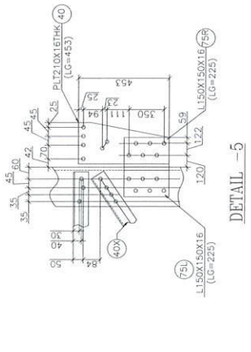


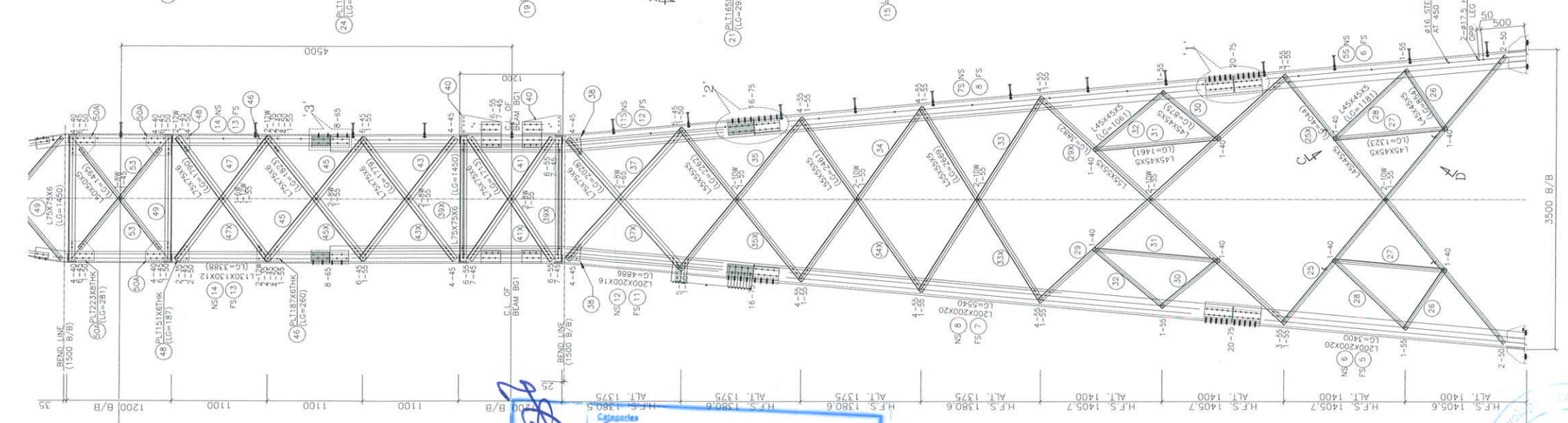


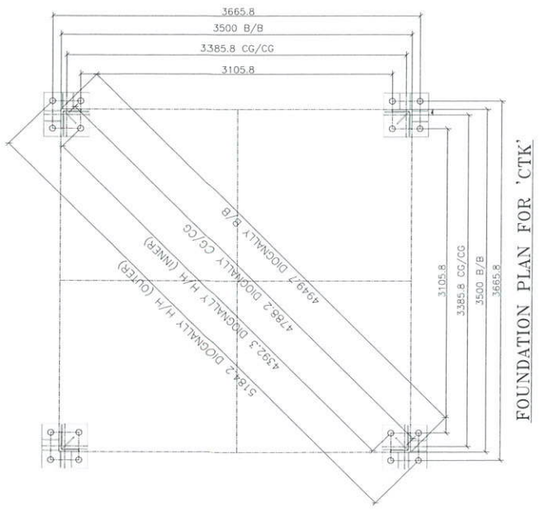


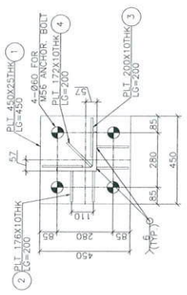












BOLTS & NUTS STATEMENT		
	SIZE (Length in mm)	TOTAL QTY.
	M16 X 35 mm	80
	M16 X 40 mm	110
	M16 X 45 mm	174
	M16 X 50 mm	354
	M16 X 55 mm	188
	M16 X 60 mm	34
	M16 X 65 mm	82
	M16 X 70 mm	2
	M16 X 75 mm	160
	M16 X 80 mm	228
SPRING WASHER	3.5 X 16 ø	1312
STEP BOLTS	M16X175	42
PACK WASHER	5 mm	--
PACK WASHER	6 mm	82
PACK WASHER	8 mm	110
PACK WASHER	10 mm	62
PACK WASHER	12 mm	0
PACK WASHER	16 mm	--

Categories
श्रेणियां
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
निर्माण/विनिर्माण हेतु अनुमोदित/ जारी।
Approved/ Issued for Fabrication/Construction/Manufacturing
subject to condition that statements and comments are included.
please submit the revised documents for approval.
निर्माण/विनिर्माण हेतु अनुमोदित/ जारी। बशर्ते दी गई टिप्पणियों को सम्मलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Informations and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802
3. BOLTS, NUTS AS PER IS:6639 (PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE @ 610 gm/sq.mt
5. ALL HOLES SHALL BE 17.5 MM DIA FOR 16MM DIA BOLTS U.N.O.
6. WELDING SHALL BE DONE AS PER IS:816
7. ALL MEMBER BOLTS AND NUTS, WASHER SHALL BE HOT DIP GALVANISED SPRING WASHER SHALL BE ELECTRO GALVANISED.
8. ALL UNNOTED BRACINGS ARE L45X45X5 WITH 2.3MM BACKMARK
9. 5% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
10. ALL ITEMS TO BE PREFIXED WITH 'CTK' THAT IS CTK-1, CTK-2 SO ON.



Kailash Devbuild (India) Pvt. Ltd. Jabalpur

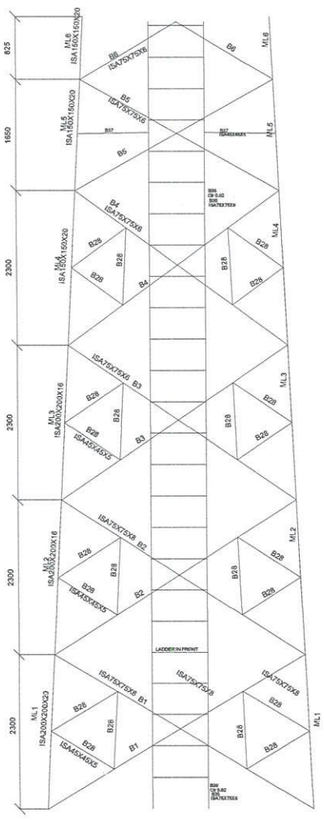
CW-17500 dt 15/4/22

REFERENCE DWG. NO.= C-ENGG-STD-220-FAB-474048

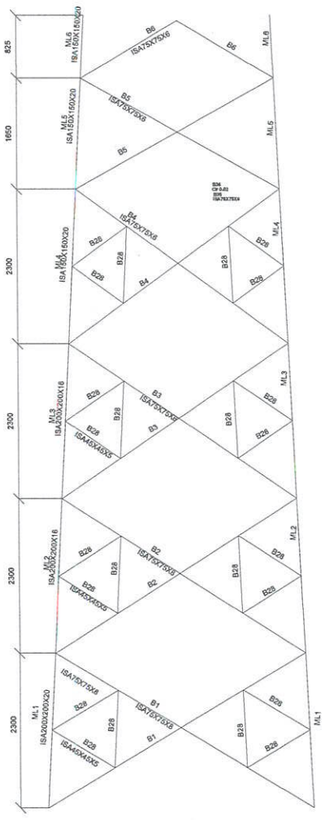
NAME OF CLIENT	POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL), Gurugram, Haryana			
EPC CONTRACTOR	KAILASH DEVBUILD INDIA PVT. LTD., JABALPUR, M.P.			
NAME OF OWNER	Jammu & Kashmir Power Transmission Co. Ltd. (JKPTCL)			
PROJECT	Construction of 2X50 MVA, 220/33 kV Nagrota (New) substation, Jammu			
P.O Reference No. :	CS/PIA/JKPTCL/SS&LILO-01/CA-I/811 Dated 21.11.2020			
TITLE	FABRICATION DETAIL FOR 220KV TOWER TYPE "CTK"			
DRAWN BY.	T.K.K.	DATE	28/01/2022	DRAWING No.
CHECKED BY.	TKK	SCALE	NTS	KDIPL/JK/NAG/220KV/CTK
APP. BY.	---	SHEET NO.	1 OF 1	REV. NO. 0

TOWER MKD.		B37	B35	B34	B33	B32	B31	B30	B29	B28	B27	B26	B25	B24	B23	B22	B21	B20	B19	B18	B17	B16	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	ML27	ML26	ML25	ML24	ML23	ML22	ML21	ML20	ML19	ML18	ML17	ML16	ML15	ML14	ML13	ML12	ML11	ML10	ML9	ML8	ML7	ML6	ML5	ML4	ML3	ML2	ML1
LM	MEMBER NAME	L45X45X5	L75X75X6		L100X100X10	L90X90X8	L65X65X6	L45X45X5	L75X75X6	L45X45X5									L50X50X6						L65X65X6							L75X75X6				L75X75X8	L75X75X6				L100X100X10				L110X110X16						L130X130X16							L150X150X16					L150X150X20			L200X200X16		L200X200X20	
	ANGLE SIZE																																																																														
	NO. OF BOLTS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	1 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	2 DS	4 DS	4 DS	4 DS	4 DS	6 DS	6 DS	8 DS	8 DS	10 DS	10 DS	10 DS	12 DS	12 DS	12 DS	14 DS	14 DS	16 DS	

PART 1 TRANSVERSE FACE OF LM



PART 1 LONGITUDINAL FACE OF LM



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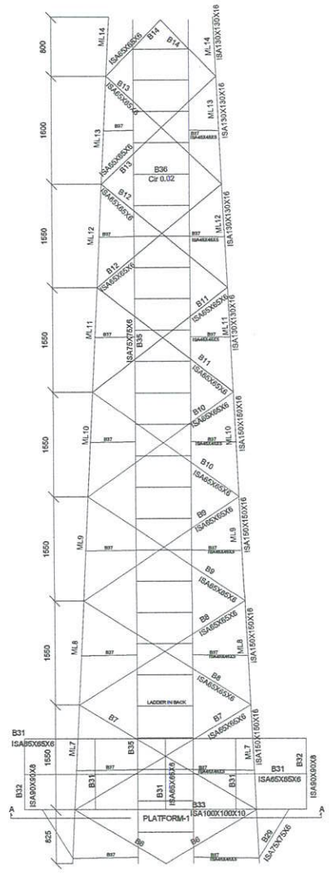

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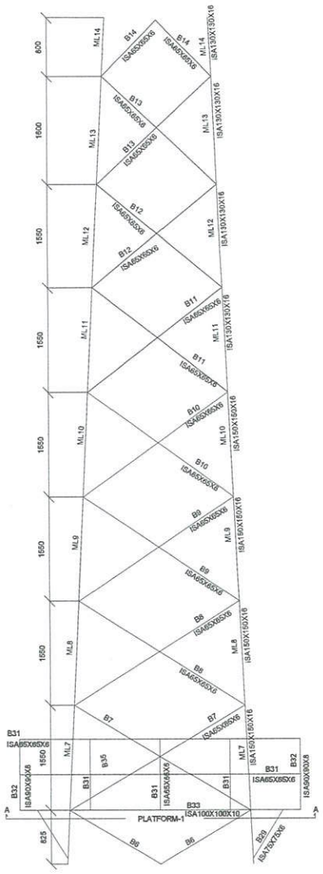

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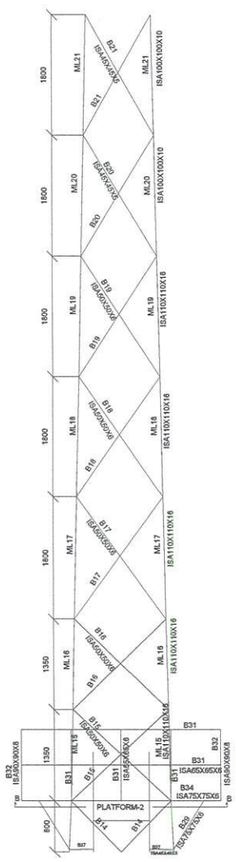

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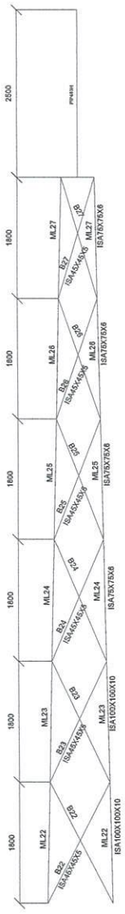
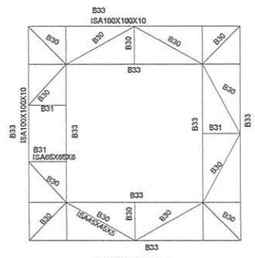
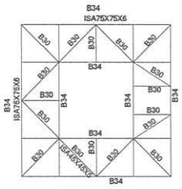


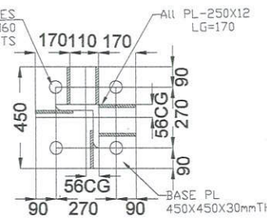
SECTION A-A
PLATFORM-1 AT 12.5M LEVEL



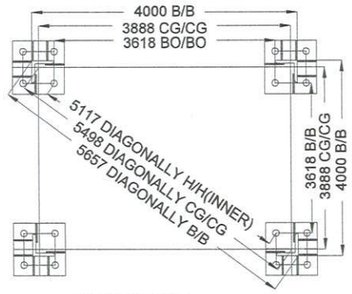
SECTION B-B
PLATFORM-2 AT 25M LEVEL



PLAN OF BASE PLATE



FOUNDATION PLAN



SLD OF LM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	SLD OF 50-M LIGHTENING MAST MKD. 'LM', FOR 220kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/32 — REV- 2
SCALE	As shown in Drawing
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	AKASH	16.03.2022	
CHECKED BY	G.H	16.03.2022	
SUBMITTED BY	Er. ANURAG	16.03.2022	

Signature/Stamp

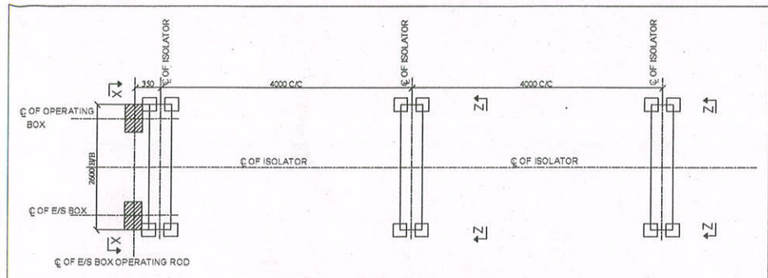
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

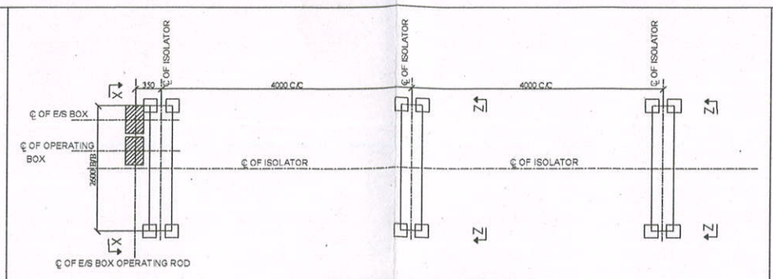
Approved issued for Fabrication/Construction/Manufacturing.
Approved issued for Fabrication/Construction/Manufacturing subject to condition that attached comments and comments are included.
Please submit the revised documents for approval.
Kindly resubmit for approval.
Approved as noted. Fabrication/Construction/Manufacturing may be carried out.
Please submit comments and submit again for approval.
For Information and record.
Not approved.

(Designation)
(Date)

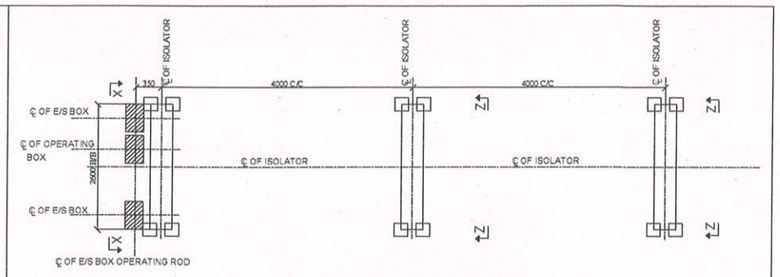
CW-14879 dt 05/05/22



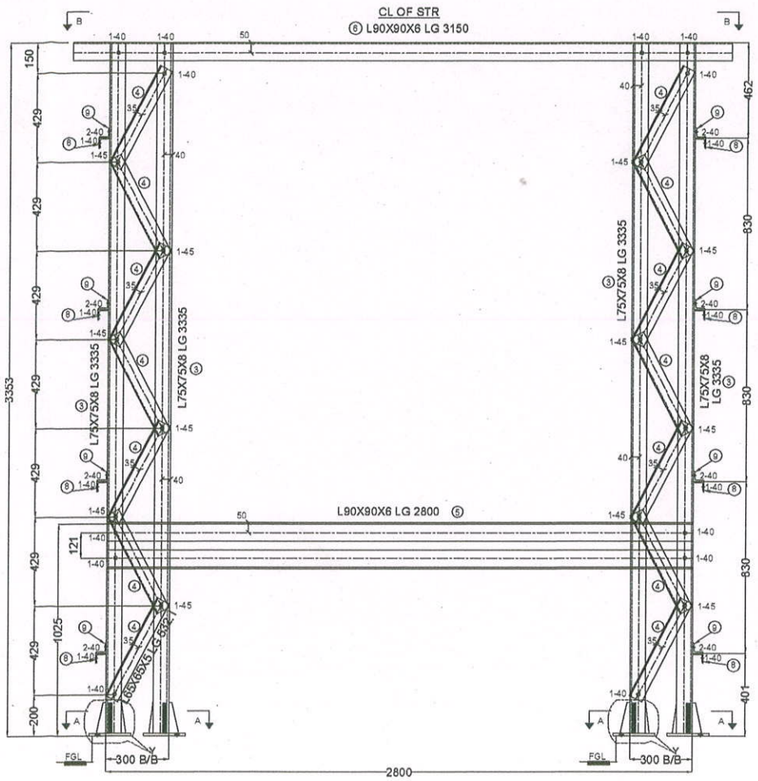
ISOLATOR WITH ONE EARTHSWITCH



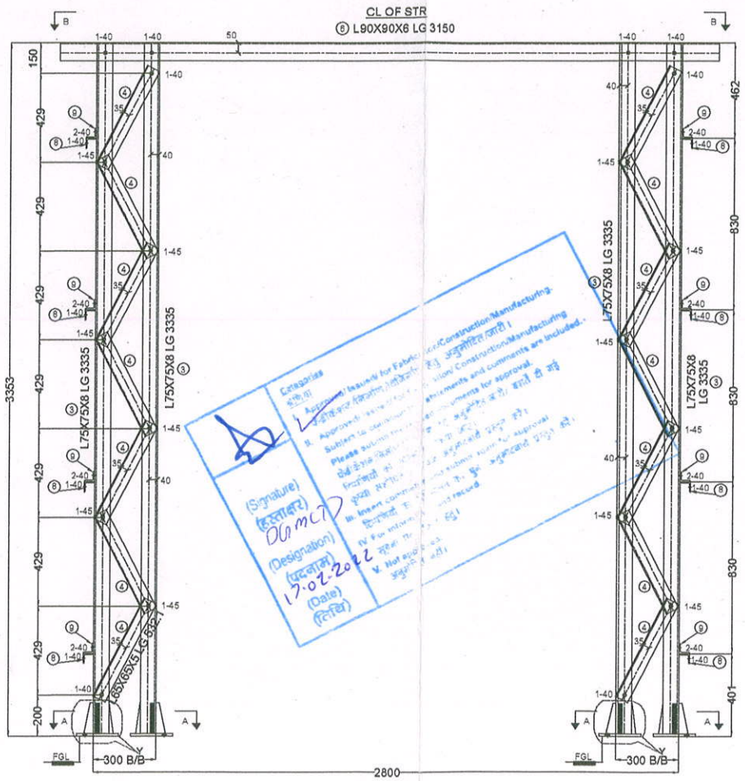
ISOLATOR WITH ONE EARTHSWITCH



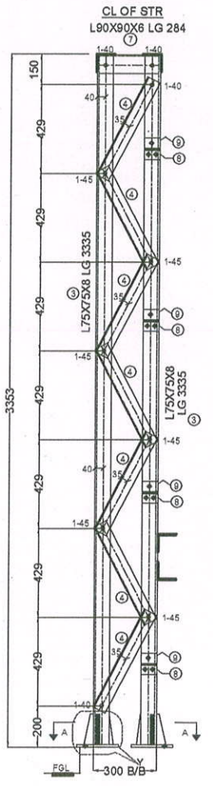
ISOLATOR WITH TWO EARTHSWITCH



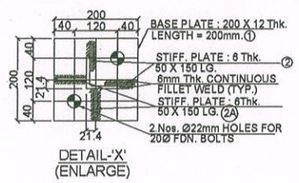
ELEVATION
SECTION X-X



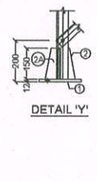
ELEVATION
SECTION Z-Z

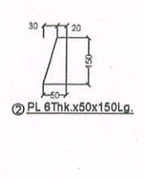


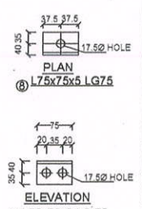
SIDE VIEW

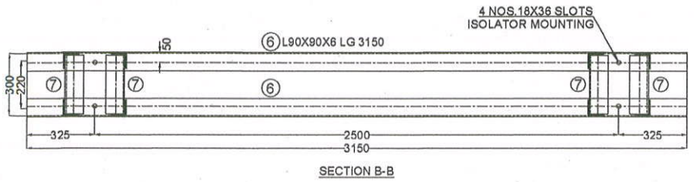


DETAIL-'X'
(ENLARGE)

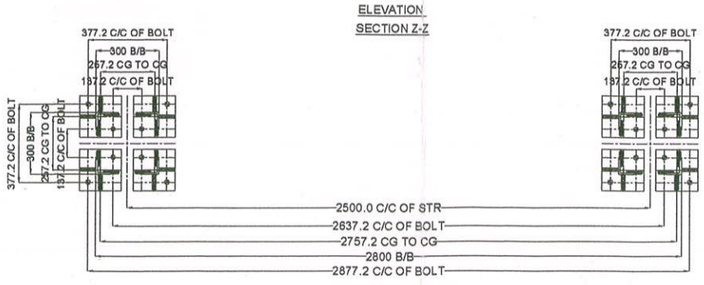








SECTION B-B



SECTION 'A-A'

BILL OF MATERIAL

SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 200X12	200	200	94.20	3.768	8	30.144
2	2	PL 50X6	150	50	47.10	0.353	16	5.652
3	2A	PL 50X6	150	50	47.10	0.353	16	5.652
4	3	L75x 75x8	3335		8.90	29.68	8	237.452
5	4	L65X65X5	532.1		4.90	2.607	56	146.008
6	5	L90X90X6	2800		8.20	22.960	2	45.920
7	6	L90X90X6	3150		8.20	25.830	2	51.660
8	7	L90X90X6	284		8.20	2.329	4	9.315
9	8	L75X75X5	75		5.70	0.428	16	6.840
10	9	L75X75X5	75		5.70	0.428	16	6.840
					WT. OF STRUCTURE (kg.) =			545.48
		TOTAL LIST OF BOLTS & NUTS						
11		M16x40 mm Bolts & Nuts				0.126	32	4.03
12		M16x45 mm Bolts & Nuts				0.134	48	6.43
13		M-16-3.5 THK SPRING WASHER				0.009	80	0.72
15		M16X100 LG. FOR EQPT. MOUNTING (FULL THREADED)				0.218	4	0.872
					TOTAL WEIGHT OF HARDWARE (kg)=			12.06
					TOTAL WEIGHT OF STRUCTURE WITH HARDWARE (kg) =			557.54

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802
3. BOLTS, NUTS SHALL BE AS PER IS:12427 (PROPERTY CLASS 5.6).
4. GALVANIZING TO BE AS PER TECHNICAL SPECIFICATION.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER I.S:816
7. ALL STRUCTURAL MEMBERS SHALL BE HOT DIP GALVANIZED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
8. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
9. EQUIPMENT MOUNTING DETAILS, & STRUCTURE HEIGTH ARE INDICATIVE ONLY, WHICH MAY CHANGE AS PER EQUIPMENT DRAWING.
10. ALL WELD SHALL BE 6MM THICK FILLET WELD.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NDA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	220KV ISO STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/54	REV- 1	
SCALE	As shown in Drawing	SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 1 OF 1	

	NAME	DATE	SIGN
PREPARED BY	RAVI	02.02.2022	
CHECKED BY	G.H	02.02.2022	
SUBMITTED BY	ANURAG	02.02.2022	Signature/Stamp

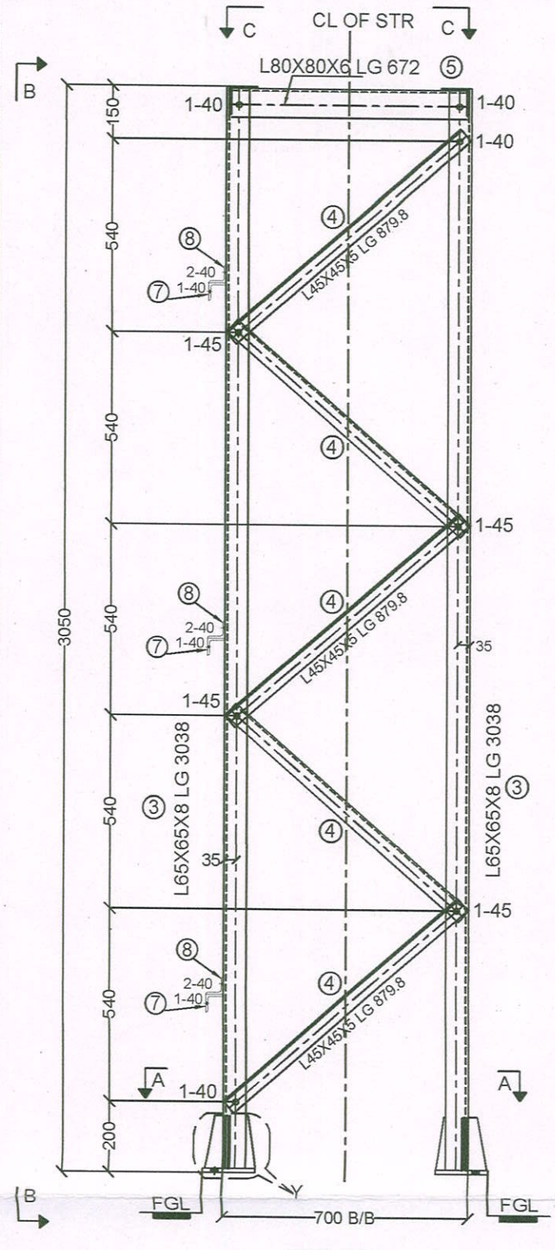
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

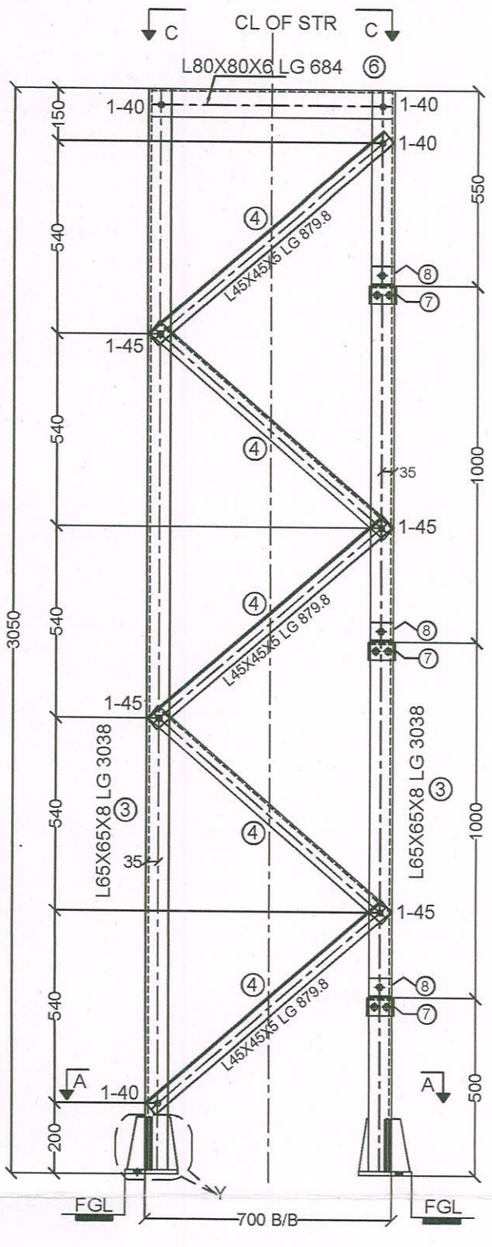
Categories
श्रेणी III
Approved Issues for Fabrication/Construction/Manufacturing
Approved for fabrication/construction/manufacturing
Subject to satisfactory incorporation of comments and comments are included.
Please submit for approval
Please submit comments for approval
Not to be fabricated/constructed/manufactured
Incomplete
अपूर्ण
Resubmit for approval
पुनः प्रस्तुत करें
In view comments are included
टिप्पणियों को शामिल किया गया है
For information
सूचना हेतु
Not approved
अस्वीकृत
(Signature) (हस्ताक्षर) Dhar
(Designation) (पदनाम) 17.02.2022
(Date) (दिनांक)

KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR

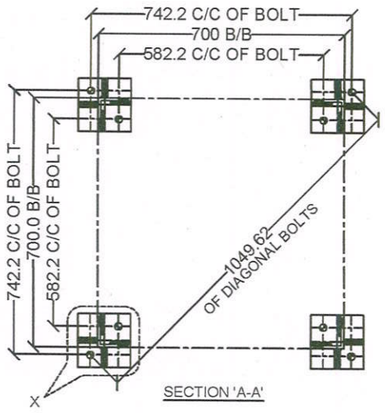
REC Power Development & Consultancy Ltd. Gurugram-122001



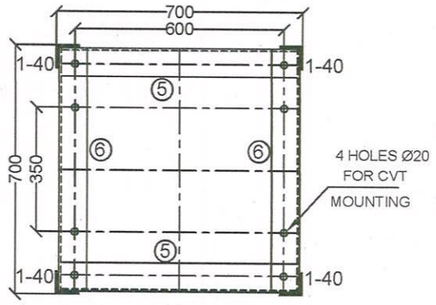
ELEVATION



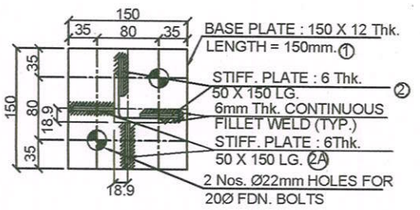
SECTION B–B



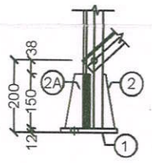
SECTION 'A-A'



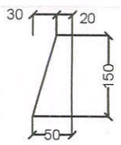
SECTION C–C



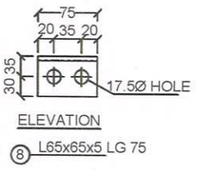
DETAIL-'X'
(ENLARGE)



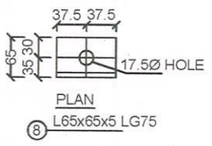
DETAIL 'Y'
(ENLARGE)



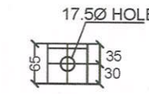
② PL 6Thk.x50x150Lg.



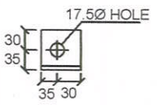
ELEVATION
⑧ L65x65x5 LG 75



PLAN
⑧ L65x65x5 LG75



PLAN
⑨ L65x65x5 LG 65



ELEVATION
⑨ L65x65x5 LG 65

BILL OF MATERIAL

SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 150X12	150	150	94.20	2.120	4	8.478
2	2	PL 50X6	150	50	47.10	0.353	8	2.826
3	2A	PL 50X6	150	50	47.10	0.353	8	2.826
4	3	L65x65x8	3038		7.70	23.39	4	93.570
5	4	L45X45X5	879.8		3.40	2.991	20	59.826
6	5	L80X80X6	672		7.30	4.906	2	9.811
7	6	L80X80X6	684		7.30	4.993	2	9.986
8	7	L75X75X5	75		5.70	0.428	6	2.565
9	8	L75X75X5	75		5.70	0.428	6	2.565
				WT. OF STRUCTURE (kg.) =				192.45
		TOTAL LIST OF BOLTS & NUTS						
10		M16x40 mm Bolts & Nuts				0.126	38	4.79
11		M16x45 mm Bolts & Nuts				0.134	16	2.14
12		M-16-3.5 THK SPRING WASHER				0.009	54	0.49
13		M20X100 LG. FOR EQPT. MOUNTING (FULL THREADED)				0.371	4	1.484
					TOTAL WEIGHT OF HARDWARE (kg)=			8.90
					TOTAL WEIGHT OF STRUCTURE WITH HARDWARE (kg) =			201.36

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802
3. BOLTS, NUTS SHALL BE AS PER IS:12427 (PROPERTY CLASS 5.6).
4. GALVANIZING TO BE AS PER TECHNICAL SPECIFICATION.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER I.S:816
7. ALL STRUCTURAL MEMEBERS SHALL BE HOT DIP GALVANIZED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
8. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
9. EQUIPMENT MOUNTING DETAILS, & STRUCTURE HEIGTH ARE INDICATIVE ONLY, WHICH MAY CHANGE AS PER EQUIPMENT DRAWING.
10. ALL WELD SHALL BE 6MM THICK FILLET WELD.

KAILASH DEVBUILD (INDIA) PVT. LTD. Authorised Signatory

REC Power Development And Consultancy Ltd.

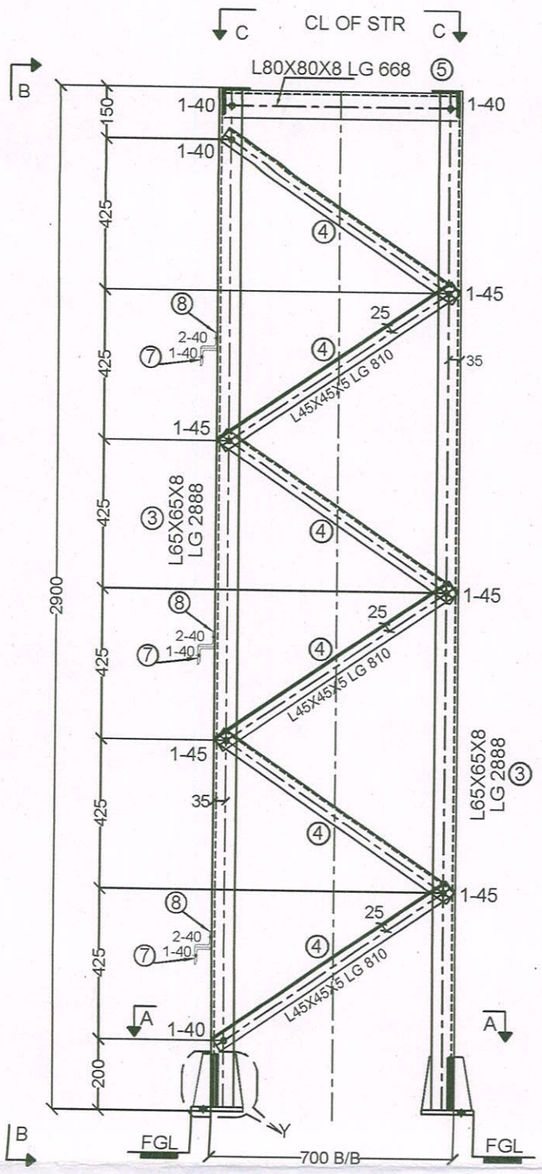
Categories
श्रेणियां
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
स्वीकृत/जारी निर्माण/निर्माणार्थ/हेतु अनुमोदित/जारी।
II. Approved/ Issued for Fabrication/ Construction/Manufacturing Subject to condition that attachments and comments are included.
Please submit the revised documents for approval.
स्वीकृत/जारी निर्माण/निर्माणार्थ हेतु अनुमोदित/जारी। बातें दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

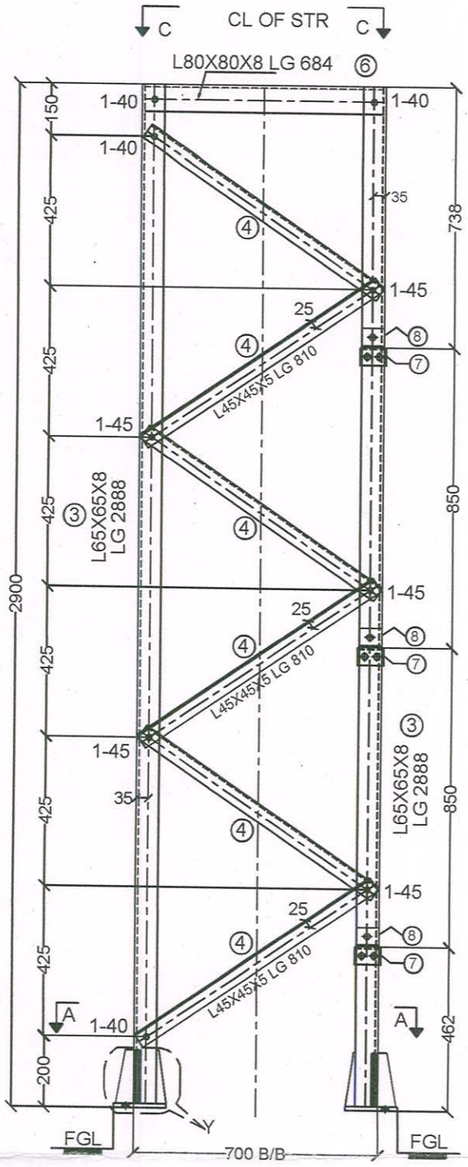
(Signature) (हस्ताक्षर)
Dgm(T) (Designation) (पदनाम)
17/2/22 (Date) (तिथि)

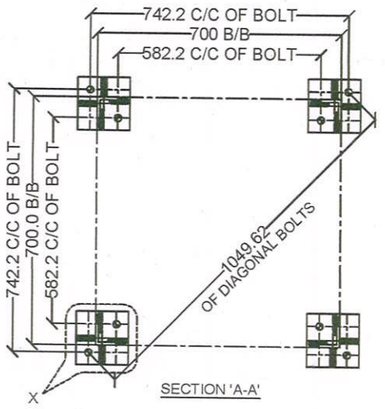
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	220KV CVT STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/57		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1
	NAME	DATE	SIGN
PREPARED BY	RAVI	05.02.2022	
CHECKED BY	G.H	05.02.2022	
SUBMITTED BY	ANURAG	05.02.2022	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

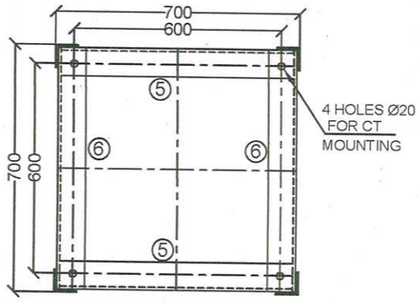
☐ More Information Date.....



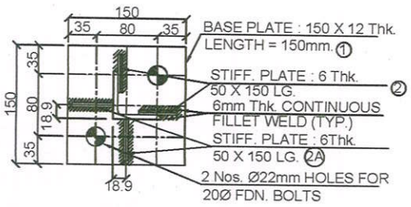




SECTION 'A-A'



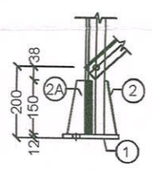
SECTION C-C



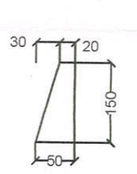
DETAIL-'X'
(ENLARGE)

ELEVATION

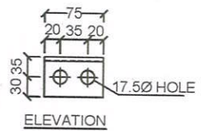
SECTION B-B



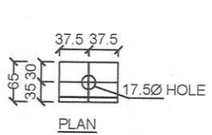
DETAIL 'Y'
(ENLARGE)



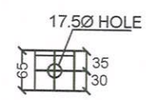
② PL 6Thk.x50x150Lg.



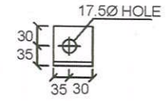
ELEVATION
⑧ L65x65x5 LG 75



PLAN
⑧ L65x65x5 LG75



PLAN
⑨ L65x65x5 LG 65



ELEVATION
⑨ L65x65x5 LG 65

BILL OF MATERIAL

SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 150X12	150	150	94.20	2.120	4	8.478
2	2	PL 50X6	150	50	47.10	0.353	8	2.826
3	2A	PL 50X6	150	50	47.10	0.353	8	2.826
4	3	L65x65x8	2888		7.70	22.24	4	88.950
5	4	L45X45X5	810		3.40	2.754	24	66.096
6	5	L80X80X8	668		9.60	6.413	2	12.826
7	6	L80X80X8	684		9.60	6.566	2	13.133
8	7	L75X75X5	75		5.70	0.428	6	2.565
9	8	L75X75X5	75		5.70	0.428	6	2.565
				WT. OF STRUCTURE (kg.) =				**200.26**
		TOTAL LIST OF BOLTS & NUTS						
10		M16x40 mm Bolts & Nuts			0.126	38		4.79
11		M16x45 mm Bolts & Nuts			0.134	20		2.68
12		M-16-3.5 THK SPRING WASHER			0.009	58		0.52
13		M16X100 LG. FOR EQPT. MOUNTING (FULL THREADED)			0.218	4		0.872
		TOTAL WEIGHT OF HARDWARE (kg)=						**8.86**
		TOTAL WEIGHT OF STRUCTURE WITH HARDWARE (kg) =						**209.13**

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802
3. BOLTS, NUTS SHALL BE AS PER IS:12427 (PROPERTY CLASS 5.6).
4. GALVANIZING TO BE AS PER TECHNICAL SPECIFICATION.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER I.S:816
7. ALL STRUCTURAL MEMEBERS SHALL BE HOT DIP GALVANIZED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
8. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
9. EQUIPMENT MOUNTING DETAILS, & STRUCTURE HEIGTH ARE INDICATIVE ONLY, WHICH MAY CHANGE AS PER EQUIPMENT DRAWING.
10. ALL WELD SHALL BE 6MM THICK FILLET WELD.

REC Power Development And Consultancy Ltd. * 122001 * Gurgaon *

KAILASH DEVBUILD (INDIA) PVT. LTD. *

Categories
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
II. Approved/ Issued for Fabrication/ Construction/Manufacturing. Subject to condition that statements and comments are incl... Please submit the revised documents for approval.
III. Insert comments and submit again for approval.
IV. For information and record.
V. Not approved.

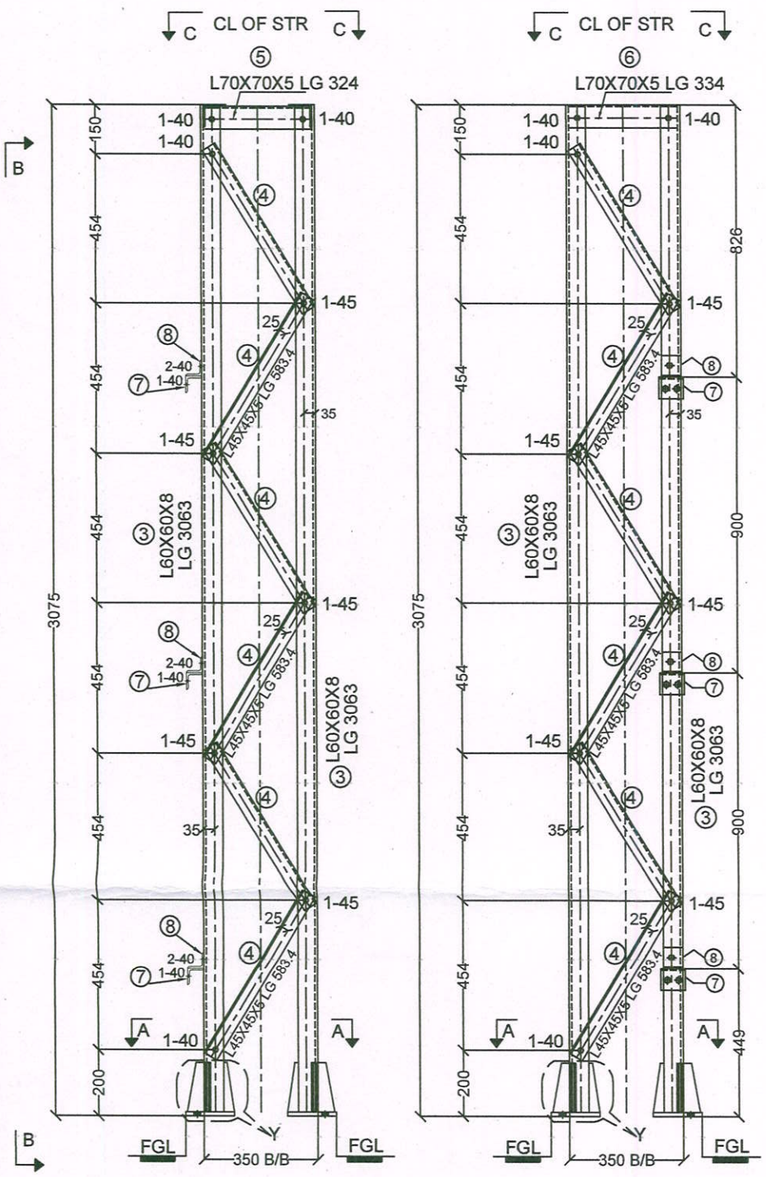
(Signature)
(Designation)
(Date)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	220KV CT STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/58 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 1

	NAME	DATE	SIGN
PREPARED BY	RAVI	08.02.2022	
CHECKED BY	G.H	08.02.2022	
SUBMITTED BY	ANURAG	08.02.2022	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



ELEVATION

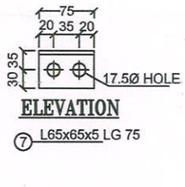
SECTION B–B

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802
3. BOLTS, NUTS SHALL BE AS PER IS:12427 (PROPERTY CLASS 5.6).
4. GALVANIZING TO BE AS PER TECHNICAL SPECIFICATION.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER I.S:816
7. ALL STRUCTURAL MEMEBERS SHALL BE HOT DIP GALVANIZED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
8. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
9. EQUIPMENT MOUNTING DETAILS, & STRUCTURE HEIGTH ARE INDICATIVE ONLY, WHICH MAY CHANGE AS PER EQUIPMENT DRAWING.
10. ALL WELD SHALL BE 6MM THICK FILLET WELD.

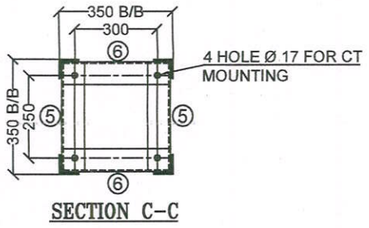
BILL OF MATERIAL

SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 150X12	150	150	94.20	2.120	4	8.478
2	2	PL 50X6	150	50	47.10	0.353	8	2.826
3	2A	PL 50X6	150	50	47.10	0.353	8	2.826
4	3	L60x60x8	3063		7.00	21.44	4	85.764
5	4	L45X45X5	583.4		3.40	1.984	24	47.605
6	5	L70X70X5	324		5.30	1.717	2	3.434
7	6	L70X70X5	334		5.30	1.770	2	3.540
8	7	L65X65X5	75		4.90	0.368	6	2.205
9	8	L65X65X5	65		4.90	0.319	6	1.911
				WT. OF STRUCTURE (kg.) =				158.59
TOTAL LIST OF BOLTS & NUTS								
10		M16x40 mm Bolts & Nuts			0.126	34	4.28	
11		M16x45 mm Bolts & Nuts			0.134	20	2.68	
12		M-16-3.5 THK SPRING WASHER			0.009	54	0.49	
13		M16X100 LG. FOR EQPT. MOUNTING (FULL THREADED)			0.218	4	0.872	
					TOTAL WEIGHT OF HARDWARE (kg)=			8.32
		TOTAL WEIGHT OF STRUCTURE WITH HARDWARE (kg) =						166.91

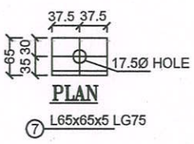


ELEVATION

⑦ L65x65x5 LG 75

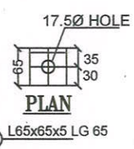


SECTION C–C



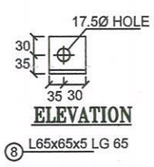
PLAN

⑦ L65x65x5 LG75



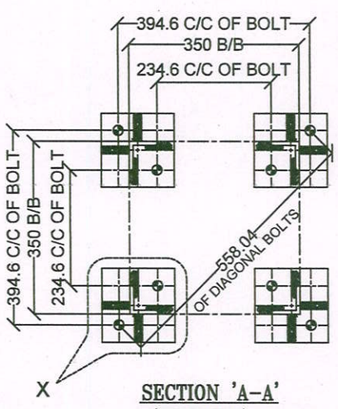
PLAN

⑧ L65x65x5 LG 65

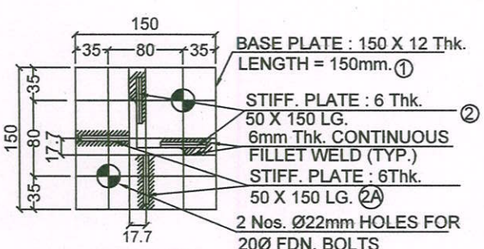


ELEVATION

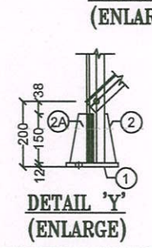
⑧ L65x65x5 LG 65



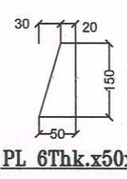
SECTION 'A–A' (ENLARGE)



DETAIL–'X' (ENLARGE)



DETAIL 'Y' (ENLARGE)



② PL 6Thk.x50x150Lg.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	33KV CT STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/59	REV- 0	
SCALE	As shown in Drawing	SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 1 OF 1	

	NAME	DATE	SIGN
PREPARED BY	RAVI	16.02.2022	
CHECKED BY	G.H	16.02.2022	
SUBMITTED BY	ANURAG	16.02.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

Signature/Stamp

Categories
श्रेणियां

(Signature)
(हस्ताक्षर)

(Designation)
(पदनाम)

(Date)
(तिथि)

i. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
संस्वीकृत/जारी/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।

ii. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
संस्वीकृत/जारी/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।

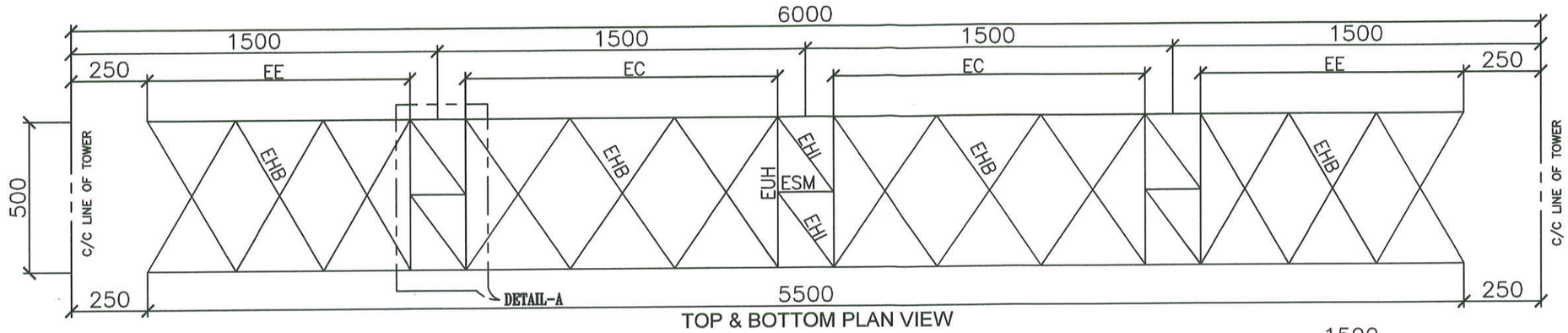
iii. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।

iv. For information and record.
सूचना एवं रिकॉर्ड हेतु।

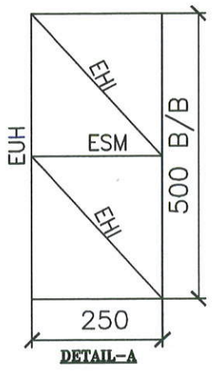
v. Not approved.
अनुमोदित नहीं।

REC Power Development And Consultancy Ltd. Gurugram-122001

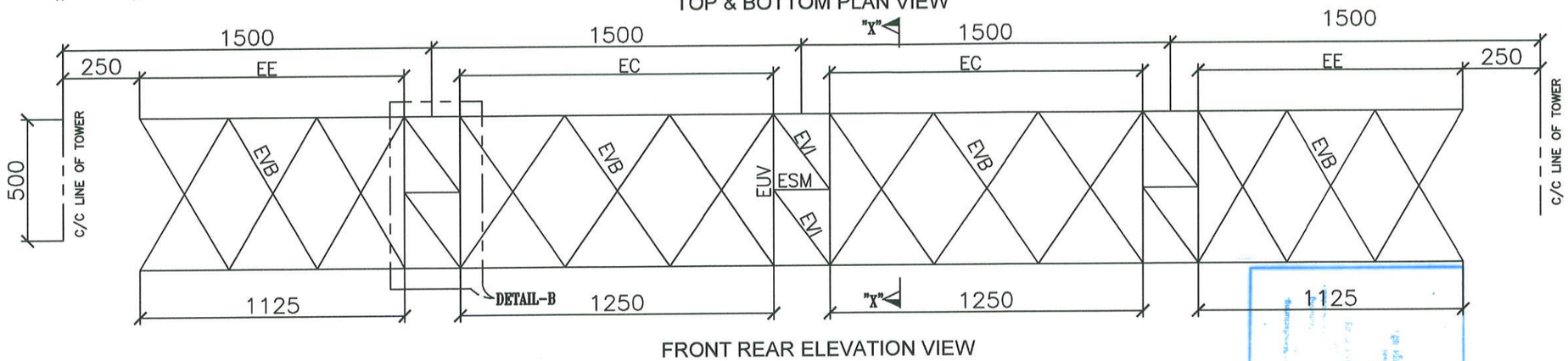
Cw-15970
dt 5/5/22



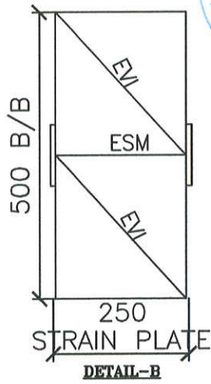
TOP & BOTTOM PLAN VIEW



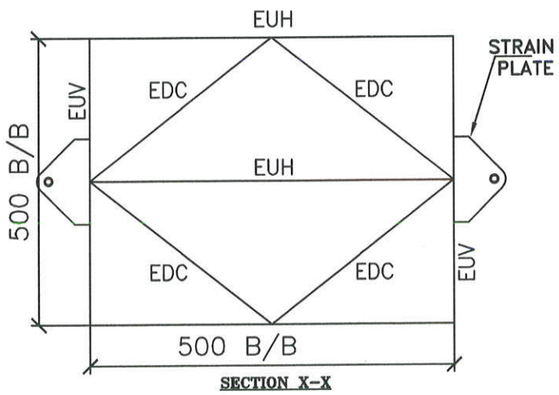
DETAIL-A



FRONT REAR ELEVATION VIEW



DETAIL-B



SECTION X-X

GIRDER MKD.	MEMBER NAME	BE	BC	EHB	EVB	EUV	EUH	EDC	EVI	EHI	ESM
3BD	ANGLE SIZE	90X90X8	90X90X8	45X45X4		50X50X5		45X45X4			
	NO. OF BOLTS	4 DS	4 DS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS

NOTES:-
1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL UNNOTED MEMBERS ARE I S A 45X45X5.
3. ALL ANGLE SECTIONS USED ARE EQUAL ANGLES.
4. ALL DIMENSION ARE CENTER LINE DIMENSIONS UNLESS NOTED OTHERWISE.
5. ALL CONNECTION BOLTS SHALL BE 16MM DIA BOLTS

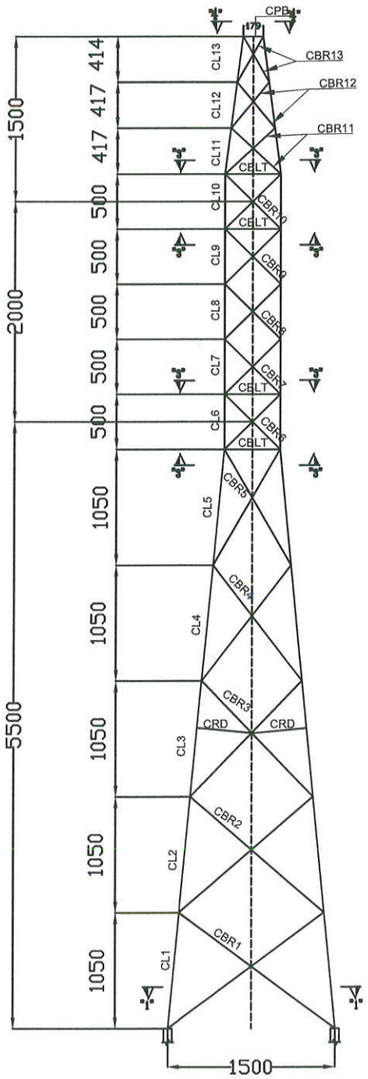
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	KD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 KD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	SLD OF 33KV BEAM 3BD Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/76	REV- 00	
SCALE	As shown in Drawing	SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM	PAGE NO. 01	
	NAME	DATE	SIGN
PREPARED BY	DEEPAK	23.03.2022	Deepak
CHECKED BY	G.H	23.03.2022	
SUBMITTED BY	KDBIL	23.03.2022	

Signature/Stamp

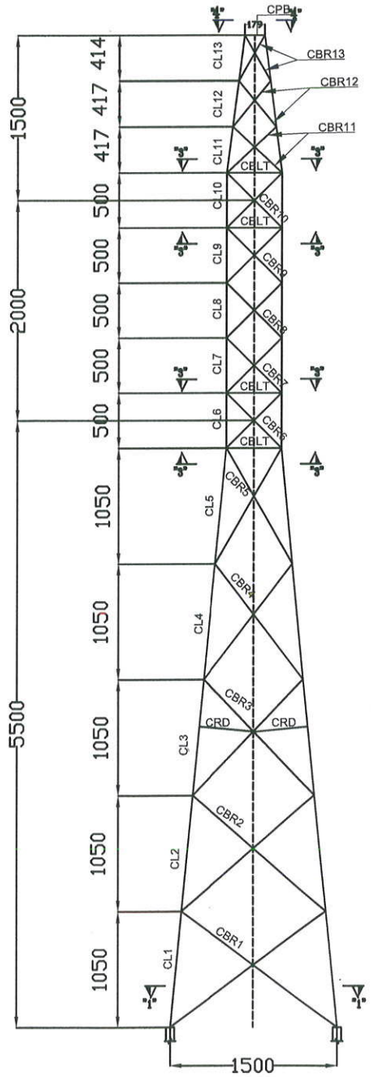
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

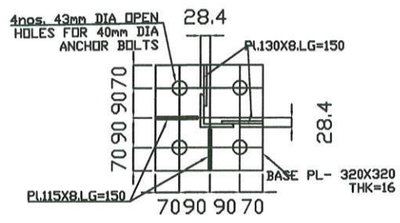
TOWER MKD.	MEMBER NAME	TM1	TM2	TM3	TM4	TM5	TM6	TM7	TM8	TM9	TM10	TM11	TM12	TM13	TB1	TB2	TB3	TB4	TB5	TB6	TB7	TB8	TB9	TB10	TB11	PB	TBE2	THB2	THRD
3TAP	ANGLE SIZE	100X100X10		90X90X10		90X90X8			75X75X6			60X60X5			50X50X5		45X45X5			50X50X5	45X45X5	50X50X5	45X45X4				60X60X5	45X45X4	45X45X4
	NO. OF BOLTS	8 DS	8 DS	8 DS	6 DS	6 DS	6 DS	6 DS	6 DS	6 DS	6 DS	2 DS	2 DS	2 DS	2 SS	2 SS	2 SS	2 SS	2 SS	2 SS	2 SS	2 SS	1 SS	1 SS	1 SS	1 SS	2 SS	1 SS	1 SS



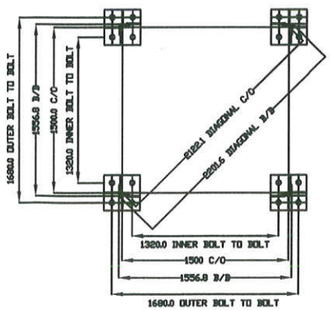
TRANSVERSE FACE OF TOWER WITH PEAK & EXT.



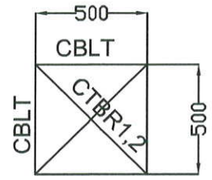
LONGITUDINAL FACE OF TOWER WITH PEAK & EXT.



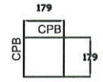
DETAIL OF BASE PLATE



SECTION 1-1



SECTION 3-3



SECTION 4-4

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL UNNOTED MEMBERS ARE IS A 45X45X4.
3. ALL ANGLE SECTIONS USED ARE EQUAL ANGLES.
4. ALL DIMENSION ARE CENTER LINE DIMENSIONS UNLESS NOTED OTHERWISE.
5. ALL CONNECTION BOLTS SHALL BE 16MM DIA BOLTS

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kallash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	SLD OF 33KV TOWER 3TAP Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/76 — REV- 00
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — PAGE NO.- 02

	NAME	DATE	SIGN
PREPARED BY	DEEPAK	23.03.2022	
CHECKED BY	G.H	23.03.2022	
SUBMITTED BY	KDBIL	23.03.2022	

Signature/Stamp

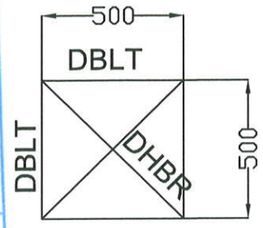
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

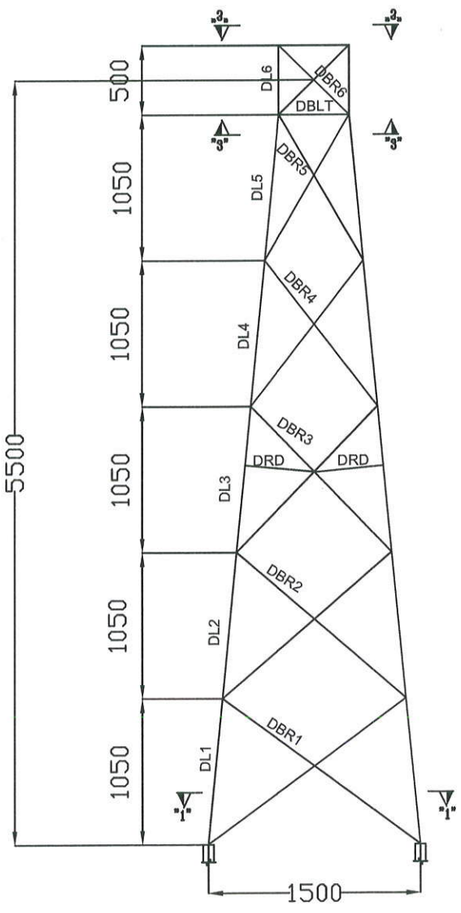
Design & Engineering by:- AUPTC

Design & Engineering by:- AUPTC

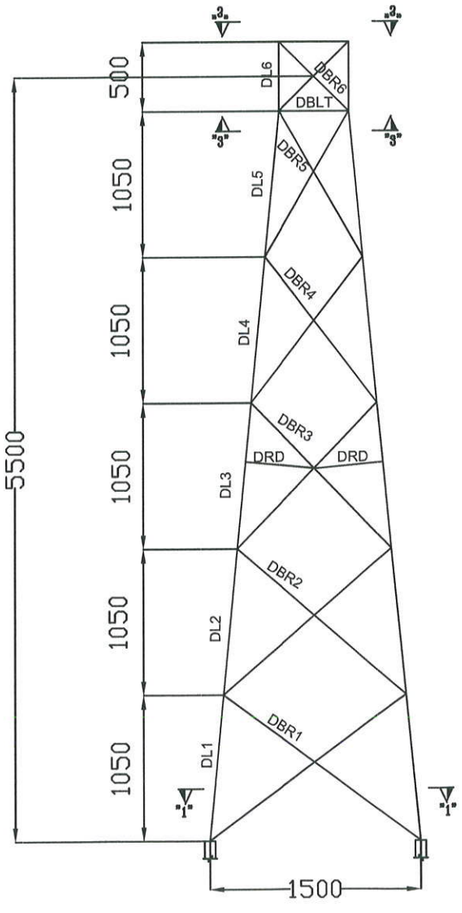
TOWER MKD.	MEMBER NAME	DL1	DL2	DL3	DL4	DL5	DL6	DBR1	DBR2	DBR3	DBR4	DBR5	DBR6	DBLT	DRD	DHBR
3TD	ANGLE SIZE	100X100X10		90X90X10		90X90X6		50X50X5		45X45X5			50X50X5	60X60X5	45X45X4	
	NO. OF BOLTS	8 DS	8 DS	8 DS	6 DS	6 DS	6 DS	6 SS	6 SS	6 SS	6 SS	2 SS	2 SS	3 SS	1 SS	1 SS



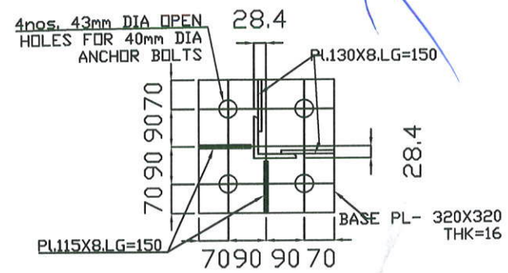
SECTION 3-3



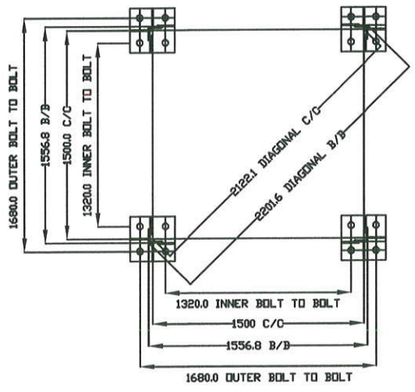
TRANSVERSE FACE OF TOWER WITH PEAK & EXT.



LONGITUDINAL FACE OF TOWER WITH PEAK & EXT.



DETAIL OF BASE PLATE



SECTION 1-1

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL UNNOTED MEMBERS ARE IS A 45X45X4.
3. ALL ANGLE SECTIONS USED ARE EQUAL ANGLES.
4. ALL DIMENSION ARE CENTER LINE DIMENSIONS UNLESS NOTED OTHERWISE.
5. ALL CONNECTION BOLTS SHALL BE 16MM DIA BOLTS

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	<i> CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-I/705 Dt. 06.11.2020 <ii> CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	SLD OF 33KV TOWER 3TD Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250-PJ/20-21/D1/76		REV-	0
SCALE	As shown in Drawing		SHEET SIZE	A3
AREA	91.6 KANAL 46336.5 SQM		PAGE NO.	01
	NAME	DATE	SIGN	
PREPARED BY	DEEPAK	23.03.2022		
CHECKED BY	G.H	23.03.2022		
SUBMITTED BY	KDBIL	23.03.2022		Signature & Comp...

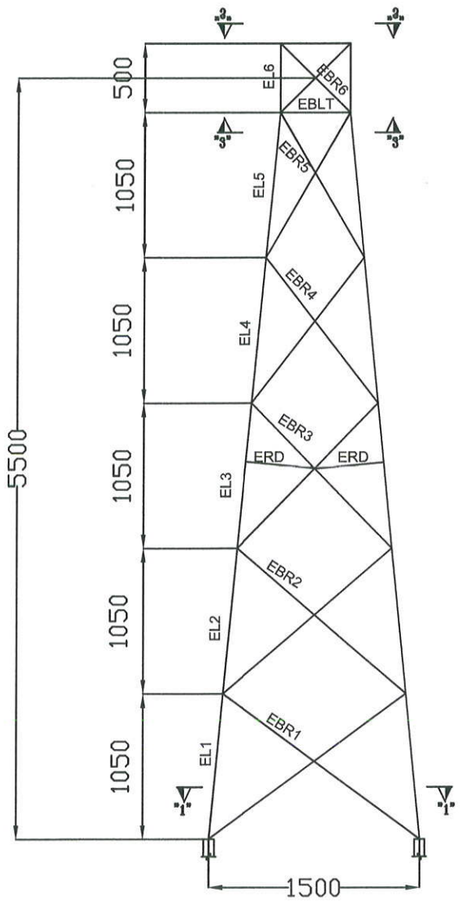
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

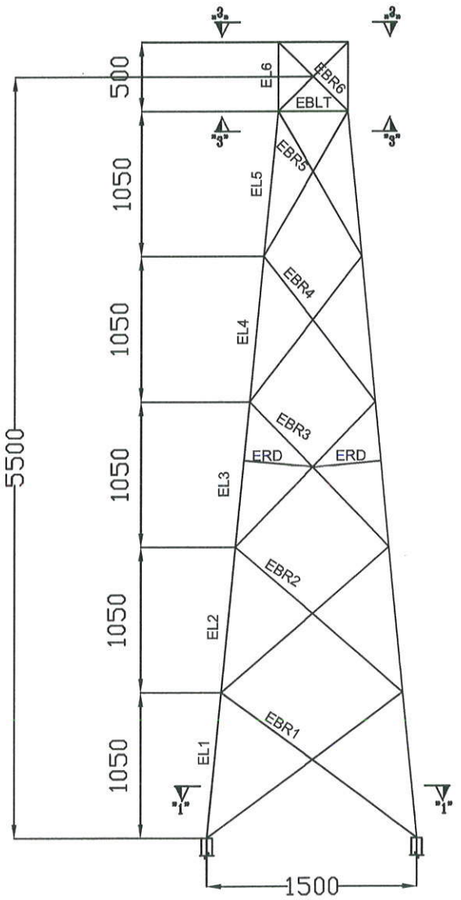
Design & Engineering by:- AUPTC

Design & Engineering by:- AUPTC

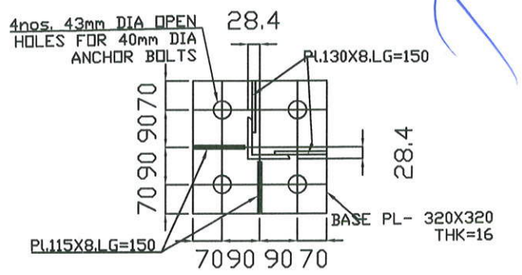
TOWER MKD.	MEMBER NAME	EL1	EL2	EL3	EL4	EL5	EL6	EBR1	EBR2	EBR3	EBR4	EBR5	EBR6	EBLT	ERD	EHBR
3TE	ANGLE SIZE	100X100X10		90X90X10		90X90X6		50X50X5		45X45X5		50X50X5	60X60X5		45X45X4	
	NO. OF BOLTS	8 DS	8 DS	8 DS	6 DS	6 DS	6 DS	6 SS	6 SS	6 SS	6 SS	2 SS	2 SS	3 SS	1 SS	1 SS



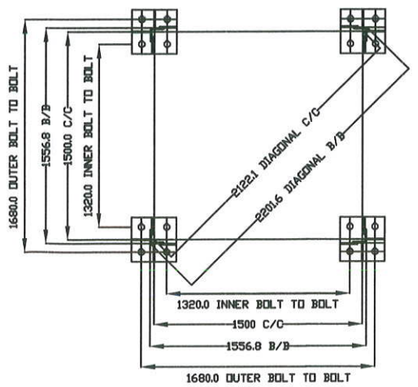
TRANSVERSE FACE OF TOWER WITH PEAK & EXT.



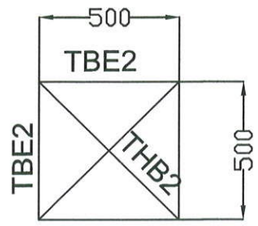
LONGITUDINAL FACE OF TOWER WITH PEAK & EXT.



DETAIL OF BASE PLATE



SECTION 1-1



SECTION 3-3

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL UNNOTED MEMBERS ARE IS A 45X45X4.
3. ALL ANGLE SECTIONS USED ARE EQUAL ANGLES.
4. ALL DIMENSION ARE CENTER LINE DIMENSIONS UNLESS NOTED OTHERWISE.
5. ALL CONNECTION BOLTS SHALL BE 16MM DIA BOLTS

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	SLD OF 33KV TOWER 3TE Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/DI/76 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — PAGE NO. 304

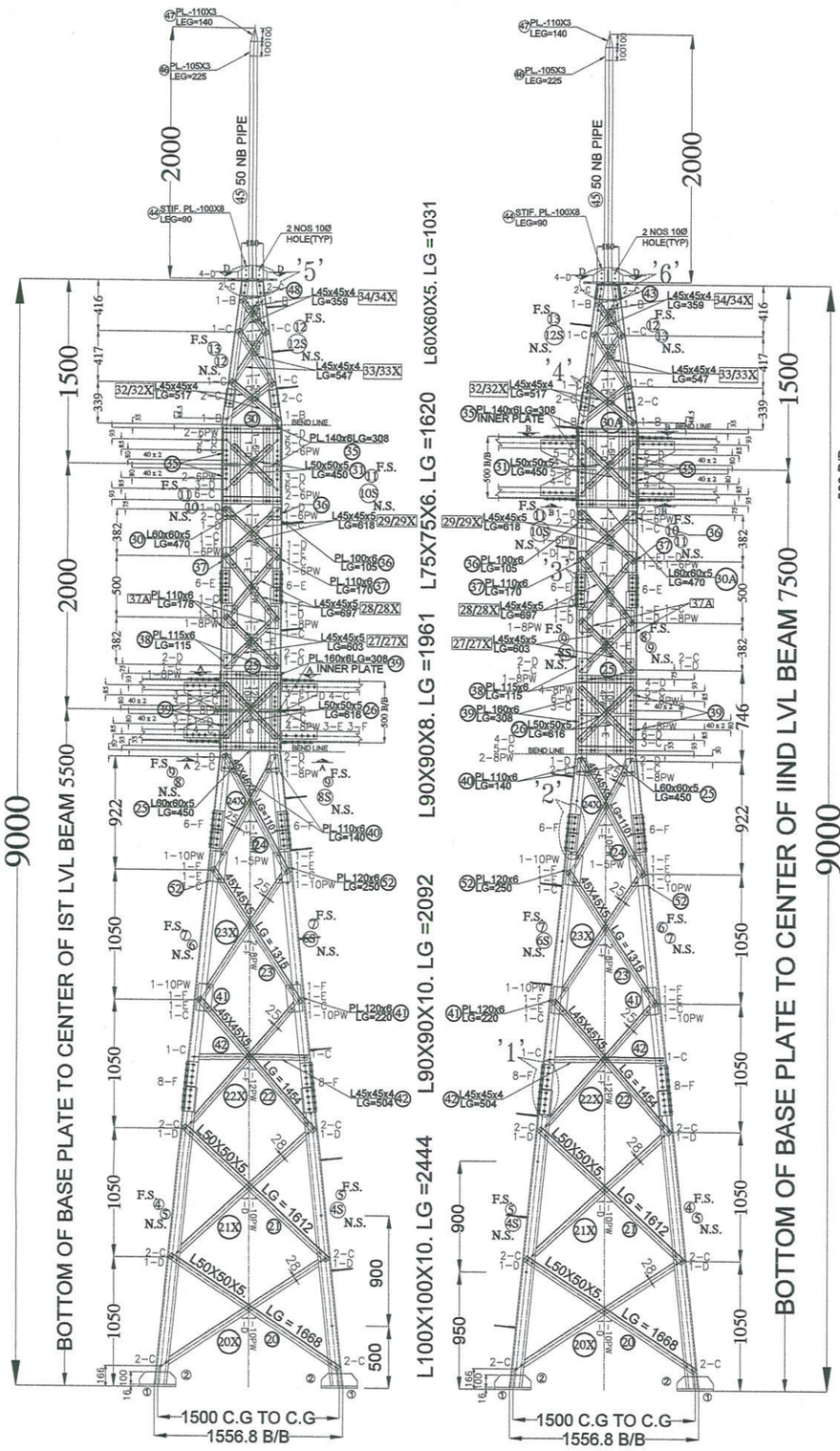
	NAME	DATE	SIGN
PREPARED BY	DEEPAK	23.03.2022	Deepak
CHECKED BY	G.H	23.03.2022	
SUBMITTED BY	KDBIL	23.03.2022	

Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

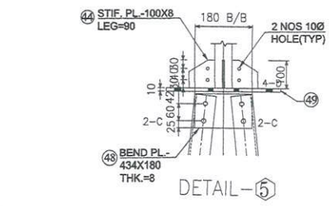
☐ More Information Date.....

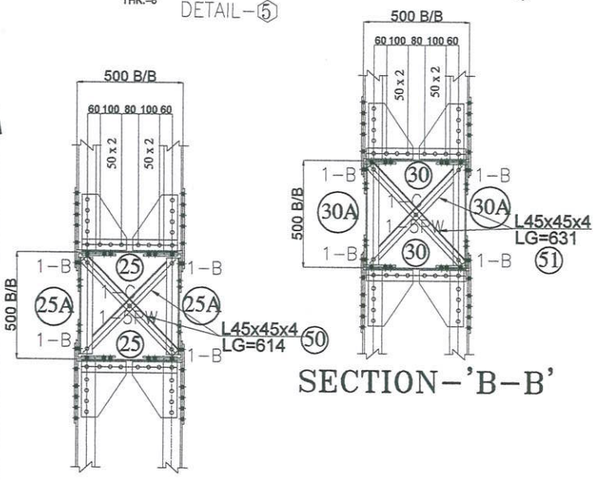
Design & Engineering by:- AUPTC

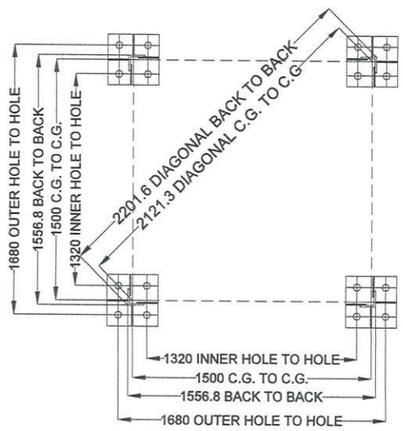


LONGITUDINAL FACE

TRANSVERSE FACE







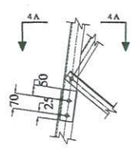
FOUNDATION PLAN

NOTES:-

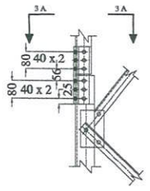
1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639(PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'CB' THAT IS CB-1,CB-2,SO ON.
8. SECTIONS NOT INDICATED ARE L45X45X5 WITH 25MM BACKMARK.

BOLTS/NUT STATEMENT			
	SPRING. WASHER	860	
12	30 ØDX12 THK PACK. WASHER	14	
10	30 ØDX10 THK PACK. WASHER	34	
8	30 ØDX8 THK PACK. WASHER	64	
6	30 ØDX6 THK PACK. WASHER	32	
5	30 ØDX5 THK PACK. WASHER	24	
3	30 ØDX4 THK PACK. WASHER	6	
	STEP BOLT Ø16X175	19	DIAGONALLY
TYPE	SIZE	QTY	REMARK
B	DIA 16X35 Lg.	48	
C	DIA 16X40 Lg.	328	
D	DIA 16X45 Lg.	208	
E	DIA 16X50 Lg.	122	
F	DIA 16X55 Lg.	152	
G	DIA 16X60 Lg.	2	

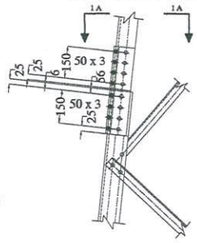
DETAIL –'4'



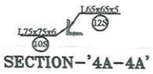
DETAIL –'3'



DETAIL –'1'



SECTION–'4A–4A'



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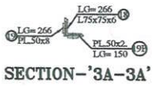

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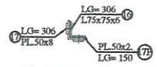
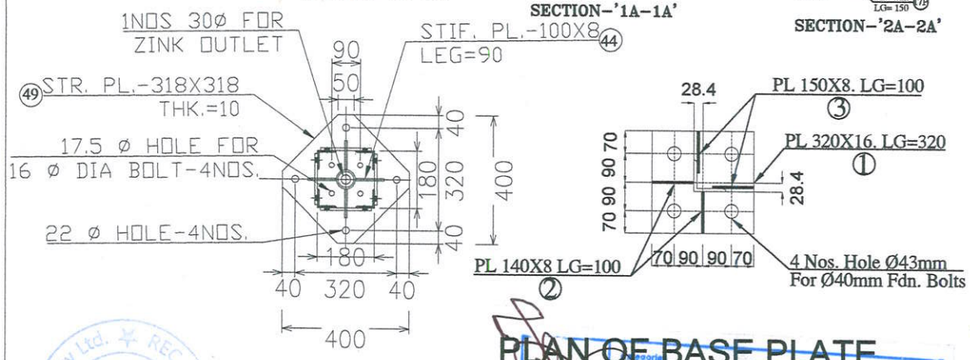
SECTION–'2A–2A'





01	01.11.2022	REVISED AS PER CLIENT COMMENT
00	01.11.2022	FIRST SUBMISSION
REV.	REV. DATE	MODIFICATION
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.	
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILD-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILD-II/NOA-II/706 Dt. 06.11.2020	
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)	
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)	
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)	
CONSULTANT	AUPTC Advanced Ultra Power Transmission Consultancy	
TITLE	ERECTION DRAWING OF 33KV TOWER 3TBP Nagrota (New) S/S, Jammu	
DRG. NO.	KDBIL/250 PJ/20-21/D1/78	
SCALE	As shown in Drawing	REV-01
AREA	91.6 KANAL 46336.5 SQM	SHEET SIZE - A2

	NAME	DATE	SIGN	
PREPARED BY	RASHID	01.11.2022	MR	KDBIL
CHECKED BY	G.H	01.11.2022		
SUBMITTED BY	Er. ANURAG	01.11.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

KAILASH DEVBUILD (INDIA) PVT. LTD. ★ JABALPUR

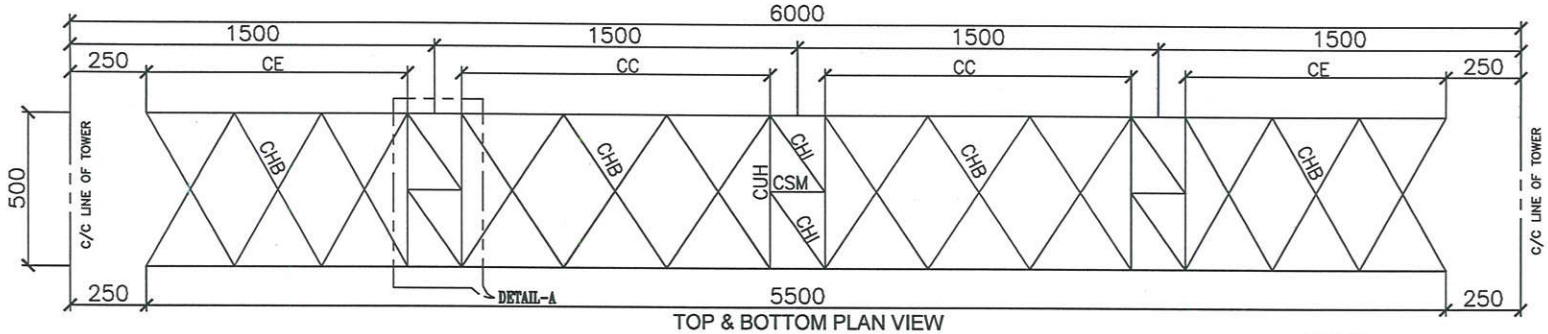
REC Power Development and Consultancy Ltd.

CN- 22128

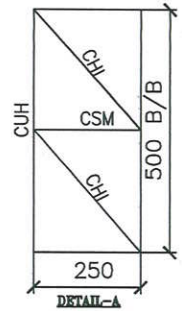
17/11/22

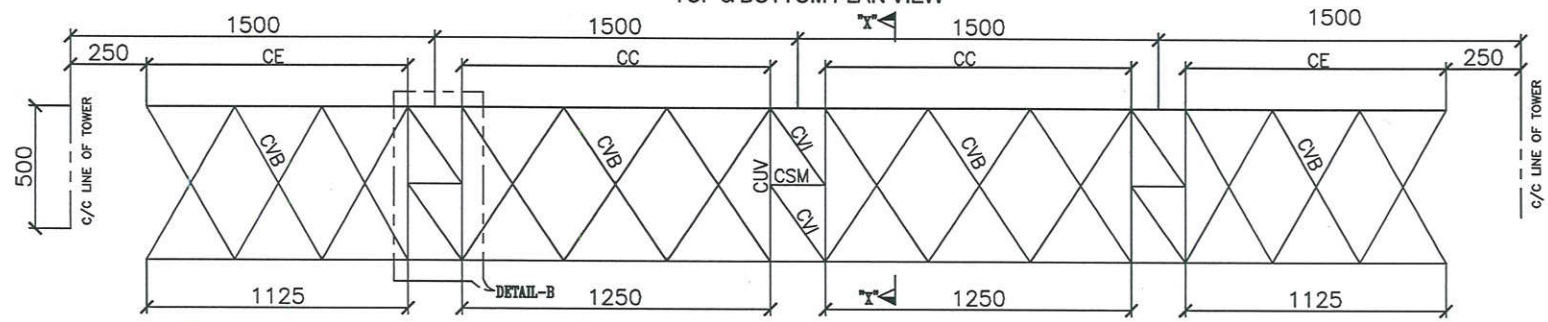
Manager

MR

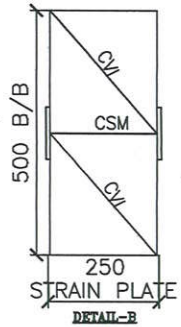


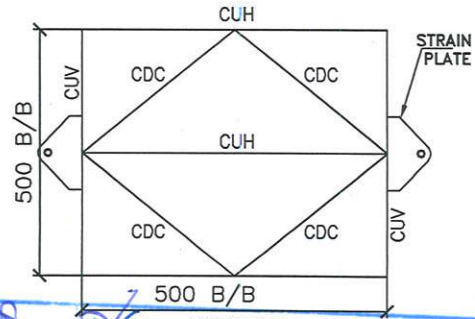
TOP & BOTTOM PLAN VIEW





FRONT REAR ELEVATION VIEW





SECTION X-X

GIRDER MKD.	MEMBER NAME	CE	CC	CHB	CVB	CUV	CUH	CDC	CVI	CHI	CSM
3BC	ANGLE SIZE	90X90X8	90X90X8	45X45X4		50X50X5		45X45X4			
	NO. OF BOLTS	4 DS	4 DS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS

NOTES:-
1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL UNNOTED MEMBERS ARE L S A 45X45X5.
3. ALL ANGLE SECTIONS USED ARE EQUAL ANGLES.
4. ALL DIMENSION ARE CENTER LINE DIMENSIONS UNLESS NOTED OTHERWISE.
5. ALL CONNECTION BOLTS SHALL BE 16MM DIA BOLTS

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	CD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 CD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	SLD OF 33KV BEAM 3BC Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/79 — REV- 00
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — PAGE NO. 02

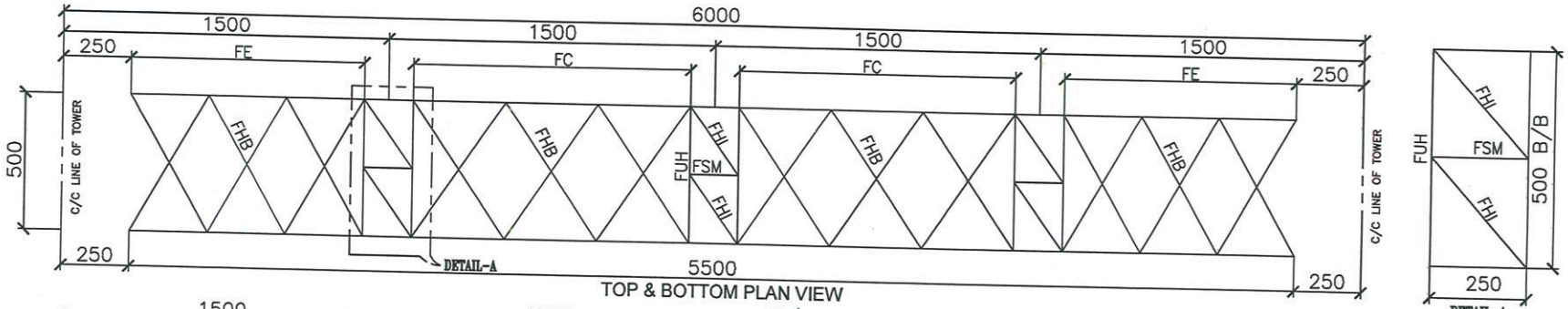
	NAME	DATE	SIGN
PREPARED BY	DEEPAK	04.04.2022	
CHECKED BY	G.H	04.04.2022	
SUBMITTED BY	KDBIL	04.04.2022	Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....

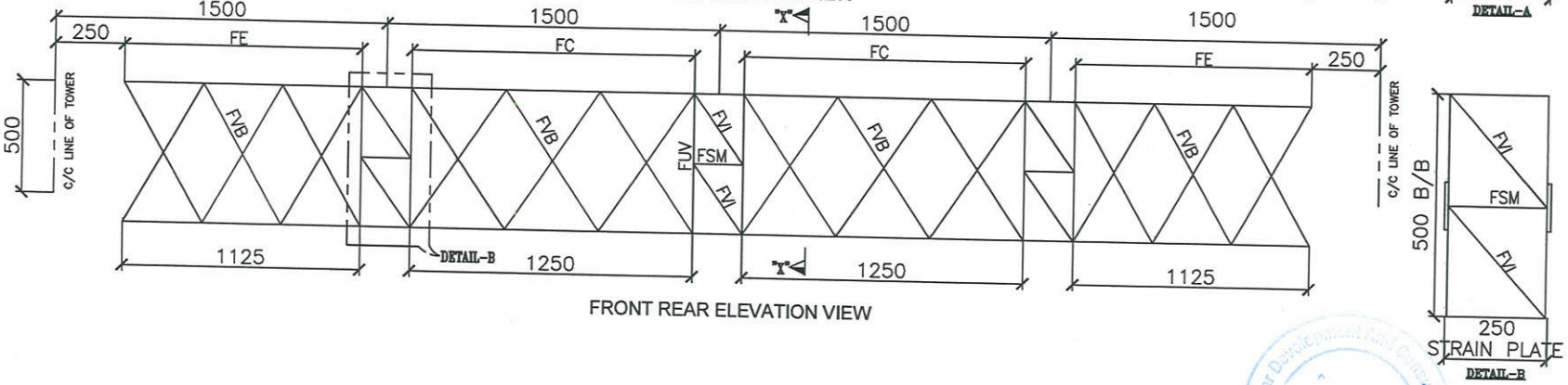
CW-18158 dt 31/3/22

Approved/Issued for Fabrication/Construction/Manufacturing.
Approved/Issued for Fabrication
Subject to correction that sta... included.
Please submit the revised do...
Comments are not required.
Insert comments and submit as...
For Information and record.
Not approved.

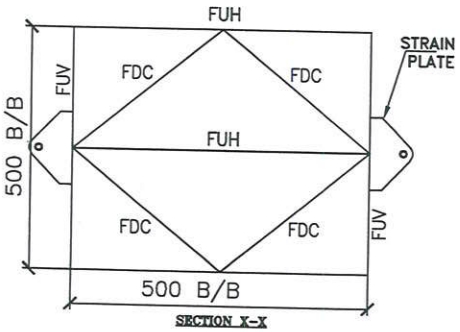
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)



TOP & BOTTOM PLAN VIEW



FRONT REAR ELEVATION VIEW



SECTION X-X

GIRDER MKD.	MEMBER NAME	FE	FC	FHB	FVB	FUV	FUH	FDC	FVI	FHI	FSM
3BF	ANGLE SIZE	90X90X8	90X90X8	45X45X4		50X50X5		45X45X4			
	NO. OF BOLTS	4 DS	4 DS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS

NOTES:-
1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL UNNOTED MEMBERS ARE I S A 45X45X5.
3. ALL ANGLE SECTIONS USED ARE EQUAL ANGLES.
4. ALL DIMENSION ARE CENTER LINE DIMENSIONS UNLESS NOTED OTHERWISE.
5. ALL CONNECTION BOLTS SHALL BE 16MM DIA BOLTS

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	SLD OF 33KV BEAM 3BF Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/79 — REV- 00
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — PAGE NO.- 05

	NAME	DATE	SIGN
PREPARED BY	DEEPAK	04.04.2022	
CHECKED BY	G.H	04.04.2022	
SUBMITTED BY	KDBIL	04.04.2022	

Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Categories
श्रेणियां
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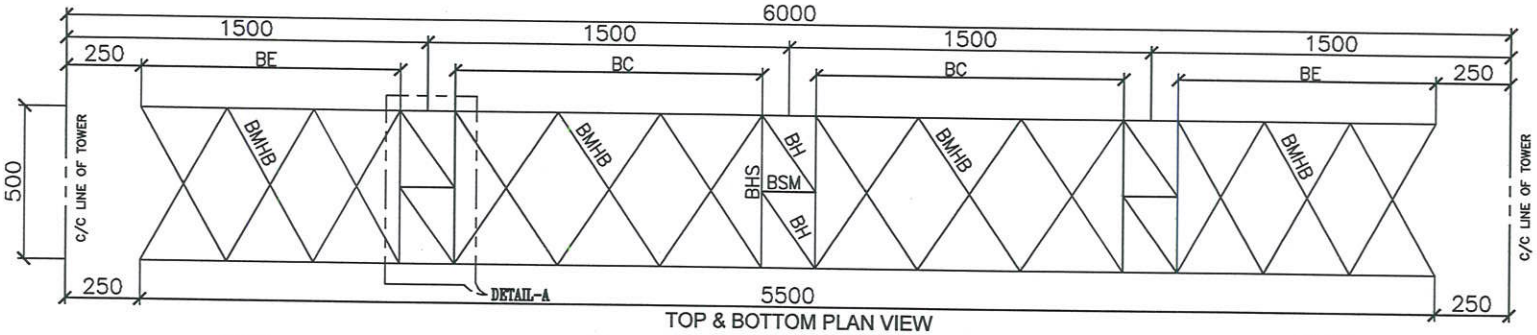
Please submit the revised document
III. Insert comments and submit again for approval
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

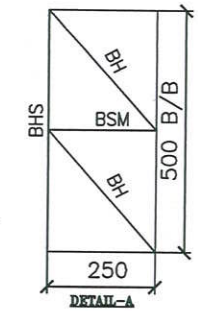
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

REC Power Development And Consultancy Ltd. Gurugram

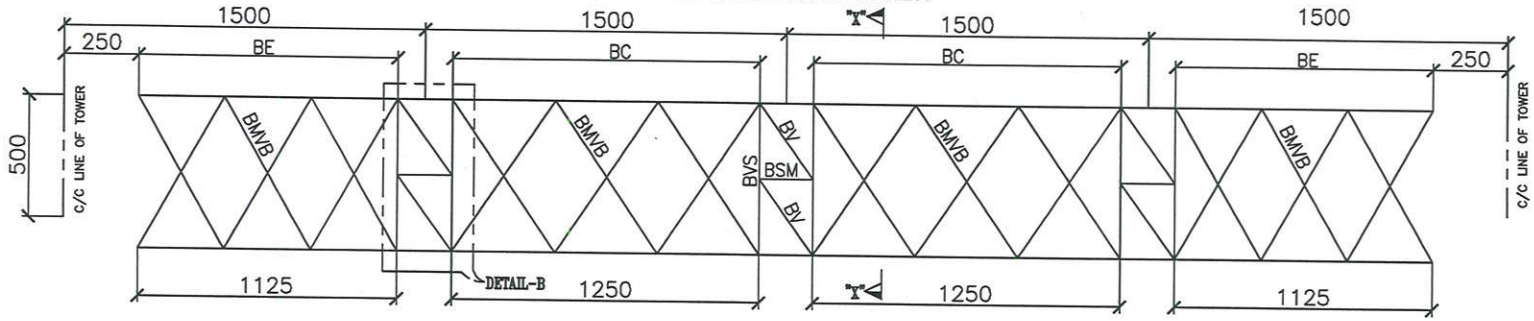
Kailash Devbuild (India) Pvt. Ltd. Jabalpur



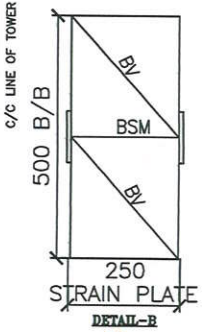
TOP & BOTTOM PLAN VIEW



DETAIL-A

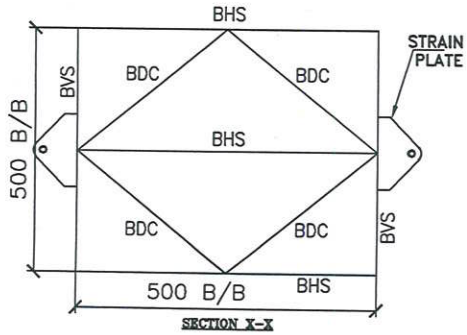


FRONT REAR ELEVATION VIEW



STRAIN PLATE

DETAIL-B



SECTION X-X

GIRDER MKD.	MEMBER NAME	BE	BC	BMHB	BMVB	BVS	BHS	BDC	BV	BH	BSM
3BG	ANGLE SIZE	90X90X8	90X90X8	45X45X4		50X50X5		45X45X4			
	NO. OF BOLTS	4 DS	4 DS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS

NOTES:-
1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL UNNOTED MEMBERS ARE I S A 45X45X5.
3. ALL ANGLE SECTIONS USED ARE EQUAL ANGLES.
4. ALL DIMENSION ARE CENTER LINE DIMENSIONS UNLESS NOTED OTHERWISE.
5. ALL CONNECTION BOLTS SHALL BE 16MM DIA BOLTS

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	SLD OF 33KV BEAM 3BG Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/79 — REV- 00
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — PAGE NO.- 03

	NAME	DATE	SIGN
PREPARED BY	DEEPAK	04.04.2022	
CHECKED BY	G.H	04.04.2022	
SUBMITTED BY	KDBIL	04.04.2022	Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Categories
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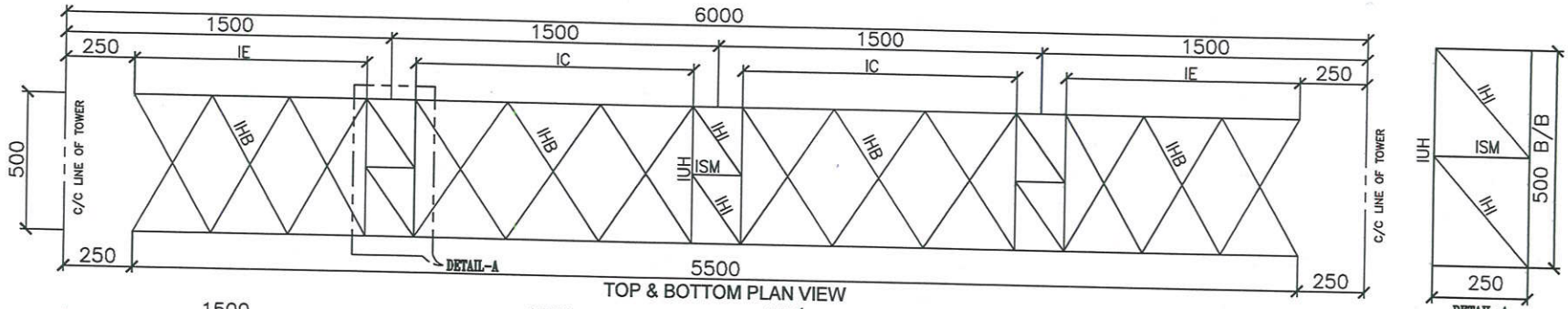
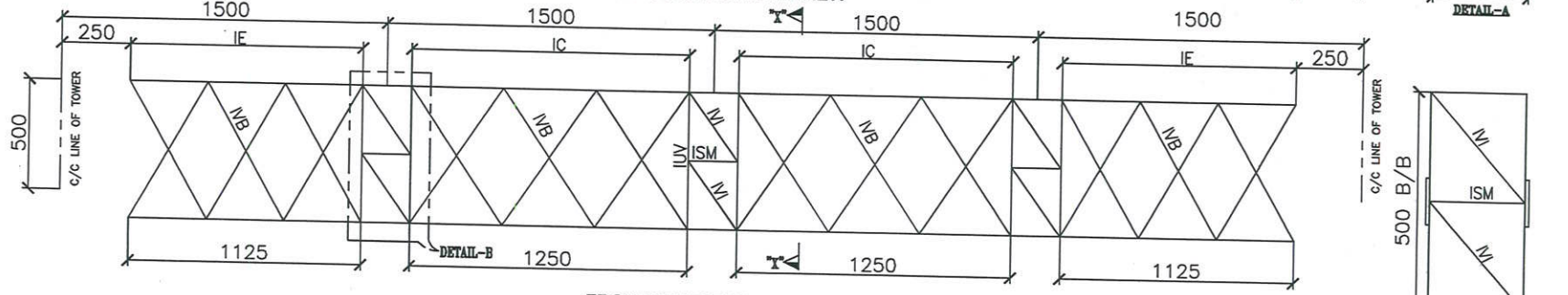
III. Insert comments and submit again for approval
IV. For information and record.
V. Not approved.

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

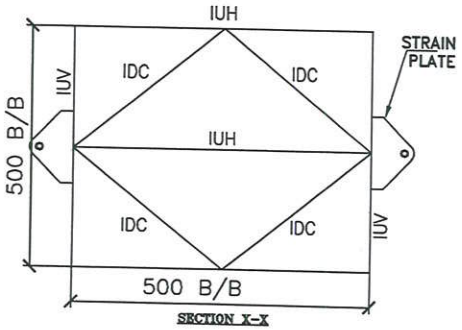
Kailash Devbuild (India) Pvt. Ltd. Jabalpur



TOP & BOTTOM PLAN VIEW



FRONT REAR ELEVATION VIEW



SECTION X-X

GIRDER MKD.	MEMBER NAME	IE	IC	IHB	IVB	IUV	IUH	IDC	IVI	IHI	ISM
3BI	ANGLE SIZE	90X90X8	90X90X8	45X45X4		50X50X5		45X45X4			
	NO. OF BOLTS	4 DS	4 DS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS	1 SS

NOTES:-
1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL UNNOTED MEMBERS ARE I S A 45X45X5.
3. ALL ANGLE SECTIONS USED ARE EQUAL ANGLES.
4. ALL DIMENSION ARE CENTER LINE DIMENSIONS UNLESS NOTED OTHERWISE.
5. ALL CONNECTION BOLTS SHALL BE 16MM DIA BOLTS

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	CD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 CD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	SLD OF 33KV BEAM 3BI Nagrota (New) S/S, Jammu
DRG. NO	KDBIL/250 PJ/20-21/DI/79 — REV- 00
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — PAGE NO- 04

	NAME	DATE	SIGN
PREPARED BY	DEEPAK	04.04.2022	
CHECKED BY	G.H	04.04.2022	
SUBMITTED BY	KDBIL	04.04.2022	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Categories
Approved/ Issued/ for Fabrication/Construction/Manufacturing
II. Approved/ Issued/ for Fabrication ...
Subject to condition that ...
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III. Insert comments and submit again for approval
IV. For information and record
V. Not approved.
अनुमोदित नहीं।

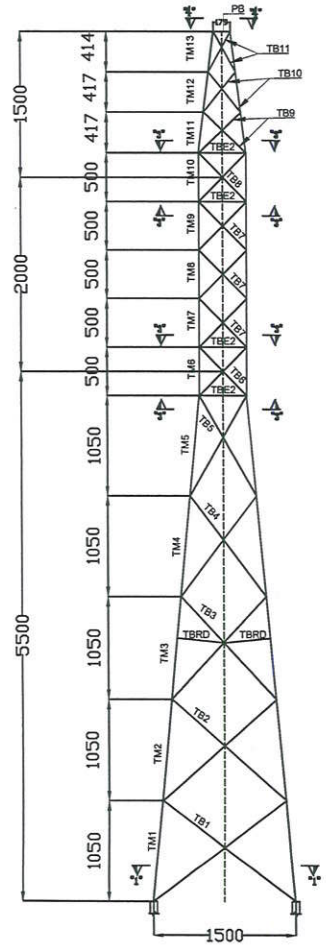
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

REC Power Development and Consultancy Ltd. Gurugram-122001

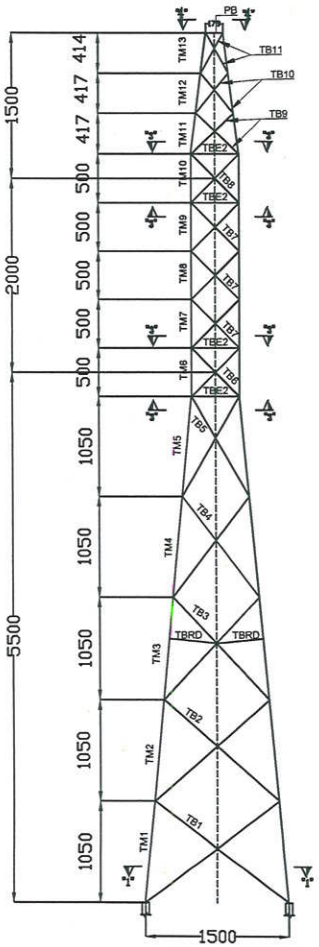
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

CN-18958 dt 7/9/22

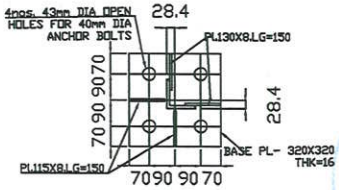
TOWER MKD.	MEMBER NAME	TM1	TM2	TM3	TM4	TM5	TM6	TM7	TM8	TM9	TM10	TM11	TM12	TM13	TB1	TB2	TB3	TB4	TB5	TB6	TB7	TB8	TB9	TB10	TB11	PB	TBE2	THB2	THRD
3TGP	ANGLE SIZE	100X100X12		100X100X12		90X90X10			75X75X6			60X60X5			50X50X5		50X50X5			50X50X5	45X45X5	50X50X5	45X45X4				60X60X5	45X45X4	45X45X4
	NO. OF BOLTS	8 DS	8 DS	8 DS	6 DS	6 DS	6 DS	6 DS	6 DS	6 DS	6 DS	2 DS	2 DS	2 DS	2 SS	2 SS	2 SS	2 SS	2 SS	2 SS	2 SS	2 SS	1 SS	1 SS	1 SS	1 SS	2 SS	1 SS	1 SS



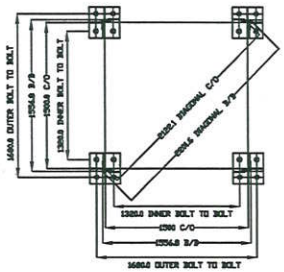
TRANSVERSE FACE OF TOWER WITH PEAK & EXT.



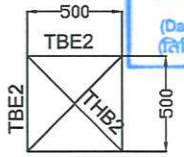
LONGITUDINAL FACE OF TOWER WITH PEAK & EXT.



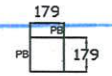
DETAIL OF BASE PLATE



SECTION 1-1



SECTION 3-3



SECTION 4-4

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL UNNOTED MEMBERS ARE IS A 45X45X4.
3. ALL ANGLE SECTIONS USED ARE EQUAL ANGLES.
4. ALL DIMENSION ARE CENTER LINE DIMENSIONS UNLESS NOTED OTHERWISE.
5. ALL CONNECTION BOLTS SHALL BE 16MM DIA BOLTS

Cv-18958
dt 7/9/22

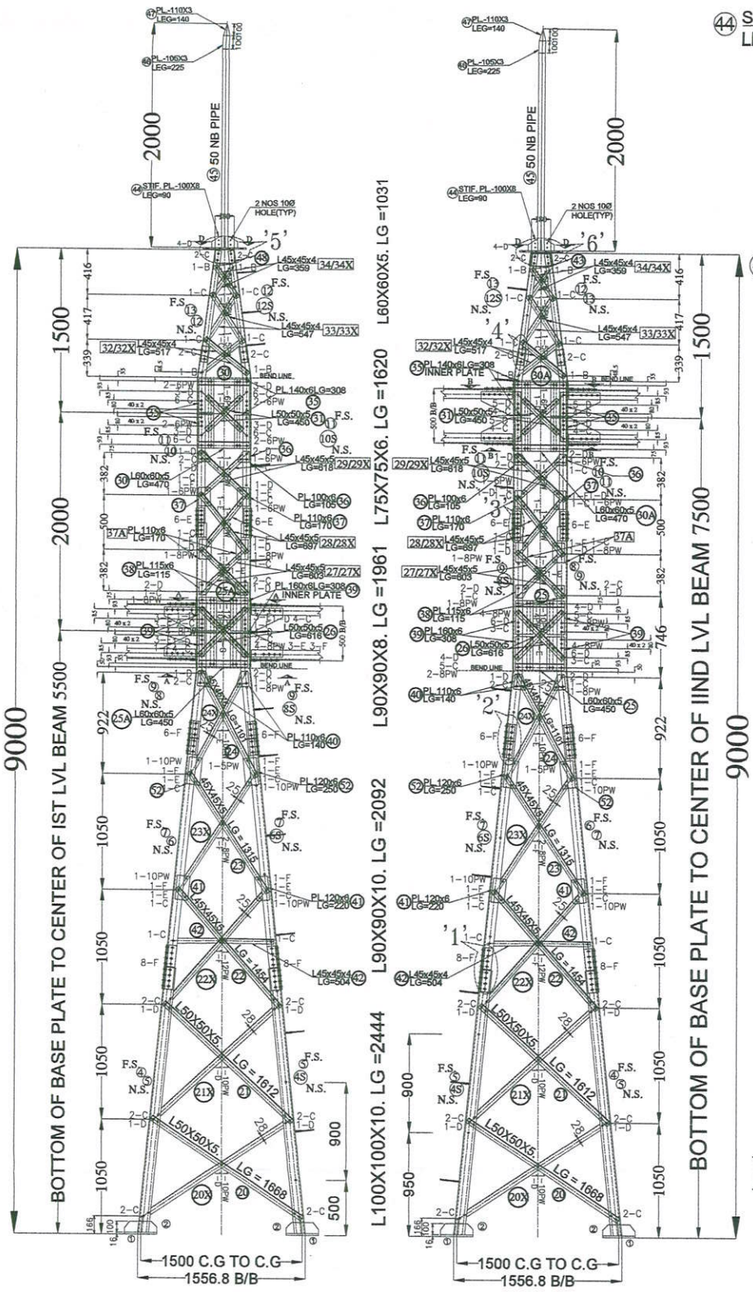
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	SLD OF 33KV TOWER 3TGP Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/79		REV- 00
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM		PAGE NO.- 01
	NAME	DATE	SIGN
PREPARED BY	DEEPAK	04.04.2022	
CHECKED BY	G.H	04.04.2022	
SUBMITTED BY	KDBIL	04.04.2022	

Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

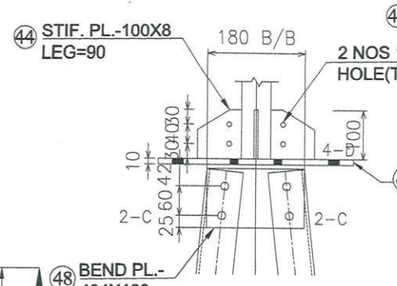
☐ More Information Date.....

Design & Engineering by:-AUPTC



LONGITUDINAL FACE

TRANSVERSE FACE



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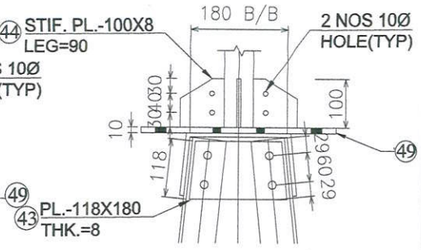

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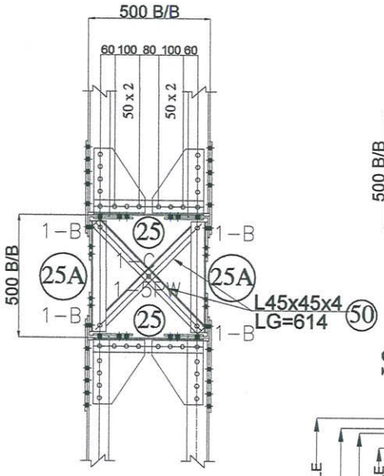

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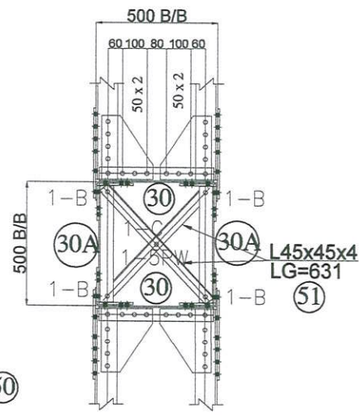

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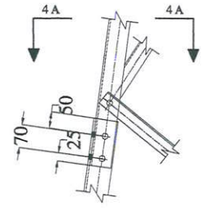

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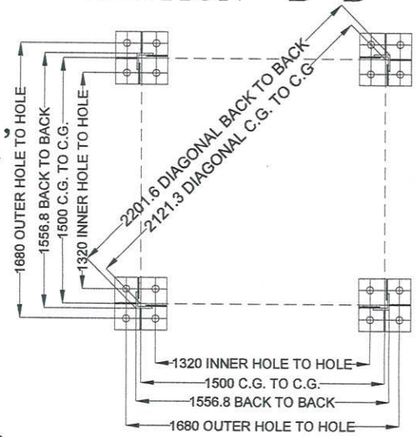
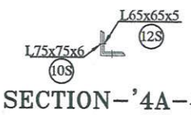


FOUNDATION PLAN



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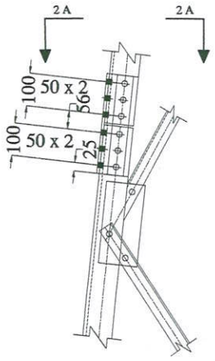

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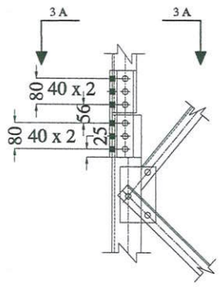

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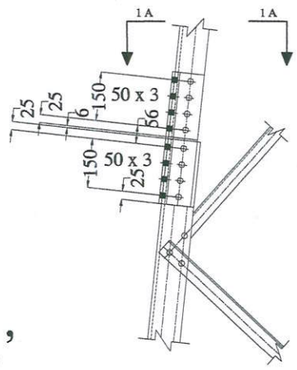

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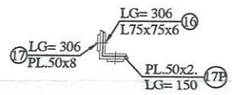

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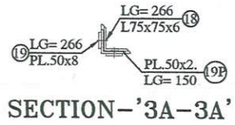

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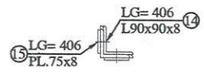

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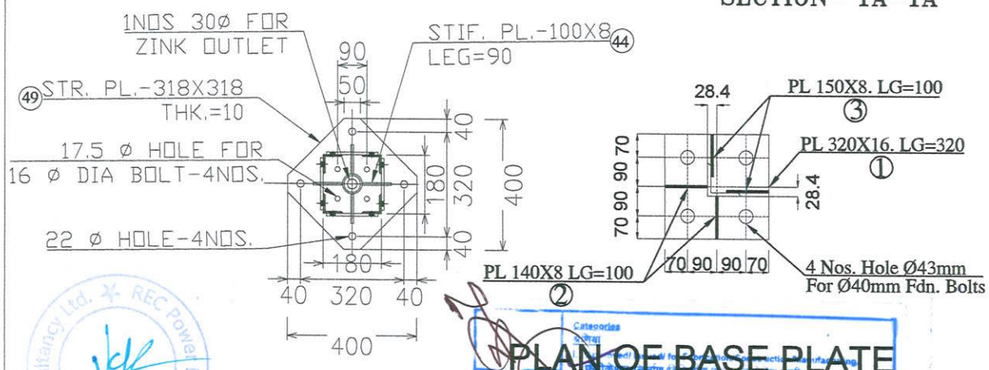


SECTION D–D

PLAN OF BASE PLATE

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639(PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'CB' THAT IS CB-1,CB-2,SO ON.
8. SECTIONS NOT INDICATED ARE L45X45X5 WITH 25MM BACKMARK.

BOLTS/NUT STATEMENT

	SPRING. WASHER	860	
12	30 ØDX12 THK PACK. WASHER	14	
10	30 ØDX10 THK PACK. WASHER	34	
8	30 ØDX8 THK PACK. WASHER	64	
6	30 ØDX6 THK PACK. WASHER	32	
5	30 ØDX5 THK PACK. WASHER	24	
3	30 ØDX4 THK PACK. WASHER	6	
	STEP BOLT Ø16X175	19	DIAGONALLY

TYPE	SIZE	QTY	REMARK
B	DIA 16X35 Lg.	48	
C	DIA 16X40 Lg.	328	
D	DIA 16X45 Lg.	208	
E	DIA 16X50 Lg.	122	
F	DIA 16X55 Lg.	152	
G	DIA 16X60 Lg.	2	

REV.	REV. DATE	MODIFICATION
01	01.11.2022	REVISED AS PER CLIENT COMMENT
00	08.06.2022	FIRST SUBMISSION

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(1) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	ERECTION DRAWING OF 33KV TOWER 3TCP Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/80
SCALE	As shown in Drawing — REV-01
AREA	91.6 KANAL 46336.5 SQM — SHEET SIZE - A2

	NAME	DATE	SIGN	
PREPARED BY	RASHID	01.11.2022	MR	KDBIL
CHECKED BY	G.H	01.11.2022		
SUBMITTED BY	Er. ANURAG	01.11.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

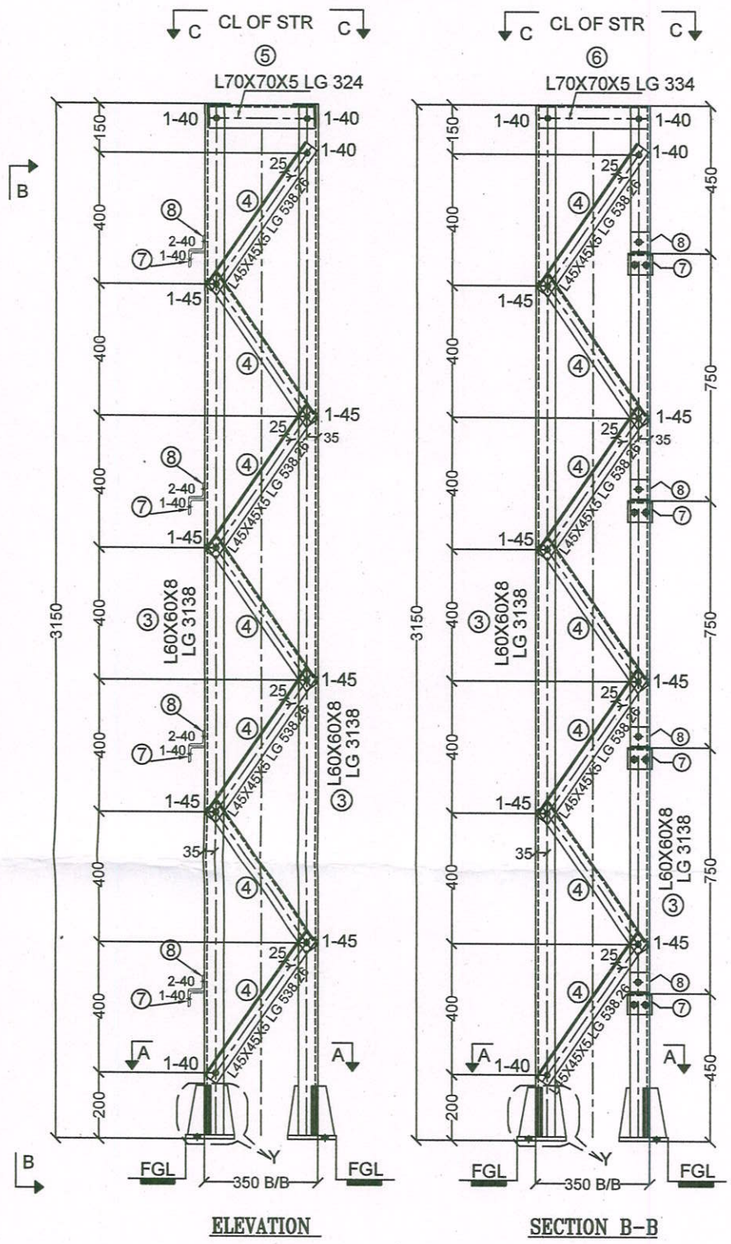
KAILASH DEVBUILD (INDIA) PVT. LTD. ★ JABALPUR

REC Power Development And Consultancy Ltd.

CN-22128
17/11/22

Categories
II. Approved/ Issued for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
III. Insert comments and submit again for approval.
IV For Information and record.
V. Not approved.
Manager
(Designation)
(Date)

MR



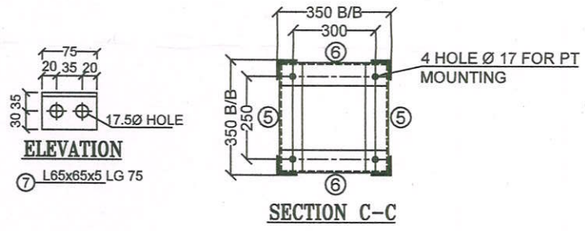
NOTES

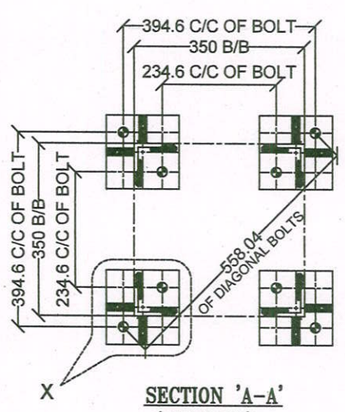
1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802
3. BOLTS, NUTS SHALL BE AS PER IS:12427 (PROPERTY CLASS 5.6).
4. GALVANIZING TO BE AS PER TECHNICAL SPECIFICATION.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER LS:816
7. ALL STRUCTURAL MEMEBERS SHALL BE HOT DIP GALVANIZED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
8. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
9. EQUIPMENT MOUNTING DETAILS, & STRUCTURE HEIGTH ARE INDICATIVE ONLY, WHICH MAY CHANGE AS PER EQUIPMENT DRAWING.
10. ALL WELD SHALL BE 6MM THICK FILLET WELD.

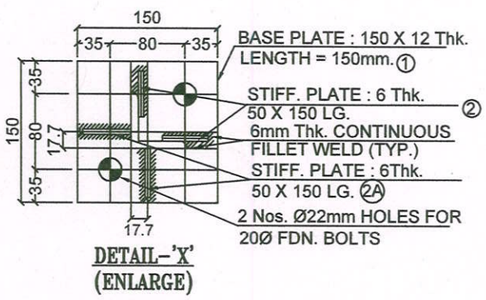
BILL OF MATERIAL

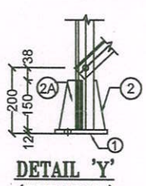
SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 150X12	150	150	94.20	2.120	4	8.478
2	2	PL 50X6	150	50	47.10	0.353	8	2.826
3	2A	PL 50X6	150	50	47.10	0.353	8	2.826
4	3	L60x60x8	3138		7.00	21.97	4	87.864
5	4	L45X45X5	583.4		3.40	1.984	28	55.540
6	5	L70X70X5	324		5.30	1.717	2	3.434
7	6	L70X70X5	334		5.30	1.770	2	3.540
8	7	L65X65X5	75		4.90	0.368	8	2.940
9	8	L65X65X5	65		4.90	0.319	8	2.548
				WT. OF STRUCTURE (kg.) =				170.00

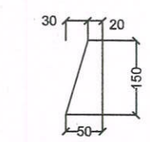
TOTAL LIST OF BOLTS & NUTS						
10		M16x40 mm Bolts & Nuts		0.126	40	5.04
11		M16x45 mm Bolts & Nuts		0.134	24	3.22
12		M-16-3.5 THK SPRING WASHER		0.009	64	0.58
13		M16X100 LG. FOR EQPT. MOUNTING (FULL THREADED)		0.218	4	0.872
				TOTAL WEIGHT OF HARDWARE (kg)=		9.70
		TOTAL WEIGHT OF STRUCTURE WITH HARDWARE (kg) =				179.70











PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	33KV PT STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/85 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 1

	NAME	DATE	SIGN
PREPARED BY	RAVI	21.04.2022	
CHECKED BY	G.H	21.04.2022	
SUBMITTED BY	ANURAG	21.04.2022	

Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

Categories
श्रेणियां

(Signature) (हस्ताक्षर)

(Designation) (पदनाम)

(Date) (तिथि)

I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
पेफ्रीकेशन/निर्माण/विनिर्माण/हेतु अनुमोदित/जारी।

II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
पेफ्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी/ बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।

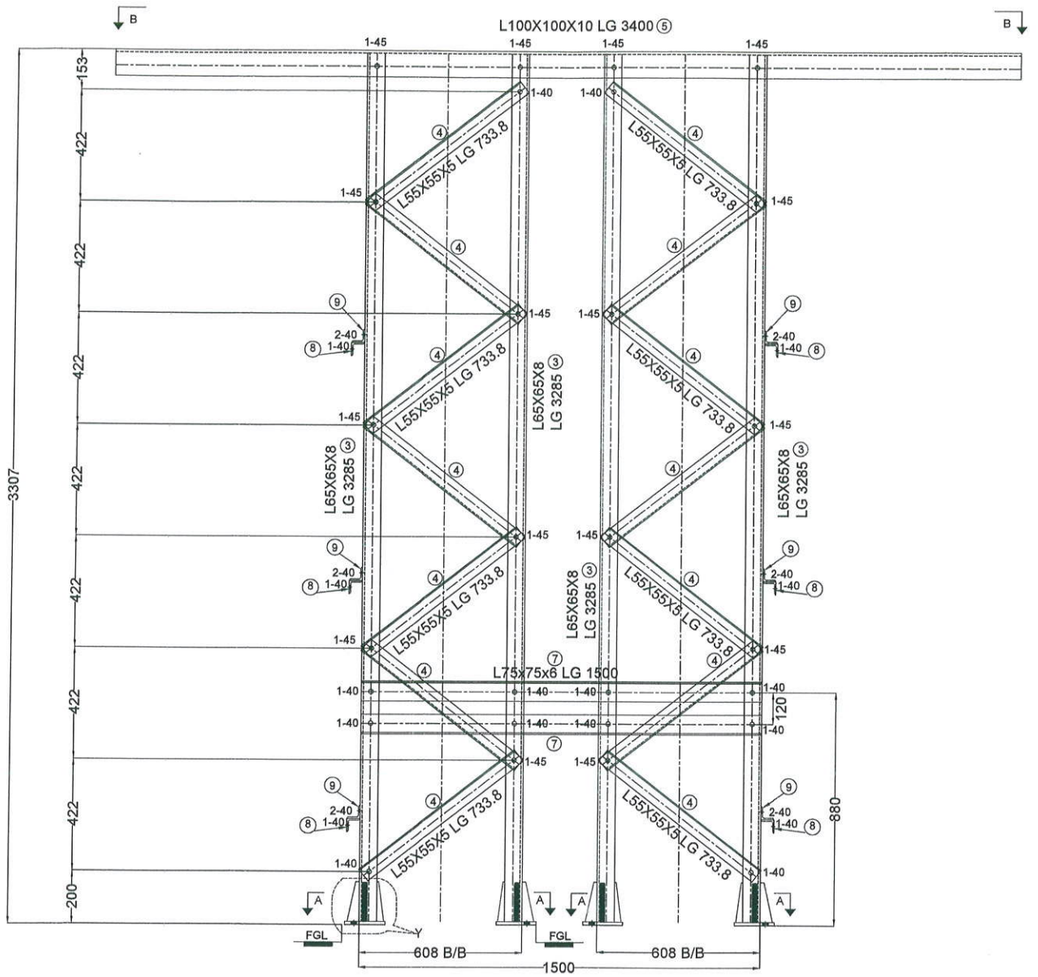
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।

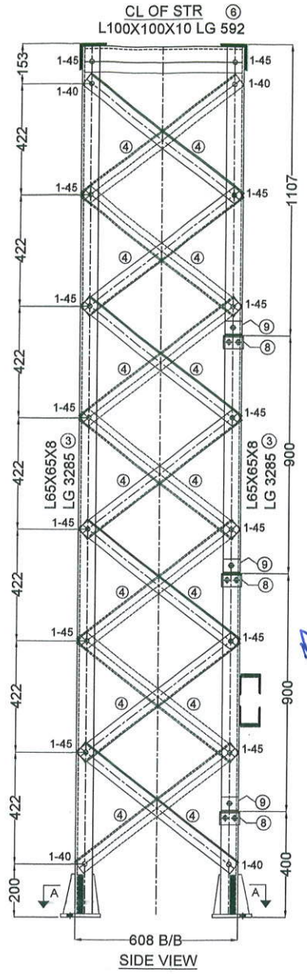
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।

V. Not approved.
अनुमोदित नहीं।

RC Power Development And Consultancy Ltd. Gurugram-122001

Cw-15977
dt 5/5/22



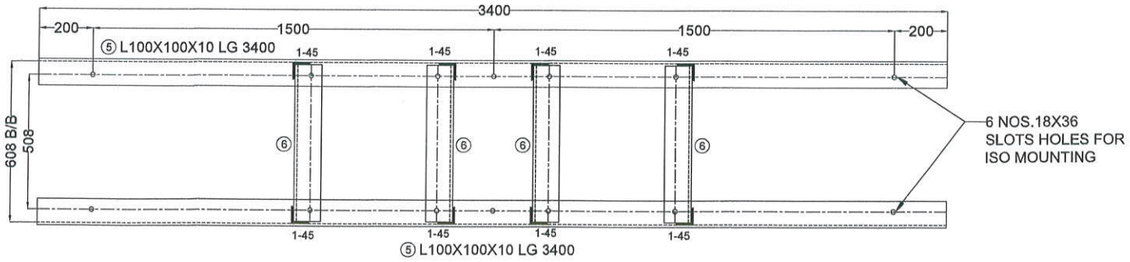


BILL OF MATERIAL

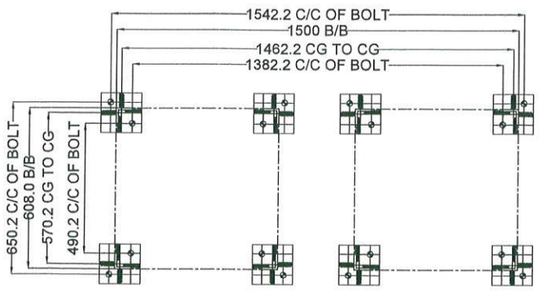
SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 150X12	150	150	94.20	2.120	8	16.956
2	2	PL 50X6	150	50	47.10	0.353	16	5.652
3	2A	PL 50X6	150	50	47.10	0.353	16	5.652
4	3	L65x65x8	3285		7.70	25.29	8	202.356
5	4	L55X55X5	733.8		4.10	3.009	56	168.480
6	5	L100X100X10	3400		14.90	50.660	2	101.320
7	6	L100X100X10	592		14.90	8.821	2	17.642
8	7	L75X75X6	1500		6.80	10.200	4	40.800
9	8	L75X75X5	75		5.70	0.428	12	5.130
10	9	L75X75X5	75		5.70	0.428	12	5.130
				WT. OF STRUCTURE (kg.) =				**569.12**
		TOTAL LIST OF BOLTS & NUTS						
11		M16x40 mm Bolts & Nuts			0.126	60	7.56	
12		M16x45 mm Bolts & Nuts			0.134	68	9.11	
13		M-16-3.5 THK SPRING WASHER			0.009	128	1.15	
15		M16X100 LG. FOR EQPT. MOUNTING (FULL THREADED)			0.218	6	1.308	
					TOTAL WEIGHT OF HARDWARE (kg)=			**19.13**
					TOTAL WEIGHT OF STRUCTURE WITH HARDWARE (kg) =			**588.25**

Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)
I. Approved/ Issued for Fabrication/Construction/manufacturing
II. Approved/ Issued for Fabrication/Construction/manufacturing
III. Insert comments and submit again for approval.
IV. For Information and record.
V. Not approved.

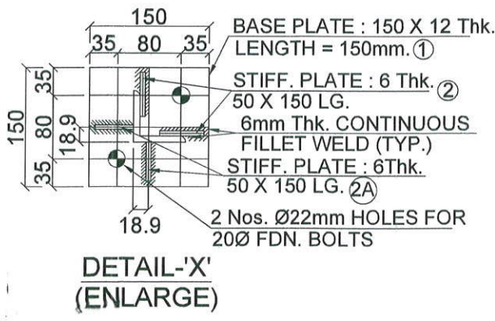
CW-17302 dt 15/06/2022



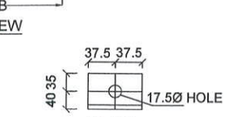
SECTION B-B



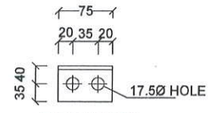
SECTION 'A-A'



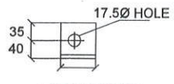
DETAIL-'X' (ENLARGE)



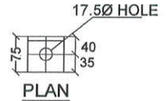
PLAN
⑧ L75x75x5 LG75



ELEVATION
⑧ L75x75x5 LG 75



ELEVATION
⑨ L75x75x5 LG 75



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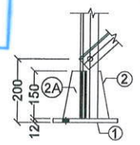
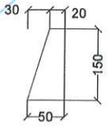


DETAIL 'Y'



② PL 6Thk.x50x150Lg.

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802
3. BOLTS, NUTS SHALL BE AS PER IS:12427 (PROPERTY CLASS 5.6).
4. GALVANIZING TO BE AS PER TECHNICAL SPECIFICATION.
5. ALL HOLES 17.5 MM DIA FOR 16 MM DIA. BOLT IF NOT STATED OTHERWISE.
6. WELDING SHALL BE DONE AS PER I.S:816
7. ALL STRUCTURAL MEMEBERS SHALL BE HOT DIP GALVANIZED SPRING WASHERS SHALL BE ELECTRO GALVANISED.
8. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
9. EQUIPMENT MOUNTING DETAILS, & STRUCTURE HEIGTH ARE INDICATIVE ONLY, WHICH MAY CHANGE AS PER EQUIPMENT DRAWING.
10. ALL WELD SHALL BE 6MM THICK FILLET WELD.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	33KV ISO STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/88 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 1

	NAME	DATE	SIGN
PREPARED BY	RAVI	30.04.2022	
CHECKED BY	G.H	30.04.2022	
SUBMITTED BY	ANURAG	30.04.2022	

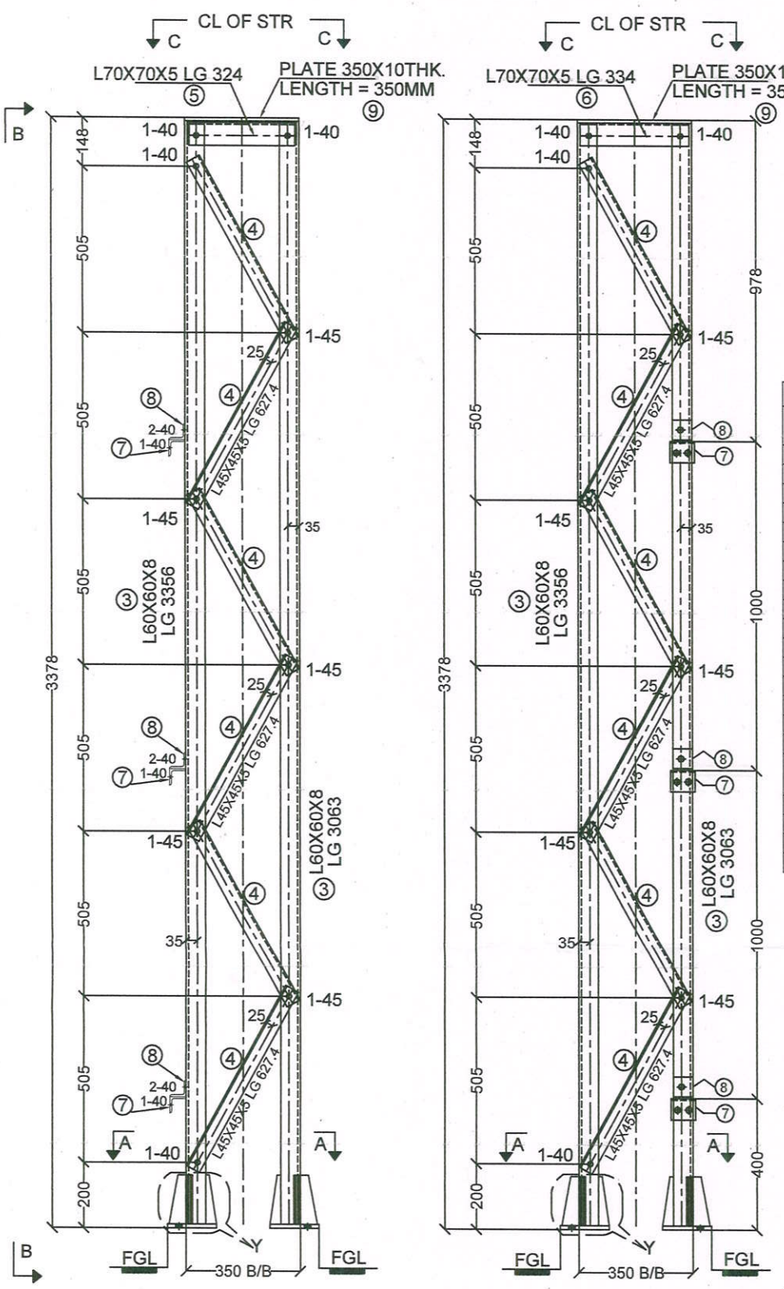
Signature & Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

REC Power Development & Consultancy Ltd. * Gurugram-122001 *

Kailash Devbuild (India) Pvt. Ltd. Jabalpur



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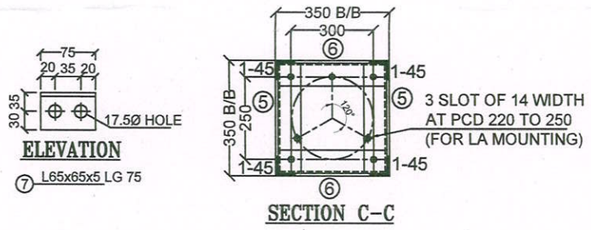
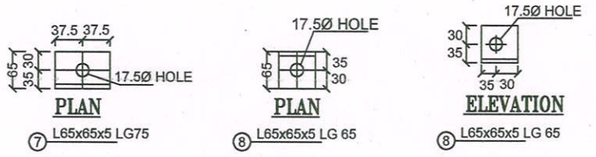
BILL OF MATERIAL

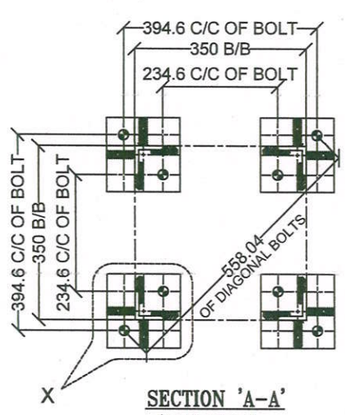
SL. NO.	MARK NO.	SECTION (MM)	LENGTH (MM)	WIDTH (MM)	UNIT WT. IN(Kg/M)	WT./Pc (Kg)	QTY. (NOS.)	TOTAL WT.(Kg)
1	1	PL 150X12	150	150	94.20	2.120	4	8.478
2	2	PL 50X6	150	50	47.10	0.353	8	2.826
3	2A	PL 50X6	150	50	47.10	0.353	8	2.826
4	3	L60x60x8	3356		7.00	23.49	4	93.968
5	4	L45X45X5	627.4		3.40	2.133	24	51.196
6	5	L70X70X5	324		5.30	1.717	2	3.434
7	6	L70X70X5	334		5.30	1.770	2	3.540
8	7	L65X65X5	75		4.90	0.368	6	2.205
9	8	L65X65X5	65		4.90	0.319	6	1.911
10	9	PL 350X10	350	350	78.50	9.616	1	9.616
				WT. OF STRUCTURE (kg.) =				180.00

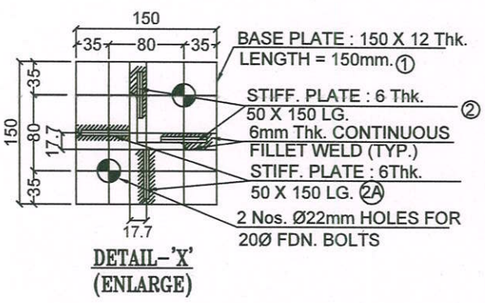
TOTAL LIST OF BOLTS & NUTS

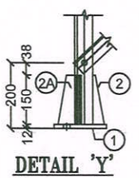
10		M16x40 mm Bolts & Nuts		0.126	34	4.28
11		M16x45 mm Bolts & Nuts		0.134	24	3.22
12		M-16-3.5 THK SPRING WASHER		0.009	58	0.52
13		M16X100 LG. FOR EQPT. MOUNTING (FULL THREADED)		0.218	3	0.654
		TOTAL WEIGHT OF HARDWARE (kg)=				8.68
		TOTAL WEIGHT OF STRUCTURE WITH HARDWARE (kg) =				188.68

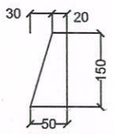












PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
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OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	33KV LA STR. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/94 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 1

	NAME	DATE	SIGN
PREPARED BY	RAVI	20.05.2022	
CHECKED BY	G.H	20.05.2022	
SUBMITTED BY	ANURAG	20.05.2022	

Approved ☐ Approved with comments ☐ Not Approved ☐ More Information Date.....

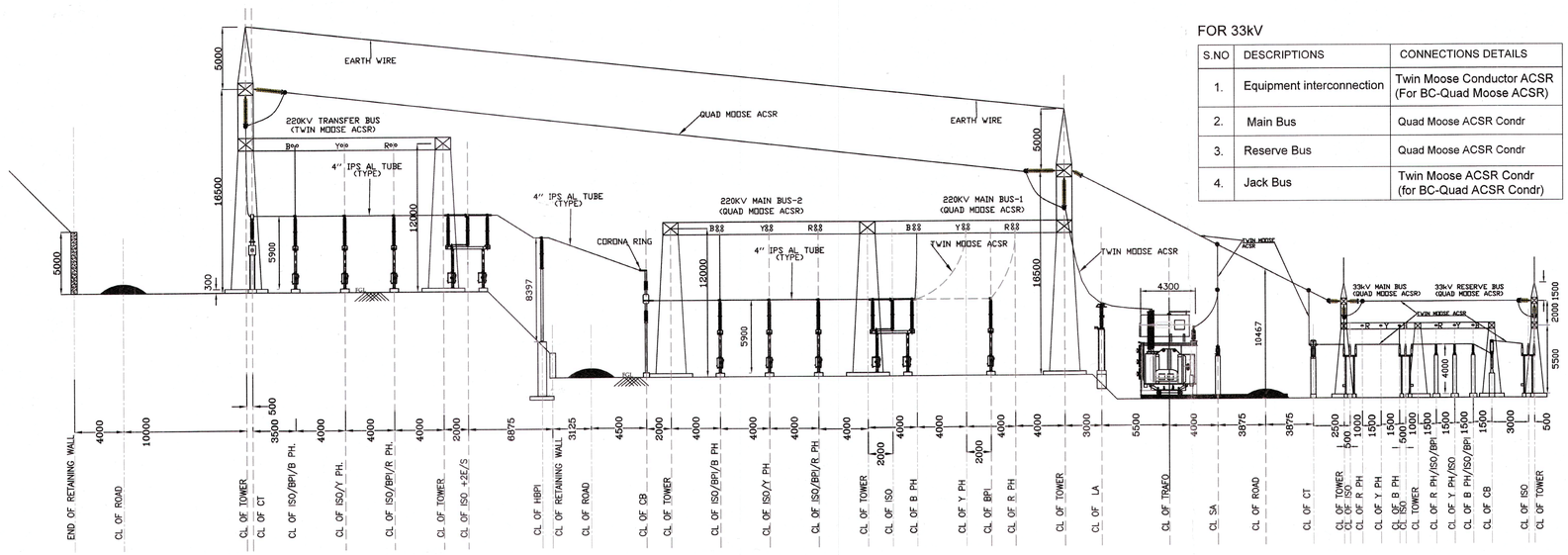
Kailash Devbuild (India) Pvt. Ltd. Jabalpur Signature/Stamp...

REC Power Development And Consultancy Ltd. Gurugram-122001

Categories
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing. फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included. Please submit the revised documents for approval. फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Re-submit comments and submit again for approval. टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record. सूचना एवं रिकॉर्ड हेतु।
V. Not approved. अनुमोदित नहीं।
(Signature) (हस्ताक्षर) 02.06.22
(Designation) (पदनाम)
(Date) (तिथि)

CR-16877
02/06/22

SECTION VIEW OF 2X50 MVA, 220/33 kV NAGROTA NEW AIS GRID SUB-STATION



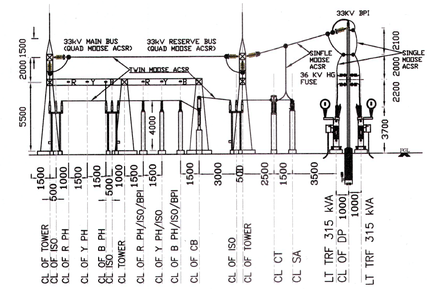
SECTION VIEW OF 50 MVA,220/33 kV TRANSFORMER BAY

FOR 33kV

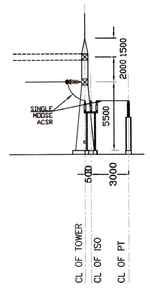
S.NO	DESCRIPTIONS	CONNECTIONS DETAILS
1.	Equipment interconnection	Twin Moose Conductor ACSR (For BC-Quad Moose ACSR)
2.	Main Bus	Quad Moose ACSR Condr
3.	Reserve Bus	Quad Moose ACSR Condr
4.	Jack Bus	Twin Moose ACSR Condr (for BC-Quad ACSR Condr)

FOR 220kV

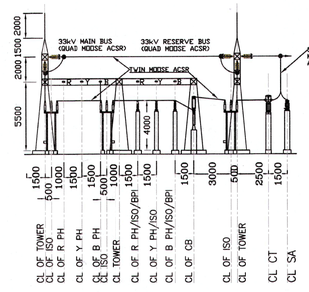
S.NO	DESCRIPTIONS	CONNECTIONS DETAILS
1.	Equipment interconnection	4Inch IPS-EH Al
2.	Main Bus	Quad Moose ACSR Condr
3.	Transfer Bus	Twin Moose ACSR Condr
4.	Jack Bus	Quad Moose ACSR Condr for BC & ICT
5.	Earthwire with peak	7.366mm GS wire(10.98mm dia)



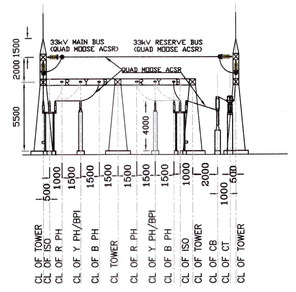
SECTION VIEW OF AUX TRF BAY



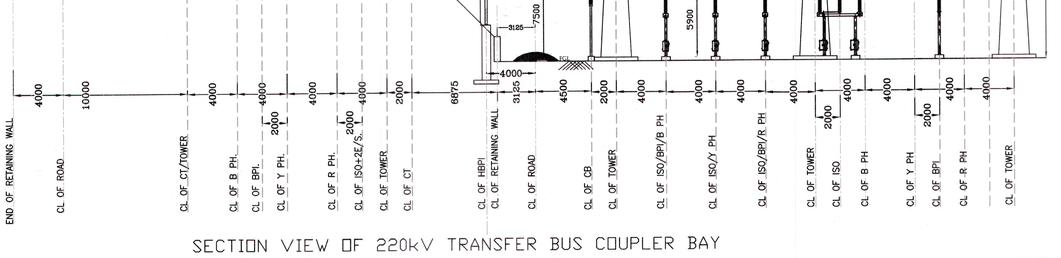
SECTION VIEW OF 33kV BUS PT



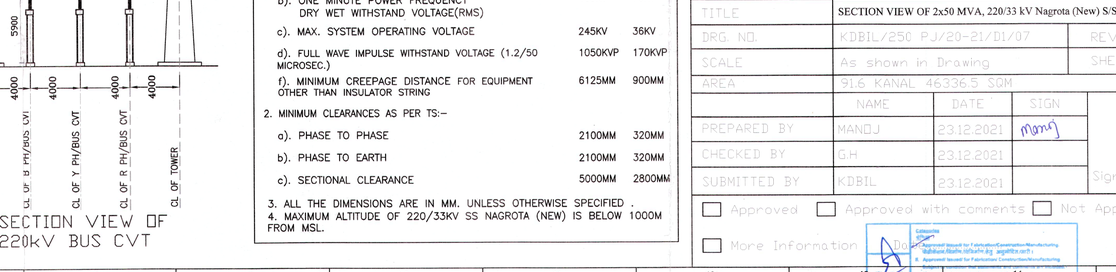
SECTION VIEW OF 33kV LINE BAY



SECTION VIEW OF 33kV BUS COUPLER BAY

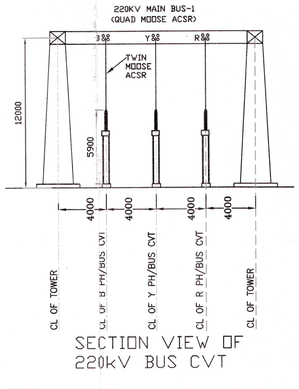


SECTION VIEW OF 220kV BUS COUPLER BAY



SECTION VIEW OF 220kV LINE BAY

SECTION VIEW OF 220kV TRANSFER BUS COUPLER BAY



SECTION VIEW OF 220kV BUS CVT

LEGENDS

PRESENT SCOPE

FUTURE SCOPE

NOTE:-

1. SYSTEM PARAMETER	220KV	33KV
a). SYSTEM OPERATING VOLTAGE	220KV	33KV
b). ONE MINUTE POWER FREQUENCY DRY WET WITHSTAND VOLTAGE(RMS)	460KV	70KV
c). MAX. SYSTEM OPERATING VOLTAGE	245KV	36KV
d). FULL WAVE IMPULSE WITHSTAND VOLTAGE (1.2/50 MICROSEC.)	1050KVP	170KVP
f). MINIMUM CREEPAGE DISTANCE FOR EQUIPMENT OTHER THAN INSULATOR STRING	6125MM	900MM
2. MINIMUM CLEARANCES AS PER TS:-		
a). PHASE TO PHASE	2100MM	320MM
b). PHASE TO EARTH	2100MM	320MM
c). SECTIONAL CLEARANCE	5000MM	2800MM

3. ALL THE DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED .
4. MAXIMUM ALTITUDE OF 220/33KV SS NAGROTA (NEW) IS BELOW 1000M FROM MSL.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
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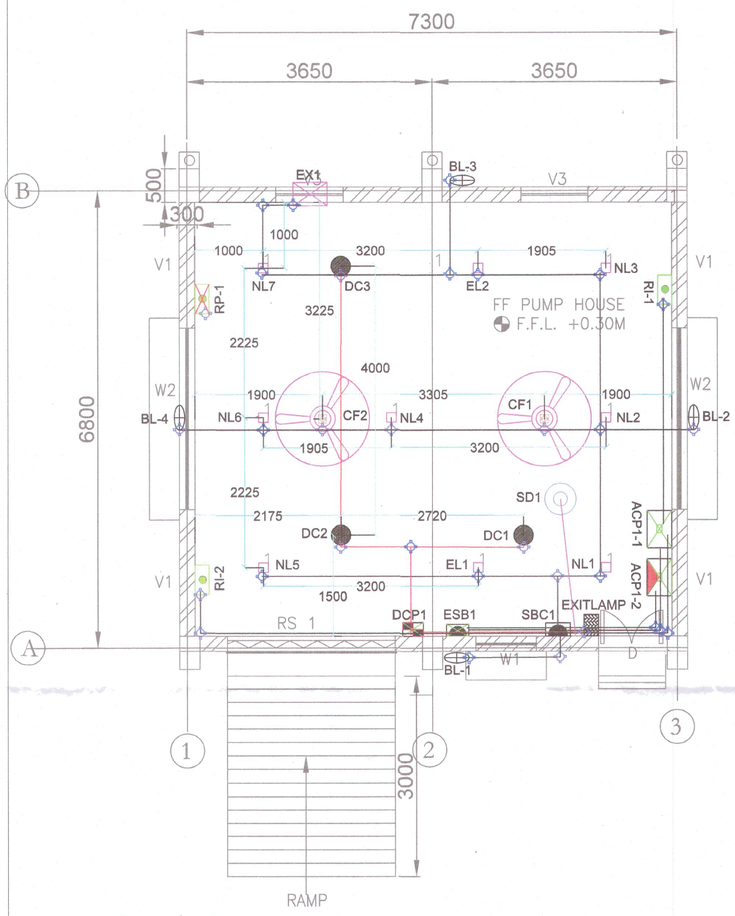
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	AUPTC Advanced Ultra Power Transmission Consultancy
TITLE	SECTION VIEW OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/07 — REV- 02
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	MANOJ	23.12.2021	
CHECKED BY	G.H	23.12.2021	
SUBMITTED BY	KDBIL	23.12.2021	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING SHALL BE REFERRED FOR ILLUMINATION LAYOUT CUM CONDUIT LAYOUT.
3. THE LIGHTING FIXTURE SHALL BE SURFACE/WALL MOUNTED AS SUITABLE.
4. SEPARATE NEUTRAL WIRE SHALL RUN FOR EACH CIRCUIT.
5. MCB BOX SHALL BE WALL/FLUSH MOUNTED TYPE.
6. BENDING RADIUS OF THE CONDUIT SHALL BE FOUR TIMES OF CONDUIT DIAMETERS.
7. EXACT LOCATION OF FITTING SHALL BE DECIDED AT THE SITE BASED ON CLEARANCE AVAILABLE WITH MAINTAINING THE SYMMETRY.
8. LOCATION OF SWITCH BOARDS & MCB BOX CAN BE ADJUSTED AS PER SITE SUITABILITY.
9. AC SUPPLY FOR LIGHTING FIXTURE & SOCKETS TO BE TAPPED FROM AC MCB BOX/SWITCH BOARD.
10. AC AND DC WIRING SHOULD NOT RUN THROUGH THE SAME CONDUIT.
11. ACP-1-1 IS FOR AC LIGHTNING.
    ACP-1-2 IS FOR EMERGENCY LIGHTNING.
    DCP-1 IS FOR DC LIGHTNING.
12. THE WIRES SHALL BE COLOUR CODED AS FOLLOWS:
    RED FOR R - PHASE
    YELLOW FOR Y - PHASE
    BLUE FOR B - PHASE
    BLACK FOR NEUTRAL
    WHITE FOR DC POSITIVE
    GREY FOR DC NEGATIVE
13. 1.5 SQ. MM CU. GREEN WIRE SHALL BE USED FOR EARTHING.
14. CEILING FAN (CF) = 80W
15. LOCATION OF DETECTORS AND CONDUIT SHOWN IS TENTATIVE HOWEVER EXACT LOCATION SHALL BE FINALISHED AT SITE TO AVOID INTERFERENCE WITH OTHER EQUIPMENT AND FITTING ETC.
16. LOCATION OF SENSORS MAY CHANGE TO SUITE SITECONDITION. SAY LOCATION OF SENSORS FOULING WITH EXISTING FAN /LIGHTING FIXTURE ETC, IN THAT CASE SENSORS SHOULD BE RE-LOCATEDCOMPLYING THE RULES OF IS: 2189/NFPA-72.

BILL OF MATERIAL

SL.NO	SYMBOL	DESCRIPTION	TECH. SPEC. LEG.	QTY/ SPR	MAKE
1.		ACP1-1 NORMAL LIGHTING PANEL	ACP-1	01 NOS.	
2.		ACP1-2 EMERGENCY LIGHTING PANEL	ACP-1	01 NOS.	
3.		DCP-1 DC LIGHTING PANEL	DCP-1	01 NOS.	
4.		SWITCH BOX WITH 6A SWITCHES (7NOS.) & 6A 3-PIN SOCKET (1NO.)	SBC	01 NOS.	
5.		EMERGENCY SWITCH BOX WITH 6A SWITCHES	ESB	01 NOS.	
6.		1400 MM SWEEP CEILING FANS COMPLETE WITH ELECTRONIC REGULATOR, SUSPENSION ROD, CANOPY AND ACCESSORIES.	CF	02 NOS.	EQUIVALENT TO REC APPROVED
7.		FAN BOX (FOR 25 MM DIA CONDUIT)		02 NOS.	
8.		5/15A, 240V INDOOR RECEPTACLE 3-PIN TYPE WITH SWITCH	RI	2 NOS.	
9.		63A, 400V INTERLOCKED RECEPTACLE WITH SWITCH	RP	1 NOS.	
10.		DC LED LAMP (10W)	DCP	03 NOS.	BAJAJ/EQUIVALENT TO REC APPROVED
11.		BULK HEAD (9W)	BL	04 NOS.	BAJAJ/EQUIVALENT TO REC APPROVED
12.		EXHAUST FAN (60W)	EX	01 NOS.	EQUIVALENT TO REC APPROVED
13.		EXIT LAMP (3W)		01 NOS.	EQUIVALENT TO REC APPROVED
14.		4 WAY JUNCTION BOX (FOR 25mm DIA CONDUIT)		30 NOS.	
15.		SMOKE DETECTOR	SD	01 NOS.	
16.		(AC)CONDUIT 25 MM DIA HEAVY DUTY PVC		80 MTR	
17.		(DC)CONDUIT 25 MM DIA HEAVY DUTY PVC		20 MTR	
18.		CONDUIT FOR SMOKE DETECTOR 25 MM DIA HEAVY DUTY PVC		5 MTR	

MOUNTING HEIGHT OF EQUIPMENT

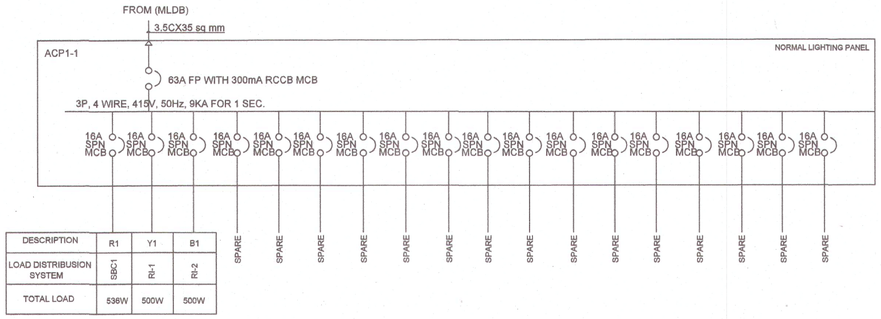
SL.NO	EQUIPMENT	MOUNTING HEIGHT
1.	LIGHTING PANEL	1800 MM
2.	SWITCH BOARD	1300 MM
3.	RECEPTACLE 5/15A 240V RI TYPE	450 MM

LIGHTING WIRING SCHEDULE

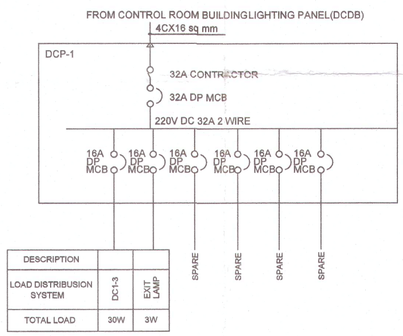
SL.NO	FROM	TO	SIZE OF WIRE
1.	LIGHTING PANEL AC NORMAL& EMERGENCY	SWITCH BOARD	4 Sq mm pvc cu.
2.	POWER DISTRIBUTION PANEL	RECEPTACLES	4 Sq mm pvc cu.
3.	SWITCH BOARD	LIGHT FIXTURES & FANS	2.5 Sq mm pvc cu.
4.	DC LIGHTING PANEL	LIGHT FIXTURES	2.5 Sq mm pvc cu.
5	FOR EARTHING		1.5 Sq mm cu green wire

Luminaire list (Building 1, FFPH)							
Index	Manufacturer	Article name	Item number	Fitting	Luminous flux	Maintenance factor	Connected load	Quantity
1	BAJAJ	C190347 BICDP 40W LED	C190347 BICDP 40W LED	1x	3608 lm	0.80	40 W	9

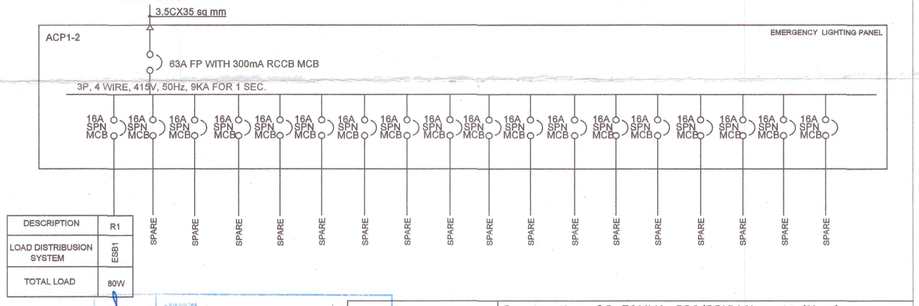
#	Name	Parameter	Min	Max	Average	Min/average	Min/max
1	Workplane (PUMP HOUSE)	Perpendicular illuminance (Adaptive)	132 lx	269 lx	221 lx	0.60	0.49



DESCRIPTION	R1	Y1	B1
LOAD DISTRIBUSION SYSTEM	SBC1	RI-1	RI-2
TOTAL LOAD	536W	500W	500W



DESCRIPTION		
LOAD DISTRIBUSION SYSTEM	DC1-3	EXIT LAMP
TOTAL LOAD	30W	3W



DESCRIPTION	R1
LOAD DISTRIBUSION SYSTEM	ESB1
TOTAL LOAD	80W

	FROM	TO
ACP1-1	SBC1	NL1-7, CF1-2 EX1, BL1-4
ACP1-2	ESB1	EL1-2

WIRING QUANTITY

S.No.	SIZE OF WIRE GF	QUANTITY IN METER
01.	4 Sq mm pvc cu.	30 M
02.	2.5 Sq mm pvc cu.	170 M
03.	1.5 Sq mm cu. green wire	AS PER REQUIREMENT

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FFPH illumination cum conduit layout
DRG. NO.	KDBIL/250 PJ/20-21/D1/40 — REV-01
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	SH.NO.: 1 OF 1

	NAME	DATE	SIGN
PREPARED BY	PAYAL	12.11.2021	
CHECKED BY	MANOJ	12.11.2021	
SUBMITTED BY	KDBIL	12.11.2021	

Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Approved for Fabrication/Construction/Manufacturing (अनुमोदित डिजाइन/ड्राइंग हेतु अनुमोदित की जाती है)
Approved for Fabrication/Construction/Manufacturing subject to condition that statements and comments mentioned (टिप्पणियों के अधीन हेतु अनुमोदित की जाती है)
Please submit the revised documents for approval (संशोधित दस्तावेज/ड्रॉइंग हेतु अनुमोदित करने के लिए टिप्पणियों को ध्यानित कर पुनः अनुमोदनार्थ प्रस्तुत करें)
Insert comments and submit again for approval (टिप्पणियों को अंकित कर पुनः अनुमोदनार्थ प्रस्तुत करें)
For Information and record (सूचना एवं रिकॉर्ड हेतु)
Not approved (अनुमोदित नहीं)

(Signature) (हस्ताक्षर)
DEE (Designation) (पदनाम)
18/11/21 (Date) (दिनांक)

REC PDCL GURUGRAM

KAILASH DEVBUILD (INDIA) PVT. LTD.

SUPPLY FROM ACDB SECTION-1 (FROM SOURCE-1)
SUPPLY FROM ACDB SECTION-2 (FROM SOURCE-2)
3.5C*70 Sq. mm Al PVC CABLE
220V CHARGER-1 FLOAT/BOOST
2# 1C*150 Sq. mm Al PVC CABLE
DC MODULE
250A MCCB
250A,DP AB SWITCH
(90-0-400A)
SHUNT
250A MCCB
250A MCCB
2# 1C*150 Sq. mm Al PVC CABLE
220V BATTERY BANK -1 500AH
BATTERY CURATIVE DISCHARGE FEEDER
(0-300V)
VSS
27 59 96
220V DC DISTRIBUTION BOARD-1
220V,400A,4kA (DC) FOR 1 SEC
250A
2# 1C*150 Sq. mm Al PVC CABLE
DC SUPPLY FOR FT PH LOCOB
DC SUPPLY FOR ACDB
DC SUPPLY FOR MBB
DC LIGHTING PANEL
DC SUPPLY FOR FT DCOB
BUSBAR PROTECTION FEEDER
SAS INVERTER
AUX PS PANEL
E-LECTROMAGNETIC LAB TEST
NFS SYSTEM
PROTECTION PANEL FOR 220KV LINE-1
PROTECTION PANEL FOR 220KV LINE-2
TPE CR & R PANEL FOR 220KV TRF-1
TPE CR & R PANEL FOR 220KV TRF-2
CR&R PANEL FOR 220KV BUS COUPLER
CR&R PANEL FOR 220KV LINE-1
CR&R PANEL FOR 220KV LINE-2
CR&R PANEL FOR 220KV TBC
CR&R PANEL FOR IC-T1 MAT
CR&R PANEL FOR IC-T2 MAT
PROTECTION PANEL FOR 220KV TBC
PROTECTION PANEL 33 KV LINE-1
PROTECTION PANEL 33 KV LINE-2
PROTECTION PANEL 33 KV LINE-3
PROTECTION PANEL 33 KV LINE-4
CR & R PANEL 33 KV LINE-1
CR & R PANEL 33 KV LINE-2
CR & R PANEL 33 KV LINE-3
CR & R PANEL 33 KV LINE-4
CR&R PANEL 33 KV BUS COUPLER
CR&R PANEL 33 KV LT1 MAT
CR&R PANEL 33 KV LT2 MAT
CR&R PANEL 33 KV SIDE TRF-1
CR&R PANEL 33 KV SIDE TRF-2
DC SUPPLY TO PROT. PANEL
DC SUPPLY TO PROT. PANEL
DC SUPPLY TO PROT. PANEL
TPE CR & R PANEL 33 KV LINE-1
TPE CR & R PANEL 33 KV LINE-2
PROTECTION PANEL FOR 220KV LINE-1
PROTECTION PANEL FOR 220KV LINE-2
CR&R PANEL FOR 220KV LINE-1
CR&R PANEL FOR 220KV LINE-2
CR&R PANEL FOR 220KV TBC
PROTECTION PANEL FOR 220KV TBC
PROTECTION PANEL 33 KV LINE-1
PROTECTION PANEL 33 KV LINE-2
PROTECTION PANEL 33 KV LINE-3
PROTECTION PANEL 33 KV LINE-4
AUXILIARY SUPPLY AS PER REQUIREMENT
STATION HMI PANEL
CR & R PANEL 33 KV SIDE TRF-1
CR & R PANEL 33 KV SIDE TRF-2
CR & R PANEL 33 KV LINE-1
CR & R PANEL 33 KV LINE-2
CR & R PANEL 33 KV LINE-3
CR & R PANEL 33 KV LINE-4
PROTECTION PANEL 33 KV LINE-1
PROTECTION PANEL 33 KV LINE-2
PROTECTION PANEL 33 KV LINE-3
PROTECTION PANEL 33 KV LINE-4
SPARE
4C*16 Sq.mm Al PVC CABLE
4C*10 Sq.mm Al PVC CABLE
4C*4 Sq.mm Al PVC CABLE

SUPPLY FROM ACDB SECTION-1 (FROM SOURCE-1)
SUPPLY FROM ACDB SECTION-2 (FROM SOURCE-2)
3.5C*70 Sq. mm Al PVC CABLE
220V CHARGER-2 FLOAT/BOOST
2# 1C*150 Sq. mm Al PVC CABLE
DC MODULE
250A MCCB
250A,DP AB SWITCH
(90-0-400A)
SHUNT
250A MCCB
250A MCCB
2# 1C*150 Sq. mm Al PVC CABLE
220V BATTERY BANK -2 500AH
BATTERY CURATIVE DISCHARGE FEEDER
(0-300V)
VSS
27 59 96
220V DC DISTRIBUTION BOARD-1
220V,400A,4kA (DC) FOR 1 SEC
250A
2# 1C*150 Sq. mm Al PVC CABLE

SUPPLY FROM ACDB SECTION-1 (FROM SOURCE-1)
SUPPLY FROM ACDB SECTION-2 (FROM SOURCE-2)
3.5C*70 Sq. mm Al PVC CABLE
48V CHARGER-1 FLOAT/BOOST
2# 1C*150 Sq. mm Al PVC CABLE
DC MODULE
250A MCCB
250A,DP AB SWITCH
(90-0-200A)
SHUNT
250A MCCB
250A MCCB
2# 1C*150 Sq. mm Al PVC CABLE
48V BATTERY BANK-1 300AH
BATTERY CURATIVE DISCHARGE FEEDER
(0-75V)
VSS
27 59 96
48V DC DISTRIBUTION BOARD-1
48V,400A,4kA (DC) FOR 1 SEC
250A
250A
FOTE PANEL
SPARE

SUPPLY FROM ACDB SECTION-1 (FROM SOURCE-1)
SUPPLY FROM ACDB SECTION-2 (FROM SOURCE-2)
3.5C*70 Sq. mm Al PVC CABLE
48V CHARGER-2 FLOAT/BOOST
2# 1C*150 Sq. mm Al PVC CABLE
DC MODULE
250A MCCB
250A,DP AB SWITCH
(90-0-200A)
SHUNT
250A MCCB
250A MCCB
2# 1C*150 Sq. mm Al PVC CABLE
48V BATTERY BANK -2 300AH
BATTERY CURATIVE DISCHARGE FEEDER
(0-75V)
VSS
27 59 96
48V DC DISTRIBUTION BOARD-2
48V,400A,4kA (DC) FOR 1 SEC
250A
250A
FOTE PANEL
SPARE

LEGEND:-

SYMBOLS	DESCRIPTION
	2 POLE MCCB,32A
A	DC SHUNT AMMETER
	DP AIR BREAK SWITCH
	48V BATTERY
	220V BATTERY
	48V FLOAT CUM BOOST BATTERY CHARGER
	220V FLOAT CUM BOOST BATTERY CHARGER
V	DC VOLTMETER
VSS	VOLTMETER SELECTOR SWITCH
27	INSTANTANEOUS UNDER VOLTAGE RELAY
59	INSTANTANEOUS OVER VOLTAGE RELAY
96	EARTH LEAKAGE RELAY

NOTES:

1. NO TWO AC SOURCES SHALL BE PARALLELED AT ANY STAGE.
2. DG SET SHALL BE OF AUTO START TYPE.
3. EACH BAY MB & TRANSFORMER MB SHALL BE FED BY ATLEAST ONE SOURCE FROM 415V ACDB. SECOND SOURCE SHALL BE LOOPED FROM NEAREST BAY MB & TRANSFORMER MB RESPECTIVELY. WHICH SHALL BE FED FROM ANOTHER SOURCE FROM 415V ACDB.
4. NUMBERS OF FEEDERS SHALL BE INCREASED IN EACH BOARD AS PER REQUIREMENT OF SUBSTATION FOR PRESENT AND FUTURE BAYS AS SHOWN IN SUBSTATION SLD.
5. ONE DC 'X' TYPE MODULE IN EACH 220V/110V DCDB SHALL BE PROVIDED FOR EACH LINE, TRANSFORMER,TBC,BC & BUS SECTION BAY FOR PRESENT AND FUTURE BAYS AS SHOWN IN SUBSTATION SLD.
6. ONE DC 'X' TYPE MODULE IN EACH 48V DCDB SHALL BE PROVIDED FOR EACH LINE BAY FOR PRESENT AND FUTURE BAYS AS SHOWN IN SUBSTATION SLD.
7. ALL DIGITAL/ANALOG INPUT/OUTPUTS REQUIRED FOR SAS SYSTEM SHALL BE CONSIDERED BY THE LT SWITCHGEAR MANUFACTURER.
8. 20% SPARE SHALL BE FOR EACH FEEDER RATING.
9. REFER DRAWING No.-KDBIL/250/PJ/20-21/D1/02 FOR SUBSTATION SLD.

Comments (Type):
1. Approved subject to Fabrication/Construction/Manufacturing Subject to condition that statements and comments are included. Please submit the revised documents for approval.
2. Approved subject to Fabrication/Construction/Manufacturing Subject to condition that statements and comments are included. Please submit the revised documents for approval.
3. Insert statements and submit again for approval.
4. For information and record.
(Signature) (ESKOM)
(Designation)
(Date) (Philip) 5/1/22

REC PDCL GURUGRAM

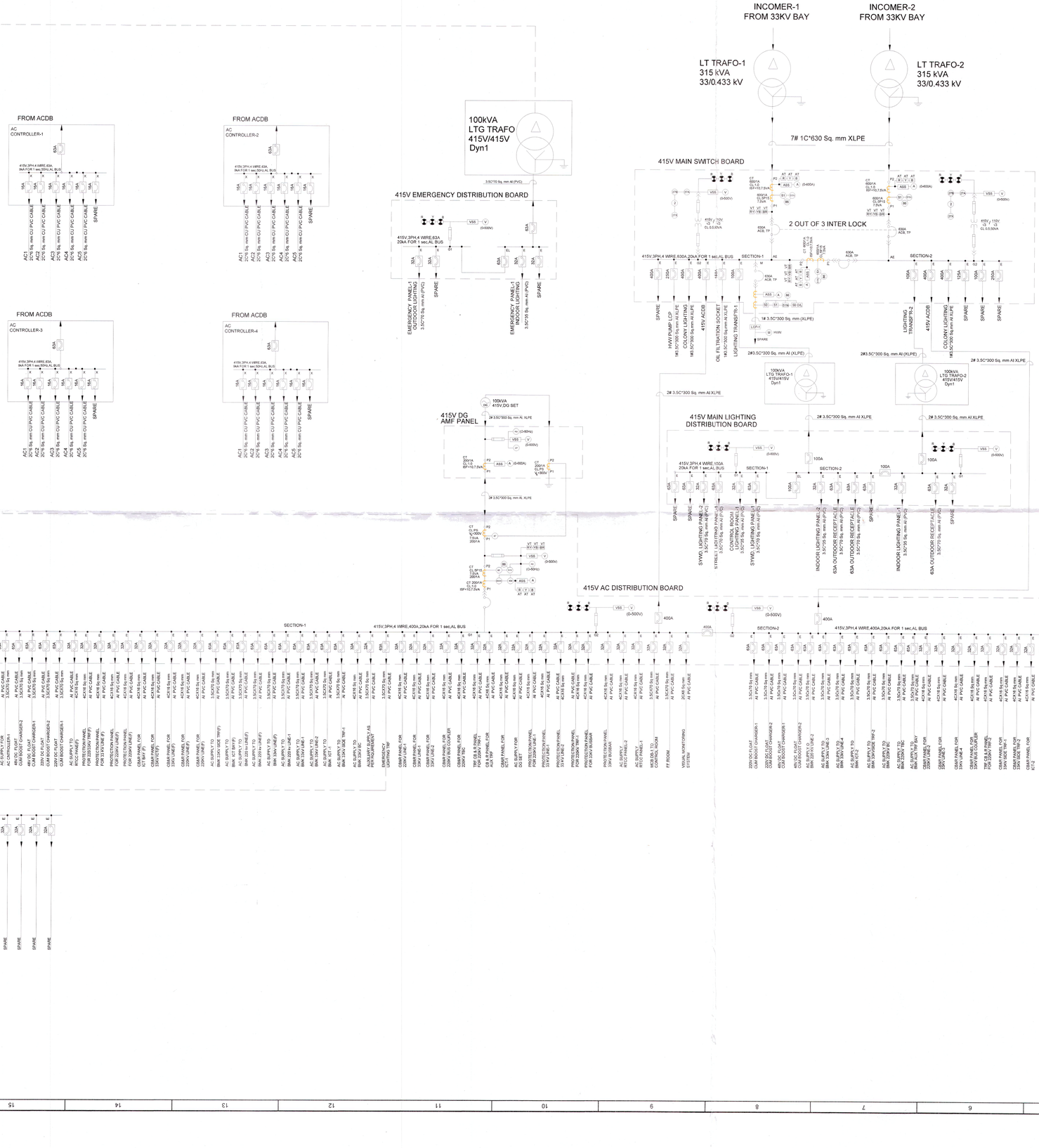
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	LT SLD (DC) OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/53 — REV- 00
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM

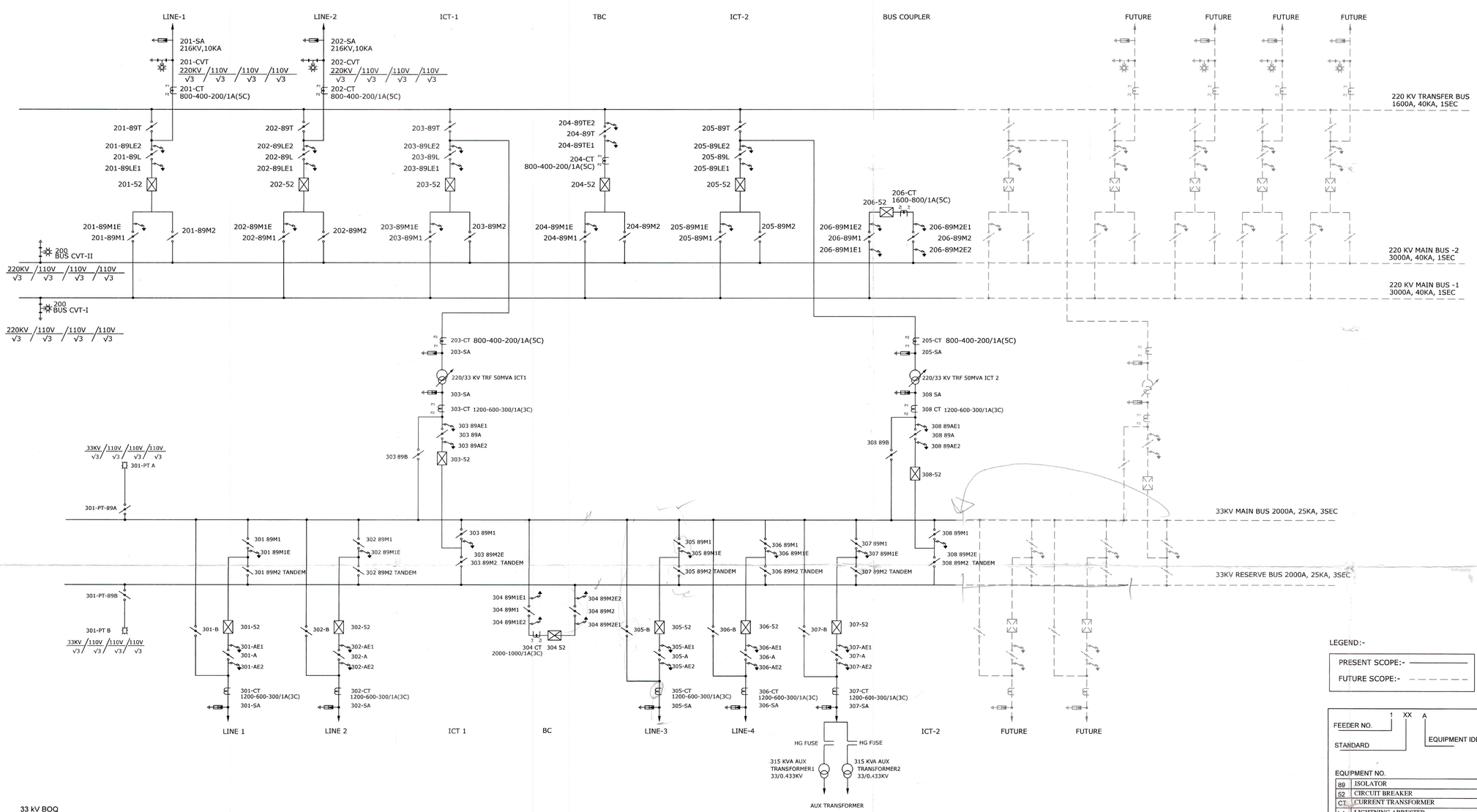
	NAME	DATE	SIGN
PREPARED BY	MANOJ	15.01.2022	
CHECKED BY	GAURAV	15.01.2022	
SUBMITTED BY	KDBIL	15.01.2022	

Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....


INCOMER-1
FROM 33KV BAY
INCOMER-2
FROM 33KV BAY
LT TRAFO-1
315 kVA
33/0.433 kV
LT TRAFO-2
315 kVA
33/0.433 kV
7# 1C*630 Sq. mm XLPE
415V MAIN SWITCH BOARD
2 OUT OF 3 INTER LOCK
415V.3PH.4 WIRE,630A,20kA FOR 1 sec.AL BUS
SECTION-1
SECTION-2
1# 3.5C*300 Sq. mm (XLPE)
2#3.5C*300 Sq. mm Al (XLPE)
2# 3.5C*300 Sq. mm Al XLPE
100kVA
LTG TRAFO-1
415V/415V
Dyn1
100kVA
LTG TRAFO-2
415V/415V
Dyn1
415V MAIN LIGHTING
DISTRIBUTION BOARD
415V.3PH.4 WIRE,100A
20kA FOR 1 sec.AL BUS
SPARE
SPARE
SYWD. LIGHTING PANEL-1
3.5C*70 Sq. mm Al (PVC)
STREET LIGHTING PANEL-1
CONTROL ROOM
LIGHTING PANEL-1
3.5C*35 Sq. mm Al (PVC)
SYWD. LIGHTING PANEL-2
3.5C*70 Sq. mm Al (PVC)
INDOOR LIGHTING PANEL-2
3.5C*35 Sq. mm Al (PVC)
63A OUTDOOR RECEPTACLE
3.5C*70 Sq. mm Al (PVC)
63A OUTDOOR RECEPTACLE
3.5C*70 Sq. mm Al (PVC)
INDOOR LIGHTING PANEL-1
3.5C*70 Sq. mm Al (PVC)
63A OUTDOOR RECEPTACLE
3.5C*70 Sq. mm Al (PVC)
SPARE
100kVA
LTG TRAFO
415V/415V
Dyn1
3.5C*70 Sq. mm Al (PVC)
415V EMERGENCY DISTRIBUTION BOARD
415V,3PH,4 WIRE,63A
20kA FOR 1 sec.AL BUS
EMERGENCY PANEL-1
OUTDOOR LIGHTING
3.5C*70 Sq. mm Al (PVC)
SPARE
EMERGENCY PANEL-2
INDOOR LIGHTING
3.5C*35 Sq. mm Al (PVC)
SPARE
415V DG
AMF PANEL
100kVA
415V,DG SET
2# 3.5C*300 Sq. mm AL XLPE
CT
2001A
CL 1.0
ISF=10.7,5VA
CT
2001A
CL PS
Vk=300V
CT
CL 5P15
7.5VA
2001A
ISF=10.7,5VA
CT
CL PS
Vk=300V
7.5VA
200/1A
415V AC DISTRIBUTION BOARD
SECTION-1
SECTION-2
415V,3PH,4 WIRE,400A,20kA FOR 1 sec.AL BUS
FROM ACDB
AC CONTROLLER-1
AC CONTROLLER-2
AC CONTROLLER-3
AC CONTROLLER-4
415V,3PH,4 WIRE,63A
20kA FOR 1 sec.AL BUS
AC1
AC2
AC3
AC4
2C*6 Sq. mm CU PVC CABLE
SPARE
SPARE
AC SUPPLY FOR
ELECTRONICS TEST ROOM
AC SUPPLY FOR
AC CONTROLLER-2
3.5C*25 Sq mm
AC SUPPLY FOR
AC CONTROLLER-1
3.5C*25 Sq mm
48V DC FLOAT
CUM BOOST CHARGER-2
3.5C*25 Sq mm
48V DC FLOAT
CUM BOOST CHARGER-1
3.5C*25 Sq mm
230V DC FLOAT
CUM BOOST CHARGER-2
3.5C*25 Sq mm
230V DC FLOAT
CUM BOOST CHARGER-1
3.5C*25 Sq mm
AC SUPPLY TO
BMK 33KV BAY
4C*16 Sq mm
AC SUPPLY TO
BMK 220KV BAY
4C*16



LEGEND:-

PRESENT SCOPE:- ————

FUTURE SCOPE:- – – – –

FEEDER NO. 1 XX A

STANDARD — EQUIPMENT IDENTIFICATION

EQUIPMENT NO.

89	ISOLATOR
52	CIRCUIT BREAKER
CT	CURRENT TRANSFORMER
LA	LIGHTNING ARRESTER
CVT	CAPACITIVE VOLTAGE TRANSFORMER

REC PDCL GURUGRAM

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

Subject to finalization of 220KV LILO Line at Nagrota. In case of LILO of 220KV Udhampur- Gladni T/L additional 220KV wave Traps may be required at Nagrota Substation.

33 kV BOQ
(FAULT LEVEL: 25 kA for 3 sec)

SYMBOL	DESCRIPTION	LINE-1	LINE-2	LINE-3	LINE-4	ICT-1	ICT-2	BC	TRF AUX	BUS PT	BUS ISO	QTY AS PER LOA	QTY AS REQUIRED	MAKE
	36 KV, 1250A, 25 KA,3-PHASE CIRCUITBREAKER WITH SUPPORT STRUCTURE	01	01	01	01	01	01	00	01	00	00	07	07	
	36 KV, 2500A, 25 KA,3-PHASE CIRCUITBREAKER WITH SUPPORT STRUCTURE	00	00	00	00	00	00	01	00	00	00	01	01	
	36KV, 1200A,25KA,1-PH CURRENT TRANSFORMER-120% RATING	03	03	03	03	03	03	00	03	00	00	21	21	
	36 KV, 2000A, 25 KA, 1-PHASE CURRENT TRANSFORMER WITH 150% EXTENDED RATING	00	00	00	00	00	00	03	00	00	00	03	03	
	POTENTIAL TRANSFORMER (1 PH.) 33KV/√3/110/√3/110V/3/110/√3	00	00	00	00	00	00	00	06	00	00	06	06	
	SURGE ARRESTORS 30KV, 1-PH ALONG WITH SURGE ARRESTOR	03	03	03	03	03	03	00	03	00	00	21	21	
	36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITH ONE E/S	01	01	01	01	01	01	00	01	00	00	07	07	
	36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITHOUT E/S	01	01	01	01	01	01	00	01	00	02	14	09	
	36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITHOUT E/S TANDEM	01	01	01	01	01	01	00	01	00	00	00	07	
	36KV,400A HORN GAP FUSE (1-PH.)	00	00	00	00	00	00	00	06	00	00	06	06	
	36 KV, 1250A, 25 KA, 3-PHASE HDB ISOLATOR WITH TWO E/S	01	01	01	01	01	01	00	01	00	00	07	07	
	36 KV, 2500A, 25 KA, 3-PHASE HDB ISOLATOR WITH TWO E/S	00	00	00	00	00	00	02	00	00	00	02	02	
	315KVA, 33/0.433KV LT TRANSFORMER	00	00	00	00	00	00	00	02	00	00	02	02	

220 kV BOQ
(FAULT LEVEL: 40 kA for 1 sec)

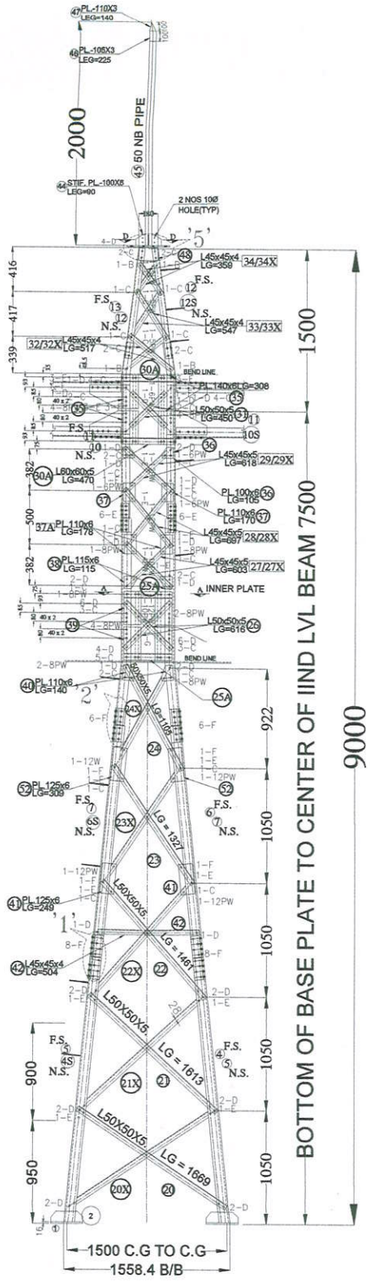
SYMBOL	DESCRIPTION	LINE-1	LINE-2	ICT-1	ICT-2	TBC	BC	BUS CVT	QTY AS PER LOA	QTY AS REQUIRED	MAKE
	50MVA 220/33KV TRANSFORMER	00	00	01	01	00	00	00	02	02	
	2500 A, 40 KA, SF6 CIRCUIT BREAKERS (WITH SUPPORT STRUCTURE) 3-PH	01	01	01	01	01	01	00	06	06	
	800A, 40KA, 5 CORE CT WITH 120% EXTENDED CURRENT RATING	03	03	03	03	03	00	00	15	15	
	1600A, 40KA, 5 CORE CT WITH 150% EXTENDED CURRENT RATING	00	00	00	00	00	03	00	03	03	
	245 KV CAPACITIVE VOLTAGE TRANSFORMER (1- PHASE 4400pF)	03	03	00	00	00	00	06	12	12	
	216 KV, 10KA SURGE ARRESTER (1-PH) ALONG WITH SURGE COUNTER	03	03	03	03	00	00	00	12	12	
	1600A, 40 KA WITH ONE EARTH SWITCH (DOUBLE BREAK ISOLATOR 3 phase)	01	01	01	01	00	00	00	05	05	
	1600A, 40 KA WITHOUT EARTH SWITCH (DOUBLE BREAK ISOLATOR 3 phase) (TANDEM)	02	02	02	02	01	00	00	09	09	
	1600A, 40KA WITH TWO EARTH SWITCH (DOUBLE BREAK ISOLATOR 3 phase)	01	01	01	01	01	00	00	05	05	
	2500A, 40KA WITH TWO EARTH SWITCH (DOUBLE BREAK ISOLATOR 3 phase)	00	00	00	00	00	02	00	02	02	

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited (RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	SINGLE LINE DIAGRAM OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/02	REV- 3	
SCALE	As shown in Drawing	SHEET SIZE A1	
AREA	91.6 KANAL 46336.5 SQM		

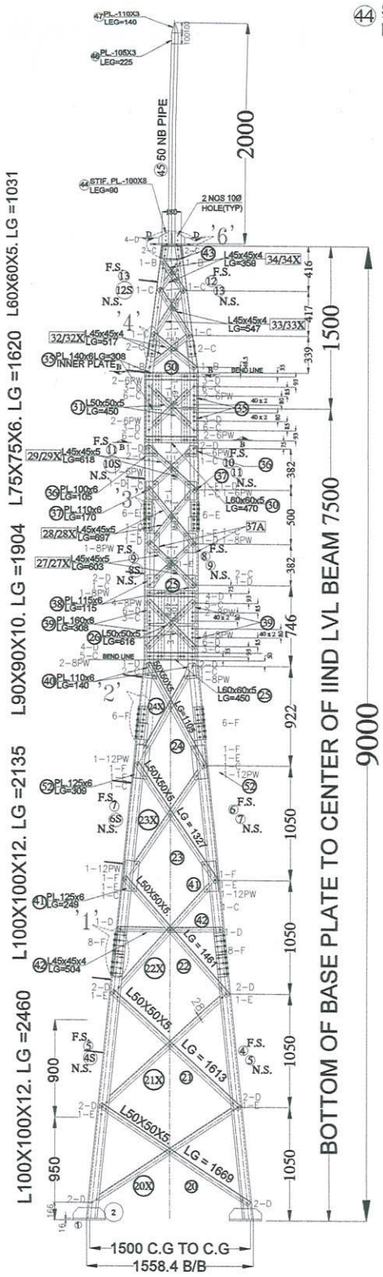
	NAME	DATE	SIGN
PREPARED BY	MANOJ	01.05.2021	Manoj
CHECKED BY	G.H	01.05.2021	
SUBMITTED BY	MR. JITENDRA	01.05.2021	R.C BANSAL Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

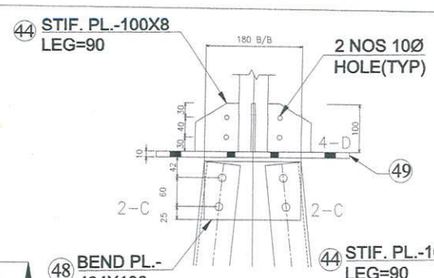
☐ More Information Date.....



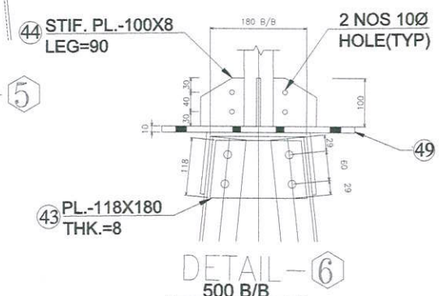
LONGITUDINAL FACE



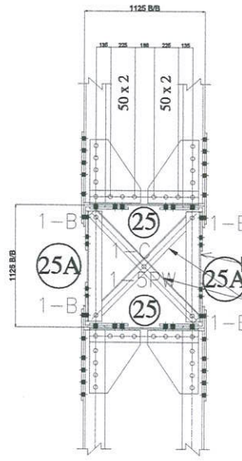
TRANSVERSE FACE



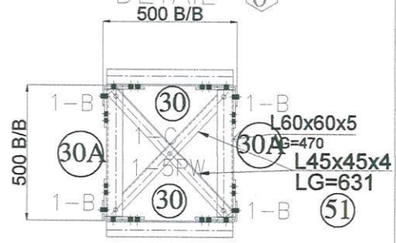
DETAIL – 5



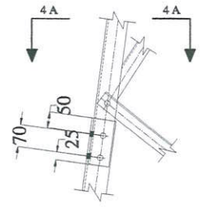
DETAIL – 6

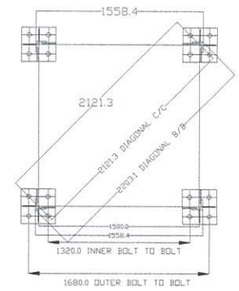


SECTION – 'A – A'

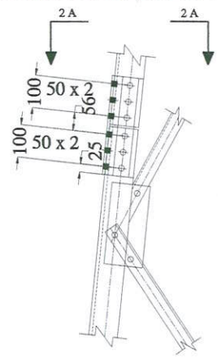


SECTION – 'B – B'

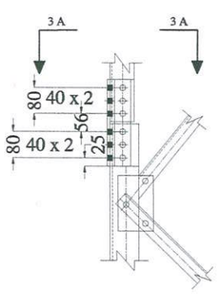




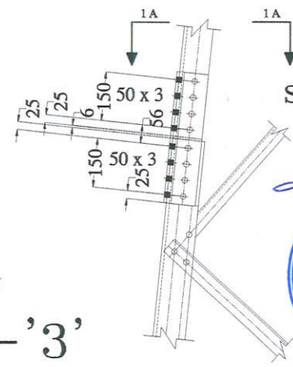
FOUNDATION PLAN



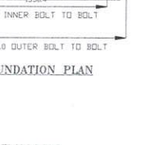
DETAIL – '2



DETAIL – '3



DETAIL – '1



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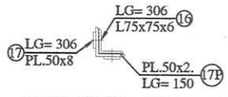

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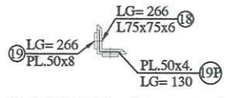
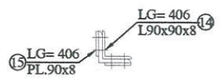
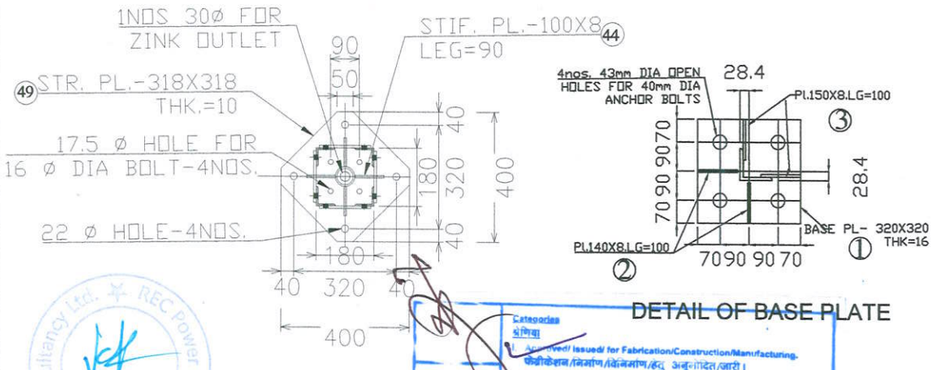


SECTION – '3A – 3A'



SECTION – '1A – 1A'



DETAIL OF BASE PLATE

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. ALL STEEL AS PER IS:2062 & FABRICATION SHALL BE AS PER IS:802.
3. BOLTS, NUTS AS PER IS:6639(PROPERTY CLASS 5.6)
4. GALVANISING SHALL BE 610 GM/MT. SQ.
5. ALL HOLES 17.5 MM DIA FOR 16MM DIA. BOLT IF NOT STATED OTHERWISE.
6. 2% EXTRA NUTS & BOLTS SHALL BE SUPPLIED FOR ERECTION.
7. ALL ITEMS TO BE PREFIXED WITH 'CB' THAT IS CB-1,CB-2,SO ON.
8. SECTIONS NOT INDICATED ARE L45X45X5 WITH 25MM BACKMARK.

BOLTS/NUT STATEMENT

	SPRING. WASHER	860	
12	30 ⌀X12 THK PACK. WASHER	18	
10	30 ⌀X10 THK PACK. WASHER	30	
8	30 ⌀X8 THK PACK. WASHER	64	
6	30 ⌀X6 THK PACK. WASHER	48	
5	30 ⌀X5 THK PACK. WASHER	24	
3	30 ⌀X4 THK PACK. WASHER	6	
	STEP BOLT ⌀16X175	19	DIAGONALLY
TYPE	SIZE	QTY	REMARK
B	DIA 16X35 Lg.	48	
C	DIA 16X40 Lg.	332	
D	DIA 16X45 Lg.	200	
E	DIA 16X50 Lg.	126	
F	DIA 16X55 Lg.	152	
G	DIA 16X60 Lg.	2	

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED(RECPDCL)
EPC COMPANY	Kallash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	ERECTION DRAWING OF 33KV TOWER 3TGP Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/117 — REV- 02
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN	
PREPARED BY	RASHID	01.11.2022		KDBIL
CHECKED BY	G.H	01.11.2022		
SUBMITTED BY	ANURAG	01.11.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

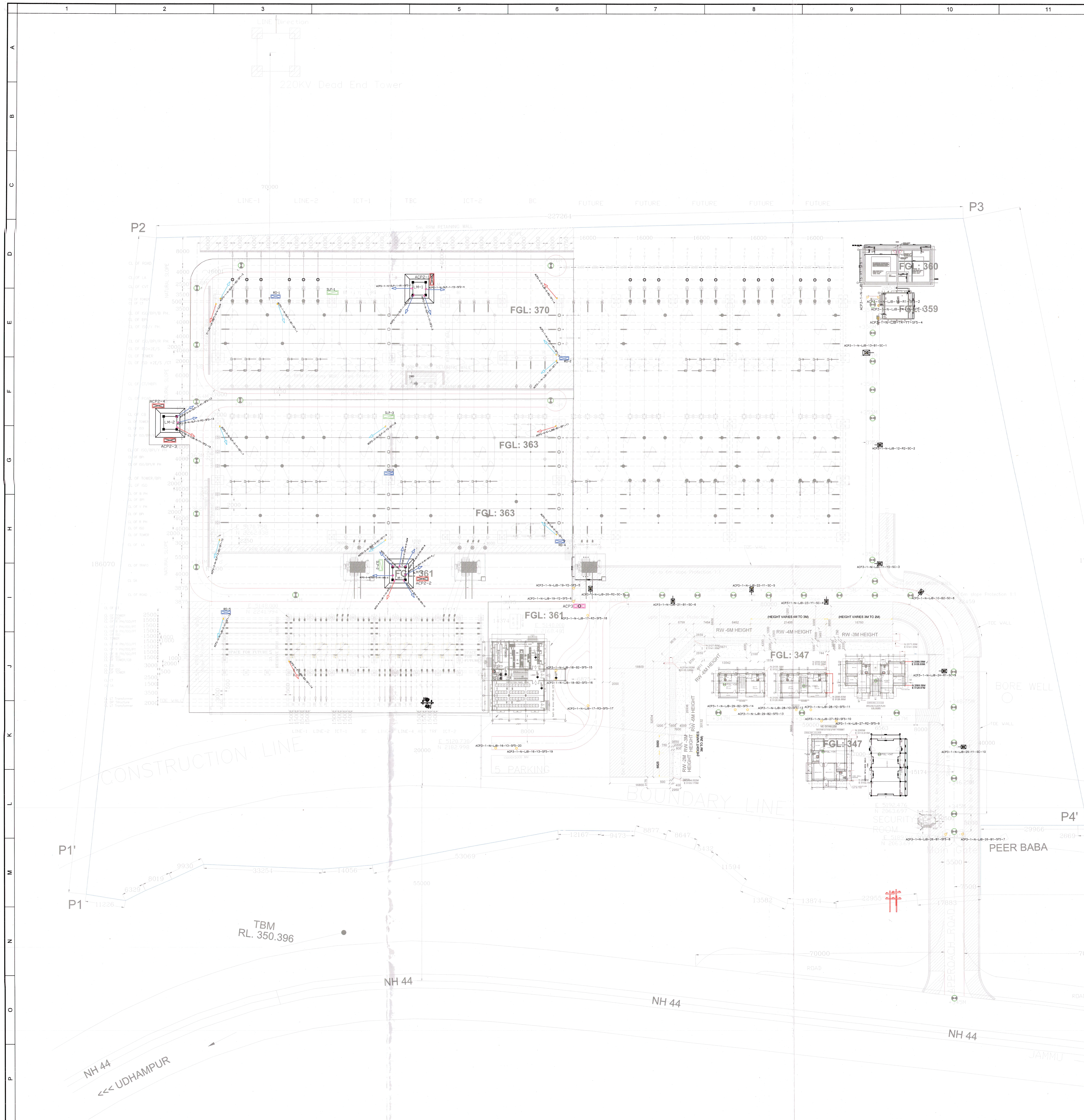
KALLASH DEVBUILD (INDIA) PVT. LTD. ★ JABALPUR

REC Power Development & Consultancy Ltd.

CN-22128
17/11/22

Manager

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
डिजाईनिंग/निर्माण/विनिर्माण/हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included. Please submit the revised documents for approval.
टिप्पणियों को शामिल करते हुए अनुमोदित/जारी। संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)



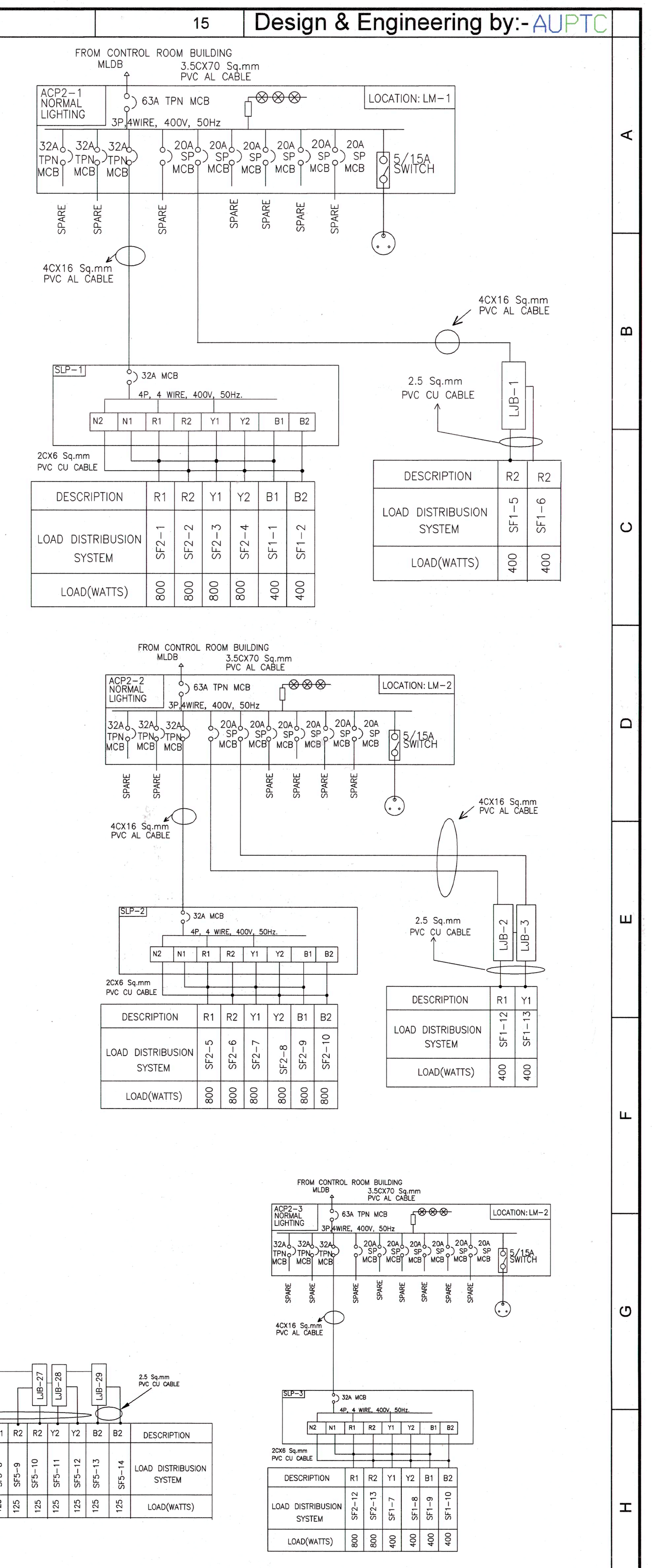
NO.	LOCATION	LUMINAIRE NO.	TILT	ROTATION	MOUNTING HEIGHT
ACP2-1	NEAR LM-1	SF2-1	-35	175	26.5
		SF2-2	-35	-110	26.5
		SF2-3	-45	-74	26.5
		SF2-4	-45	2	26.5
		SF1-1	-35	-74	12.0
		SF1-2	-45	53	12.0
		SF1-5	-45	126	12.0
		SF1-6	-25	-150	12.0

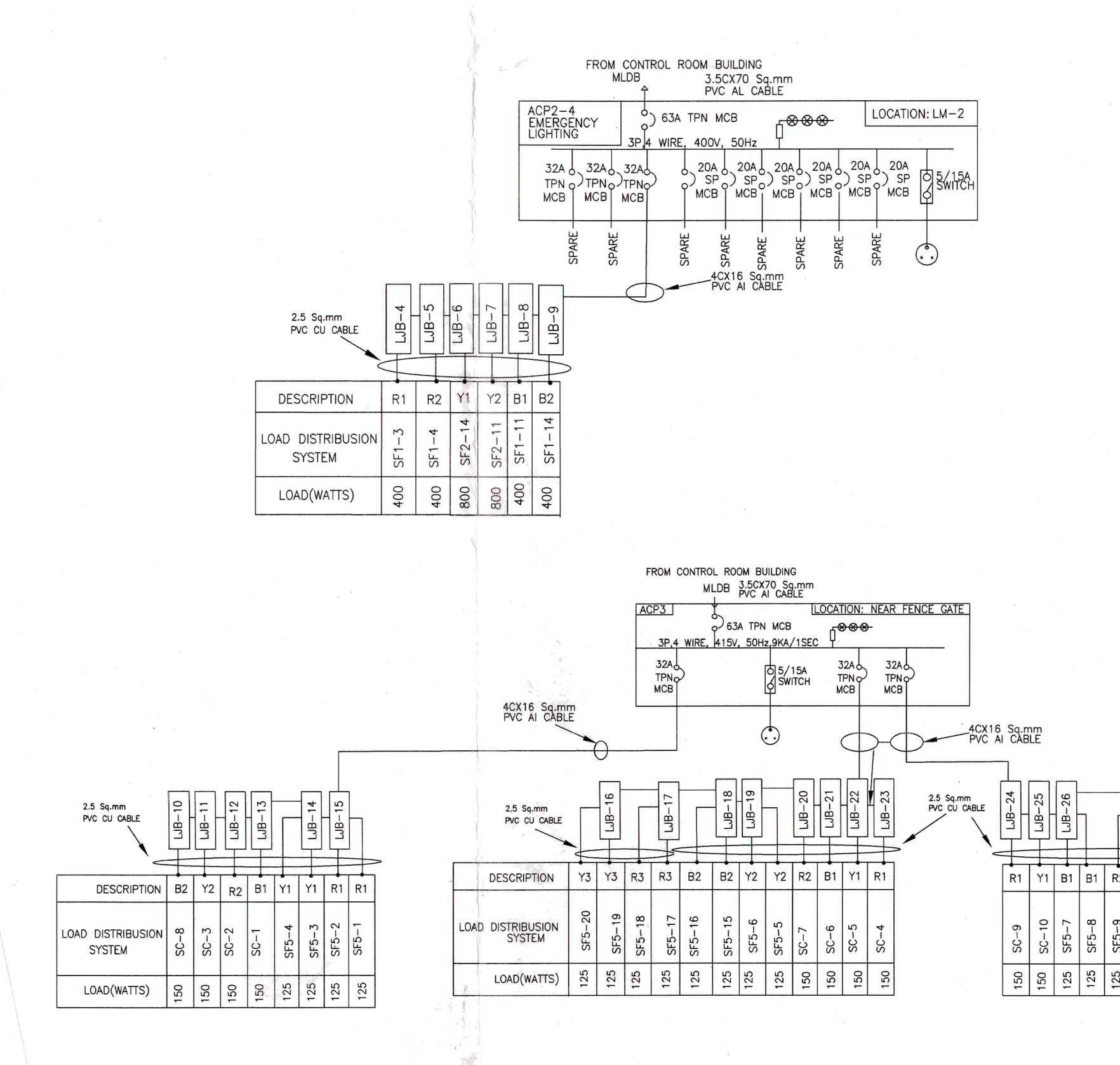
NO.	LOCATION	LUMINAIRE NO.	TILT	ROTATION	MOUNTING HEIGHT
ACP2-2	NEAR LM-3	SF2-5	-45	175	26.5
		SF2-6	-45	120	26.5
		SF2-7	-45	80	26.5
		SF2-8	-45	60	26.5
		SF2-9	-25	20	26.5
		SF2-10	-45	-60	26.5
		SF1-12	-35	150	12.0
		SF1-13	-35	-100	7.5

NO.	LOCATION	LUMINAIRE NO.	TILT	ROTATION	MOUNTING HEIGHT
ACP2-3	NEAR LM-3	SF2-12	-35	35	26.5
		SF2-13	-45	15	26.5
		SF1-7	-35	-85	12.0
		SF1-8	-35	-140	12.0
		SF1-9	-35	-130	12.0
		SF1-10	-35	-100	12.0

NO.	LOCATION	LUMINAIRE NO.	TILT	ROTATION	MOUNTING HEIGHT
ACP2-4	NEAR LM-3	SF1-3	-45	-70	12.0
		SF1-4	-35	140	12.0
		SF2-14	-45	-30	26.5
		SF1-11	-45	-168	12.0
		SF2-11	-45	-102	26.5
		SF1-14	-35	-50	7.5

NO.	LOCATION	LUMINAIRE NO.	TILT	ROTATION	MOUNTING HEIGHT
ACP3-1	NEAR FENCE GATE	SF5-1	00	00	6.3
		SF5-2	00	00	6.3
		SF5-3	00	00	6.3
		SF5-4	00	00	6.3
		SC-1	-15	00	6.3
		SC-2	-15	-180	8.3
		SC-3	-15	170	8.3
		SC-4	-15	90	8.3
		SC-5	-15	90	8.3
		SC-6	-15	90	8.3
		SC-7	-15	90	8.3
		SC-8	-15	-130	8.3
		SC-9	-15	00	8.3
		SC-10	-15	-180	8.3
		SF5-5	00	00	2.5
		SF5-6	00	00	2.5
		SF5-7	00	00	2.5
		SF5-8	00	00	2.5
		SF5-9	00	00	6.3
		SF5-10	00	00	6.3
		SF5-11	00	00	6.3
		SF5-12	00	00	6.3
		SF5-13	00	00	6.3
		SF5-14	00	00	6.3
		SF5-15	00	00	6.3
		SF5-16	00	00	6.3
		SF5-17	00	00	6.3
		SF5-18	00	00	6.3
		SF5-19	00	00	6.3
		SF5-20	00	00	6.3





Luminaire list (Site 1) FOR SWITCHYARD

Index	Manufacturer	Article name	Fitting	Luminous flux	Light loss factor	Connected load	Quantity
1	BAJAJ/REC APPROVED	BJENF 24 (2 X 400 SV T)	1x 2 X 400W SV T	96000 lm	0.80	892 W	14
2	BAJAJ/REC APPROVED	BJENF 14 (1 X 400 SV T)	1x 1 X 400W SV T	48000 lm	0.80	446 W	14

#	Name	Parameter	Min	Max	Average	Min/average	Min/max
1	Workplane (Outdoor space 2)	Perpendicular illuminance (Adaptive)	5.72 lx	173 lx	62.7 lx	0.091	0.033
2	Workplane (Outdoor space 1)	Perpendicular illuminance (Adaptive)	2.66 lx	197 lx	65.3 lx	0.041	0.014

Luminaire list (Site 1) FOR STREET LIGHT

Index	Manufacturer	Article name	Fitting	Luminous flux	Light loss factor	Connected load	Quantity
1	BAJAJ/REC APPROVED	12887 BGEST 150w SV FG SHK PDC	1x 150W SV (T)	14000 lm	0.80	174 W	10
2	BAJAJ/ REC APPROVED	BJDPTI 125 MV	1x 1 x 125W MV E	6300 lm	0.80	143 W	16

#	Name	Parameter	Min	Max	Average	Min/average	Min/max
1	Workplane (street) 1)	Perpendicular illuminance (Adaptive)	4.12 lx	90.5 lx	20.1 lx	0.20	0.046
2	Workplane (street) 2)	Perpendicular illuminance (Adaptive)	5.68 lx	34.5 lx	20.1 lx	0.28	0.16

ITEM NAME	QUANTITY (METER)
4CX16 Sq.mm PVC Al CABLE	1500
20X6 Sq.mm PVC CU CABLE	600
2.5 Sq.mm PVC CU CABLE	400

S.N	TYPE	LEGEND	ITEM NAME	REQ. QTY	NOA QTY	MAKE
1	ACP-2		AC LIGHTING PANEL (FOR SWITCHYARD)	04	04	
2	ACP-3		AC LIGHTING PANEL (FOR STREET)	01	02	
3	SLP		SUB LIGHTING PANEL (OUTDOOR TYPE)	03	04	
4	RP		63A 415V 3 PHASE 4PIN INTERLOCKED PLUG AND SWITCH WITH EARTHING CONTACTS.	02	02	
5	RD		15A 230V OUTDOOR RECEPTACLE 2POLE 3-PIN TYPE	05	05	
6	SF1		LED FLOOD LIGHT (1X400W)	14	15	BAJAJ/REC APPROVED
7	SF2		LED FLOOD LIGHT (2X400W)	14	20	BAJAJ/REC APPROVED
8	SF5		125W MV LAMP IN WEATHER PROOF TOP POST LANTERN	20	16	BAJAJ/REC APPROVED
9	SC		150W SON-T TUBULAR SODIUM VAPOUR LAMP IN STREET LIGHTING	10	10	BAJAJ/REC APPROVED
10	LJB		LIGHTING JUNCTION BOX	29		
10	A1		LIGHTING POLES TYPE A1	10	10	
10	E1		LIGHTING POLES TYPE E1	16	16	

NOTES:
1.ALL DIMENSIONS ARE IN MM OTHERWISE SPECIFIED.
2.LOCATIONS FOR LIGHTING PANELS TO BE DECIDED AT SITE AS SUITED.
3.ALL LIGHTING PANELS,JB'S, FIXTURES TO BE EARTHED.
4.CABLE SIZE AS FOLLOWS:
SLP/ACP TO FIXTURES = 2C X 6 SQ.MM AL PVC
MLDB/ELDB TO ACP2, ACP3 = 3.5C X 70 SQ.MM PVC AL CABLE.
5.JB TO FIXTURES IN STREET LIGHT = 2.5 SQ.MM CU PVC
6.ALL JB'S ARE MOUNTED AT A HEIGHT OF 1500MM AND ACP AT 2000MM FROM GROUND LEVEL.
7.LIGHT JB'S IN STREET LIGHT ARE MOUNTED AT A HEIGHT OF 1000MM FROM GROUND LEVEL.
8.LIGHT LOSS FACTOR = 0.80
9.DISTANCE BETWEEN POLE CENTRE AND EDGE OF THE SHOULD MAINTAIN 1000-1200 MM
10.25% OF LIGHTING FIXTURES SHALL BE FED FROM AC EMERGENCY PANEL.
11.ALL LIGHTING PANEL WILL BE GROUNDED WITH 50X6 MM G.S. FLAT AND WELDED TO NEAREST EARTHMAT.
12.FOR RECEPTACLES THE SUPPLY SHALL BE FROM MLDB.
12.NORMAL FIXTURES SF-1 ARE DEPICTED AS CYAN ARROW(—)
NORMAL FIXTURES SF-2 ARE DEPICTED AS BLUE ARROW(—)
EMERGENCY FIXTURES ARE DEPICTED AS RED ARROW(—).
13.MOUNTING HEIGHT OF LUMINARES AS FOLLOW;
LUMINARES MOUNTED ON LM1- 26.5M
LUMINARES MOUNTED ON LM2- 26.5M
LUMINARES MOUNTED ON LM3- 26.5M
LUMINARES MOUNTED ON GANTRY- 12M
LUMINARES MOUNTED ON GANTRY- 7.5M
LUMINARES MOUNTED ON A1 POLE- 9.3M
LUMINARES MOUNTED ON E1 POLE- 6.3M
LUMINARES MOUNTED ON GATE-2.5M
14.NO OF JUNCTION BOX USED = 27, JUNCTION BOX SHALL BE USED ONLY WHERE REQUIRED.
15.IF THE MINOR CHANGE IS REQUIRED, SAME CAN BE DONE IN CONSULTATION WITH POWERGRID SITE INCHARGE

NOMENCLATURE(LIGHTING MATERIALS)
ACP2-2-N/E-SLP-2-Y2-SF2-6
- FIXTURE NUMBER
- FIXTURE TYPE
- PHASE OF LOAD
- SUBLIGHTING PANEL NO.
- NORMAL/EMERGENCY PANEL
- CIRCUIT NO.
- ACP TYPE

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	OUTDOOR ILLUMINATION DRAWING OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/126	REV- 01	
SCALE	As shown in Drawing	SHEET SIZE- A0	
AREA	91.6 KANAL 46336.5 SQM		
	NAME	DATE	SIGN
PREPARED BY	JAI	11.10.2022	
CHECKED BY	PAYAL	11.10.2022	
SUBMITTED BY	KDBIL	11.10.2022	Signature

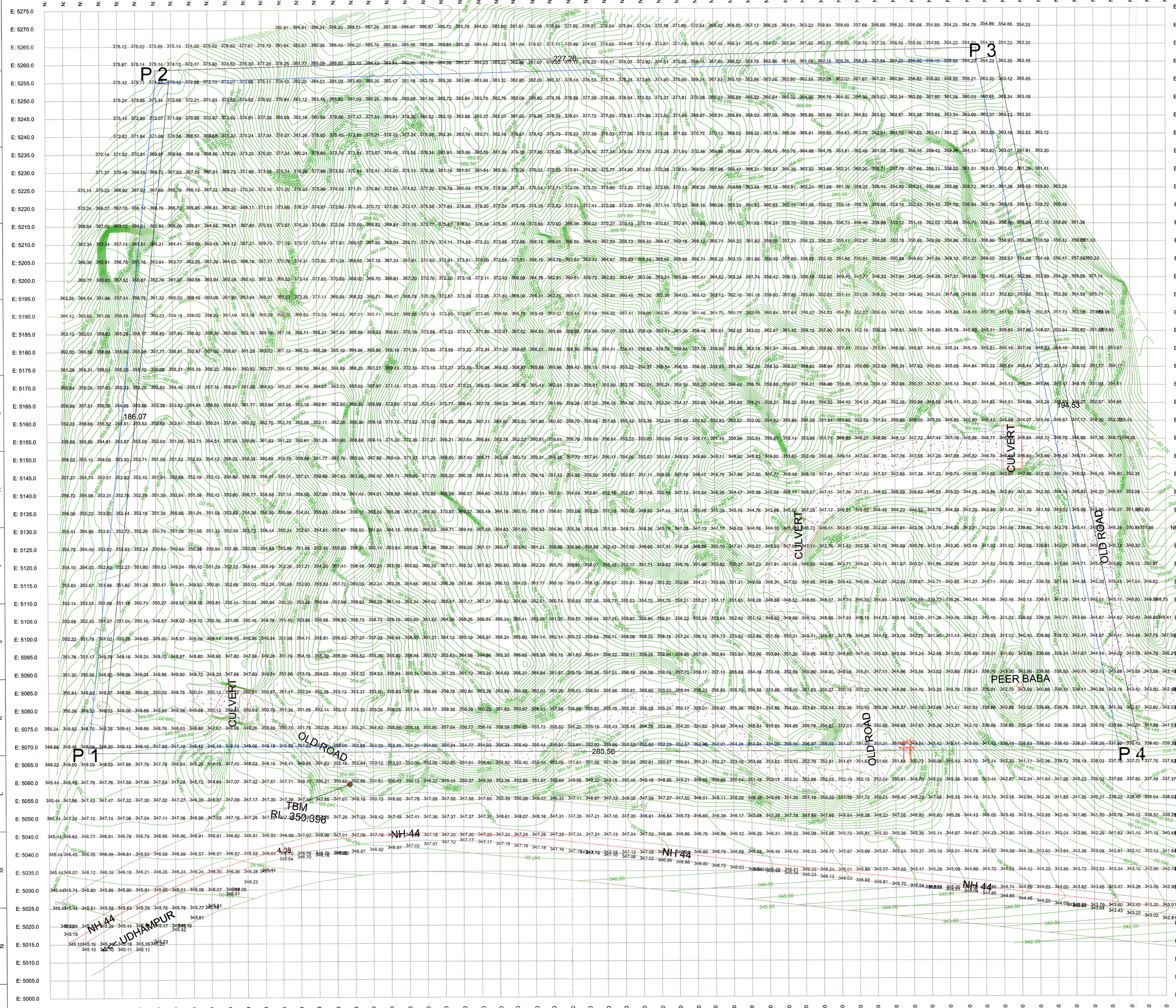
☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date..............

Design & Engineering by:-AUPTC

CN-21398
26/10/22
2056

Design & Engineering by:- AUPTC

SITE / CONTOUR PLAN OF 2 X 50 MVA, 220 / 33 KV, AIS GRID SUB-STATION NAGROTA, JAMMU



Drawing is prepared by Local Co-ordinates

SCHEDULE OF BOUNDARY MARKING

POINT	LATITUDE	LONGITUDE	EASTING	NORTHING	LEVEL
P 1	32°49'11.52"N	74°53'56.94"E	5069.98	2298.89	348.08
P 2	32°49'9.8"N	74°54'3.8"E	5255.04	2279.45	374.32
P 3	32°49'2.51"N	74°54'2.18"E	5260.58	2052.25	354.23
P 4	32°49'2.4"N	74°53'54.70"E	5069.98	2013.33	337.82

SCHEDULE OF TBM MARKING

TBM MARK	EASTING	NORTHING	LEVEL
TBM	5059.38	2226.51	350.396
TBM VALUE IS TAKEN FROM RETAINING WALL OF NATIONAL HIGHWAY MARKED BY NH-IA			

Note:- 1. Not less than 100ft clearance is to be left from the N.H before any type of construction.
2. Area handed over by forest department to JKPTCL is 92 Kanal 8 Ed Mala only.
3. Final boundary will may be decided in keeping with above facts.
4. Contour details at Plant are checked & verified with TBM as noted in the dgn.

Verified & Forwarded to RECTPCL HO.
C/S (Shivratan Singh)
Chief Manager

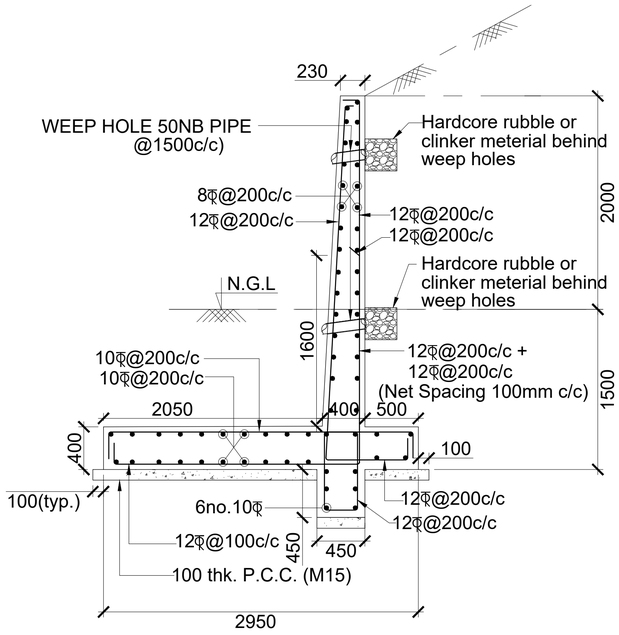
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Transmission Projects Company Limited(RECTPCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	AUPTC — Advanced Ultra Power Transmission Consultancy
TITLE	Site/Contour Plan of 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/01
SCALE	1 : 400
AREA	95.33 KANAL 48180.4715 SQM

	NAME	DATE	SIGN
PREPARED BY	Er. SUBHASH	12.12.2020	
CHECKED BY	Er. SANJAY	14.12.2020	
SUBMITTED BY	Er. SANJAY	14.12.2020	Signature/Stamp...

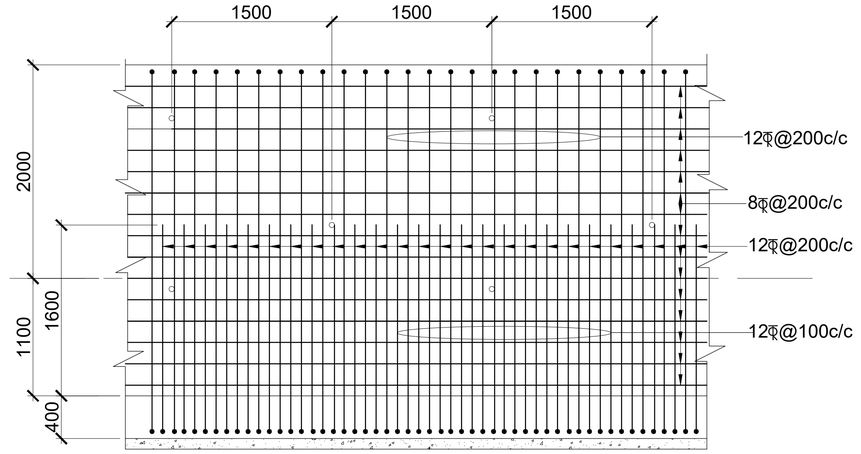
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Design & Engineering by:- AUPTC



TYPICAL RETAINING WALL FOR 2M HEIGHT



Weep hole elevation soil face

Notes:-

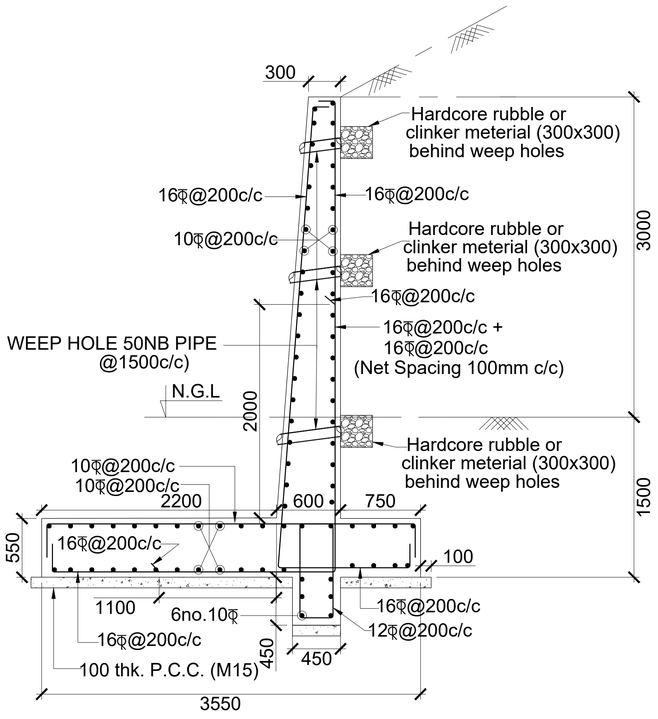
1. All dimensions are in mm
2. Do not scale any dimensions
3. Concrete grade shall be M25.
4. This drawing shall be read in conjunction with relevant structure/services drawings. Any discrepancy found therein consultant.
5. Steel R/F Fe 500 shall be used. and Steel R/F shall conform to IS: 1786
6. S.B.C of soil is taken as 15 T/m at 1.5m below N.G.L & 20 T/m at 2m below N.G.L

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	NS CONSULTING & ENGINEERING SERVICES PVT. LTD. Office : H-No. 11, Second floor -09, Ayanagar, New Delhi - 110047.		
TITLE	RETAINING WALL FOR 2M HEIGHT OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/01	REV- 0	
SCALE	As shown in Drawing	SHEET SIZE- A3	
AREA	95.33 KANAL 48180.4715 SQM	SH.NO.: 1 OF 5	

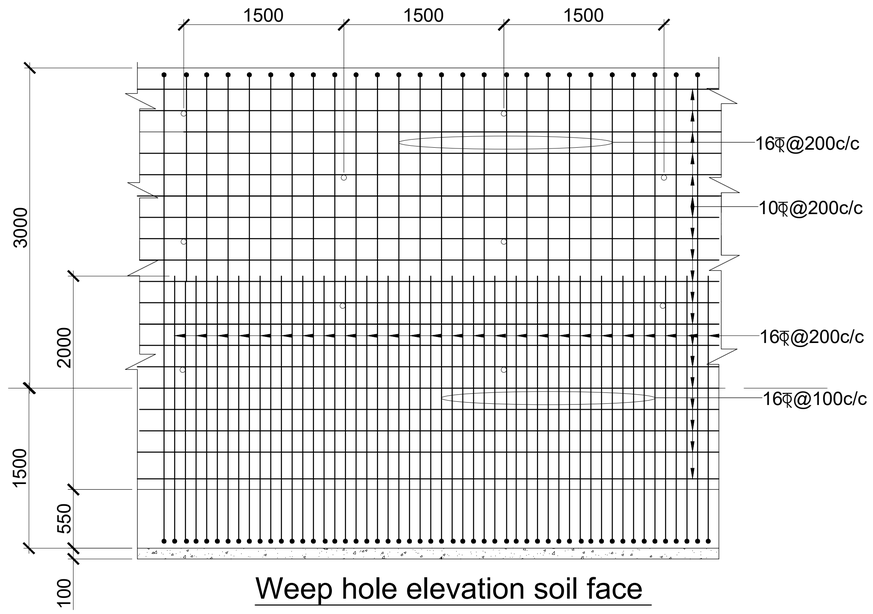
	NAME	DATE	SIGN	
PREPARED BY	S.K.M	27.09.2021		Kailash Devbuild (India) Pvt. Ltd
CHECKED BY	P.D	27.09.2021		
SUBMITTED BY	ANURAG TIWARI	27.09.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



TYPICAL RETAINING WALL FOR 3M HEIGHT



Weep hole elevation soil face

Notes:-

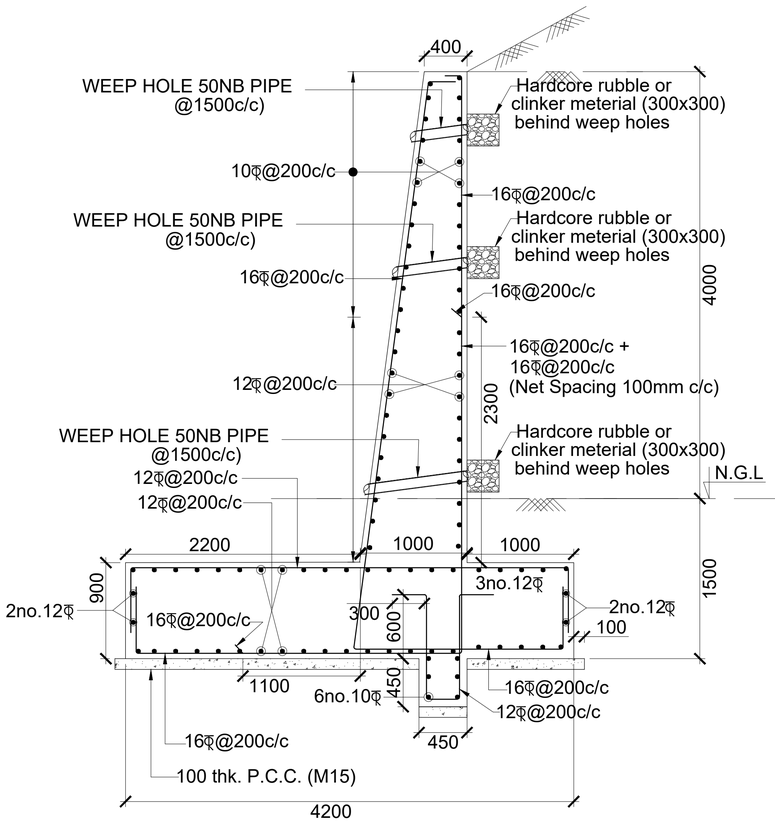
1. All dimensions are in mm
2. Do not scale any dimensions
3. Concrete grade shall be M25.
4. This drawing shall be read in conjunction with relevant structure/services drawings. Any discrepancy found therein consultant.
5. Steel R/F Fe 500 shall be used. and Steel R/F shall conform to IS: 1786
6. S.B.C of soil is taken as 15 T/m at 1.5m below N.G.L & 20 T/m at 2m below N.G.L

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	NS CONSULTING & ENGINEERING SERVICES PVT. LTD. Office : H-No. 11, Second floor -09, Ayanagar, New Delhi - 110047.
TITLE	RETAINING WALL FOR 3M HEIGHT OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/01 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	95.33 KANAL 48180.4715 SQM — SH.NO.: 2 OF 5

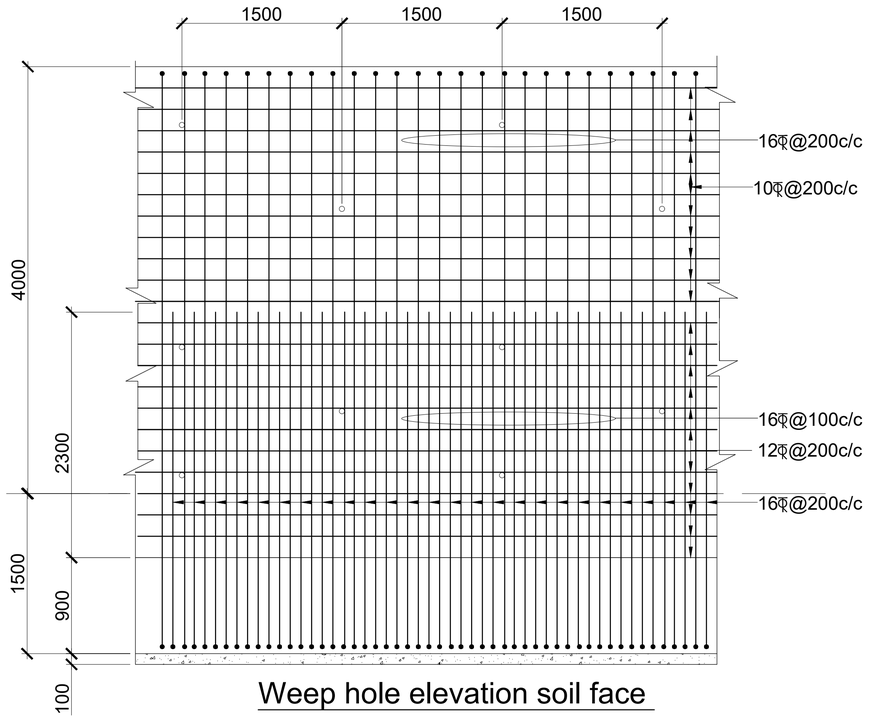
	NAME	DATE	SIGN	
PREPARED BY	S.K.M	27.09.2021		Kailash Devbuild (India) Pvt. Ltd
CHECKED BY	P.D	27.09.2021		
SUBMITTED BY	ANURAG TIWARI	27.09.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



TYPICAL RETAINING WALL FOR 4M HEIGHT



Weep hole elevation soil face

Notes:-

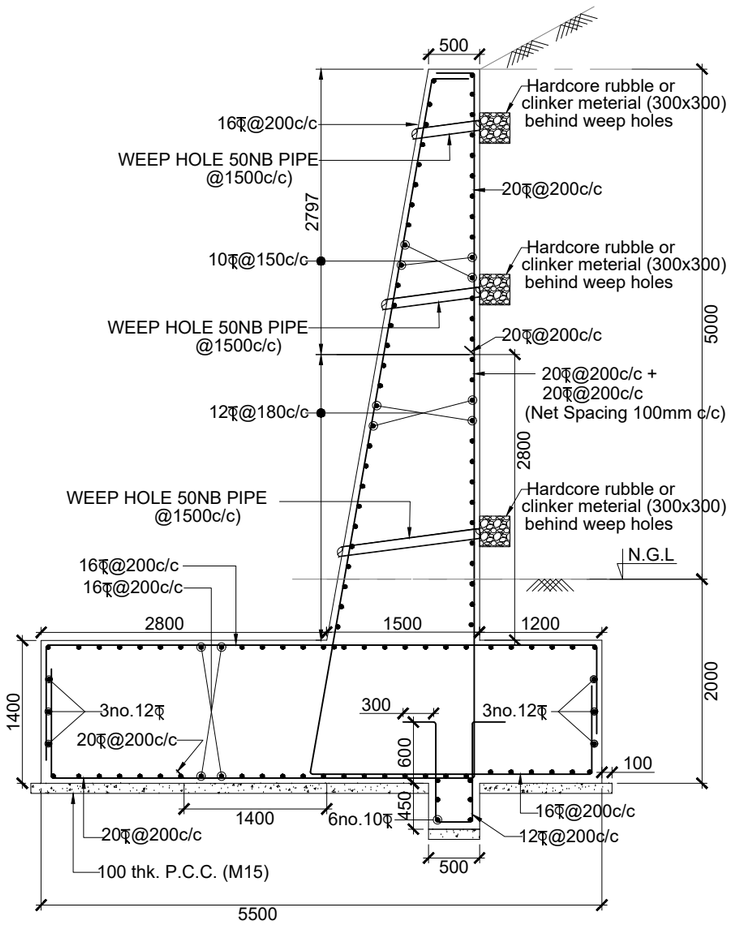
1. All dimensions are in mm
2. Do not scale any dimensions
3. Concrete grade shall be M25.
4. This drawing shall be read in conjunction with relevant structure/services drawings. Any discrepancy found therein consultant.
5. Steel R/F Fe 500 shall be used. and Steel R/F shall conform to IS: 1786
6. S.B.C of soil is taken as 15 T/m at 1.5m below N.G.L & 20 T/m at 2m below N.G.L

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	NS CONSULTING & ENGINEERING SERVICES PVT. LTD. Office : H-No. 11, Second floor -09, Ayanagar, New Delhi - 110047.		
TITLE	RETAINING WALL FOR 4M HEIGHT OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/01		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	95.33 KANAL 48180.4715 SQM		SH.NO.: 3 OF 5

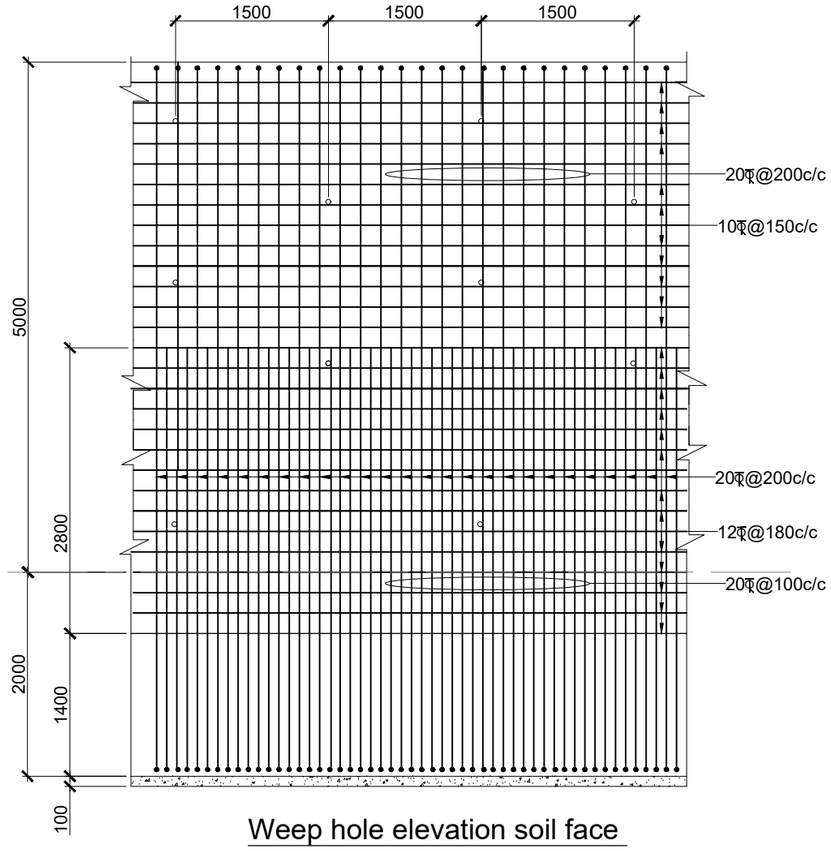
	NAME	DATE	SIGN	
PREPARED BY	S.K.M	27.09.2021		Kailash Devbuild (India) Pvt. Ltd
CHECKED BY	P.D	27.09.2021		
SUBMITTED BY	ANURAG TIWARI	27.09.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



TYPICAL RETAINING WALL FOR 5M HEIGHT



Weep hole elevation soil face

Notes:-

1. All dimensions are in mm
2. Do not scale any dimensions
3. Concrete grade shall be M25.
4. This drawing shall be read in conjunction with relevant structure/services drawings. Any discrepancy found therein consultant.
5. Steel R/F Fe 500 shall be used. and Steel R/F shall conform to IS: 1786
6. S.B.C of soil is taken as 15 T/m at 1.5m below N.G.L & 20 T/m at 2m below N.G.L

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	NS CONSULTING & ENGINEERING SERVICES PVT. LTD. Office : H-No. 11, Second floor -09, Ayanagar, New Delhi - 110047.
TITLE	RETAINING WALL FOR 5M HEIGHT OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/01 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	95.33 KANAL 48180.4715 SQM — SH.NO.: 4 OF 5

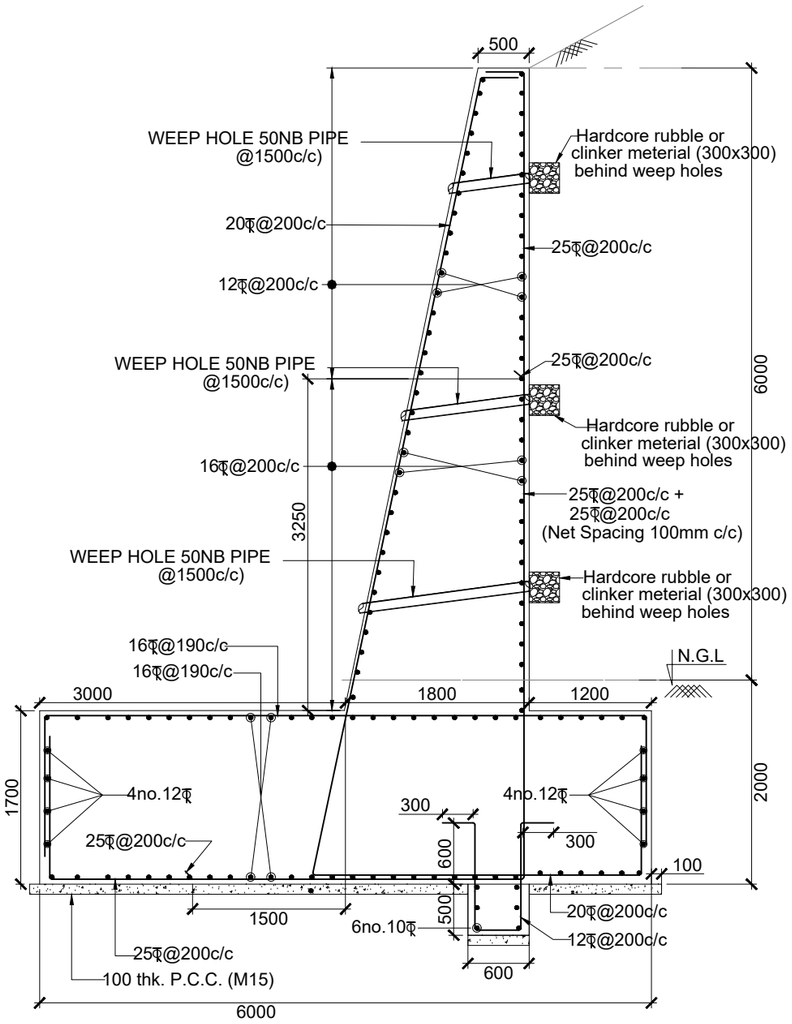
	NAME	DATE	SIGN
PREPARED BY	S.K.M	27.09.2021	
CHECKED BY	P.D	27.09.2021	
SUBMITTED BY	ANURAG TIWARI	27.09.2021	

Kailash Devbuild (India) Pvt. Ltd

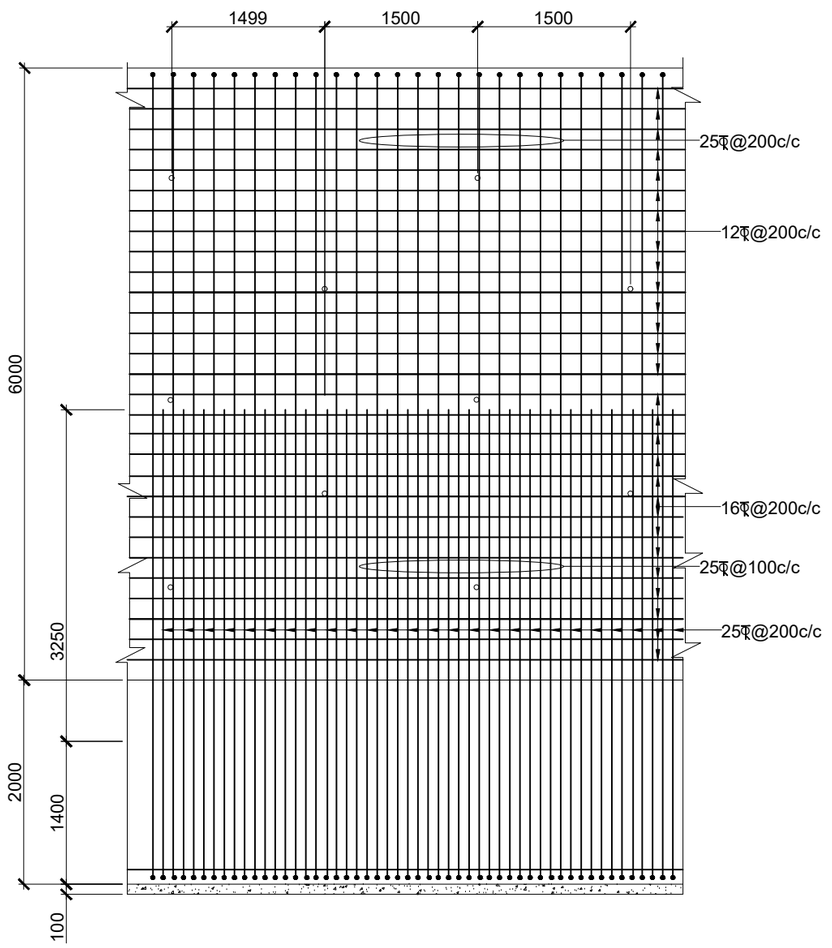
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



TYPICAL RETAINING WALL FOR 6M HEIGHT



Weep hole elevation

Notes:-

1. All dimensions are in mm
2. Do not scale any dimensions
3. Concrete grade shall be M25.
4. This drawing shall be read in conjunction with relevant structure/services drawings. Any discrepancy found therein consultant.
5. Steel R/F Fe 500 shall be used. and Steel R/F shall conform to IS: 1786
6. S.B.C of soil is taken as 15 T/m at 1.5m below N.G.L & 20 T/m at 2m below N.G.L

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	NS CONSULTING & ENGINEERING SERVICES PVT. LTD. Office : H-No. 11, Second floor -09, Ayanagar, New Delhi - 110047.		
TITLE	RETAINING WALL FOR 6M HEIGHT OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/01		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	95.33 KANAL 48180.4715 SQM		SH.NO.: 5 OF 5
	NAME	DATE	SIGN
PREPARED BY	S.K.M	27.09.2021	
CHECKED BY	P.D	27.09.2021	
SUBMITTED BY	ANURAG TIWARI	27.09.2021	

Kailash Devbuild (India) Pvt. Ltd

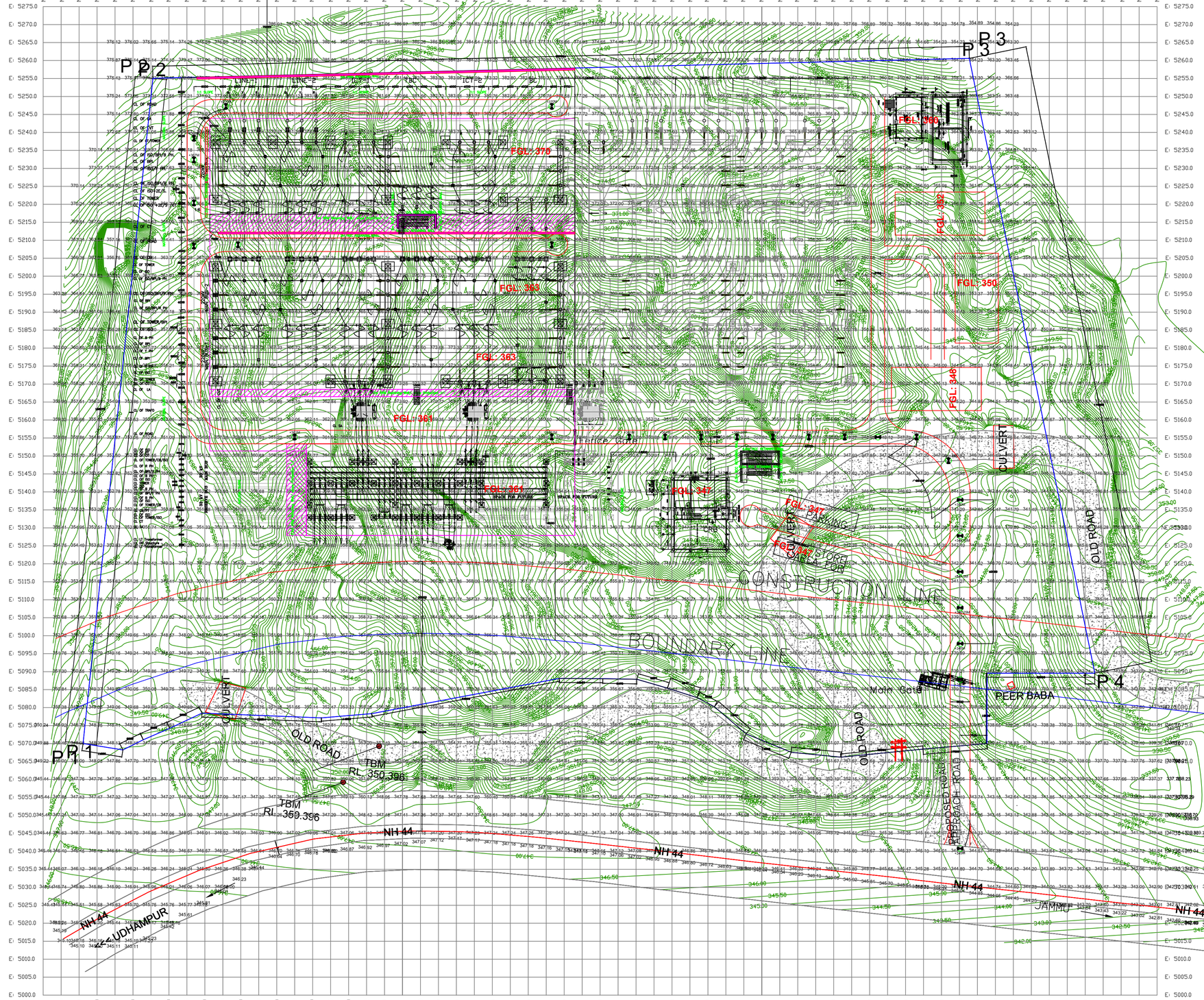
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

220KV Dead End Tower

SITE / CONTOUR PLAN OF 2 X 50 MVA, 220 / 33 KV, AIS GRID SUB-STATION NAGROTA, JAMMU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P 2
P 3
P 4
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LINE-II
ICT-I
ICT-II
BC
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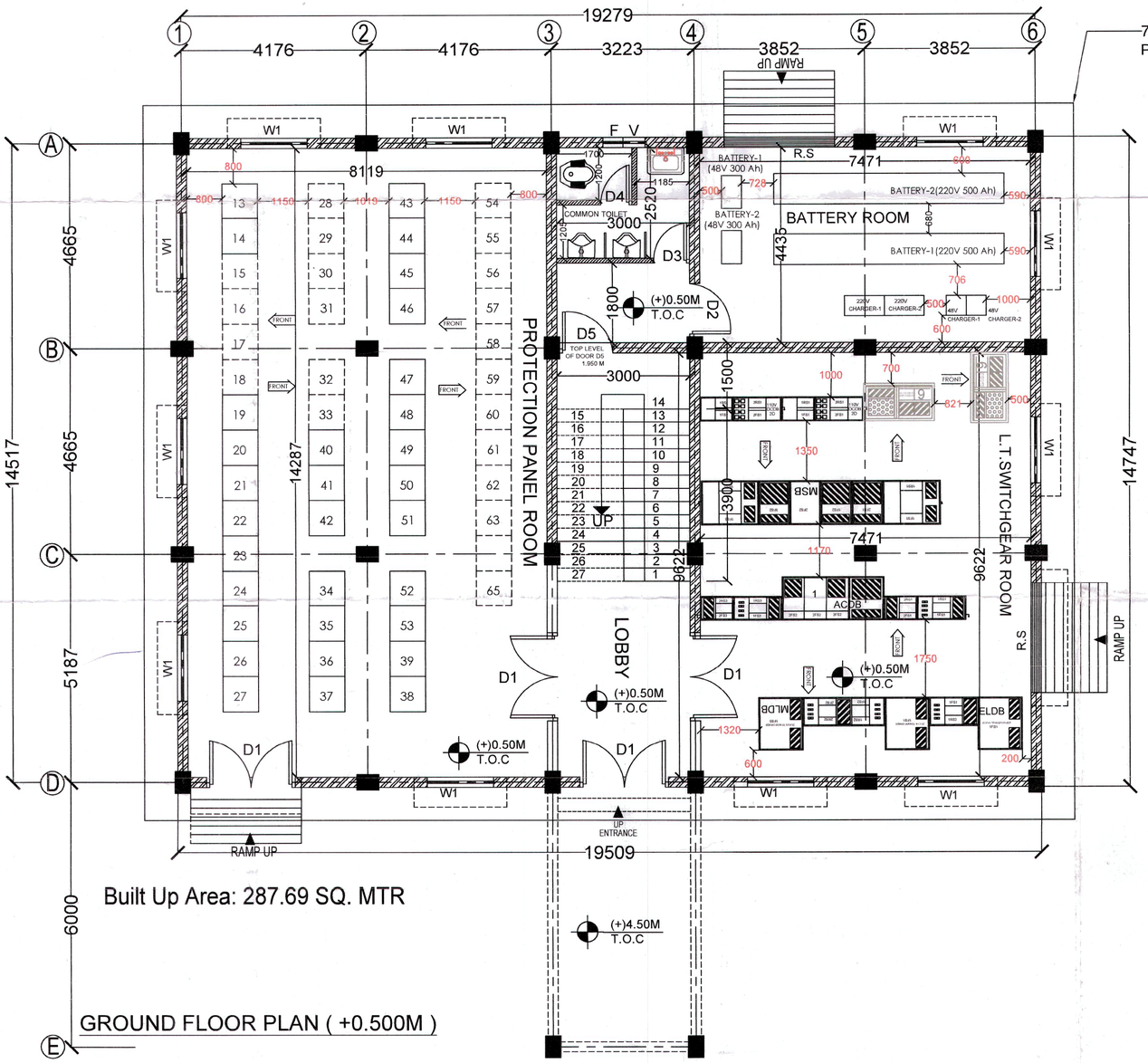


PANEL DETAILS

PANEL NO.	DESCRIPTION	SIZE
1	ACDB	6000X1000X2375
2	MSB	5400X1000X2375
3	MLDB	3850X1200X2375
4	ELDB	1200X2100X2375
5	DCDB-1(220V)	1850X550X2375
6	DCDB-2(220V)	1850X550X2375
7	DCDB-1(48V)	1600X850X1800
8	DCDB-2(48V)	1600X850X1800
9	220V BATTERY CHARGER-1	900X450
10	220V BATTERY CHARGER-2	900X450
11	48V BATTERY CHARGER-1	450X450
12	48V BATTERY CHARGER-2	1200X800
13	220 KV LINE PROTECTION-1	800X900X2315
14	220 KV LINE PROTECTION-2	800X900X2315
15	220 KV LINE PROTECTION-1(F)	800X900X2315
16	220 KV LINE PROTECTION-2(F)	800X900X2315
17	220 KV LINE PROTECTION-3(F)	800X900X2315
18	220 KV LINE PROTECTION-4(F)	800X900X2315
19	220KV TRF-1 (HV & LV)	800X800X2315
20	220KV TRF-2 (HV & LV)	800X800X2315
21	220KV BUSBAR PROTECTION	800X800X2315
22	220 KV CB RELAY LINE-1	800X800X2315
23	220 KV CB RELAY LINE-2	800X800X2315
24	220 KV CB RELAY ICT-1	800X800X2315
25	220 KV CB RELAY ICT-2	800X800X2315
26	220 KV CB RELAY TBC	800X800X2315
27	220 KV CB RELAY BC	800X800X2315
28	220 KV CB RELAY LINE-3 (F)	800X800X2315
29	220 KV CB RELAY LINE-4 (F)	800X800X2315
30	220 KV CB RELAY LINE-5 (F)	800X800X2315
31	220 KV CB RELAY LINE-6 (F)	800X800X2315
32	220 KV CB RELAY ICT-3 (F)	800X800X2315

PANEL DETAILS

33	220KV TRF-3 (HV & LV) (F)	800X800X2315
34	DPC PANEL -1	800X800X2315
35	DPC PANEL -2	800X800X2315
36	FOTE-1	800X800X2315
37	SDH PANEL	800X800X2315
38	SAS PANEL-1	800X800X2315
39	SAS PANEL-2	800X800X2315
40	33KV LINE PROTECTION-1	800X800X2315
41	33KV LINE PROTECTION-1	800X800X2315
42	33KV LINE PROTECTION-1	800X800X2315
43	33KV LINE PROTECTION-1	800X800X2315
44	33 KV CB RELAY LINE-1	800X800X2315
45	33 KV CB RELAY LINE-2	800X800X2315
46	33 KV CB RELAY LINE-3	800X800X2315
47	33 KV CB RELAY LINE-4	800X800X2315
48	33 KV CB RELAY ICT-1	800X800X2315
49	33 KV CB RELAY ICT-2	800X800X2315
50	33 KV CB RELAY BC	800X800X2315
51	33 KV CB RELAY LT TRF	800X800X2315
52	RTCC-1	800X800X2315
53	RTCC-2	800X800X2315
54	RTCC-3 (F)	800X800X2315
55	33KV LINE PROTECTION-5 (F)	800X800X2315
56	33KV LINE PROTECTION-6 (F)	800X800X2315
57	33KV LINE PROTECTION-7 (F)	800X800X2315
58	33KV LINE PROTECTION-8 (F)	800X800X2315
59	33KV LINE PROTECTION-9 (F)	800X800X2315
60	33 KV CB RELAY LINE-5 (F)	800X800X2315
61	33 KV CB RELAY LINE-6 (F)	800X800X2315
62	33 KV CB RELAY LINE-7 (F)	800X800X2315
63	33 KV CB RELAY LINE-8(F)	800X800X2315
64	33 KV CB RELAY LINE-9 (F)	800X800X2315
65	33 KV CB RELAY ICT-3 (F)	800X800X2315

LEGENDS:-

- WALL 230 MM THK.
- WALL 115 MM THK.
- (W) WINDOW
- (D) DOOR
- (V) VENTILATOR
- (G) GLAZING
- (F) EXHAUST FAN
- (R.S) ROLLING SHUTTER

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Transmission Projects Company Limited(RECTPCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	CONTROL ROOM BUILDING GROUND FLOOR PLAN, 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/09	REV- 01	
SCALE	As shown in Drawing	SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM	SH. NO.:- 1 OF 5	

	NAME	DATE	SIGN
PREPARED BY	AMIR	22.05.2021	
CHECKED BY	G.H	22.05.2021	
SUBMITTED BY	Er. SANJAY	22.05.2021	

R.C BANSAL

Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

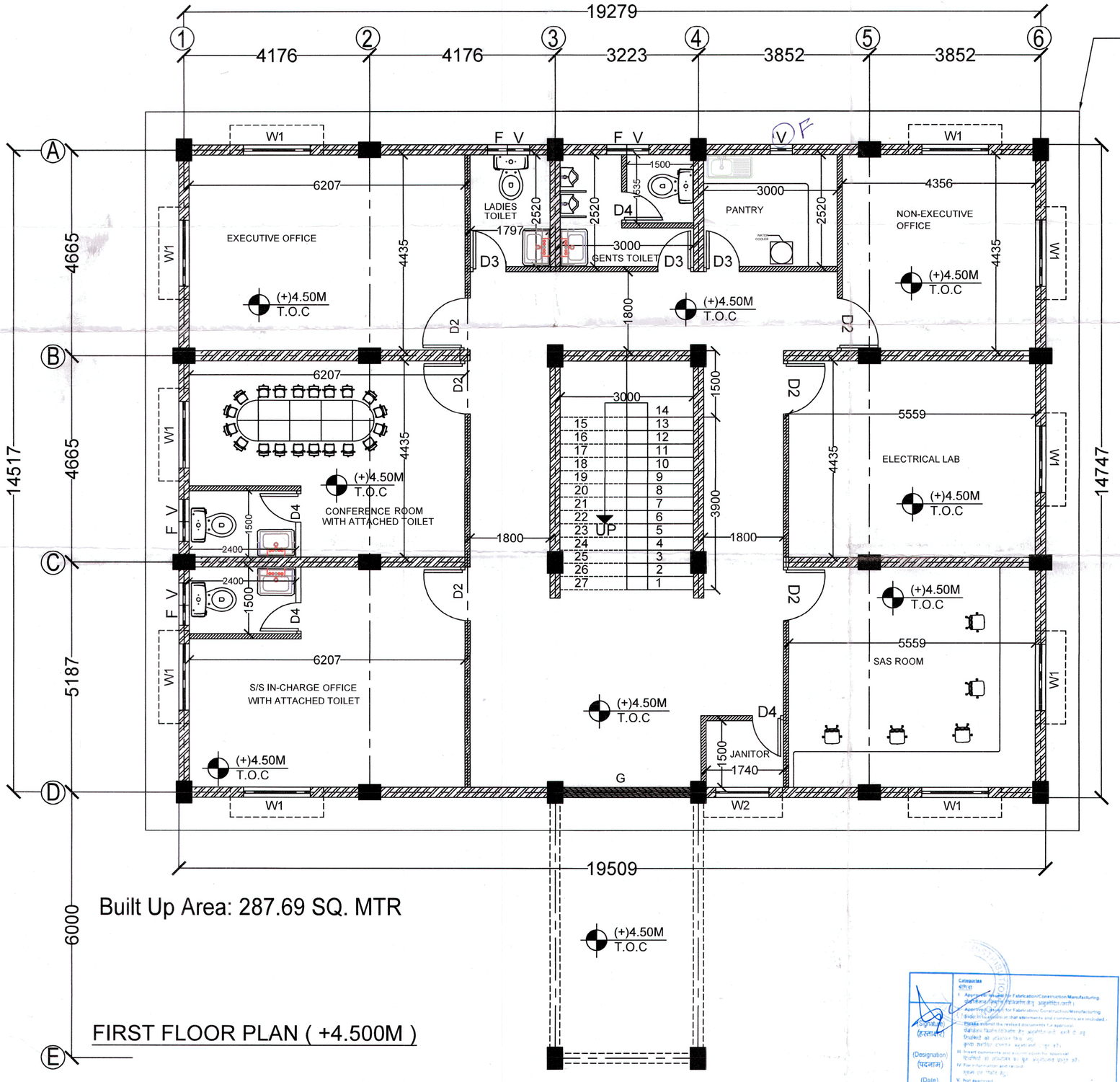
☐ More Information Date.....

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

(Designation) (पदनाम)

(Date) (तिथि)

Categories
श्रेणियां
A) Approved subject to for Fabrication/Construction/Manufacturing.
निर्माण/विनिर्माण के लिए अनुमोदित की जाती है।
B) To comply as noted. Resubmission not required.
टिप्पणी के अनुसार पालन करें। पुनः प्रस्तुत करने की आवश्यकता नहीं है।
C) Not approved. Please submit the revised documents for approval.
अस्वीकृत। कृपया संशोधित दस्तावेज अनुमोदन के लिए भेजें।
D) To comply as noted. Resubmission not required. All comments are included.
टिप्पणी के अनुसार पालन करें। पुनः प्रस्तुत करने की आवश्यकता नहीं है। सभी टिप्पणियां शामिल हैं।
Please submit the revised documents for approval.
कृपया संशोधित दस्तावेज अनुमोदन के लिए भेजें।
E) Resubmit comments and submit again for approval.
टिप्पणियों को संशोधित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।



Built Up Area: 287.69 SQ. MTR

FIRST FLOOR PLAN (+4.500M)

LEGENDS:-

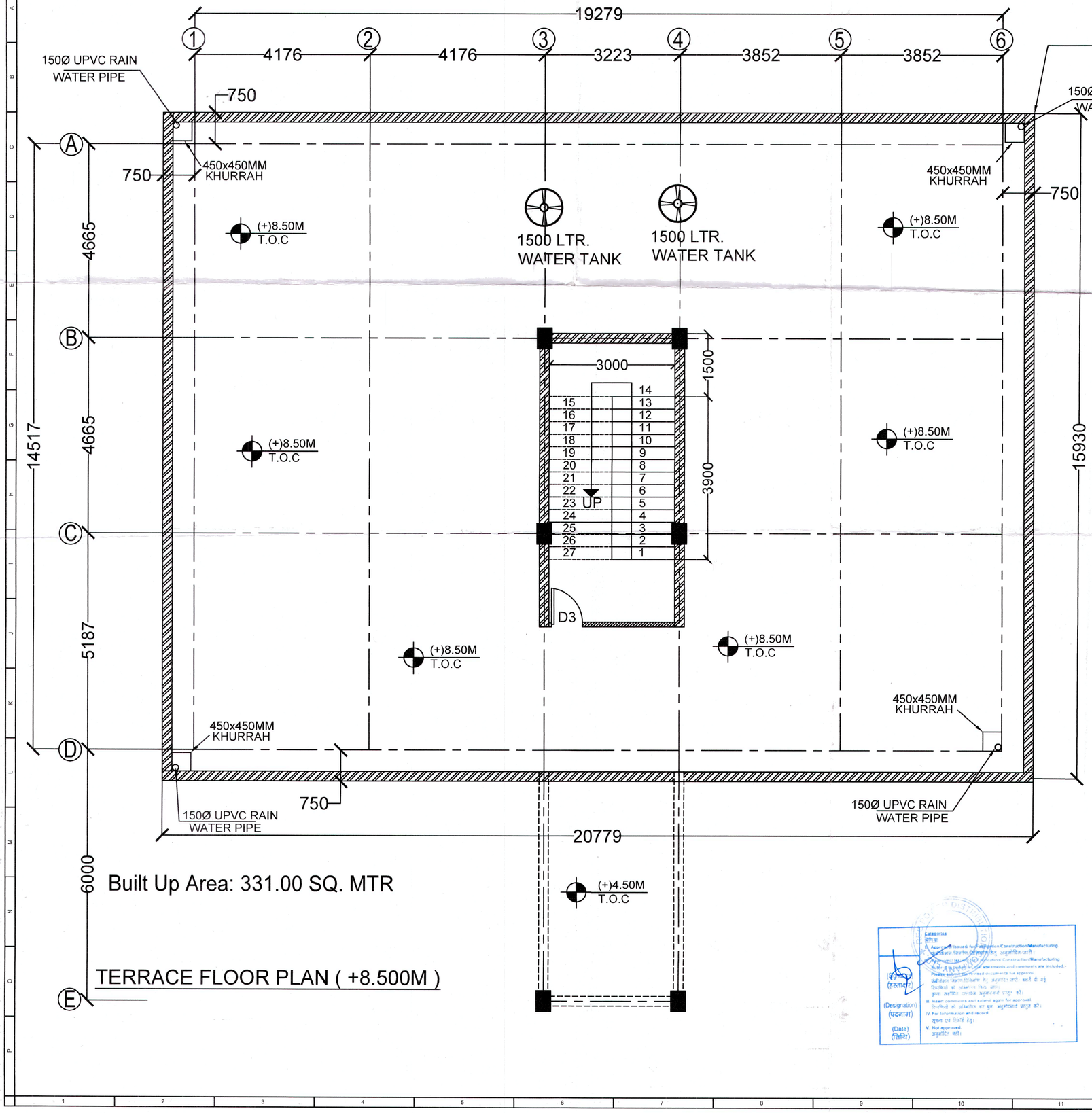
- WALL 230 MM THK.
- WALL 115 MM THK.
- (W) WINDOW
- (D) DOOR
- (V) VENTILATOR
- (G) GLAZING
- (F) EXHAUST FAN
- (R.S) ROLLING SHUTTER

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Transmission Projects Company Limited(RECTPCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	CONTROL ROOM BUILDING FIRST FLOOR PLAN, 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/09		REV- 01	
SCALE	As shown in Drawing		SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM		SH. NO.:- 2 OF 5	
	NAME	DATE	SIGN	
PREPARED BY	AMIR	22.05.2021		R.C BANSAL
CHECKED BY	G.H	22.05.2021		
SUBMITTED BY	Er. SANJAY	22.05.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



LEGENDS:-

- WALL 230 MM THK.
- WALL 115 MM THK.
- (W) WINDOW
- (D) DOOR
- (V) VENTILATOR
- (G) GLAZING
- (F) EXHAUST FAN
- (R.S) ROLLING SHUTTER

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Transmission Projects Company Limited(RECTPCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	CONTROL ROOM BUILDING TERRACE FLOOR PLAN, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/09 — REV- 01
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH. NO.:- 3 OF 5

	NAME	DATE	SIGN
PREPARED BY	AMIR	22.05.2021	
CHECKED BY	G.H	22.05.2021	
SUBMITTED BY	Er. SANJAY	22.05.2021	

R.C BANSAL
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Categories
(श्रेणियां)
I. Approved issued for start of Construction/Manufacturing.
निर्माण/विनिर्माण प्रारंभ करने हेतु अनुमोदित जारी।
II. Approved issued to start of Construction/Manufacturing.
Provided all the final statements and comments are included.
निर्माण/विनिर्माण प्रारंभ करने हेतु अनुमोदित जारी, बशर्ते दी गई टिप्पणियों का शामिल किया जाए।
III. Revise and resubmit documents for approval.
कृपया अनुमोदित दस्तावेजों को पुनः अनुमोदन हेतु करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Designation) (पदनाम)
(Date) (तिथि)

INTERNAL FINISHING SCHEDULE CONTROL ROOM BUILDING AND GIS HALL.

S.No	LOCATION	FLOORING & SKIRTING 150MM HIGH	WALL(INTERNAL)	CEILING	DOOR,WINDOWS & VENTILATOR
1	Control Room	Vitrified tiles 8mm thk. size 600 x 600mm.	Premium Acrylic emulsion paint on smooth surface applied with plaster of paris (2 mm thick)	White wash above False Ceiling	Windows shall be powder coated aluminium frames of 5.5 mm double glass, hermetically sealed with air gap of 40 mm by using suitable patch fittings/spider fittings. The glass shall extend horizontally from column to column and vertically from sill level of 0.75 m to bottom of lintel/roof beam. All doors shall be glazed powder coated aluminium doors and frames with 5.5.mm Thick double glazing & hermetically sealed.
2	Conference	Vitrified tiles 8mm thk. size 600 x 600mm.	Premium Acrylic emulsion paint on smooth surface applied with plaster of paris (2 mm thick)	White wash above False Ceiling	Windows shall be of powder coated aluminium frames with 5.5mm Thick double glazing & hermetically sealed. All doors shall be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
3	S/S In-Charge Room	Vitrified tiles 8mm thk. size 600 x 600mm.	Premium Acrylic emulsion paint on smooth surface applied with plaster of paris (2 mm thick)	White wash above False Ceiling	Windows shall be of powder coated aluminium frames with 5.5mm Thick double glazing & hermetically sealed. All doors shall be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
4	Office Room	Vitrified tiles 8mm thk. size 600 x 600mm.	Premium Acrylic emulsion paint on smooth surface applied with plaster of paris (2 mm thick)	White wash above False Ceiling	Windows shall be of powder coated aluminium frames with 5.5mm Thick double glazing & hermetically sealed. All doors shall be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
5	Electronics Test Lab	Vitrified tiles 8mm thk. size 600 x 600mm.	Premium Acrylic emulsion paint on smooth surface applied with plaster of paris (2 mm thick)	White wash above False Ceiling	Windows shall be of powder coated aluminium frames with 5.5mm Thick double glazing & hermetically sealed. All doors shall be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
6	ACDB&DCDB Room	62 mm thick cement concrete flooring with metallic hardener topping. skirting shall be of cement sandplaster.	Oil bound washable distemper on smooth surface applied with plaster of paris putty	Oil bound washable distemper on smooth surface applied with plaster of paris putty	Steel door 45mm thick double sheet 18 gauge MS steel suitably reinforced and filled with mineral wool. Windows/ventilator shall be of powder coated aluminium with 4mm glazing.
7	Battery Room	Vitrified tiles 8mm thk. size 600 x 600mm.	Premium Acrylic emulsion paint on smooth surface applied with plaster of paris (2 mm thick)	False ceiling and white wash above False Ceiling	Steel door 45mm thick double sheet 18 gauge MS steel suitably reinforced and filled with mineral wool. Windows/ventilator shall be of powder coated aluminium with 4mm glazing.
8	Lobby	Vitrified tiles 8mm thk. size 600 x 600mm.	Premium Acrylic emulsion paint on smooth surface applied with plaster of paris (2 mm thick)	Oil bound washable distemper on smooth surface applied with plaster of paris putty	Windows shall be of powder coated aluminium frames with 5.5mm Thick double glazing & hermetically sealed. All doors shall be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
9	Reception/ Lobby/ Corridor	Vitrified tiles size 600 x 600mm.	Premium Acrylic emulsion paint on smooth surface applied with plaster of paris (2 mm thick)	Oil bound washable distemper on smooth surface applied with plaster of paris putty	Windows shall be of powder coated aluminium frames with 5.5mm Thick double glazing & hermetically sealed. All doors shall be glazed powder coated aluminium doors with 5.5.mm Thick double glazing & hermetically sealed.
10	Portico	Cast-in-situ 52mm thk. Cement concrete with metallic hardner	Granite cladding	Oil bound washable distemper on smooth surface applied with plaster of paris putty	All doors shall be glazed powder coated aluminium doors with 5.5mm thk. Glazing & hermetically sealed.
11	Toilet	Ceramic tiles	Vitrified tiles 8mm thk. size 600 x 600mm.	Oil bound washable distemper	Windows/ ventilator shall be of powder coated aluminium with 5.5mm thick double glazing & hermetically sealed. All doors shall be flush door shutters made of pre-laminated particle board (with powder coated aluminium frame.)
12	Janitor Room	Ceramic tiles with white cement	DADO glazed tile 2100mm height,oil bound washable distemper above DADO.	Oil bound washable distemper	Windows/ ventilator shall be of powder coated aluminium with 5.5mm thick double glazing & hermetically sealed. All doors shall be flush door shutters made of pre-laminated particle board (with powder coated aluminium frame.)

WATERPROOFING DETAILS:-

Roof of the building shall consist of cast-in-situ R.C.C. slab treated with a water proofing system which shall be an integral cement based treatment conforming to relevant Indian Standards/ equivalent International Standards. The water proofing treatment shall comprise the following:

(a) Applying a cement slurry coat of neat cement using 2.75 kg/m2 of cement admixed with water proofing compound conforming to relevant Indian Standards/equivalent International Standards over the R.C.C. slab including cleaning the surface with wire brushes and keeping the cleaned surface wet for 24 hours before treatment.

(b) Laying cement concrete using broken stone of size from 25mm to 100mm size with 50% of cement mortar 1:5 (1 cement: 5 coarse sand admixed with water proofing compound conforming to relevant Indian Standards/ equivalent International Standards over 20mm thick layer of cement mortar 1:5 (1 Cement: 5 coarse sand) admixed with water proofing compound conforming to relevant Indian Standards/ equivalent International Standards to required slope and treating similarly the adjoining walls up to 300mm height including rounding of junctions of walls and slabs.

(c) After two days of proper curing, applying a second coat of cement slurry admixed with water proofing compound conforming relevant Indian Standards/ equivalent International Standards.

(d) Finishing the surface with 20mm thick joint less cement mortar of mix 1:4 (1 cement : 4 coarse sand) admixed with waterproofing compound conforming to relevant Indian Standards/ equivalent International Standards and finally finishing the surface with trowel with neat cement slurry and making of 300 x 300 mm square.

(e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All the above operations shall be carried out in order specified above and as directed by the Employer/PMC.

(f) Average thickness of water proofing shall be 120 mm and minimum thickness at khurra shall be 65 mm.

LEGENDS:-

WALL 230 MM THK.

WALL 115 MM THK.

(W) WINDOW

(D) DOOR

(V) VENTILATOR

(G) GLAZING

(F) EXHAUST FAN

(R.S) ROLLING SHUTTER

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Transmission Projects Company Limited(RECTPCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	GENRAL NOTES OF CONTROL ROOM BUILDING , 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/09 — REV- 01
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH. NO.:- 4 OF 5

	NAME	DATE	SIGN
PREPARED BY	AMIR	22.05.2021	
CHECKED BY	G.H	22.05.2021	
SUBMITTED BY	Er. SANJAY	22.05.2021	

R.C BANSAL

Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information

Date (दिनांक) (Designation) (पदनाम) (Date) (तिथि)

I. Approved drawings for Fabrication/Construction. निर्माण/निर्माण हेतु अनुमोदित जारी

II. Approved as noted. Resubmit after incorporating comments. टिप्पणियों को शामिल करने के बाद पुनः प्रस्तुत करें।

III. Insert comments and submit again for approval टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।

IV. For information and record. सूचना एवं रिकॉर्ड हेतु।

V. Not approved. अनुमोदित नहीं।

Note:-

1. HEIGHT OF ROOMS TO BE CLEARED AS PER ELECTRICAL REQUIREMENT BEFORE RELEASE.
2. PROVIDE OPENING IN WALL FOR CABLE ENTRY AS PER ELECTRICAL LAYOUT.
3. MINIMUM THICKNESS OF EXTERNAL WALLS SHALL BE 230 MM (ONE BRICK) THICK AND SHALL BE LAID IN CEMENT SAND MORTAR 1:6 (1 CEMENT: 6 COARSE SAND).
4. INTERNAL PARTITION WALLS, SHALL BE OF 115 MM THICK(HALF BRICK) REINFORCED BRICK MASONRY WALL IN CEMENT SAND MORTAR 1:4 (1 CEMENT : 4COARSE SAND) DULY PROVIDING TWO 6 MM REINFORCEMENT BARS AT EVERY FOURTH LAYER.
5. MINIMUM HEIGHT OF SKIRTING ABOVE FINISHED FLOOR LEVEL SHALL BE 150 MM.
6. EXTERNAL SURFACES OF BUILDINGS SHALL HAVE 18 MM THICK CEMENT SAND PLASTER IN TWO LAYERS, WITH THE UNDER LAYER OF 12MM THICK PLASTER IN 1:5 CEMENT SAND MORTAR (1CEMENT : 5 MEDIUM SAND) AND THE TOP LAYER 6.0 MM THICK PLASTER IN 1:6 CEMENT SAND MORTAR (1 CEMENT : 6 FINE SAND).
7. INSIDE FACES OF WALLS SHALL BE PROVIDED 12MM OR 15 MM THICK CEMENT SAND PLASTER IN 1:6 CEMENT SAND MORTAR (1 CEMENT : 6 FINE SAND). ROUGH FACES OF WALLS SHALL RECEIVE 15MM THICK CEMENT SAND PLASTER AND EVEN FACES, 12 MM THICK CEMENT SAND PLASTER.
8. ALL R.C.C. CEILINGS SHALL BE PROVIDED WITH 6.0 MM THICK CEMENT SAND PLASTER IN 1:3 CEMENT SAND MORTAR (1CEMENT : 3 FINE SAND) EXCEPT FOR AREAS WITH FALSE CEILING .
9. ALL DIMENSIONS ARE IN MM.
10. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSIONS ONLY.
11. ALL DIMENSIONS SHALL BE CHECKED PRIOR TO EXECUTION
12. FOR LOCATION OF BUILDING REFER GA PLAN OF THE WORK.
13. LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGE IN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
14. ANY DESCREPANCY IN DRAWING TO BE BROUGHT TO THE NOTICE OF SITE INCHARGE.
15. COLUMN SHOWN IN THE DRAWING ARE INDICATIVE, FOR EXACT COLUMN LOCATIONS REFER STRUCTURAL DRAWING
16. SITE SHALL PROCURE THE LOOSE FURNITURES SEPARATELY
17. DIMENSIONS OF COLUMN AND BEAM SUBJECT TO CHANGE
18. 150 MM DIAMETER UPVC RAINWATER DOWN COMER PIPES CONFORMING TO RELEVANT INDIAN STANDARD / EQUIVALENT INTERNATIONAL STANDARDS WITH WATER TIGHT LEAD JOINTS SHALL BE PROVIDED TO DRAIN OFF THE RAIN WATER FROM THE ROOFS
19. ALL OUTSIDE DOOR CHAJJA SHALL BE 750MM WIDE AND PROJECT 300MM BEYOND THE OPENING ON EITHER SIDE.
20. ALL OUTSIDE WINDOW CHAJJA SHALL BE 450MM WIDE AND PROJECT 300MM BEYOND THE OPENING ON EITHER SIDE.
21. CONC. FOR R.C.C WORK SHALL BE OF M25 GRADE
22. REINF. BARS SHALL BE H.Y.S.D. BARS OR TMT BARS CONFORMING TO IS:1786 AS PER B.P.S

SCHEDULE OF DOORS

SL. NO.	NOS. REQD.	MKD AS	MASONRY OPENING (WIDTHxHEIGHT)	SWING
1.	4	D1	2000 x 2700	SEE PLAN
2.	7	D2	1200 x 2400	SEE PLAN
3.	5	D3	800 x 2100	SEE PLAN
4.	5	D4	700 x 2100	SEE PLAN
5.	1	D5	1200 x 1950	SEE PLAN

SCHEDULE OF WINDOWS

SL. NO	MKD AS	MASONRY OPENING (WIDTHxHEIGHT)
1.	W1	1500 x 1500
2.	W2	1200 x 1500
3.	V	500 x 500
4.	F	450 x 450
5.	G	AS PER PLAN
6.	RS	2500 x 3000

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Transmission Projects Company Limited(RECTPCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	GENRAL NOTES OF CONTROL ROOM BUILDING , 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/09 — REV- 01
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH. NO.:- 5 OF 5

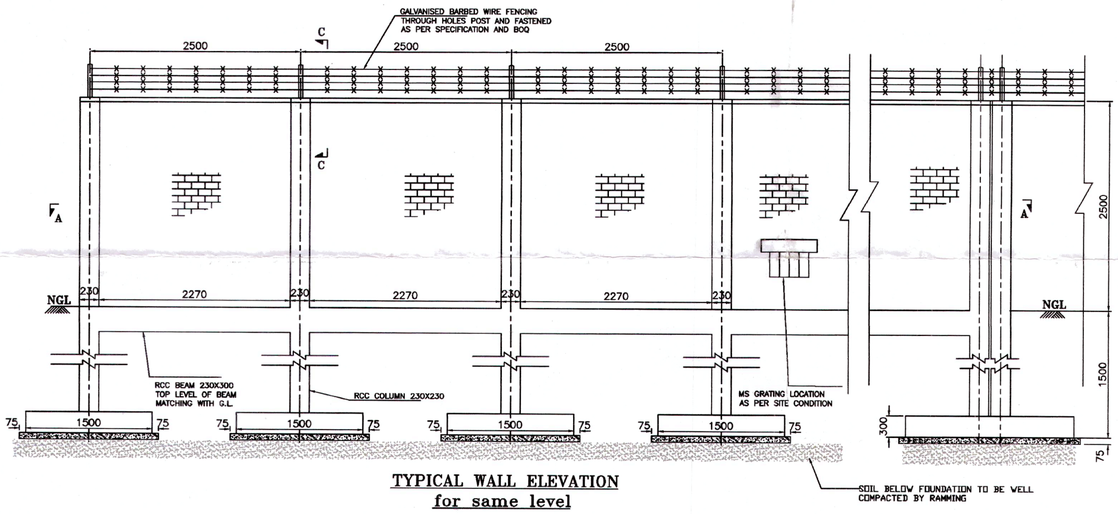
	NAME	DATE	SIGN	
PREPARED BY	AMIR	22.05.2021		R.C BANSAL
CHECKED BY	G.H	22.05.2021		
SUBMITTED BY	Er. SANJAY	22.05.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

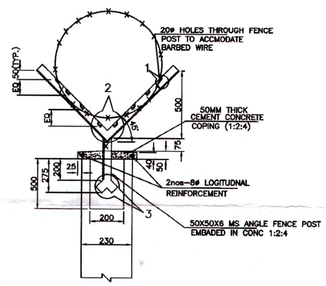
☐ More Information Date.....

Categories श्रेणियां
I. Approved for Fabrication/Construction/Manufacturing. फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/Issued for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते टी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

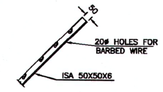
Kailash Devbuild (India) Pvt. Ltd. Jabalpur



TYPICAL WALL ELEVATION
for same level



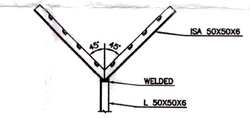
SECTION C–C



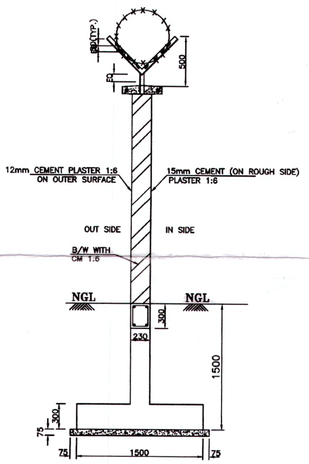
DETAIL–1



DETAIL '3'



DETAIL–2



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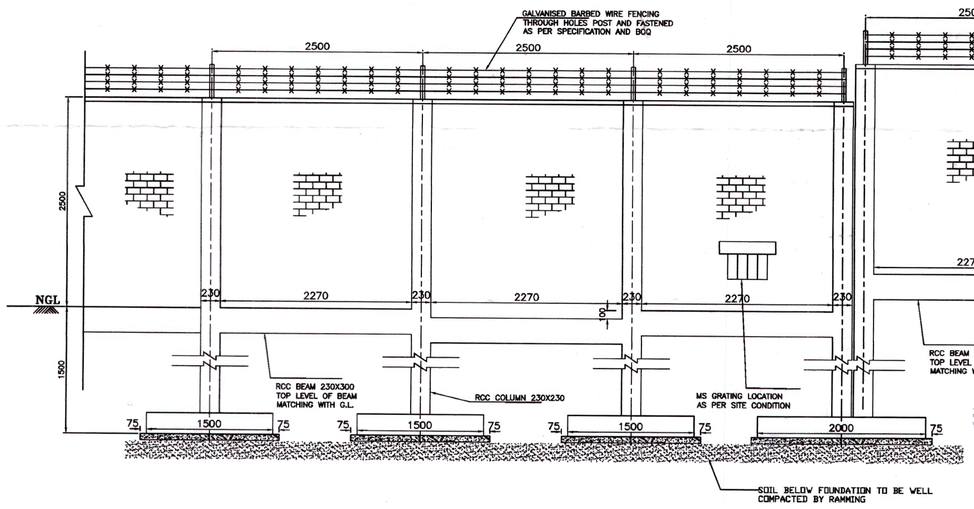
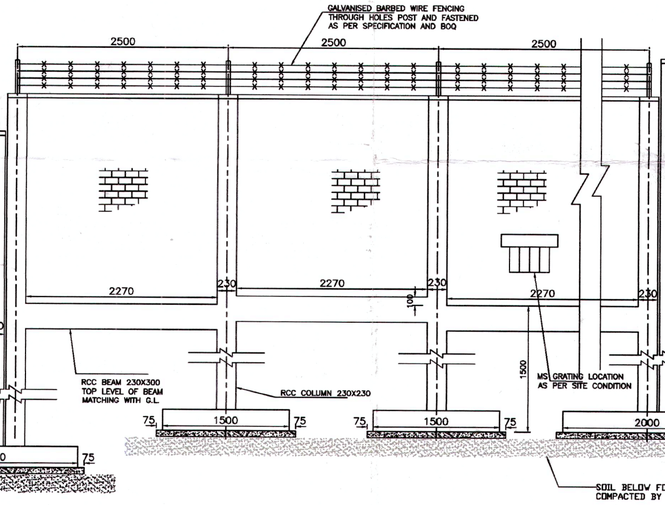
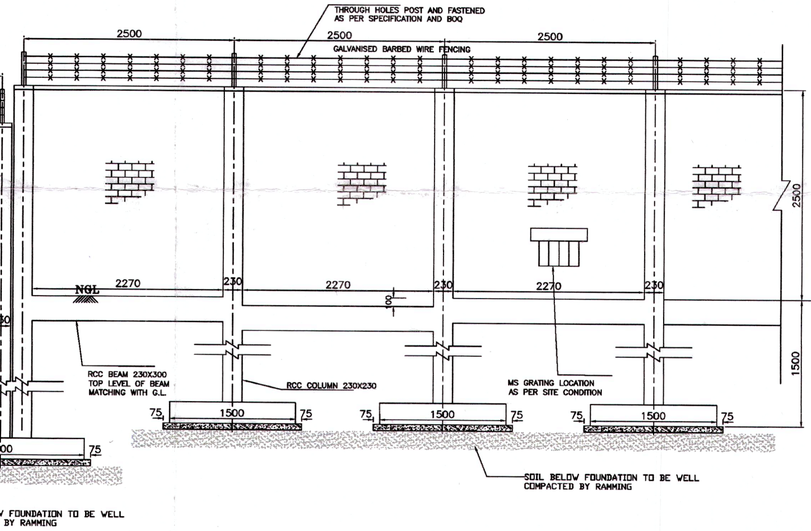
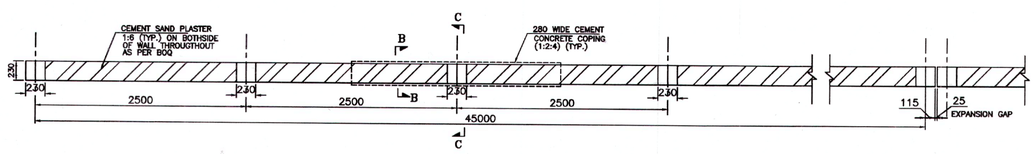


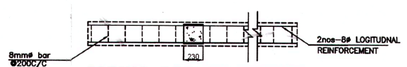




TYPICAL WALL ELEVATION
FOR VARIATION OF LEVEL



SECTION A–A



COPING REINFORCEMENT
DETAIL

NOTES–

1. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. LOCATION OF BOUNDARY WALL SHALL BE AS PER GA/DWG. LATEST APPROVED.
3. PROVIDE BRICK WORK IN ENGLISH BOND IN 1:6 CEMENT MORTAR(1 CEMENT :6 COARSE SAND.
4. CONC. GROUTING FOR ANGLE POST AT TOP OF BOUNDARY WALL SHALL BE IN 1:2:4 ((CEMENT: 2 COARSE SAND :4 STONE AGGREGATE).
5. a). BRICK TO BE DONE WITH BRICK OF FIRST CLASS DESIGNATION –75.
   b). PLASTER WORK SHALL BE AS PER TECHNICAL SPECIFICATION.
6. P.C.C. OF 1:4:8 GRADE SHALL BE WITH 40mm NOMINAL SIZE AGGREGATE.
7. EXPANSION JOINT ARE TO BE PROVIDED MIN. BOUNDARY WALL AT
   A) MAXIMUM OF 45METRE.
8. ALL EXPOSED PLASTER SURFACES ARE TO BE PAINTED WITH WATER PROOFING CEMENT PAINT AS PER BOQ.
9. STR. STEEL FOR ANGLE POSTS SHALL CONFORM TO IS:2062. ANGLE POST SHALL BE PAINTED WITH 2 OR MORE COATS OF ENAMEL PAINTS OF APPROVED BRAND AND MANUFACTURE OVER A PRIMING COAT OF APPROVED STEEL PRIMER.
10. ALL M.S SECTION USED FOR GRATING SHALL BE PAINTED WITH TWO OR MORE OF BLACK ANTICORROSIVE BITUMASTIC PAINT OF APPROVED BRAND AND MANUFACTURE OVER A PRIMING COAT OF APPROVED STEEL PRIMER.
11. CONC. FOR R.C.C WORK SHALL BE OF M25 GRADE
12. REINF. BARS SHALL BE H.Y.S.D. BARS OR TMT BARS CONFORMING TO IS:1786 LATEST REVISION.
13. STRUCTURE STEEL USED FOR GRATING SHALL CONFORM TO 1S:2062 LATEST EDITION.
14. LAP/ANCHORAGE SHALL BE 50 X DIA OF BAR
15. CLEAR COVER TO MAIN REINFORCEMENT SHALL BE AS FOLLOWS
    (a)FOOTING–50MM (b) SLAB–20MM (c) COLUMN–40MM d) BEAMS–25MM
16. TOP OF PLINTH BEAM SHALL BE REDUCED BY 100mm WHEREVER MS GRATING IS TO BE PROVIDED FOUNDATION SHALL BE PROVIDED.
17. THE SBC OF SOIL AT 1.5M DEPTH IS 6.1TN/SQM
18. EXPANSION JOINT ARE TO BE PROVIDED MIN. BOUNDARY WALL AT
    A) MAXIMUM OF 45METRE.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NDA No.	CD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-I/705 Dt. 06.11.2020 CD CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NDA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur–482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	BOUNDARY WALL OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/10		REV- 1	
SCALE	As shown in Drawing		SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM		SH.NO. 1 OF 3	
	NAME	DATE	SIGN	
PREPARED BY	RAVI	26.05.2021		R.C BANSAL
CHECKED BY	G.H	26.05.2021		Signature/Stamp...
SUBMITTED BY	RACHIT	26.05.2021		

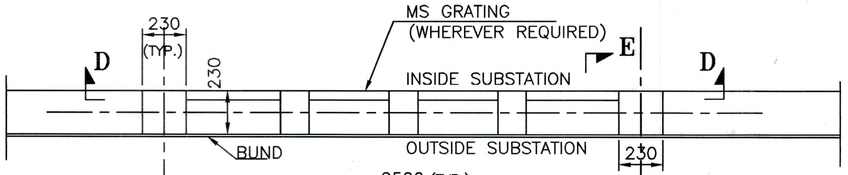
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

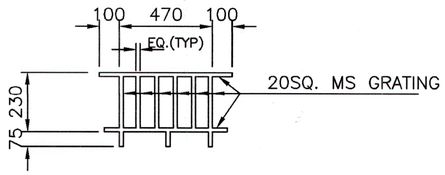
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (दिनांक)

Categories
श्रेणियां
I. Approved for Fabrications/Construction/Manufacturing.
निर्माण/निर्माण/विनिर्माण हेतु अनुमोदित।
II. Approved/ issued for Fabrications/ Construction/Manufacturing
Subject to condition that statements and comments are included..
Please submit the revised documents for approval.
शर्तों के अधीन निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते ये नई
टिप्पणियों को शामिल किया जाए
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें.
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

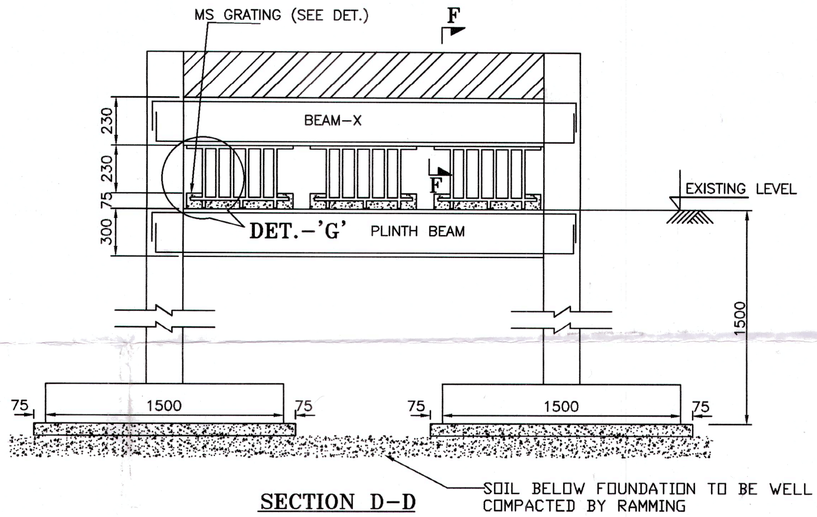
Kailash Devbuild (India) Pvt. Ltd. Jabalpur



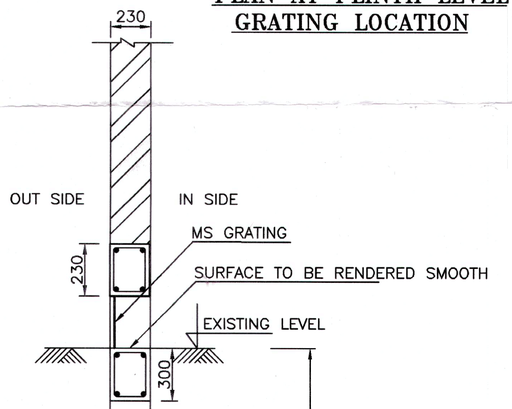
PLAN AT PLINTH LEVEL GRATING LOCATION



MS GRATING FOR DRAINAGE THROUGH BOUNDARY WALL



SECTION D–D



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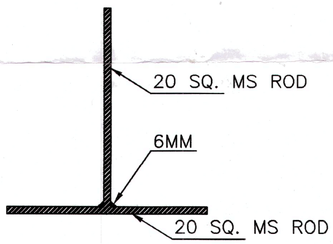
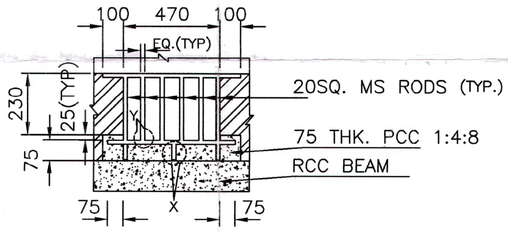
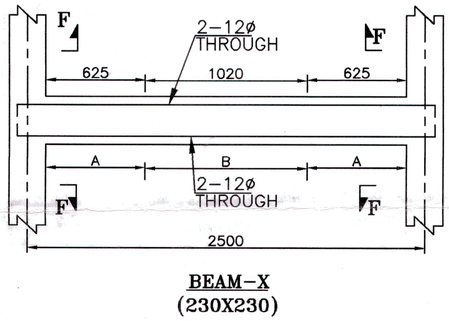


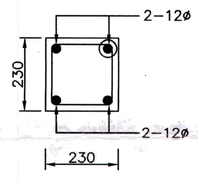
DETAIL 'Y'



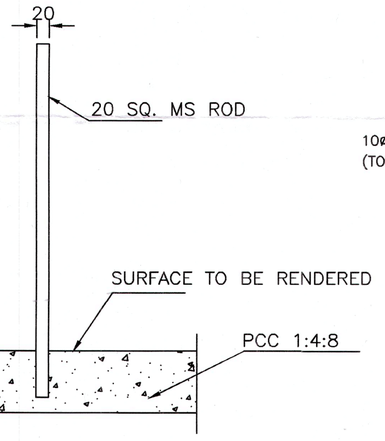
MS GRATING FOR DRAINAGE THROUGH BOUNDARY WALL DETAIL 'G'



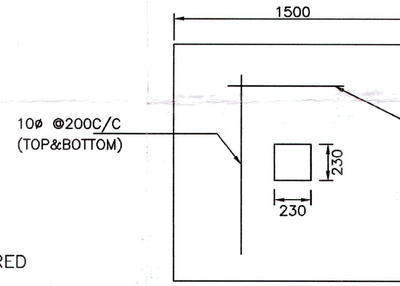
BEAM–X (230X230)



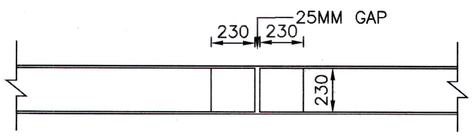
SECTION F–F



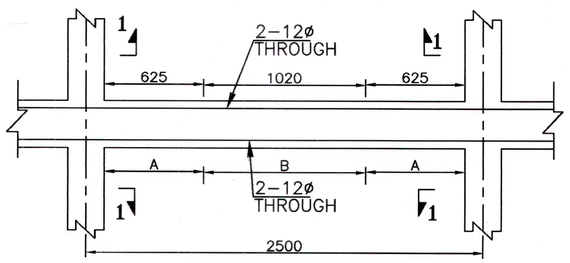
TYP. DETAIL OF –'X'



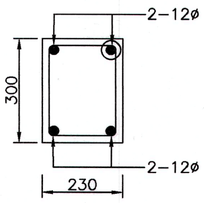
TYP. FOOTING REINFORCEMENT DETAILS



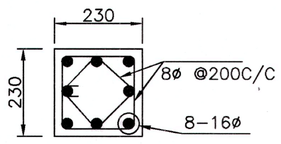
TYP. DETAIL EXPANSION JOINT



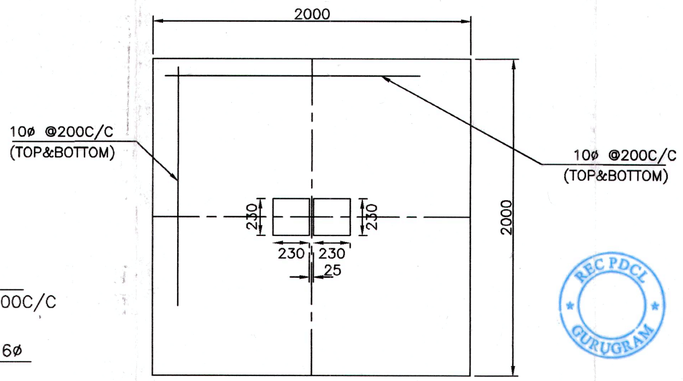
PLINTH BEAM (300X230)



SECTION 1–1



TYP. COLUMN REINFORCEMENT DETAILS



TYP. FOOTING FOR TWIN COLUMN (EXPANSION JOINT) REINFORCEMENT DETAILS

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	BOUNDARY WALL OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/10	REV- 1	
SCALE	As shown in Drawing	SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 2 OF 3	
	NAME DATE	SIGN	
PREPARED BY	RAVI 26.05.2021		R.C BANSAL
CHECKED BY	G.H 26.05.2021		Signature/Stamp...
SUBMITTED BY	RACHIT 26.05.2021		

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

REC PDCL GURUGRAM

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

BAR BENDING SCHEDULE OF COLUMN

COLUMN TYPE- C1	DIA OF BARS	LENGTH OF BAR (MM) a	b		LENGTH OF ONE BAR	NO. OF BARS/COLUMN	UNIT WEIGHT OF BAR (Kg/M)	COLUMN QTY.	TOTAL WT OF BAR(Kg)	SHAPE
MAIN REFN.	Y16	3850	800	HOOK (c)	4650	8	1.58	1	58.785	a / b
	DIA OF BARS	a	b		LENGTH OF ONE RING BAR	NO. OF STIRRUPS/COLUMN	UNIT WEIGHT OF BAR (Kg/M)	COLUMN QTY.	TOTAL WT OF BAR(Kg)	SHAPE
STIRRUPS	Y8	170	170	80	840	22	0.395	1	7.301	c a / b a b
	Y8	120	120	80	400	22	0.395	1	3.477	a c b / b a
							TOTAL WT (Kg) =		69.562	
							TOTAL WT (TONNE) =		0.070	

BAR BENDING SCHEDULE FOR FOOTING

FOOTING REINFORCEMENT (F1)

		DIA OF BARS	SPACING	LENGTH OF BAR (MM)		NO. OF BARS	UNIT WEIGHT OF BAR (Kg/M)	TOTAL WEIGHT OF BAR IN Kg.
TOP	MAIN REFN.	Y10	10Ø@200c/c	1400+200+200	1800	7	0.617	7.78
	DISTRIBUTION REFN.	Y10	10Ø@200c/c	1400+200+200	1800	7	0.617	7.78
BOTTOM	MAIN REFN.	Y10	10Ø@200c/c	1400+200+200	1800	7	0.617	7.78
	DISTRIBUTION REFN.	Y10	10Ø@200c/c	1400+200+200	1800	7	0.617	7.78
							TOTAL Wt.=	31.11 Kg

TOTAL Wt. OF REINFORCEMENT IN TONNE = 0.03 Tn

BAR BENDING SCHEDULE OF COPING

COLUMN TYPE- C1	DIA OF BARS	LENGTH OF BAR (MM) a		LENGTH OF ONE BAR	NO. OF BARS/COLUMN	UNIT WEIGHT OF BAR (Kg/M)	COLUMN QTY.	TOTAL WT OF BAR(Kg)
MAIN REFN.	Y8	2680	HOOK (c)	2680	2	0.40	1	2.118
	Y8	230		230	13	0.40	1	1.181
						TOTAL WT (Kg) =		3.299
						TOTAL WT (TONNE) =		0.003

PLINTH BEAM

Name of Work :-

Sl. No.	Description	Symbol	Dia of Bar	Shape of Bars	Spacing	Span Length	No. of Bars			Total Nos.	Length in Mtr	Total Length	8	10	12	16	20	25	28	32
1	PLINTH BEAM																			
	PB1(a)																			
	Bottom Main Bar		12	250 / 2680 / 250			1	2	1	2	3.18	6.36			6.360					
	Top Main Bar		12	250 / 2680 / 250			1	2	1	2	3.18	6.36			6.360					
	Main Ties		8	250 / 180 / 180 / 250			1	7	1	7	0.98	6.86	6.860							
	Main Ties		8	250 / 180 / 180 / 250			1	8	1	8	0.98	7.84	7.840							
	Main Ties		8	250 / 180 / 180 / 250			1	7	1	7	0.98	6.86	6.860							
	Total Qty. (In Rmt)												21.560		12.720					
	Unit Weight (Kg/Rmt)												0.395	0.617	0.889	1.58	2.469	3.858	4.84	6.321
	Total Qty. (In Kg)												8.5162		11.30808					
													8.516		11.308					

TOTAL Qty. (In Kg) 19.82428

GRATING BEAM

Name of Work :-

Sl. No.	Description	Symbol	Dia of Bar	Shape of Bars	Spacing	Span Length	No. of Bars			Total Nos.	Length in Mtr	Total Length	8	10	12	16	20	25	28	32
1	PLINTH BEAM																			
	PB1(a)																			
	Bottom Main Bar		12	250 / 2680 / 250			1	2	1	2	3.18	6.36			6.360					
	Top Main Bar		12	250 / 2680 / 250			1	2	1	2	3.18	6.36			6.360					
	Main Ties		8	250 / 180 / 180 / 250			1	7	1	7	0.98	6.86	6.860							
	Main Ties		8	250 / 180 / 180 / 250			1	8	1	8	0.98	7.84	7.840							
	Main Ties		8	250 / 180 / 180 / 250			1	7	1	7	0.98	6.86	6.860							
	Total Qty. (In Rmt)												21.560		12.720					
	Unit Weight (Kg/Rmt)												0.395	0.617	0.889	1.58	2.469	3.858	4.84	6.321
	Total Qty. (In Kg)												8.5162		11.30808					
													8.516		11.308					

TOTAL Qty. (In Kg) 19.82428

VOLUME OF COLUMN

C1 = 0.23X0.23X3.65X1
0.19 M^3

TOTAL VOLUME OF COLUMN = 0.19 M^3

VOLUME OF FOOTING

F1 = 1.5X1.5X0.30X1
0.68 M^3

TOTAL VOLUME OF FOOTING = 0.68 M^3

VOLUME OF PLINTH BEAM

PB 1(a) = 0.1725 M^3

TOTAL VOLUME OF PLINTH BEAM = 0.17 M^3

VOLUME OF GRATING BEAM

GB 1(a) = 0.13225 M^3

TOTAL VOLUME OF GRATING BEAM = 0.13 M^3

VOLUME OF COPING

TOTAL VOLUME OF COPING = 0.035 M^3

TOTAL VOLUME = 1.21 M^3

CIVIL ESTIMATE

SL.No.	DESCRIPTION OF ITEMS	UNIT	BOQ
1	PCC 1:4:8 75mm thk.	m^3	0.204
2	RCC M-25	m^3	1.210
3	Reinforcement(Tonne)	T	0.143
4	Brick work 230mm thk.	m^3	1.279
5	12mm (av.) wall plaster (1:6) (OUTER SIDE)	m^3	0.674
6	15mm plaster(1:6) (IN SIDE)	m^3	0.083

REC PDCL GURUGRAM

Approved Issued for Fabrication/Construction/Manufacturing
Approval Issued for Fabrication/Construction/Manufacturing
Subject to condition that deficiencies and comments are included.
Please submit the revised documents for approval.
Approved as noted. Resubmit copy for approval.
Not approved. Revise and resubmit again for approval.
As Inscribed. Resubmit as per suggestions.
For Information and record.
Not Approved.

Signature (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

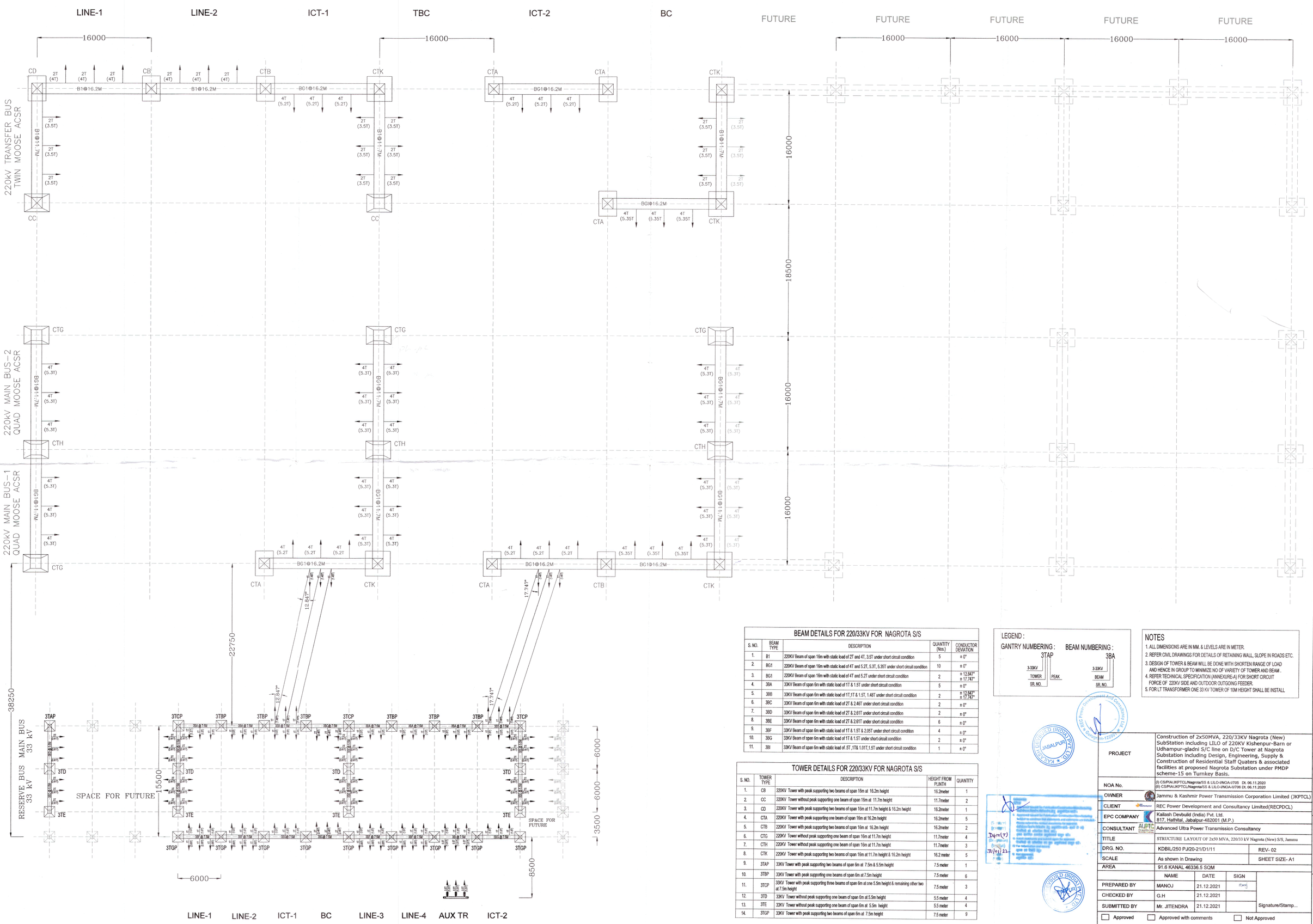
STIRRUPS SCHEDULE FOR BEAM

S.NO.	ZONE	DETAILS
1.	A	8ø-100 C/C
2.	B	8ø-145 C/C

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NDA No.	(1) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-I/705 Dt. 06.11.2020 (2) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	BOUNDARY WALL OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/10	REV- 1		
SCALE	As shown in Drawing	SHEET SIZE- A2		
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 3 OF 3		
	NAME	DATE	SIGN	
PREPARED BY	RAVI	26.05.2021		R.C BANSAL
CHECKED BY	G.H	26.05.2021		
SUBMITTED BY	RACHIT	26.05.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....

Kailash Devbuild (India) Pvt. Ltd. Jabalpur



BEAM DETAILS FOR 220/33KV FOR NAGROTA S/S

S. NO.	BEAM TYPE	DESCRIPTION	QUANTITY (Nos.)	CONDUCTOR DEVIATION
1.	B1	220KV Beam of span 16m with static load of 2T and 4T, 3.5T under short circuit condition	5	± 0°
2.	BG1	220KV Beam of span 16m with static load of 4T and 5.2T, 5.3T, 5.35T under short circuit condition	10	± 0°
3.	BG1	220KV Beam of span 16m with static load of 4T and 5.2T under short circuit condition	2	± 12.847° ± 17.747°
4.	3BA	33KV Beam of span 6m with static load of 1T & 1.5T under short circuit condition	5	± 0°
5.	3BB	33KV Beam of span 6m with static load of 1T,1T & 1.5T, 1.48T under short circuit condition	2	± 12.847° ± 17.747°
6.	3BC	33KV Beam of span 6m with static load of 2T & 2.46T under short circuit condition	2	± 0°
7.	3BD	33KV Beam of span 6m with static load of 2T & 2.61T under short circuit condition	2	± 0°
8.	3BE	33KV Beam of span 6m with static load of 2T & 2.61T under short circuit condition	6	± 0°
9.	3BF	33KV Beam of span 6m with static load of 1T & 1.5T & 2.05T under short circuit condition	4	± 0°
10.	3BG	33KV Beam of span 6m with static load of 1T & 1.5T under short circuit condition	2	± 0°
11.	3BI	33KV Beam of span 6m with static load of .5T ,1T& 1.01T,1.5T under short circuit condition	1	± 0°

TOWER DETAILS FOR 220/33KV FOR NAGROTA S/S

S. NO.	TOWER TYPE	DESCRIPTION	HEIGHT FROM PLINTH	QUANTITY
1.	CB	220KV Tower with peak supporting two beams of span 16m at 16.2m height	16.2meter	1
2.	CC	220KV Tower without peak supporting one beam of span 16m at 11.7m height	11.7meter	2
3.	CD	220KV Tower with peak supporting two beams of span 16m at 11.7m height & 16.2m height	16.2meter	1
4.	CTA	220KV Tower with peak supporting one beam of span 16m at 16.2m height	16.2meter	5
5.	CTB	220KV Tower with peak supporting two beams of span 16m at 16.2m height	16.2meter	2
6.	CTG	220KV Tower without peak supporting one beam of span 16m at 11.7m height	11.7meter	4
7.	CTH	220KV Tower without peak supporting one beam of span 16m at 11.7m height	11.7meter	3
8.	CTK	220KV Tower with peak supporting two beams of span 16m at 11.7m height & 16.2m height	16.2 meter	5
9.	3TAP	33KV Tower with peak supporting two beams of span 6m at 7.5m & 5.5m height	7.5 meter	1
10.	3TBP	33KV Tower with peak supporting one beams of span 6m at 7.5m height	7.5 meter	6
11.	3TCP	33KV Tower with peak supporting three beams of span 6m at one 5.5m height & remaining other two at 7.5m height	7.5 meter	3
12.	3TD	33KV Tower without peak supporting one beam of span 6m at 5.5m height	5.5 meter	4
13.	3TE	33KV Tower without peak supporting one beam of span 6m at 5.5m height	5.5 meter	4
14.	3TGP	33KV Tower with peak supporting two beams of span 6m at 7.5m height	7.5 meter	9

LEGEND :

GANTRY NUMBERING : 3TAP (3-33KV TOWER SR. NO. / PEAK)

BEAM NUMBERING : 3BA (3-33KV BEAM SR. NO.)

NOTES

1. ALL DIMENSIONS ARE IN MM. & LEVELS ARE IN METER.
2. REFER CIVIL DRAWINGS FOR DETAILS OF RETAINING WALL, SLOPE IN ROADS ETC.
3. DESIGN OF TOWER & BEAM WILL BE DONE WITH SHORTEN RANGE OF LOAD AND HENCE IN GROUP TO MINIMIZE NO OF VARIETY OF TOWER AND BEAM .
4. REFER TECHNICAL SPECIFICATION (ANNEXURE-A) FOR SHORT CIRCUIT FORCE OF 220KV SIDE AND OUTDOOR OUTGOING FEEDER.
5. FOR LT TRANSFORMER ONE 33 KV TOWER OF 10M HEIGHT SHALL BE INSTALL

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	STRUCTURE LAYOUT OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/11 — REV- 02
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	MANOJ	21.12.2021	
CHECKED BY	G.H	21.12.2021	
SUBMITTED BY	Mr. JITENDRA	21.12.2021	

Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

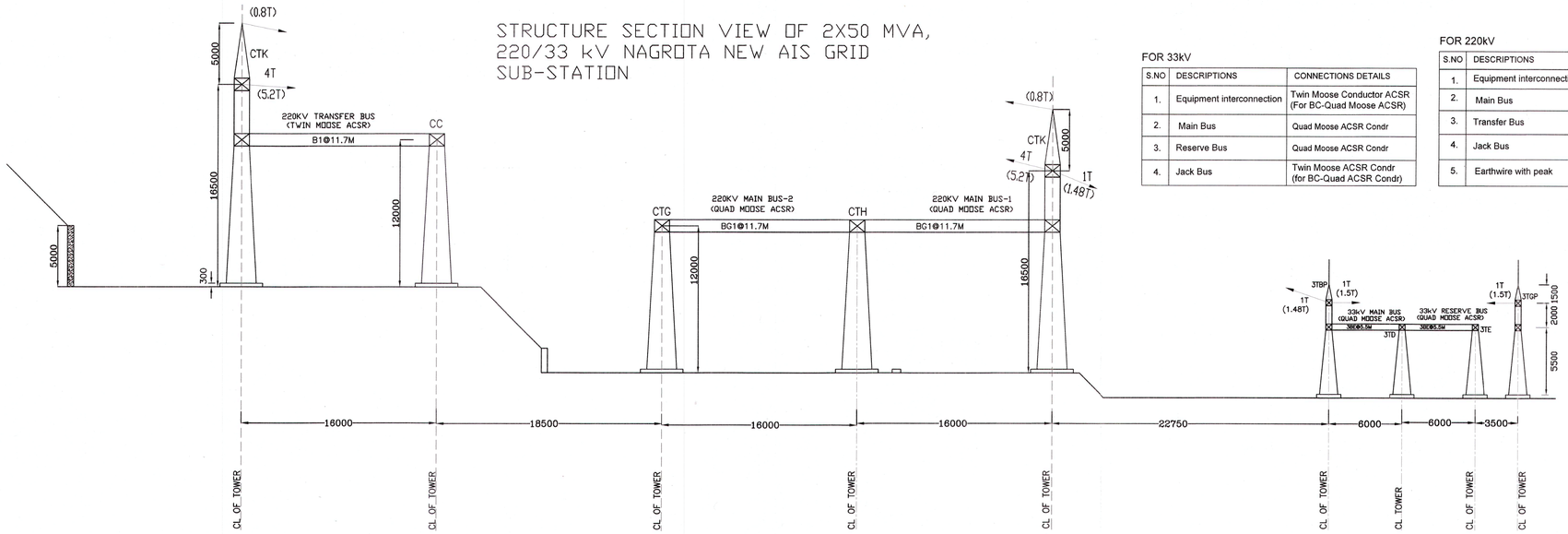
STRUCTURE SECTION VIEW OF 2X50 MVA, 220/33 kV NAGROTA NEW AIS GRID SUB-STATION

FOR 33kV

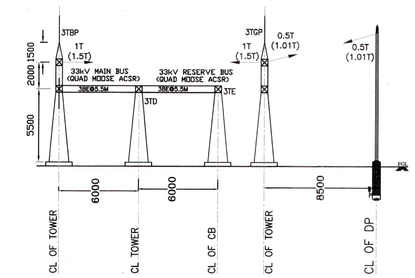
S.NO	DESCRIPTIONS	CONNECTIONS DETAILS
1.	Equipment interconnection	Twin Moose Conductor ACSR (For BC-Quad Moose ACSR)
2.	Main Bus	Quad Moose ACSR Condr
3.	Reserve Bus	Quad Moose ACSR Condr
4.	Jack Bus	Twin Moose ACSR Condr (for BC-Quad ACSR Condr)

FOR 220kV

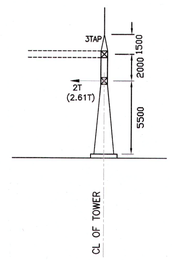
S.NO	DESCRIPTIONS	CONNECTIONS DETAILS
1.	Equipment interconnection	4Inch IPS-EH Al
2.	Main Bus	Quad Moose ACSR Condr
3.	Transfer Bus	Twin Moose ACSR Condr
4.	Jack Bus	Quad Moose ACSR Condr for BC & Twin Moose for ICT
5.	Earthwire with peak	7.366mm GS wire(10.98mm dia)



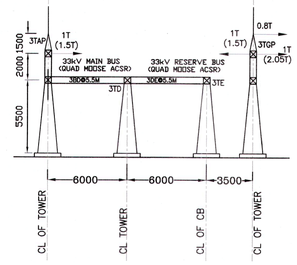
SECTION VIEW OF 50 MVA,220/33 kV TRANSFORMER BAY



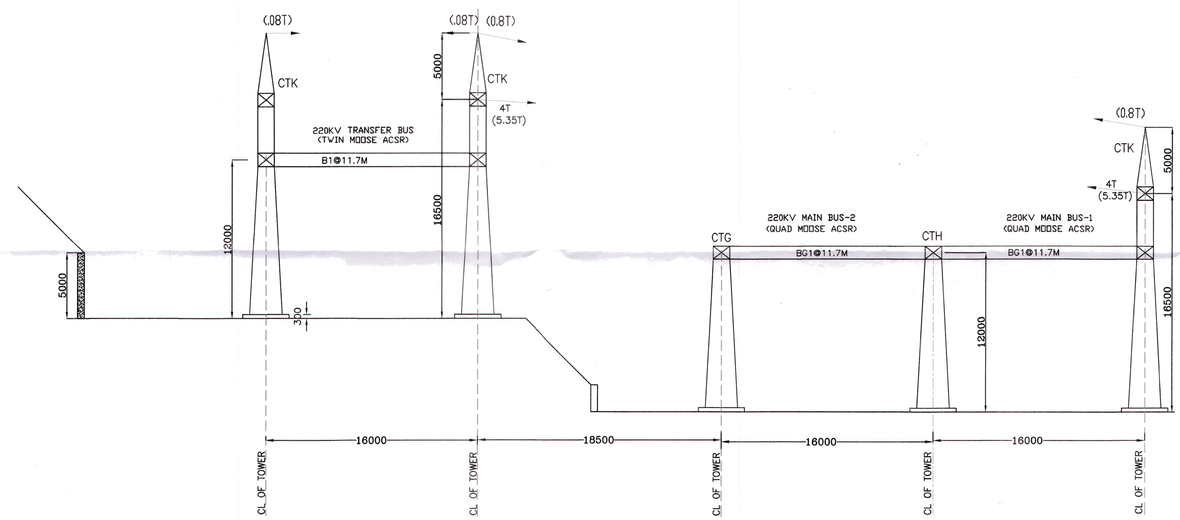
SECTION VIEW OF AUX TRF BAY



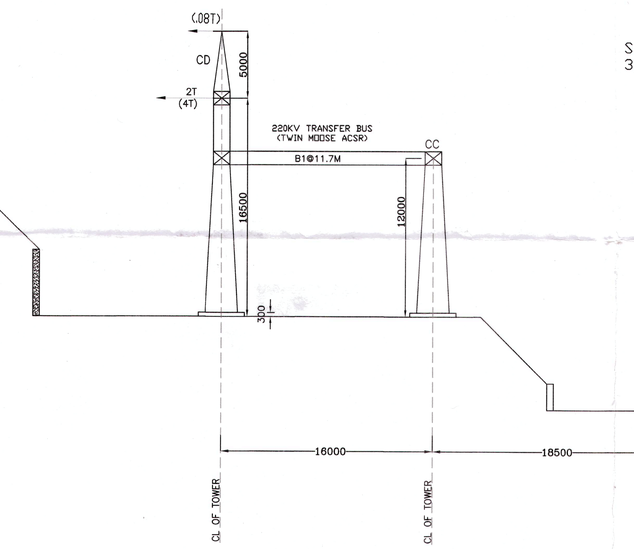
SECTION VIEW OF 33kV BUS PT



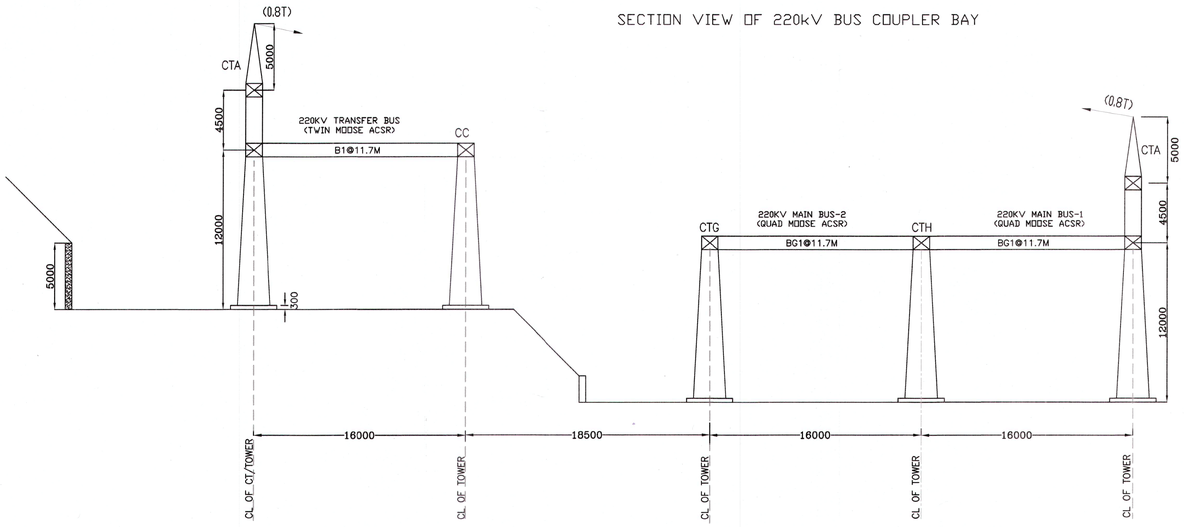
SECTION VIEW OF 33kV LINE BAY



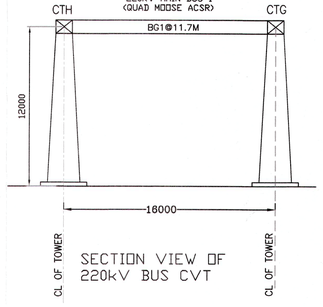
SECTION VIEW OF 220kV BUS COUPLER BAY



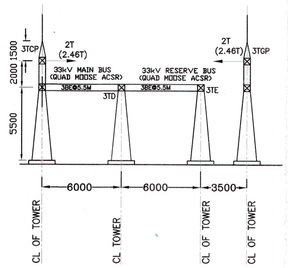
SECTION VIEW OF 220kV LINE BAY



SECTION VIEW OF 220kV TRANSFER BUS COUPLER BAY



SECTION VIEW OF 220kV BUS CVT



SECTION VIEW OF 33kV BUS COUPLER BAY

NOTES

1. ALL DIMENSIONS ARE IN MM. & LEVELS ARE IN METER.
2. REFER CIVIL DRAWINGS FOR DETAILS OF RETAINING WALL, SLOPE IN ROADS ETC.
3. DESIGN OF TOWER & BEAM WILL BE DONE WITH SHORTEN RANGE OF LOAD AND HENCE IN GROUP TO MINIMIZE NO OF VARIETY OF TOWER AND BEAM..
4. REFER TECHNICAL SPECIFICATION (ANNEXURE-A) FOR SHORT CIRCUIT FORCE OF 220KV SIDE AND OUTGOING FEEDER.
5. FOR LT TRANSFORMER ONE 33 KV TOWER OF 10M HEIGHT SHALL BE INSTALL

LEGEND :

GANTRY NUMBERING : 3TAP (3-33KV TOWER SR.NO. / PEAK)

BEAM NUMBERING : 3BA (3-33KV BEAM SR.NO.)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NDA No.	CD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-1/705 Dt. 06.11.2020 CID CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NDA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Pol Ultra Power Transmission Consultancy
TITLE	STRUCTURE SECTION VIEW OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBL/250 PJ/20-21/01/12 REV.- 02
SCALE	As shown in Drawing SHEET SIZE- A1
AREA	910 KANAL, 365356.5 SQM

	NAME	DATE	SIGN.
PREPARED BY	MANOJ	01.12.2021	
CHECKED BY	GH	01.12.2021	
SUBMITTED BY	Mr. JITENDRA	01.12.2021	

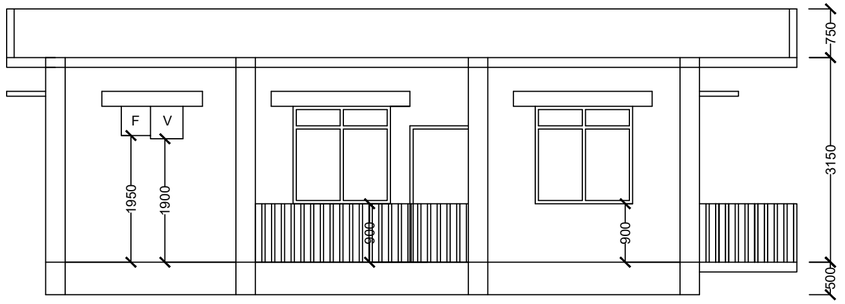
Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

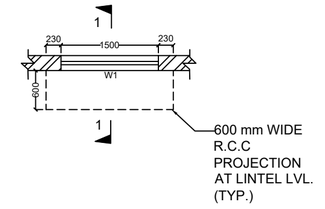
☐ More Information Date.....



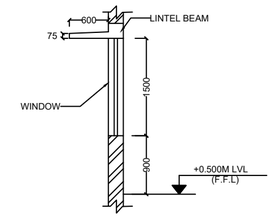
FRONT ELEVATION



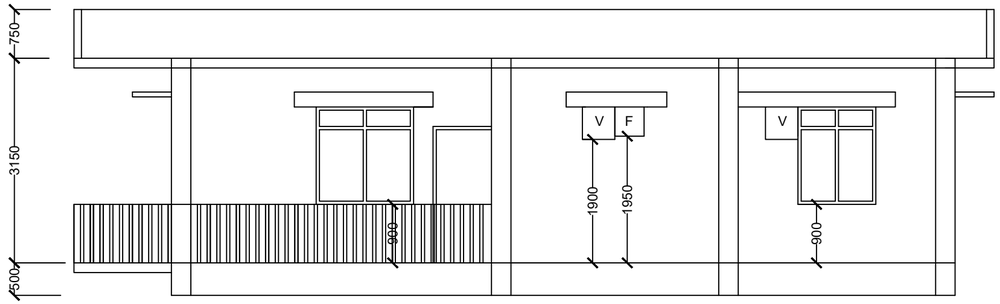
REAR ELEVATION



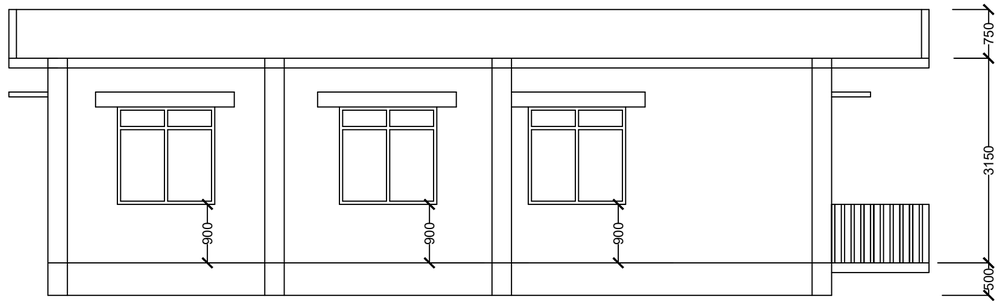
SUNSHADE DETAIL



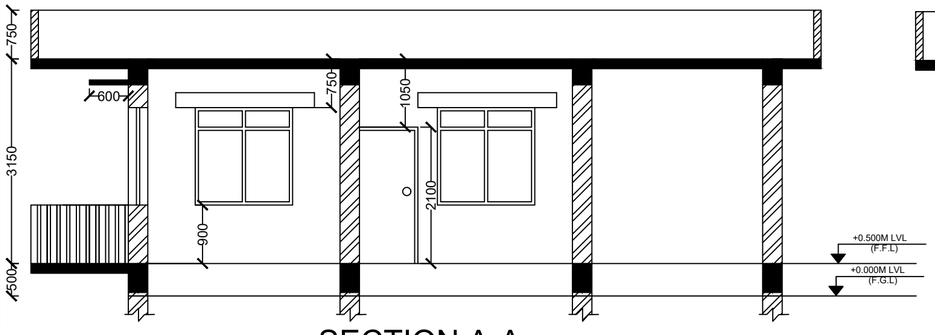
SECTION 1-1



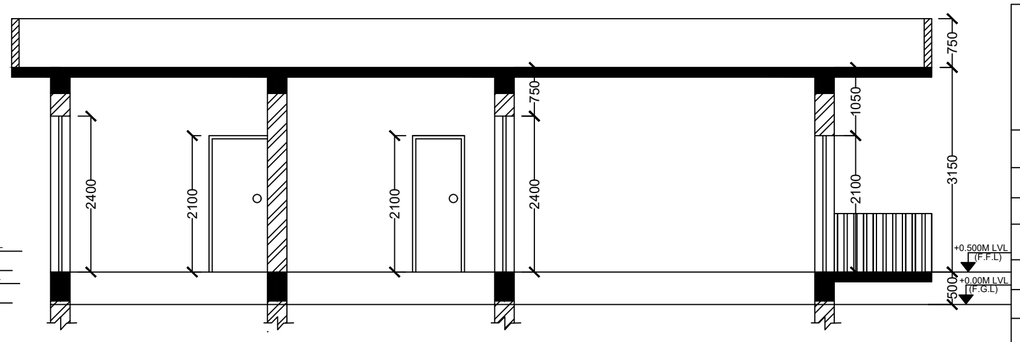
LEFT SIDE ELEVATION



RIGHT SIDE ELEVATION



SECTION A-A



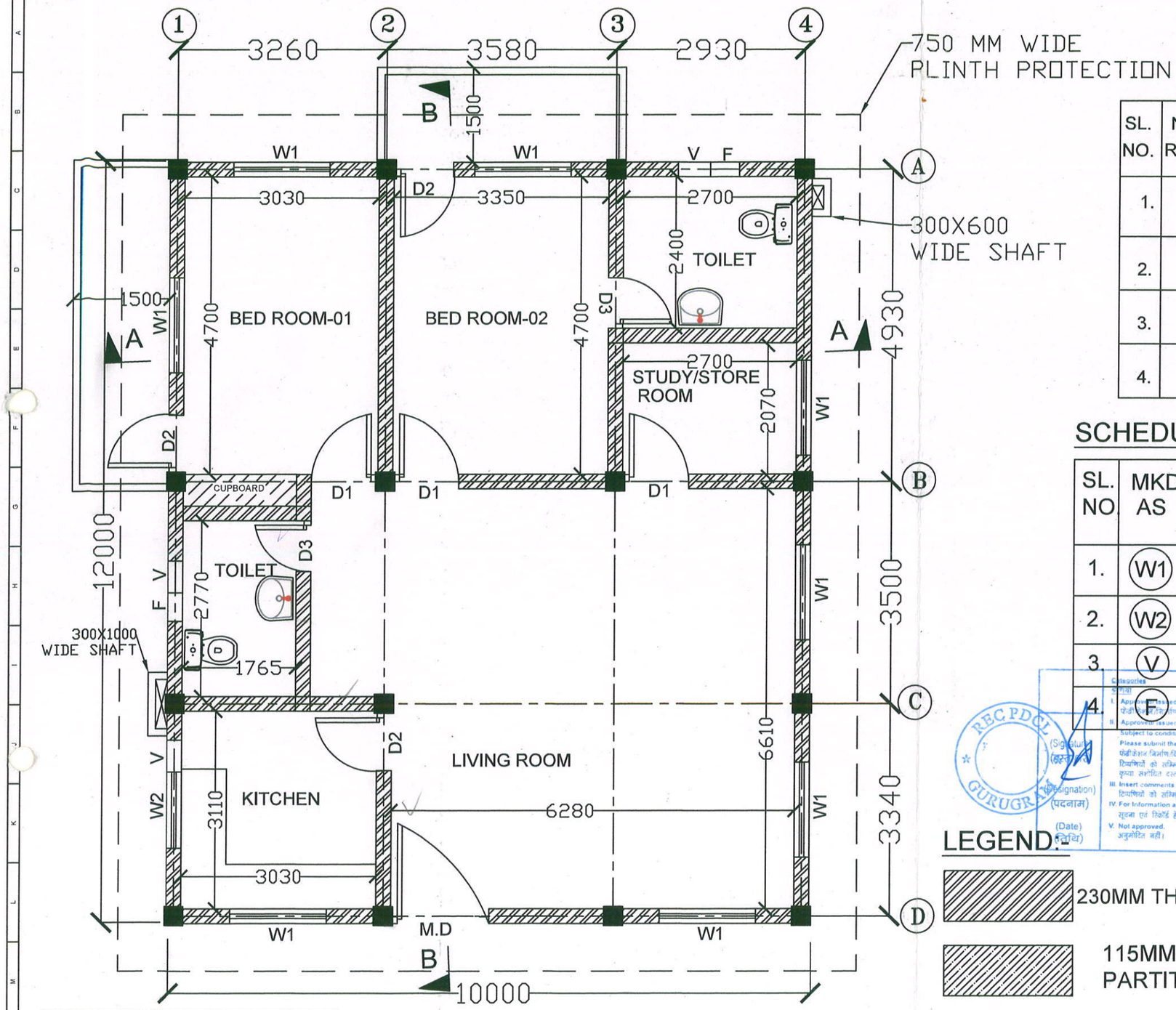
SECTION B-B

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	ELEVATION AE QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/13	REV- 2	
SCALE	As shown in Drawing	SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 3 OF 3	

	NAME	DATE	SIGN	
PREPARED BY	AMIR	16.07.2021		R.C BANSAL
CHECKED BY	G.H	16.07.2021		
SUBMITTED BY	RACHIT	16.07.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



CARPET AREA : 115.77 SQ.M

GROUND FLOOR PLAN (+0.500M)

AE QUARTER

SCHEDULE OF DOORS

SL. NO.	NOS. REQD.	MKD AS	MASONRY OPENING (WIDTHxHEIGHT)	SWING	SILL LEVEL WR. TO FFL.	LINTEL LEVEL WR. TO FFL.
1.	1	M.D	1500 x 2400	SEE PLAN	--	+2.40 M
2.	2	D1	1000 x 2400	SEE PLAN	--	+2.40 M
3.	3	D2	900 x 2100	SEE PLAN	--	+2.10 M
4.	2	D3	800 x 2100	SEE PLAN	--	+2.10 M

SCHEDULE OF WINDOWS

SL. NO	MKD AS	MASONRY OPENING (WIDTHxHEIGHT)	SILL LEVEL WR. TO FFL.	LINTEL LEVEL WR. TO FFL.
1.	W1	1500 x 1500	+0.90 M	+2.40 M
2.	W2	1200 x 1500	+0.90 M	+2.40 M
3.	V	500 x 500	+1.90 M	+2.40 M
4.	F	450 x 450	+1.950 M	+2.40 M

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/ Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी/ बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
कृप्या संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

REC PDCL GURUGRAM
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

LEGEND:-

230MM THICK EXTERNAL WALL

115MM INTERNAL ROOM PARTITION WALL

W1, W2	WINDOW
M.D	MAIN DOOR
D1,D2,D3	DOOR
V	VENTILATOR
F	EXHAUST FAN

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

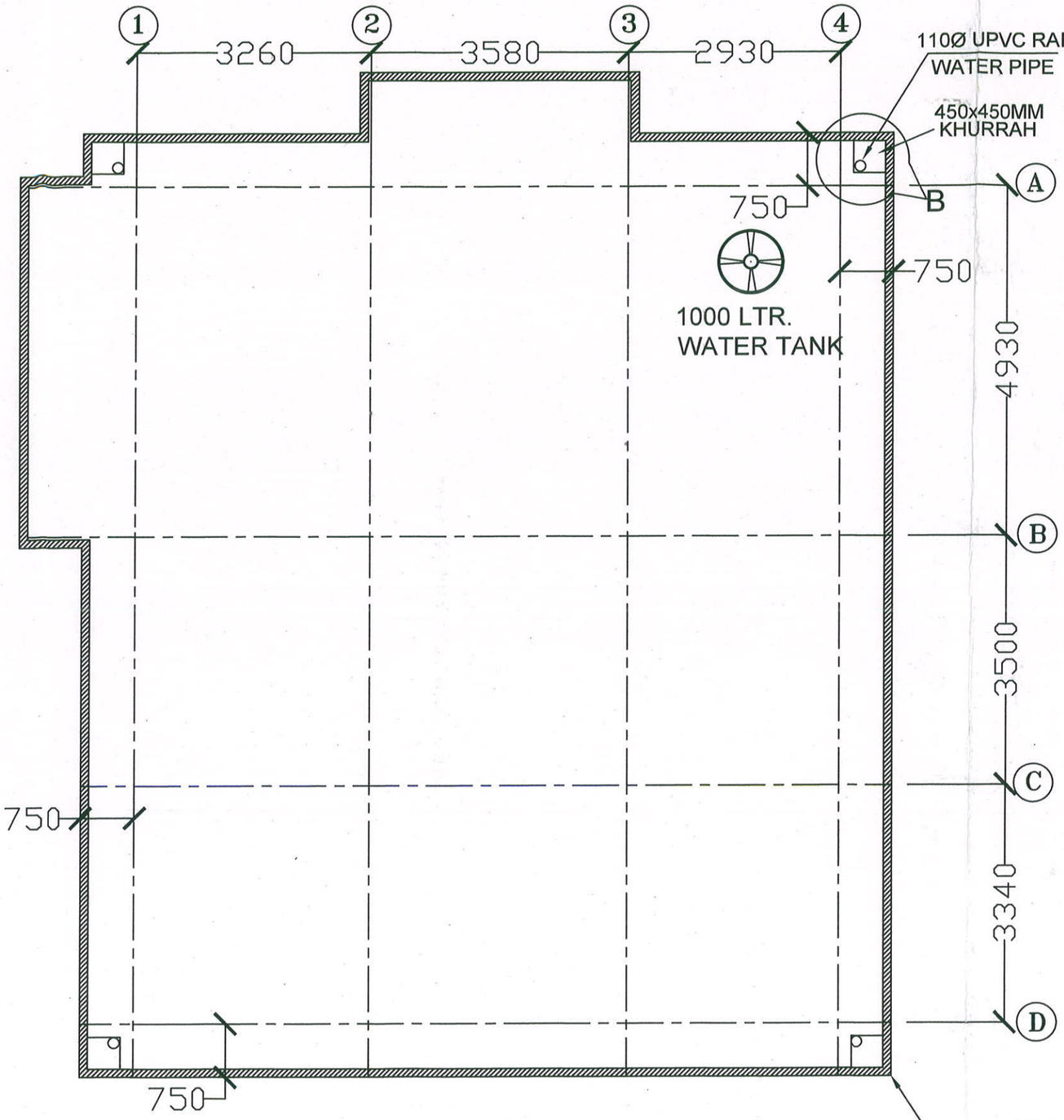
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	ARCHITECTURE AE QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/13 — REV- 3
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 3

	NAME	DATE	SIGN	
PREPARED BY	AMIR	23.07.2021		R.C BANSAL
CHECKED BY	G.H	23.07.2021		
SUBMITTED BY	RACHIT	23.07.2021	Rachit	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

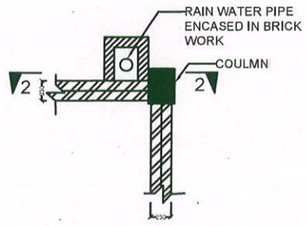
☐ More Information Date.....

Design & Engineering by:- AUPTC

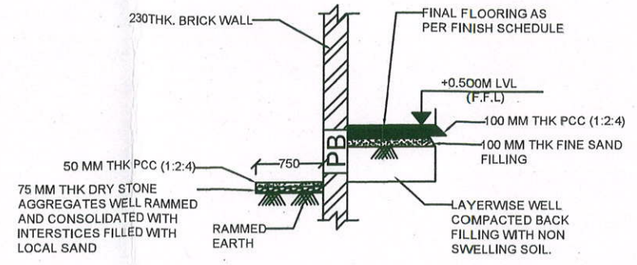


TERRACE FLOOR PLAN (+3.650M)

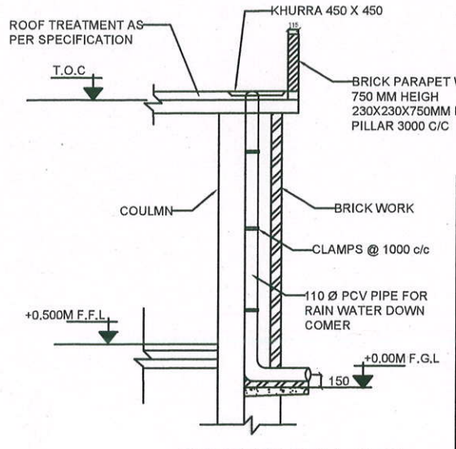
AE QUARTER



DETAIL-B



TYP. DETAILS OF PLINTH PROTECTION & FLOORING



SECTION 2-2

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN.
3. ALL DIMENSIONS SHALL BE CHECKED PRIOR TO EXECUTION DIMENSIONS ONLY.
4. FOR LOCATION OF BUILDING REFER GA PLAN.
5. EXTERNAL PERIPHERY WALL FOR GROUND FLOOR SHALL BE 230 MM THK.
6. ALL INTERNAL WALL SHALL BE 115MM THK.
7. THE DRAWING TO BE READ IN CONJUCTION WITH RELEVANT STRUCTURAL DRAWINGS BOTH FOR DIMENSIONS AND LAYOUT.
8. LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGE IN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
9. ANY DESCREPANCY IN DRAWING TO BE BROUGHT TO THE NOTICE OF SITE INCHARGE.
10. COLUMN SHOWN IN THE DRAWING ARE INDICATIVE, FOR EXACT COLUMN LOCATIONS REFER STRUCTURAL DRAWING
11. DIMENSIONS OF COLUMN AND BEAM SUBJECT TO CHANGE AFTER DESIGN.

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.- Please submit the revised documents for approval.
फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

(Signature) (हस्ताक्षर) Dchm (Designation) (पदनाम) 11/08/21 (Date) (तिथि)

REC PDCL GURUGRAM

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	ARCHITECTURE AE QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/13		REV- 3	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 2 OF 3	
	NAME	DATE	SIGN	
PREPARED BY	AMIR	23.07.2021		R.C BANSAL
CHECKED BY	G.H	23.07.2021		
SUBMITTED BY	RACHIT	23.07.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Design & Engineering by:- AUPTC

Design & Engineering by:- AUPTC

DETAIL OF FINISH SCHEDULE.

S.No.	LOCATION	FLOORING & SKIRTING 150MM HIGH	WALL(INTERNAL)	CEILING	DOOR,WINDOWS & VENTILATOR
1	Residential Buildings	Vitrified tiles 8mm thick size600 x 600mm	Non VOC acrylic emulsion paint over 2mm POP putty upto ceiling over approved primer coat	Ceiling painted with Non VOC acrylic emulsion paint to give an even shade.	Door shall have flush door shutter 35 mm thick with commercial ply duly painted & polished as per CPWD specification & as per the approval of Engineer- In- Charge. Door frames should be of sal/hard wood/ Red Marandi as per the as per CPWD specification & as per the approval of Engineer- In- Charge.
2	Toilets	Ceramic tiles.	DADO glazed tile 2100mm high, above that non VOC acrylic emulsion paint over 2 mm thick POP putty along with primer coat.)	Non VOC acrylic Emulsion paint over approved primer coat for RCC building.	Windows should be wooden panel window with glazing as perCPWD specifications & approval of Engineers in Charge Windows frames should be of shawl/hard wood/ Red Marandi as per the as per CPWD specification & as per the approval of Engineer-in-Charge.

Notes:-

PLASTERING:-

1. EXTERNAL SURFACE OF BUILDING SHALL HAVE 18 MM THICK PLASTER IN TWO LAYERS, WITH THE UNDER. LAYER 12 MM THICK 1:5 CEMENT SAND PLASTER AND THE TOP LAYER 6 MM THICK 1:6 CEMENT SAND PLASTER .INSIDE WALLS SURFACES SHALL HAVE 12/15 MM THICK 1:6 CEMENT SAND PLASTER. ROUGH SURFACES SHALL HAVE 15MM AND SMOOTH SURFACE SHALL HAVE 12 MM THICK CEMENT SAND PLASTER.
2. ALL R.C.C. CEILINGS SHALL BE PROVIDED WITH 6.0 MM THICK CEMENT SAND PLASTER IN 1:3 CEMENT SAND MORTAR (1CEMENT : 3 FINE SAND) EXCEPT FOR AREAS WITH FALSE CEILING .
3. MINIMUM HEIGHT OF SKIRTING ABOVE FINISHED FLOOR LEVEL SHALL BE 150 MM.
4. ALL DIMENSIONS ARE IN MM.
5. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSIONS ONLY.
6. ALL DIMENSIONS SHALL BE CHECKED PRIOR TO EXECUTION
7. LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGE IN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
8. ANY DESCREPANCY IN DRAWING TO BE BROUGHT TO THE NOTICE OF SITE INCHARGE.
9. COLUMN SHOWN IN THE DRAWING ARE INDICATIVE, FOR EXACT COLUMN LOCATIONS REFER STRUCTURAL DRAWING.
10. DIMENSIONS OF COLUMN AND BEAM SUBJECT TO CHANGE.
11. 150 MM DIAMETER UPVC RAINWATER DOWN COMER PIPES CONFORMING TO RELEVANT INDIAN STANDARD / EQUIVALENT INTERNATIONAL STANDARDS WITH WATER TIGHT LEAD JOINTS SHALL BE PROVIDED TO DRAIN OFF THE RAIN WATER FROM THE ROOFS.

WATERPROOFING DETAILS:-

Integral cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terraces etc. consisting of following operations:

a) Applying a slurry coat of neat cement using 2.75 kg/sq. m. of cement admixed with water proofing compound conforming to IS. 2645 and approved by Engineer-in-charge over the RCC slab including adjoining walls up to 300mm height including cleaning the surface before treatment.

b) Laying brick bats with mortar using broken bricks/brick bats 25 mm to 115 mm size with 50% of cement mortar 1:5 (1 cement : 5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge over 20 mm thick layer of cement mortar of mix 1:5 (1 cement :5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge to required slope and treating similarly the adjoining walls up to 300 mm height including rounding of junctions of walls and slabs.

c) After two days of proper curing applying a second coat of cement slurry using 2.75 kg/ sq. m. of cement admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-charge.

d) Finishing the surface with 20 mm thick joint less cement mortar of mix 1:4 (1 cement: 4 coarse sand) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-charge including laying glass fibre cloth of approved quality in top layer of plaster and finally finishing the surface with trowel with neat cement slurry and making pattern of 300x300 mm square 3 mm deep.

e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by the Engineer-in-Charge.

f) With average thickness of 120mm and minimum thickness at khurra as 65 mm.

AE QUARTER

REC PDCL GURUGRAM

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing.
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Sign/Name) (हस्ता./नाम) DGM
(Designation) (पदनाम)
(Date) (तिथि) 11/08/21

LEGEND:-

	230MM THICK EXTERNAL WALL
	115MM INTERNAL ROOM PARTITION WALL
W1, W2	WINDOW
M.D	MAIN DOOR
D1,D2,D3	DOOR
V	VENTILATOR
F	EXHAUST FAN

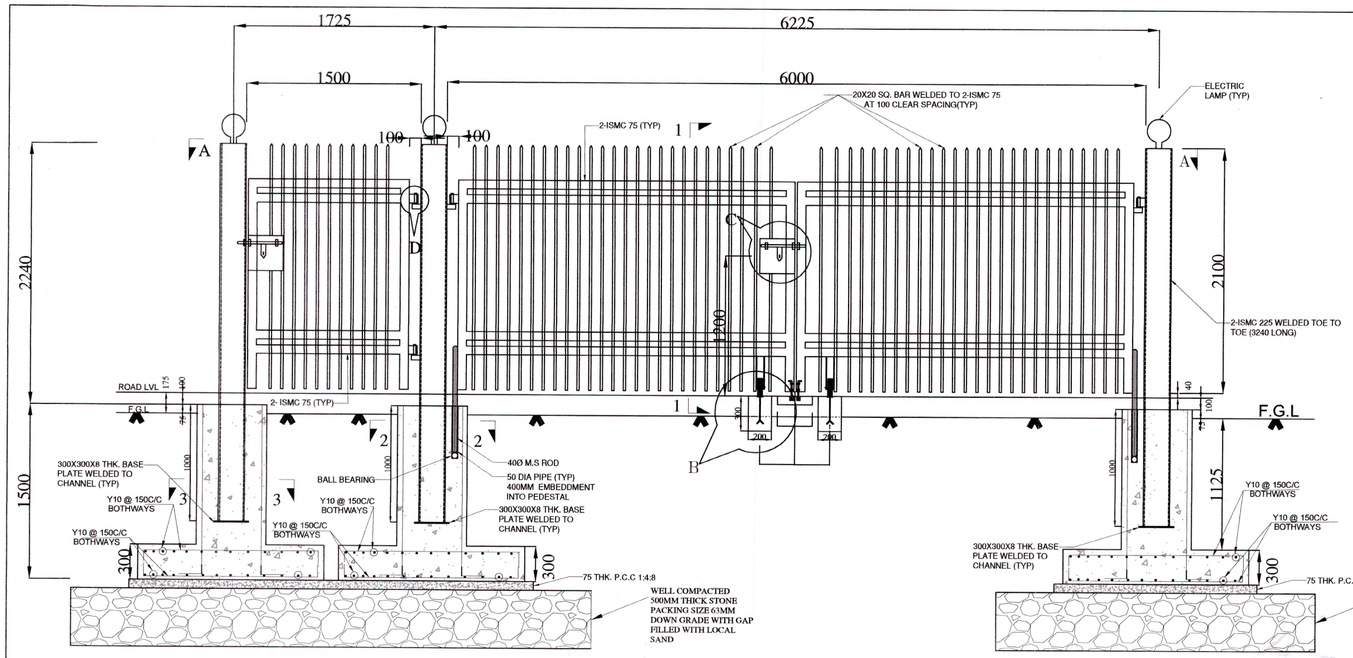
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	KD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 KD CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	GENERAL NOTES AE QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/13		REV- 3	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH.NO. 3 OF 3	
	NAME	DATE	SIGN	
PREPARED BY	AMIR	23.07.2021		R.C BANSAL
CHECKED BY	G.H	23.07.2021		
SUBMITTED BY	RACHIT	23.07.2021		Signature/Stamp...

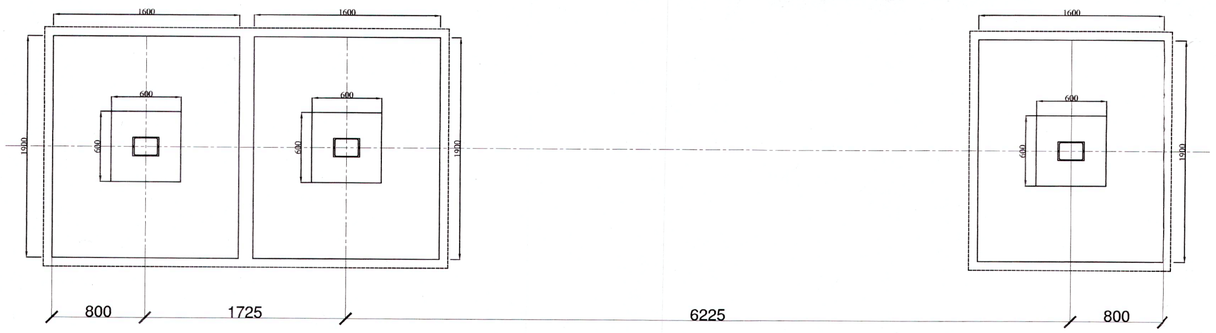
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

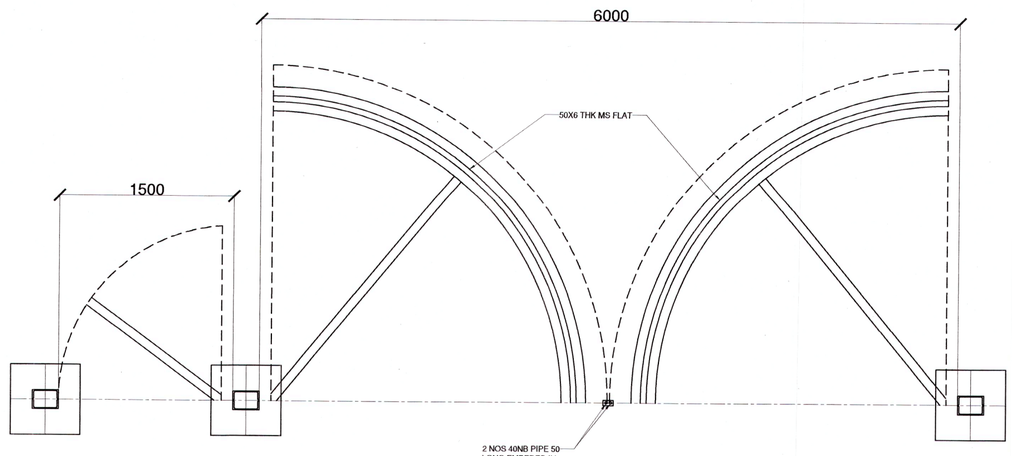
Design & Engineering by:- AUPTC



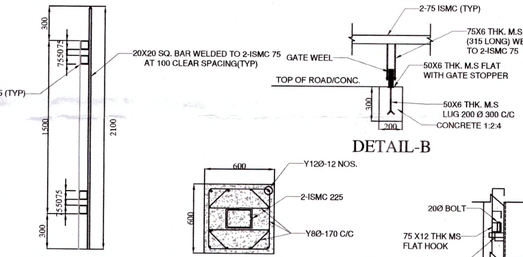
FRONT ELEVATION OF MAIN GATE



FOUNDATION LAYOUT OF MAIN GATE



VIEW A-A



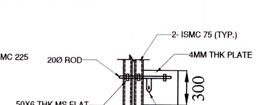
SECTION 1-1

DETAIL-B

SECTION 2-2

SECTION 3-3

DETAIL-D



DETAIL-C

NOTES:-

1. ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CLEAR COVER TO REINFORCEMENT SHALL BE AS GIVEN BELOW :-
   a) 40MM FOR COLUMN
   b) 50MM FOR FOOTING
   c) 25MM FOR BEAM
   d) 20MM FOR SLAB
3. GRADE OF CONCRETE SHALL BE OF GRADE M25.
4. GRADE OF REINFORCEMENT SHALL BE Fe500 AS PER IS 1786.
5. LAP LENGTH SHALL BE 47-TIMES DIA OF BAR.
6. LINK AND LAPS SHALL BE TACK WELDED.
7. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF BARS SHALL BE AS PER IS:456-2000.
   B.O.L = BOTTOM OF LINTEL
   T.O.S = TOP OF SLAB
   T.O.C = TOP OF CONCRETE
   B.O.C = BOUNDARY OF CONCRETE
8. ALL STRUCTURAL STEEL AS PER THE IS 2062 AND SHALL BE PAINTED WITH TWO OR MORE COATS OF ENAMEL PAINT OF APPROVED BRAND AND MANUFACTURE OVER A PRIMING COAT OF APPROVED STEEL PRIMER.
9. THE SBC OF SOIL AT 1.5 DEPTH IS 4.0 TN/SQM CONSIDERED.

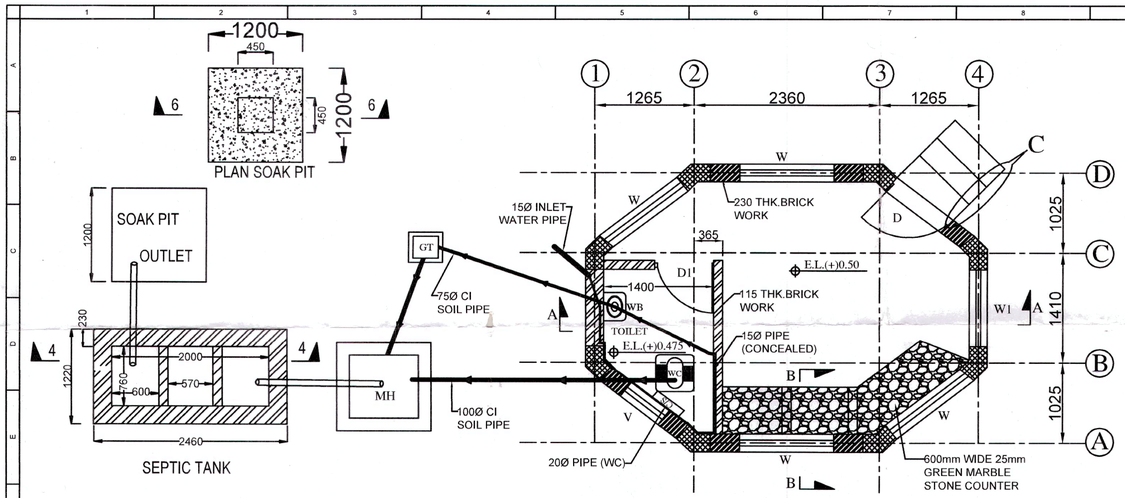
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	DETAILS OF MAIN GATE , 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 P.I/20-21/D1/14	REV- 2	
SCALE	As shown in Drawing	SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM	SH. NO.:- 1 OF 1	

	NAME	DATE	SIGN
PREPARED BY	AMIR	05.03.2022	
CHECKED BY	G.H	05.03.2022	
SUBMITTED BY	ANURAG	05.03.2022	

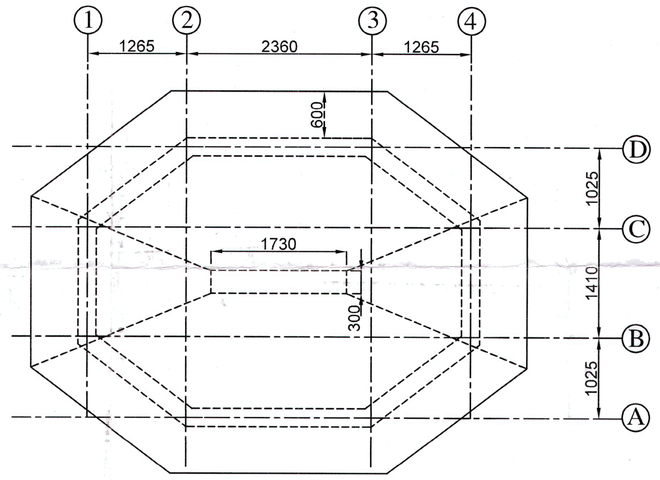
Signature/Stamp:

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



FLOOR PLAN
(1:50)



ROOF PLAN

SCHEDULE OF DOOR & WINDOW

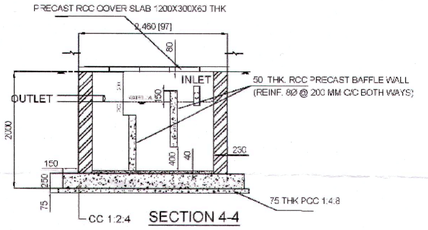
MKD.	SIZE		DESCRIPTION	NOS. REQD.
	WIDTH	HEIGHT		
D	900	2100	12MM THK. TOUGNENED GLASS DOOR WITH DESIGNER FROSTED FILM ON PATCH FITTING	1
D1	750	2100	DOOR SHALL BE FLUSH DOOR SHUTTERS MADE OF PRE LAMINATED PARTICLE BOARD WITH POWDER COATED ALUMINIUM FRAME.	1
W1	1000	1000	2 EQUAL PANELS SLIDING UPVC WINDOW AS PER MANUFACTURER'S SPECIFICATION	1
W	1200	1200	3 EQUAL PANELS SLIDING UPVC WINDOW AS PER MANUFACTURER'S SPECIFICATION	4
V	600	450	UPVC TOP HUNG VENTILATOR WITH EXHAUST FAN AS PER MANUFACTURER'S SPECIFICATION.	1

FINISHING SCHEDULE

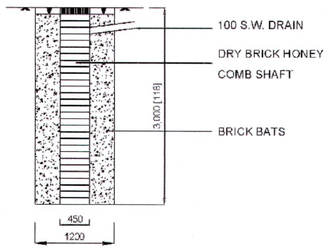
AREA/ ROOM	AREA/ ROOM	SKIRTING/DADO	CEILING	INTERNAL PAINT ON WALLS	PAINTS ON CEILING
GUARD ROOM	20THK. KOTA STONE FLOOR	100 HIGH KOTA	RCC SLAB WITH 6mm PLASTER	OBD	OBD
TOILET	CERAMIC TILES	GLAZED TILE DADO UP TO 1.5 HIGH	RCC SLAB WITH PLASTER	OBD	OBD

PLUMBING & SANITARY SCHEDULE

SR. NO.	ITEM	DESCRIPTION	NOS. REQD.
1.	INTERNAL/EXTERNAL WATER SUPPLY PIPES	15Ø GI PIPE AS PER SPECIFICATION FOR ALL SANITARY FIXTURES, CONNECTIONS AND LOFT TANK.	-
2.	W.C. (INDIAN STYLE)	ORISSA PATTERNS WC ALONG WITH ALL FITTING OF APPROVED MAKE AS PER SPECIFICATION.	1
3.	WASH BASIN	FLAT BACK WASH BASIN WITH ALL ITS ACCESSORIES AS PER SPECIFICATION	1
4.	MIRROR	ABOVE WASH BASIN SIZE- 600 X 450 AS PER SPECIFICATION	1
5.	TOWEL RAIL	CP BARS SIZE - 600 LONG 20Ø ROD AS PER SPECIFICATION.	1
6.	SOAP HOLDER	CP BARS AS PER SPECIFICATION	1

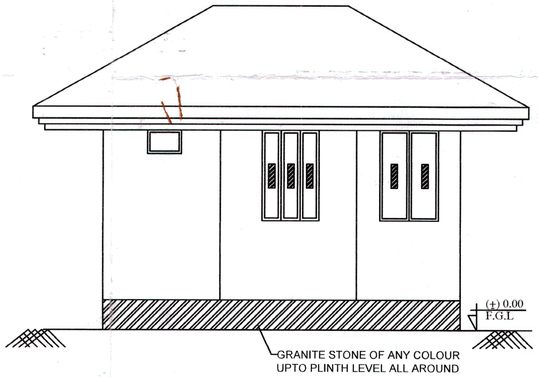


SECTION 4-4

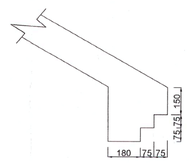


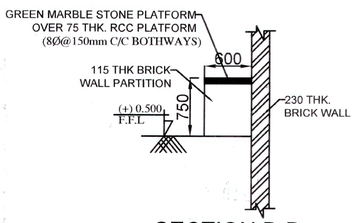
SECTION 6-6

SECTION A-A

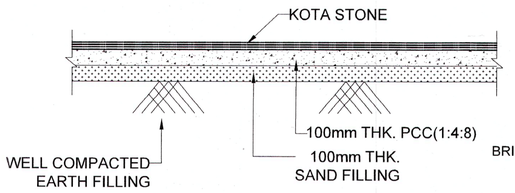


FRONT ELEVATION

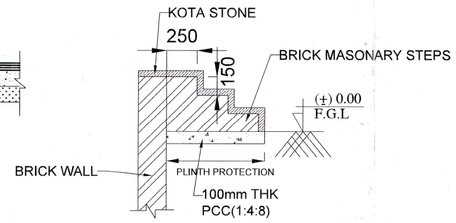




SECTION B-B



FLOORING DETAIL



DETAIL- C

DETAIL- D

NOTES:-

1. ALL DIMENSION ARE IN MM.
2. ALL ELEVATION ARE IN METERS.
3. PLASTERING:-
   a. OUTER FACE SHALL HAVE TEXTURE PAINT FINISH OVER EXTERNAL 12mm THK. PLASTER IN 1:6 CEMENT SAND MORTAR MIXED WITH WATER PROOFING COMPOUND.
   b. INTERNAL - 15THK. PLASTER IN 1:6 CEMENT SAND MORTAR.
4. 900mm WIDE PLINTH PROTECTION SHALL BE PROVIDED AS PER SPECIFICATION.
5. ALL FITTING REQUIRED FOR DOORS SHALL BE AS PER THE INSTRUCTION ON SITE- INCHARGE.
6. DOORS SHALL BE PROVIDED WITH LOCKING ARRANGEMENT.
7. MANGALORE ROOF TILES SHALL BE PROVIDED AS ROOF TREATMENT.
8. ALL EXTERNAL WALLS SHALL BE PROVIDED WITH INSULATION OF 80 MM PUFF PANELS (WOOD LOOK PAINT) AS PER SPECIFICATION OF PUFF PANELS WITH AN AIR GAP OF 40 MM FIXED WITH SUITABLE TIE MEMBERS, OPENING FOR WINDOWS/VENTILATORS/EXHAUST FANS SHALL BE MAINTAINED AND SEALED IN THE SIDES.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	ARCHITECTURE DRAWING OF SECURITY ROOM , 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/15		REV- 2
SCALE	As shown in Drawing		SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM		SH. NO.:- 1 OF 1
	NAME / DATE / SIGN		
PREPARED BY	AMIR 22.07.2021		R.C BANSAL
CHECKED BY	G.H 22.07.2021		Signature/Stamp...
SUBMITTED BY	Er. SANJAY 22.07.2021		

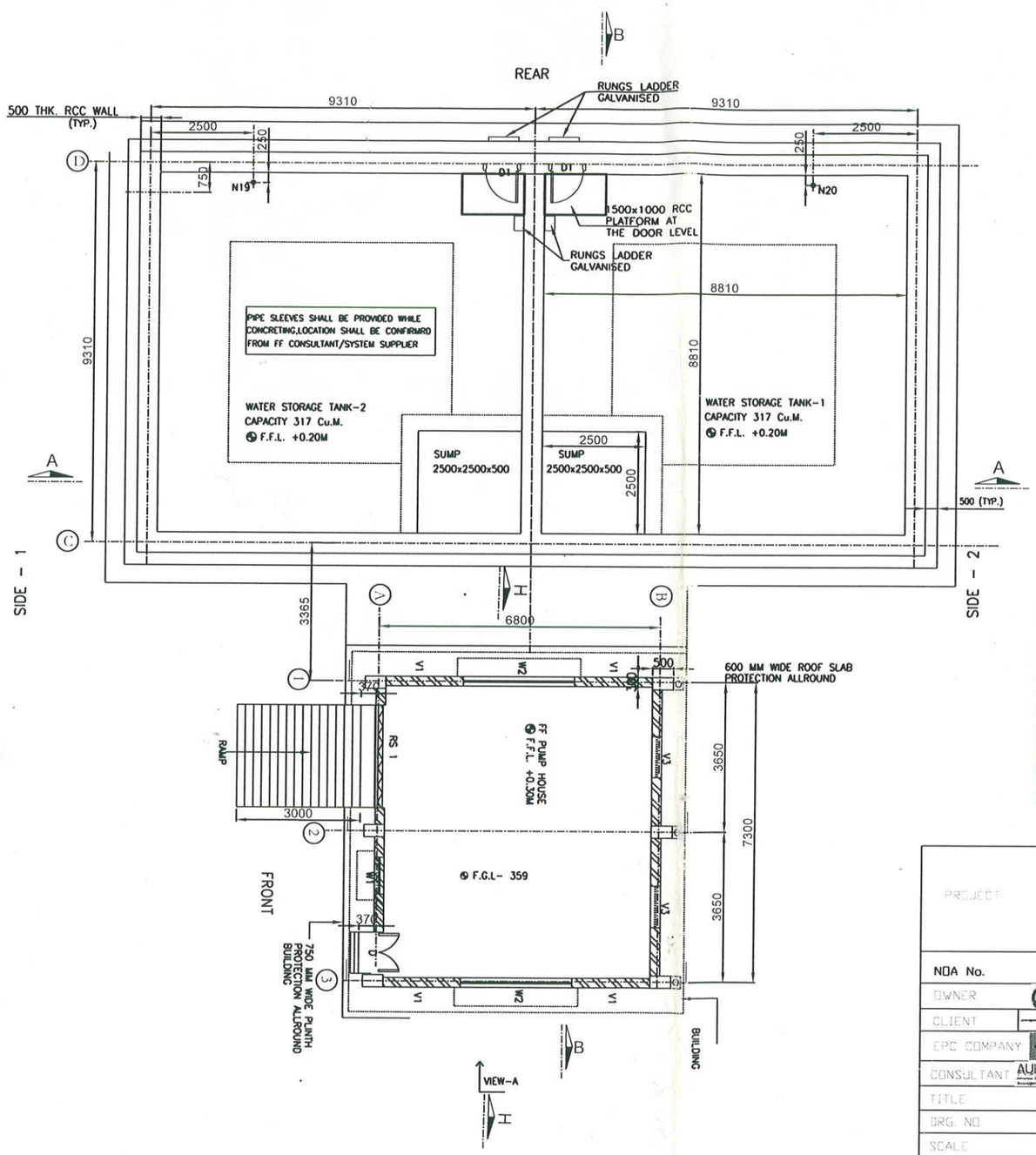
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

Categories
A. Approval (issued for Fabrication/Construction/Manufacturing)
B. Approval (issued for Fabrication/Construction/Manufacturing subject to condition that attachments and comments are included)
Please submit the revised documents for approval.
C. Approval not required
D. Insert comments and submit again for approval.
E. For Information and record.
F. Not approved.

REC PDCL GURUGRAM



GROUND FLOOR PLAN FOR FFPH & WATER TANK

LEGENDS	
	BRICK MASONARY
	R.C.C
	DOOR AND WINDOWS

I. Approved/Issued for Fabrication/Construction/Manufacturing
II. Approved/Issued for Fabrication/Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
III. Insert comments and submit again for approval.
IV. For information and record.
V. Not approved.

(Signature) (हस्ताक्षर)
DEE (Designation) (पदनाम)
18/11/22 (Date) (तिथि)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	COMBINE ARCHITECTURAL DWG. OF FFPH & WATER TANK OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/DI/17 — REV-3
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO. 1 OF 6

	NAME	DATE	SIGN	
PREPARED BY	B.K B.K.	25.11.2021		R.C. BANSAL
CHECKED BY	G.H	25.11.2021		
SUBMITTED BY	RACHIT	25.11.2021		Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

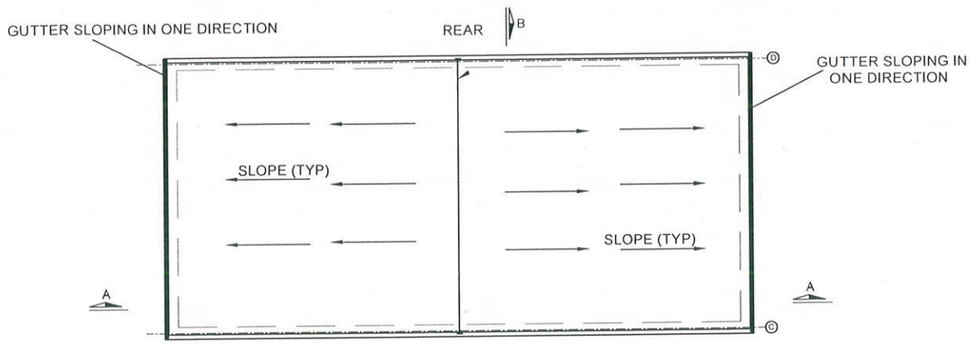
☐ More Information Date

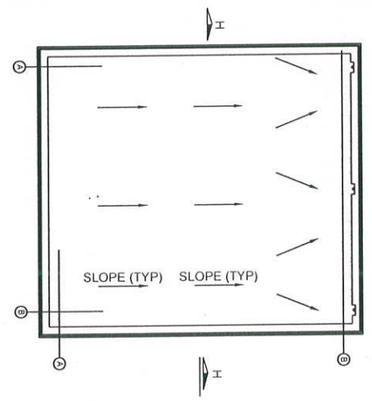
REC PDCL GURUGRAM

KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR

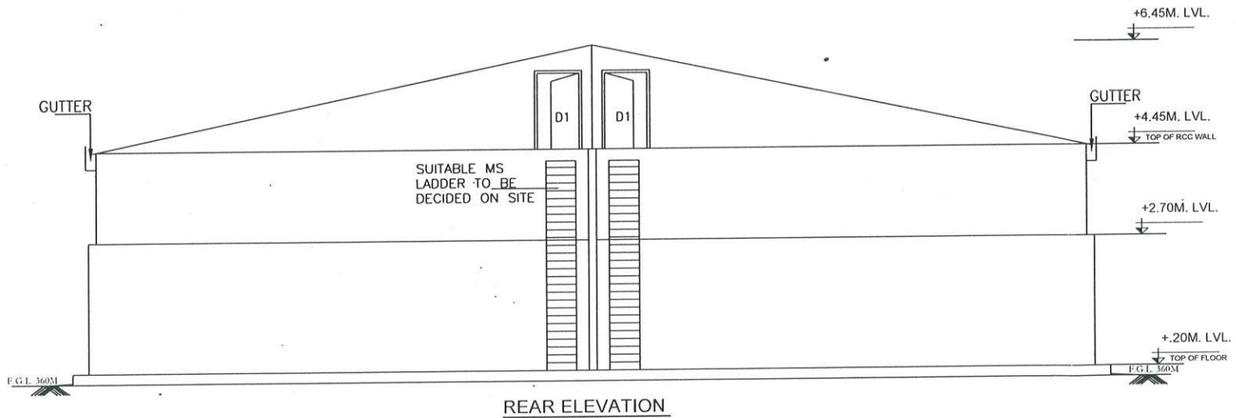


VIEW-A

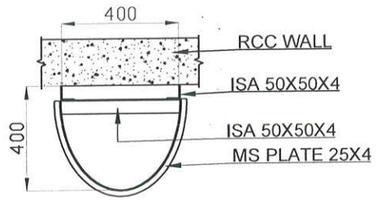




TERRACE LEVEL PLAN FOR FFPH



REAR ELEVATION



DETAIL OF GI LADDER WITH CAGE

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur--482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	COMBINE ARCHITECTURAL DWG OF FFPH & WATER TANK OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/17 — REV-3
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SHNO. 2 OF 6

	NAME	DATE	SIGN	
PREPARED BY	B.K	25.11.2021		R.C BANSAL
CHECKED BY	G.H	25.11.2021		
SUBMITTED BY	RACHIT	25.11.2021		Signature/Stamp

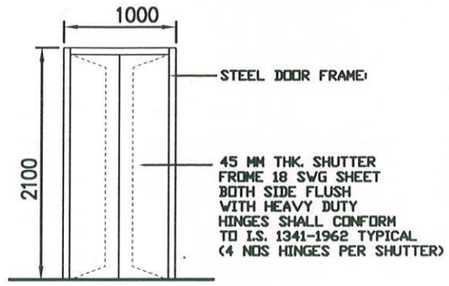
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

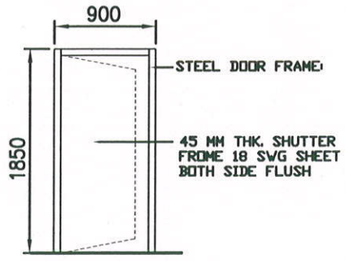
Categories
I. Approved issued for construction/manufacturing.
II. Approved subject to incorporation of comments and construction/manufacturing.
Subject to compliance of the observations and construction/manufacturing.
Please submit the revised documents for approval.
III. Rejected as submitted/resubmitted.
Resubmit as mentioned above for approval.
IV. For information and record.
V. Not approved.

(Signature) DEE (Designation) 18/11/22 (Date)

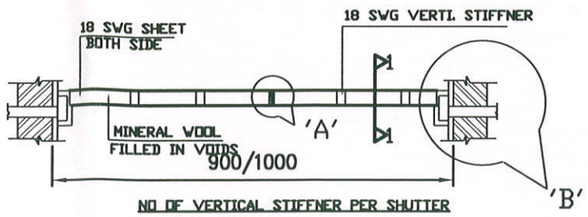
REC PDCL GURUGRAM



D-1000X2100

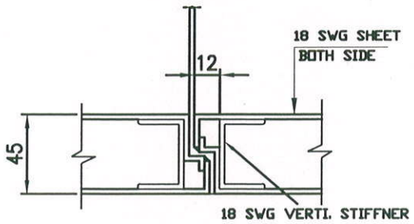


D1-900X1850

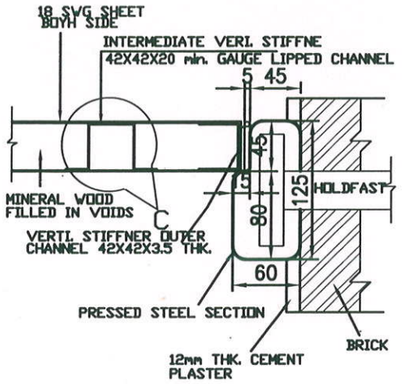


NO OF VERTICAL STIFFNER PER SHUTTER
1 NO FOR D & D1

TYPICAL STEEL DOOR FRAME DETAIL



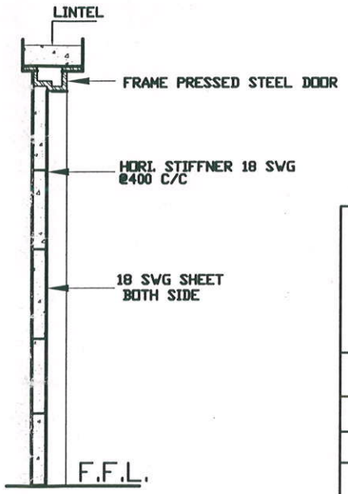
DETAIL - A



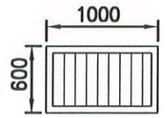
DETAIL - B



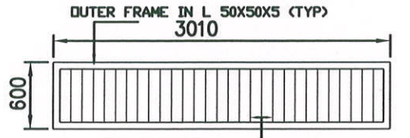
DETAIL - C



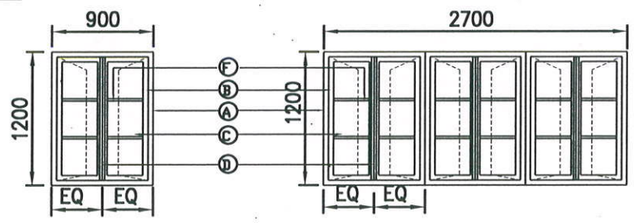
SECTION 1-1



V3-1000X600
ALUMINUM GRILL



V1-3010X600
ALUMINUM GRILL



W1-900X1200

W2 -2700x1200

LEGEND:-

S. NO	MARKED	DESCRIPTION	SIZE	REMARKS
01	A	OUTER FRAME	F7D SECTION	AS PER I.S. 7452-1990
02	B	INNER SHUTTER FRAME	F7D SECTION	AS PER I.S. 7452-1990
03	C	PLAIN GLASS	4.0 MM THK.	----
04	D	CENTRAL MULLION	F4B SECTION	AS PER I.S. 7452-1990
05	E	VERTICAL GLAZING BAR	F4B SECTION	AS PER I.S. 7452-1990
06	F	HORIZOTAL GLAZING BAR	T2 SECTION	AS PER I.S. 7452-1990

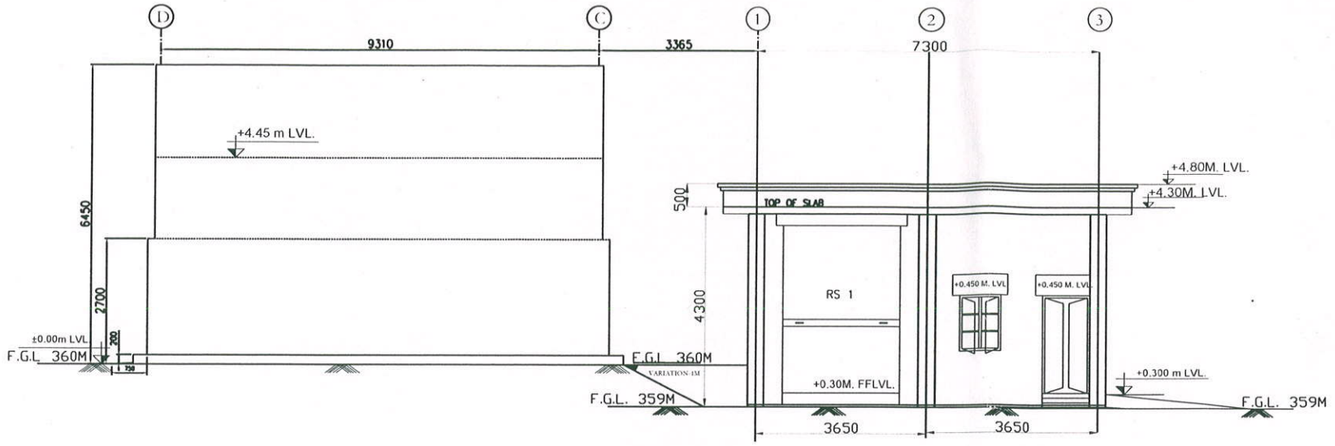
Consulting
I. Approved for Fabrication/Construction/Manufacturing
II. Approved subject to fabrication/construction/manufacturing
Subject to ... that statements and commitments ...
Please submit the revised documents for approval
III. Incorrect comments and submit again for approval
IV. For information and record
V. Not approved.
(Signature) (हस्ताक्षर)
DEG
(Designation) (पदनाम)
18/1/22
(Date) (तिथि)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited(RECPDCL)		
EPC COMPANY	Kallash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	COMBINE ARCHITECTURAL DWG. OF FFPH & WATER TANK OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/17		REV-3
SCALE	As shown in Drawing		SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM		SH.NO: 3 OF 6
	NAME DATE	SIGN	
PREPARED BY	B.K. 25.11.2021		R.C BANSAL
CHECKED BY	G.H 25.11.2021		
SUBMITTED BY	RACHIT 25.11.2021		Signature/Stamp

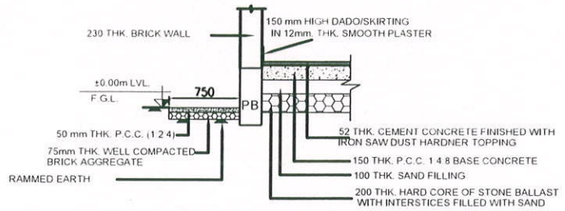
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

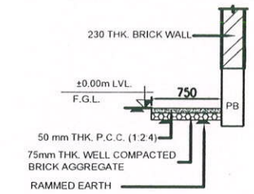
REC PDCL GURUGRAM



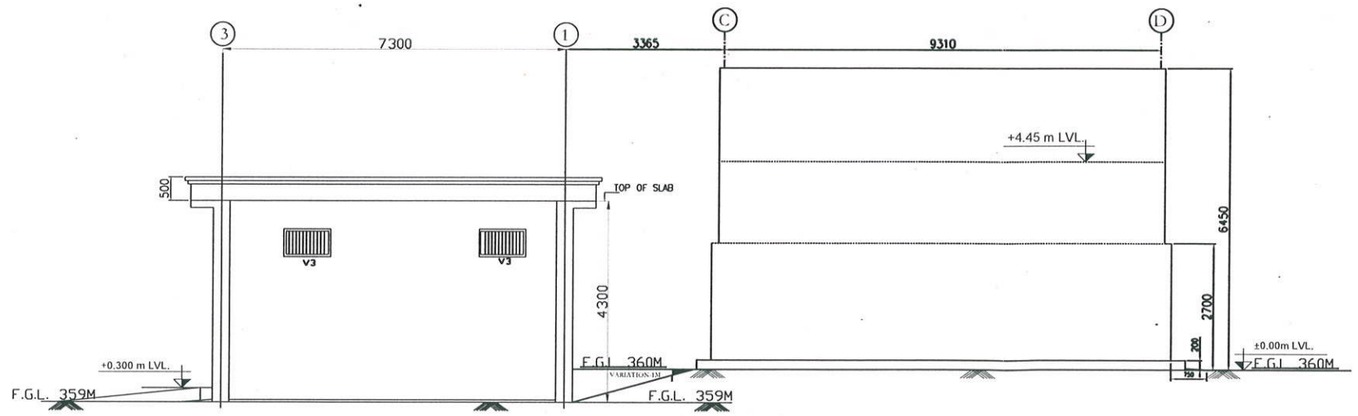
ELEVATION SIDE - 1 / FRONT VIEW



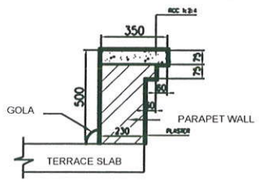
TYP. DETAILS FOR PLINTH PROTECTION AND FLOORING DETAILS FOR FFPH BUILIDING



TYP. DETAILS FOR PLINTH PROTECTION



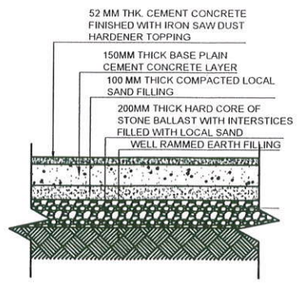
ELEVATION SIDE - 2



TYP. DETAILS OF CORBELLING FOR PARAPET AT ROOF LEVEL

SCHEDULE OF OPENING:-

SR. NO.	OPENING MARK	SIZE WXD mm	CILL LVL. mts.	LINTEL LVL. mts.	NOS.	
01	ROLLING SHUTTER RS1	2500X3400	+0.300	+3.70	01	STANDERED STEEL ROLLING SHUTTER DESCRIPTION
02	DOOR D	1000X2100	+0.300	+2.40	01	M.S. SHEET DOUBLE SHUTTER
03	DOOR D1	900X1850	+4.45	+6.3	02	STEEL DOOR - SINGLE SHUTTER
04	WINDOW W1	900X1200	+1.20	+2.40	01	ALUMINUM WINDOW (1200mm) GLAZED MADE FROM HOT ROLLED SECTION
05	WINDOW W2	2700X1200	+1.20	+2.40	02	ALUMINUM WINDOW (1200mm) GLAZED OPENING MADE FROM HOT ROLLED SECTIONS.
06	VENTILATOR V1	3010X600	AT BEAM BOTTOM		04	ALUMINUM GRILL OPENING MADE FROM HOT ROLLED SECTIONS.
07	VENTILATOR V3	1000X600	AT BEAM BOTTOM		02	ALUMINUM GRILL



FLOORING DETAILS

(i) Approved / cleared for Fabrication/Construction/Manufacturing.
(ii) Approved / cleared for Fabrication/Construction/Manufacturing subject to rectification that statements and comments are included.
Please scan it the revised documents for approval.
(iii) Insert comments and submit again for approval.
(iv) For information and record.
(v) Not approved.

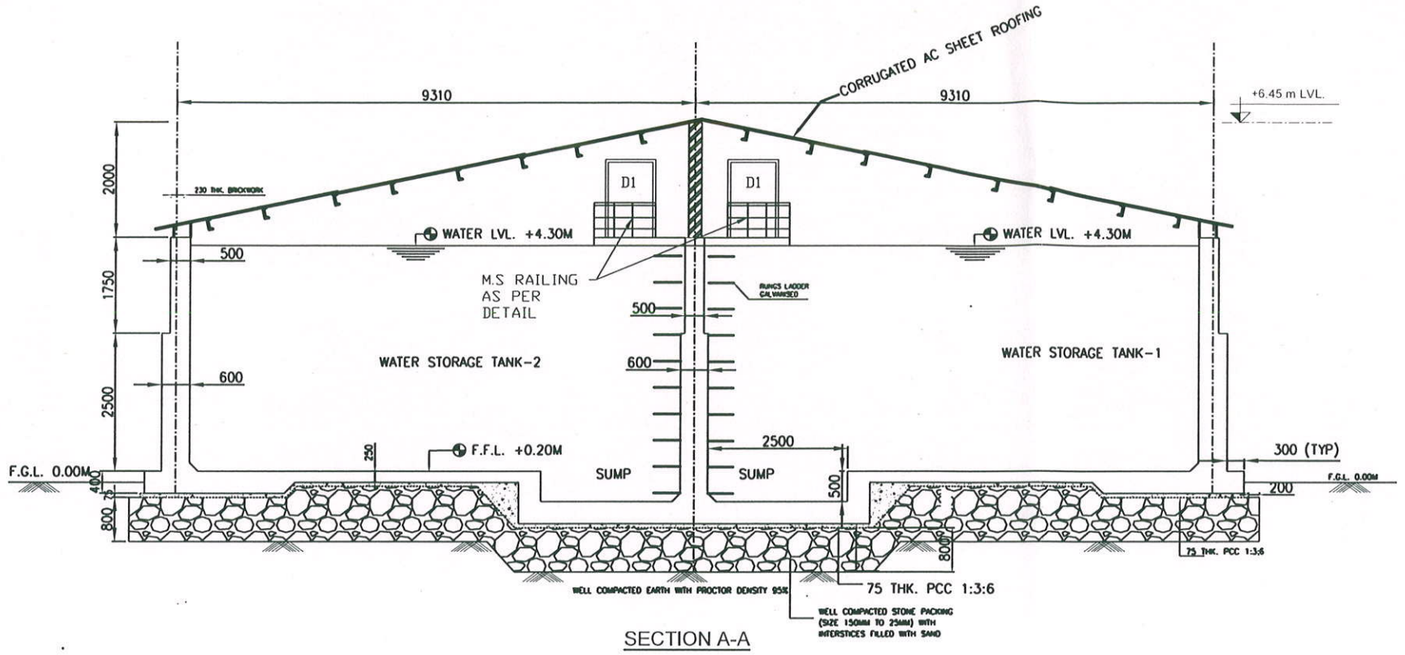
DEE (Designation) (पदनाम)
18/11/21 (Date) (तिथि)

REC PDCL GURUGRAM

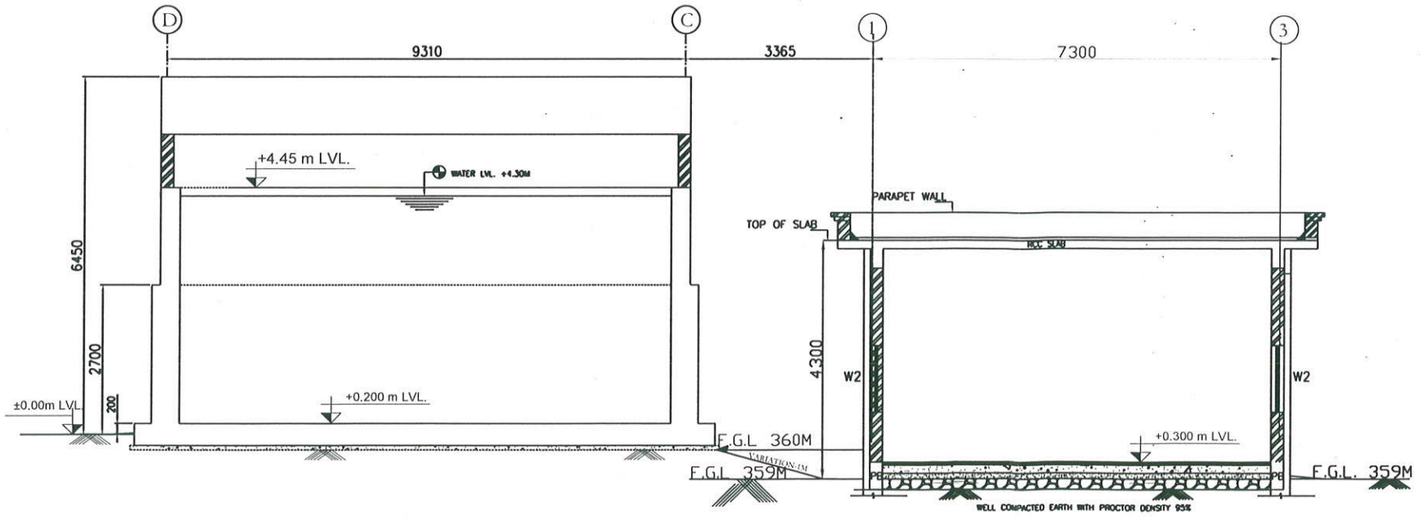
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	COMBINE ARCHITECTURAL DWG. OF FFPH & WATER TANK OF 220/33 KV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/17 REV-3
SCALE	As shown in Drawing SHEET SIZE- A3
AREA	916 KANAL 46336.5 SQM SHNO. 4 OF 6

	NAME	DATE	SIGN	
PREPARED BY	B.K.	23.11.2021		R.C. BANSAL
CHECKED BY	G.H.	23.11.2021		Signature/Stamp
SUBMITTED BY	RACHIT	23.11.2021		

☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....



SECTION A-A



SECTION B-B

REC PDCL GURUGRAM

Calculation Sheet
i. Approved for fabrication/Construction/Manufacturing.
वेल्डिंग/फैब्रिकेशन/निर्माण हेतु अनुमोदित।
ii. Approved as per the Fabrication/Construction/Manufacturing Drawings subject to condition that statements and comments made in Review Sheet of the revised documents for approval.
वेल्डिंग/फैब्रिकेशन/निर्माण हेतु अनुमोदित, यदि रिव्यू शीट में टिप्पणियों को संशोधित दस्तावेजों में अनुमोदन हेतु पुनः प्रस्तुत करने की शर्त पर।
iii. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
iv. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
v. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
DEE (Designation) (पदनाम)
18/11/22 (Date) (दिनांक)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	COMBINE ARCHITECTURAL DWG. OF FFPH & WATER TANK OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/17 — REV-3
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO: 5 OF 6

	NAME	DATE	SIGN	
PREPARED BY	B.K.	25.11.2021		R.C BANSAL
CHECKED BY	G.H	25.11.2021		
SUBMITTED BY	RACHIT	25.11.2021		Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

GENRAL NOTES:-

(1) ALL DIMENSIONS ARE IN MM AND LEVEL IN METERS.

(2) DO NOT SCALE THE DRG. FOLLOW WRITTEN DIMENSIONS ONLY

(3) THE GRADE OF CONCRETE FOR ALL RCC WORK SHALL BE M25

(4) WATER NOT TO BE FILLED IN TANK UNTILL TOP LIFT HAS BEEN CAST & CURED

(5) INTEGRAL WATER PROOFING COMPOUND SHALL BE ADDED WHILE CONCRETING AS PER Manufacturer's RECOMENDATIONS

(6) ALL INSERTS, NOZZLES, PIPE SLEEVES ETC. SHOWN IN DRG. ARE INDICATIVE ONLY. THESE SHALL BE PLACED IN POSITION BEFORE CONCRETING AS PER FIREFIGHTING REQUIREMENTS.

(7) PURLINS SHALL BE MANUFACTURED AFTER EXACT MEASUREMENT AT SITE.

(8) ALL EXTERNAL BRICK WALLS ARE 230 THICK

(9) WATER PROOFING SHALL BE DONE AS PER SPECIFICATION

(10) ALL EXTERNAL SURFACES SHALL HAVE 18 MM THK CEMENT PLASTER AS PER SPECIFICATION

(11) ALL INTERNAL SURFACES SHALL HAVE 12 MM THK CEMENT PLASTER ON SMOOTH SURFACE OF BRICKWALL & 15mm THK. CEMENT PLASTER ON ROUGH SIDE OF BRICKWALL AS PER SPECIFICATION

(12) OUTSIDE AND INSIDE SURFACES OF FIRE WATER TANK SHALL BE UNPLASTERED AND PROVIDED WITH A WATER PROOF CEMENT PAINT OF APPROVED SHADE

(13) P.V.C. WATER STOPPER SHALL BE PROVIDED AT ALL CONSTRUCTION JOINT OF WATER STORAGE TANKS

(14) ALL STRUCTURAL STEEL MEMBERS FOR ROOFING WORK SHALL BE PAINTED WITH SYNTHETIC ENAMEL PAINT OF APPROVED SHADE TWO OR MORE COATS TO GIVE EVEN SHADE OVER STEEL PRIMER.

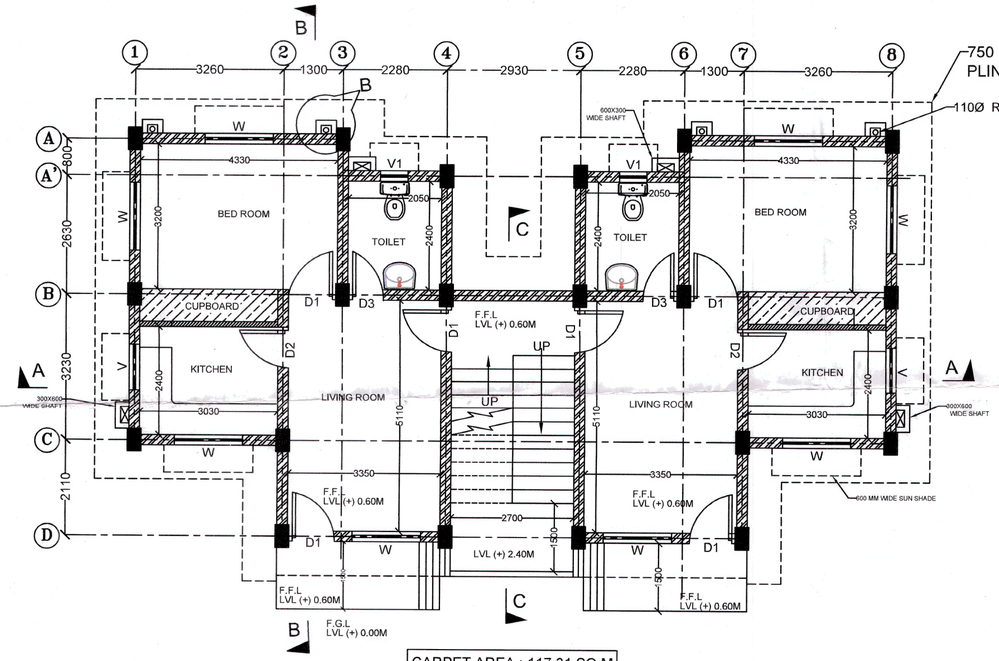
Categories
(Signature)
(हस्ताक्षर)
DEE
(Designation)
(पदनाम)
18/11/21
(Date)
(तिथि)

REC PDCL GURUGRAM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy.			
TITLE	COMBINE ARCHITECTURAL DWG. OF FFPH & WATER TANK OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/17		REV-3	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 6 OF 6	
	NAME	DATE	SIGN	
PREPARED BY	B.K. B.R.	25.11.2021		R.C BANSAL
CHECKED BY	G.H	25.11.2021		
SUBMITTED BY	RACHIT	25.11.2021		Signature/Stamp

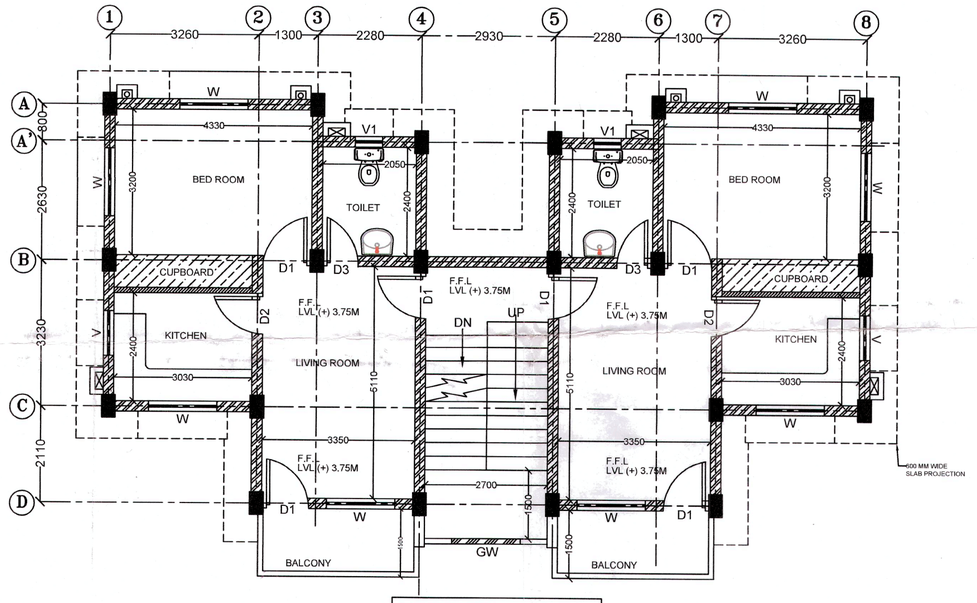
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



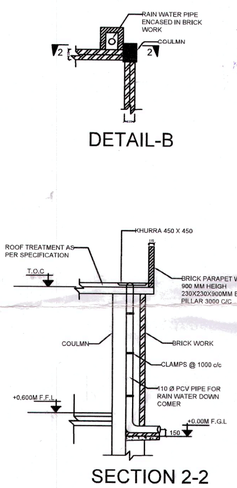
CARPET AREA : 117.31 SQ.M

GROUND FLOOR PLAN
LVL (+0.60)



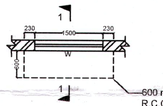
CARPET AREA : 117.31 SQ.M

FIRST FLOOR PLAN
LVL (+3.75)



DETAIL-B

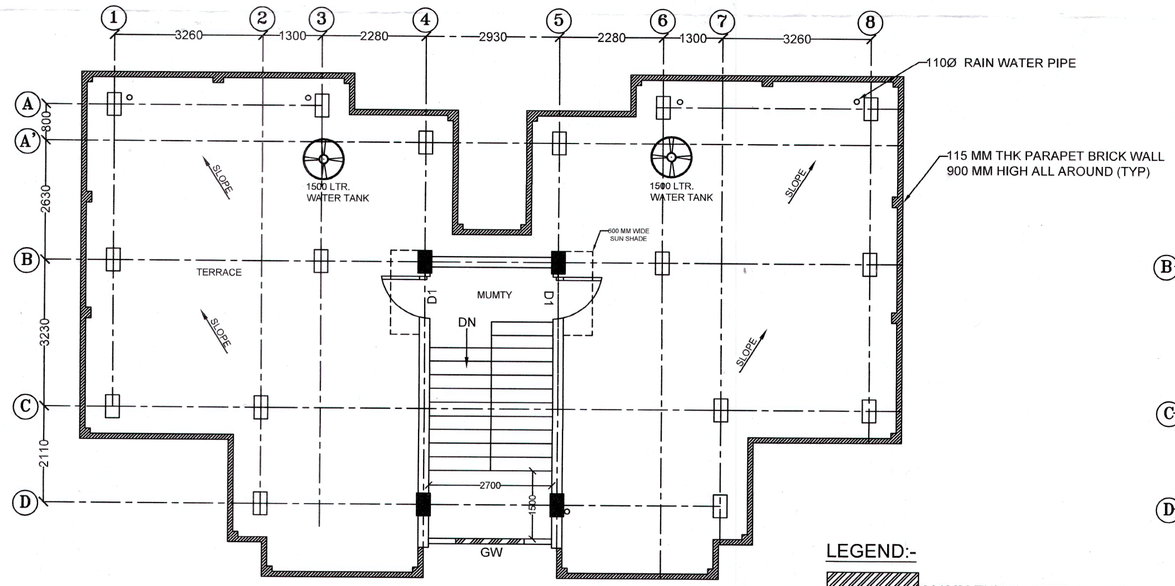
SECTION 2-2



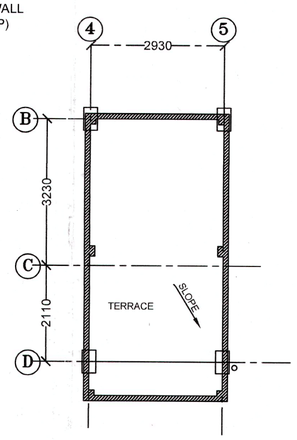
SUNSHADE DETAIL

SCHEDULE OF OPENING

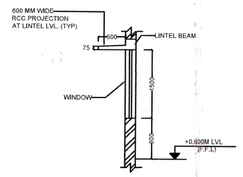
SL. NO.	TYPE	SIZE (WIDTHxHEIGHT)	SWING	SILL LEVEL WR. TO FFL.	LINTEL LEVEL WR. TO FFL.
1.	D1 (DOOR)	1000 x 2400	SEE PLAN	--	+2.40 M
2.	D2 (DOOR)	900 x 2400	SEE PLAN	--	+2.40 M
3.	D3 (DOOR)	750 x 2100	SEE PLAN	--	+2.40 M
4.	W (WINDOW)	1500 x 1500	--	+0.90 M (G.F.)	+2.40 M (G.F.)
				+4.05 M (F.F.)	+5.55 M (F.F.)
5.	V (VENTILATOR)	1000 x 600	--	+1.80 M (G.F.)	+2.40 M (G.F.)
				+4.95 M (F.F.)	+5.55 M (F.F.)
6.	V1 (VENTILATOR)	600 x 600	--	+1.80 M (G.F.)	+2.40 M (G.F.)
				+4.95 M (F.F.)	+5.55 M (F.F.)
7.	GW (GLAZED WINDOW)	1500 x 1500	--	AT STAIRCASE WASTE SLAB LVL. (02No) REFER SECTION C-C	



TERRACE PLAN
LVL (+6.90)



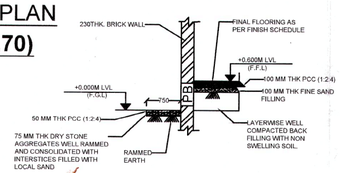
TERRACE PLAN
LVL (+9.70)



SECTION 1-1

LEGEND:-

	230MM THICK EXTERNAL WALL
	115MM INTERNAL ROOM PARTITION WALL
W1	WINDOW
D1,D2,D3	DOOR
V	VENTILATOR
GW	GLAZED WINDOW



TYP. DETAILS OF PLINTH PROTECTION & FLOORING

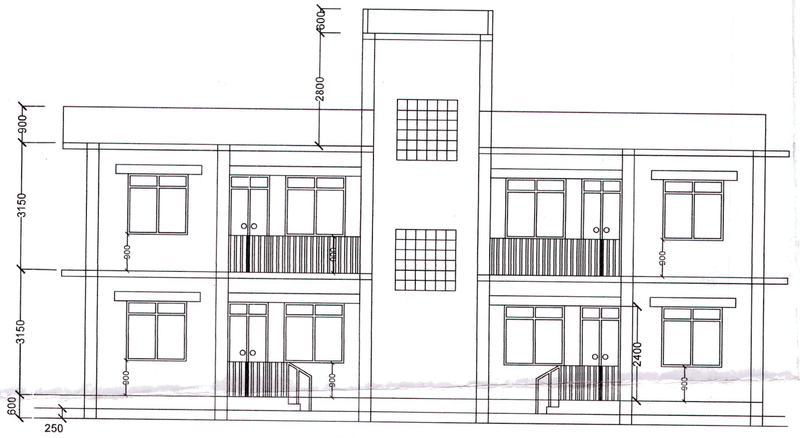
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	ARCHITECTURE JE QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/20		REV- 1
SCALE	As shown in Drawing		SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 2

	NAME	DATE	SIGN	
PREPARED BY	AMIR	16.07.2021		R.C BANSAL
CHECKED BY	G.H	16.07.2021		
SUBMITTED BY	RACHIT	16.07.2021		Signature/Stamp...

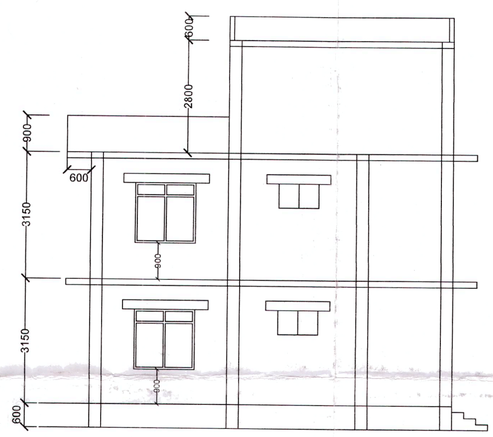
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

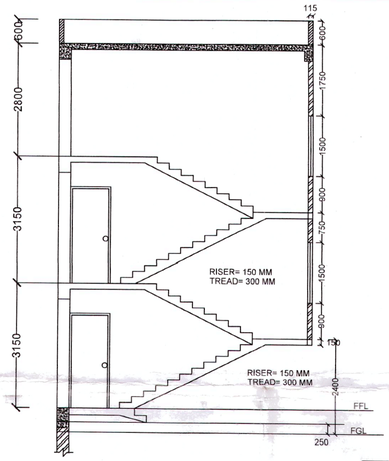
Kailash Devbuild (India) Pvt. Ltd. Jabalpur



FRONT ELEVATION



LEFT SIDE ELEVATION



SECTION C-C

WATERPROOFING DETAILS:-

Integral cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terraces etc. consisting of following operations:

a) Applying a slurry coat of neat cement using 2.75 kg/sq. m. of cement admixed with water proofing compound conforming to IS. 2645 and approved by Engineer-in-charge over the RCC slab including adjoining walls up to 300mm height including cleaning the surface before treatment.

b) Laying brick bats with mortar using broken bricks/brick bats 25 mm to 115 mm size with 50% of cement mortar 1:5 (1 cement : 5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge over 20 mm thick layer of cement mortar of mix 1:5 (1 cement :5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge to required slope and treating similarly the adjoining walls up to 300 mm height including rounding of junctions of walls and slabs.

c) After two days of proper curing applying a second coat of cement slurry using 2.75 kg/ sq. m. of cement admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-charge.

d) Finishing the surface with 20 mm thick joint less cement mortar of mix 1:4 (1 cement: 4 coarse sand) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-charge including laying glass fibre cloth of approved quality in top layer of plaster and finally finishing the surface with trowel with neat cement slurry and making pattern of 300x300 mm square 3 mm deep.

e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by the Engineer-in-Charge.

f) With average thickness of 120mm and minimum thickness at khurra as 65 mm.

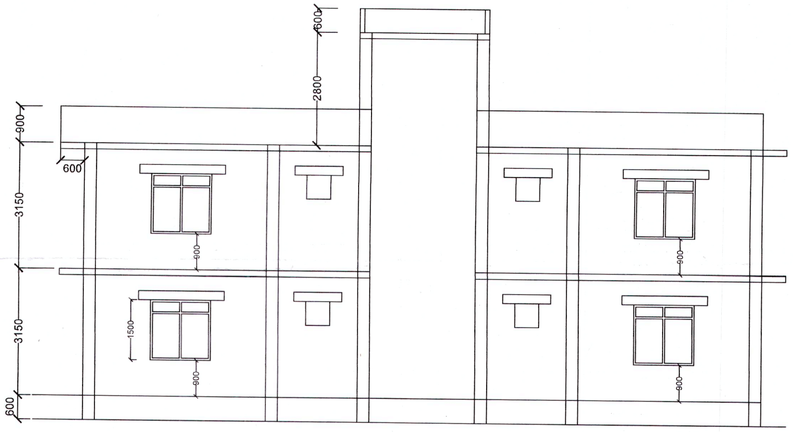
DETAIL OF FINISH SCHEDULE:

S.NO.	LOCATION	FLOORING & SKIRTING 150MM HIGH	WALL(INTERNAL)	CEILING	DOOR,WINDOWS & VENTILATOR
1	Residential Buildings	Vitrified tiles 8mm thick size600 x 600mm	Non VOC acrylic emulsion paint over 2mm POP putty upto ceilling over approved primer coat	Ceiling painted with Non VOC acrylic emulsion paint to give an even shade.	Door shall have flush door shutter 35 mm thick with commercial ply duly painted & polished as per CPWD specification & as per the approval of Engineer- in- Charge. Door frames should be of sal/hard wood/ Red Marandi as per the as per CPWD specification & as per the approval of Engineer- in- Charge.
2	Toilets	Ceramic tiles.	DADO glazed tile 2100mm high, above that non VOC acrylic emulsion paint over 2 mm thick POP putty along with primer coat.)	Non VOC acrylic Emulsion paint over approved primer coat for RCC building.	Windows should be wooden panel window with glazing as perCPWD specifications & approval of Engineers in Charge Windows frames should be of shawl/hard wood/ Red Marandi as per the as per CPWD specification & as per the approval of Engineer-in-Charge.

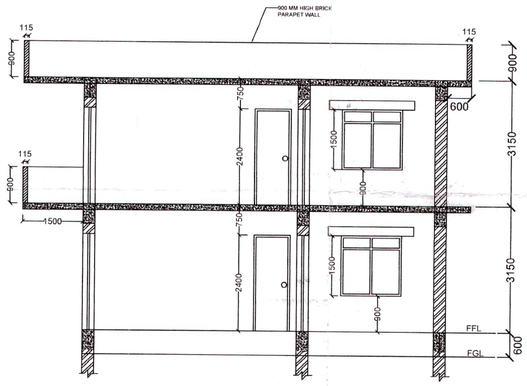
Notes:-

PLASTERING:-

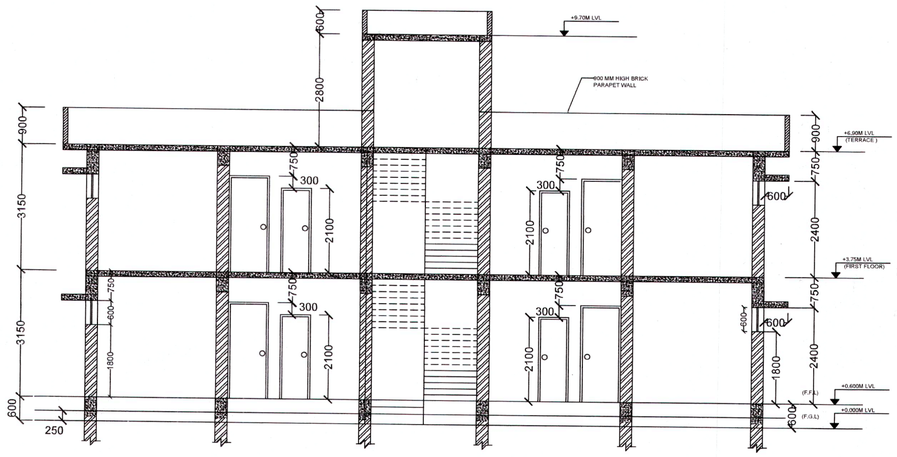
1. EXTERNAL SURFACE OF BUILDING SHALL HAVE 18 MM THICK PLASTER IN TWO LAYERS, WITH THE UNDER. LAYER 12 MM THICK 1:5 CEMENT SAND PLASTER AND THE TOP LAYER 6 MM THICK 1:6 CEMENT SAND PLASTER. INSIDE WALLS SURFACES SHALL HAVE 12/15 MM THICK 1:6 CEMENT SAND PLASTER. ROUGH SURFACES SHALL HAVE 15MM AND SMOOTH SURFACE SHALL HAVE 12 MM THICK CEMENT SAND PLASTER.
2. ALL R.C.C. CEILINGS SHALL BE PROVIDED WITH 6.0 MM THICK CEMENT SAND PLASTER IN 1:3 CEMENT SAND MORTAR (1CEMENT : 3 FINE SAND) EXCEPT FOR AREAS WITH FALSE CEILING .
3. MINIMUM HEIGHT OF SKIRTING ABOVE FINISHED FLOOR LEVEL SHALL BE 150 MM.
4. ALL DIMENSIONS ARE IN MM.
5. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSIONS ONLY.
6. ALL DIMENSIONS SHALL BE CHECKED PRIOR TO EXECUTION
7. LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGE IN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
8. ANY DESCREPANCY IN DRAWING TO BE BROUGHT TO THE NOTICE OF SITE INCHARGE.
9. COLUMN SHOWN IN THE DRAWING ARE INDICATIVE, FOR EXACT COLUMN LOCATIONS REFER STRUCTURAL DRAWING.
10. DIMENSIONS OF COLUMN AND BEAM SUBJECT TO CHANGE.
11. 150 MM DIAMETER UPVC RAINWATER DOWN COMER PIPES CONFORMING TO RELEVANT INDIAN STANDARD / EQUIVALENT INTERNATIONAL STANDARDS WITH WATER TIGHT LEAD JOINTS SHALL BE PROVIDED TO DRAIN OFF THE RAIN WATER FROM THE ROOFS.



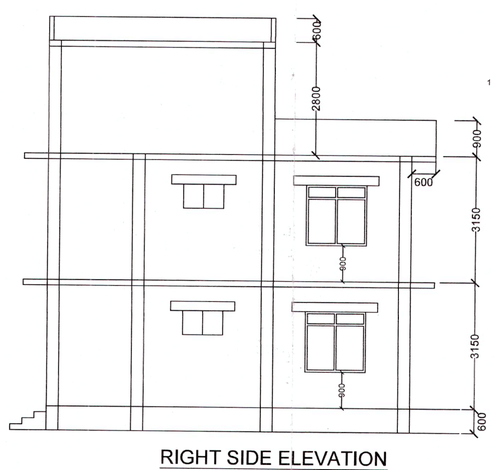
REAR ELEVATION



SECTION B-B



SECTION A-A



RIGHT SIDE ELEVATION

Comments
(If Any)
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
(संशोधित रेखाचित्र निर्माण/कार्य हेतु अनुमोदित/जारी)
II. Approved/ Issued for Fabrication/Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
(संशोधित रेखाचित्र/दस्तावेज हेतु अनुमोदित/जारी शर्तो के तहत कि टिप्पणियों को शामिल किया जाए)
कृपया संशोधित दस्तावेज प्रस्तुतकरें (पुनः करें)
III. Insert comments and submit again for approval.
टिप्पणियों को शामिल कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
11/08/21 (Date) (दिनांक)

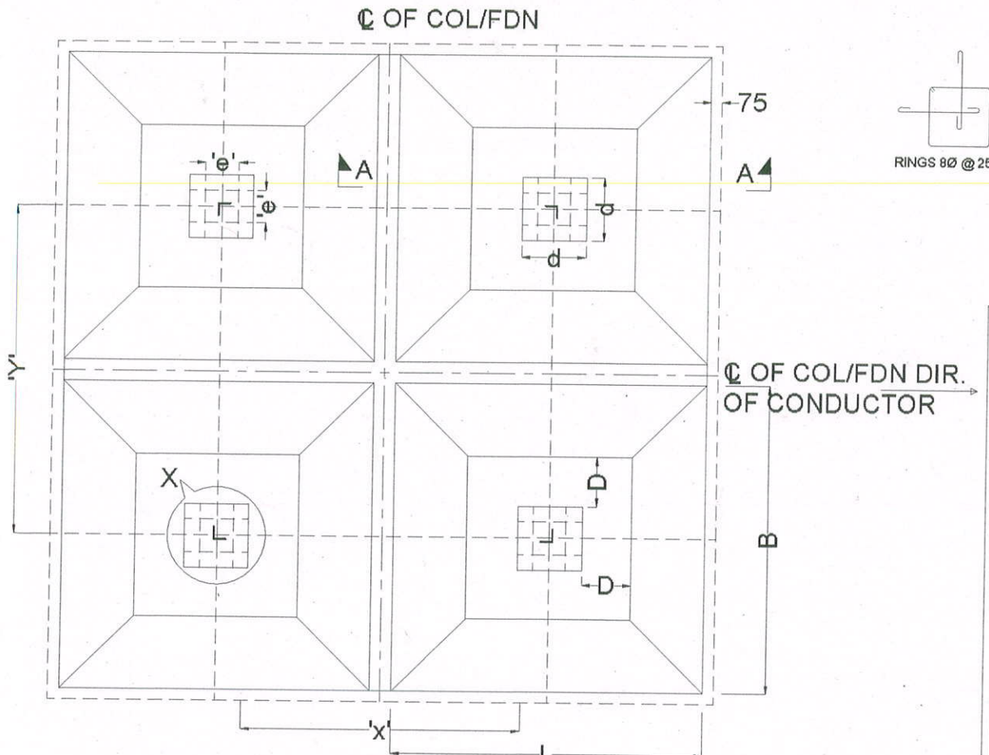
REC PDCL GURUGRAM

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

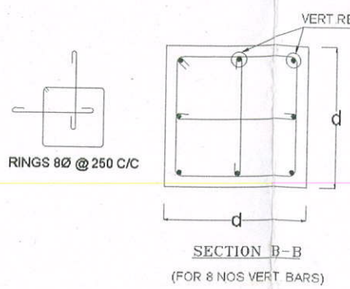
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	ELEVATION JE QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/20		REV- 1	
SCALE	As shown in Drawing		SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 2 OF 2	
	NAME	DATE	SIGN	
PREPARED BY	AMIR	16.07.2021		R.C BANSAL
CHECKED BY	G.H	16.07.2021		
SUBMITTED BY	RACHIT	16.07.2021	Rachit	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



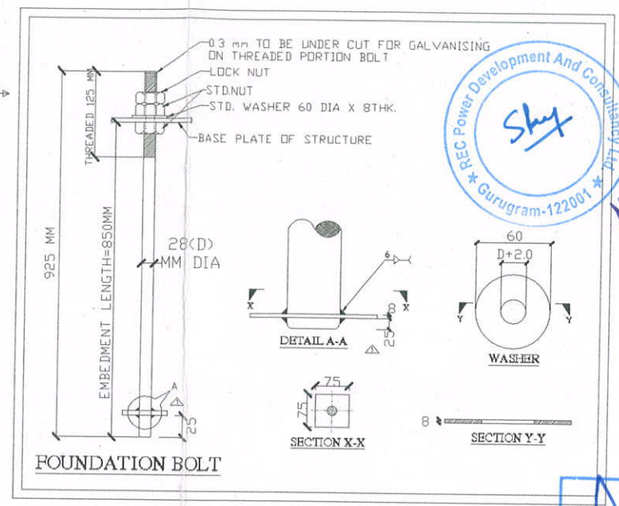
FOUNDATION PLAN FOR TOWER



SECTION B–B

(FOR 8 NOS VERT BARS)

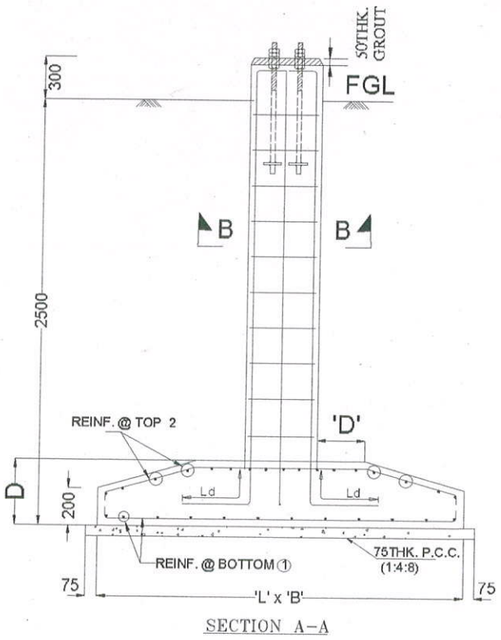
S.NO.	TOWER	L	B	'd'	D	(1)	(2)	(3)	'e'	N	X	Y	'Ø'
1	CTH	3350	2350	500	500	12Ø @ 175 C/C	12Ø @ 175 C/C	8-25Ø	210	4	3426.6	2426.6	40
2	CTG	2400	2000	500	450	12Ø @ 200 C/C	12Ø @ 200 C/C	8-20Ø	210	4	3440	2440	28



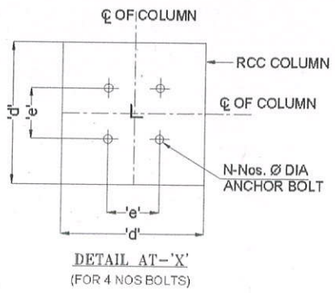
FOUNDATION BOLT

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE GRADE SHALL BE M25 (1:1:2) AS PER TS.
3. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 500 CONFIRM TO IS:1786-1985.
5. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR BOTTOM, TOP & SIDE OF RAFT AND 50mm COVER FOR COLUMN.
4. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN LAYOUT.
6. IF FOUNDATION BOLTS FOUL WITH STIRRUPS, STIRRUPS SHALL BE ADJUSTED AT SITE.
7. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
8. NET BEARING CAPACITY IS CONSIDERED 9 T/sqm FOR 2.5M DEPTH AS PER SOIL INVESTIGATION REPORT.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. ALL HOOKS, BENDS AND SPLICES SHALL BE AS PER IS:456 AND IS:2502.
11. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.
12. GRADE OF FOUNDATION BOLT SHALL BE 5.6.

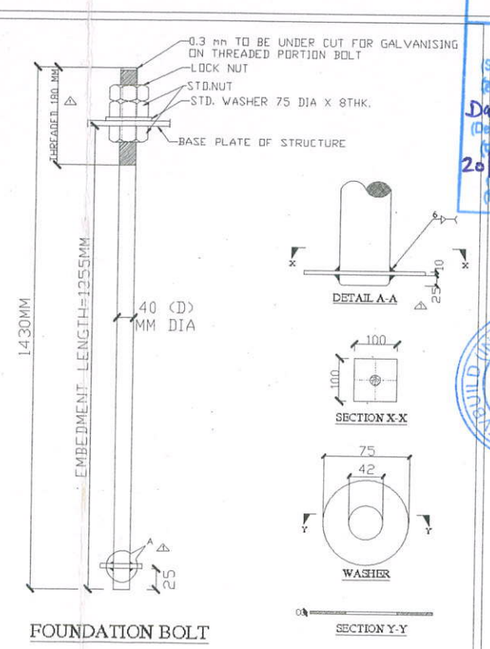


SECTION A–A



DETAIL AT–'X'

(FOR 4 NOS BOLTS)



FOUNDATION BOLT

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NEA NO.	(1) OS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) ICS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FOUNDATION DRAWING CTG-CTH (0-FILLING) FOR 220kV Nagrota (New) S/S, Jammu
DRG NO.	KDBIL/250 PJ/20-21/D1/24 — REV- 1
SCALE	As shown in Drawing
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	AKASH	04.01.2022	
CHECKED BY	G.H	04.01.2022	
SUBMITTED BY	KDBIL	04.01.2022	

Signature/Stamp...

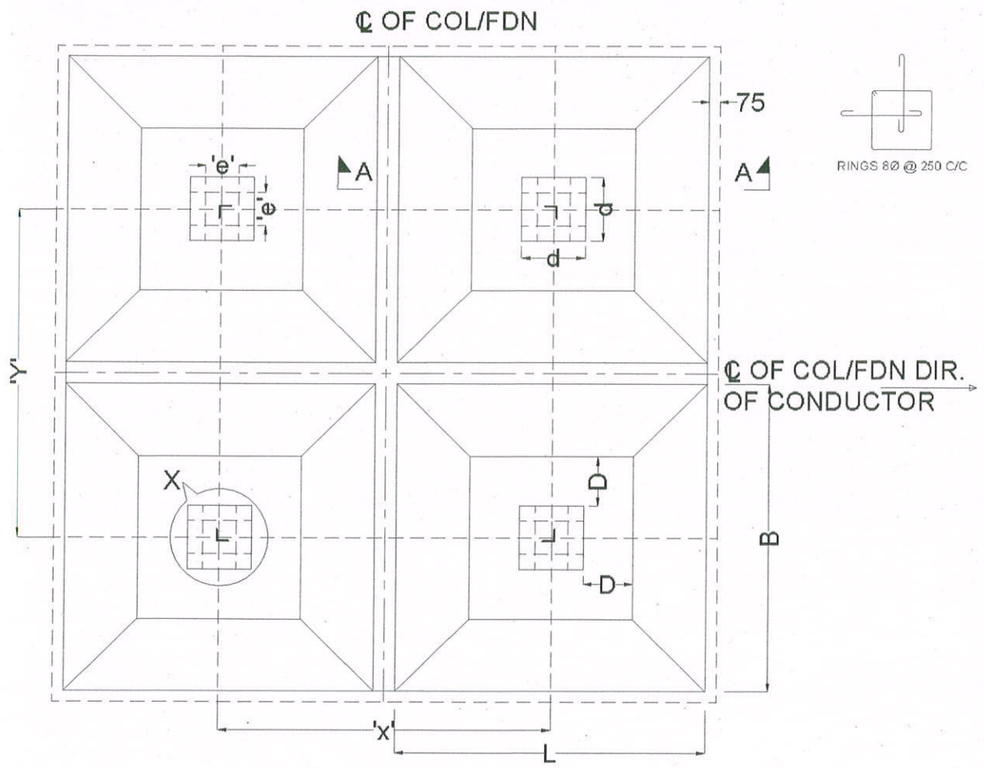
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

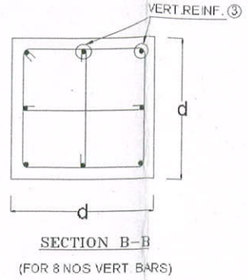
REC Power Development And Consultancy Ltd. * Gurugram-122001 *

(Signature) (हस्ताक्षर) Dam(7) (Designation) (पदनाम) 20/1/22 (Date) (तिथि)

KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR

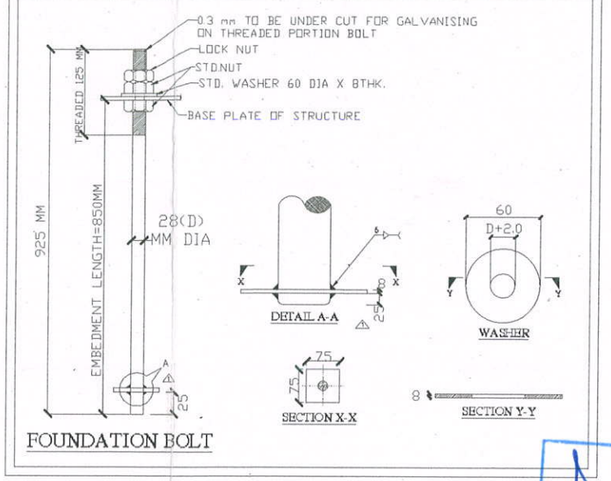


FOUNDATION PLAN FOR TOWER

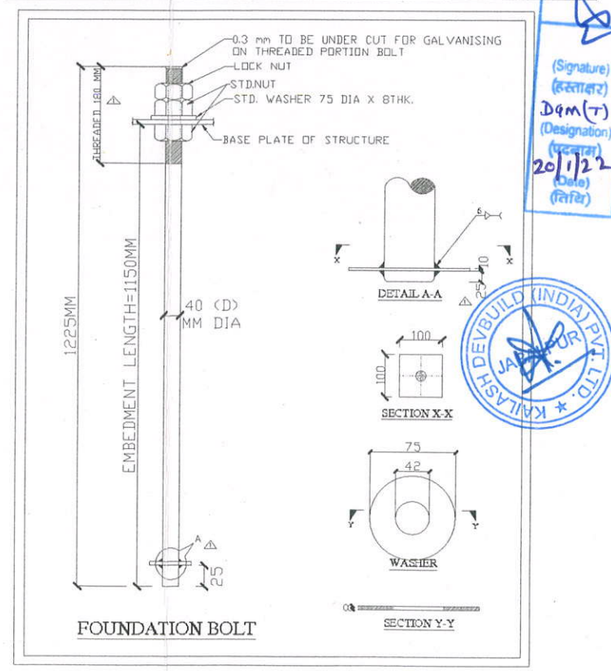


SECTION B–B
(FOR 8 NOS VERT. BARS)

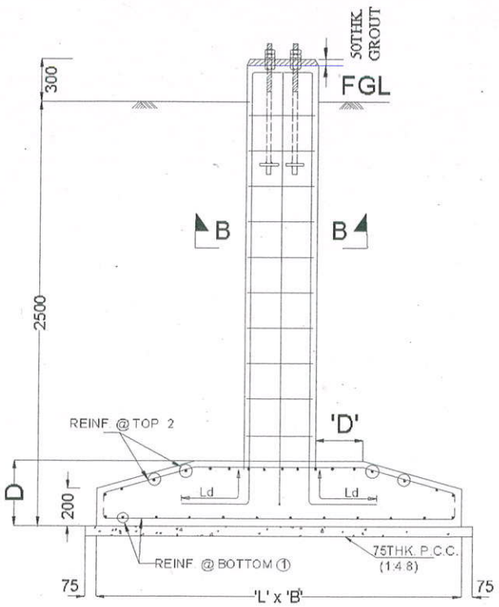
S.NO.	TOWER	L	B	'd'	D	(1)	(2)	(3)	'e'	N	X	Y	'Ø'
1	CC	2600	2100	500	500	12Ø @ 175 C/C	12Ø @ 175 C/C	4-20Ø 4-16Ø	210	4	3444.8	2444.8	28
2	CD	3200	3200	500	500	12Ø @ 175 C/C	12Ø @ 175 C/C	8-25Ø	210	4	3428.2	3428.2	40



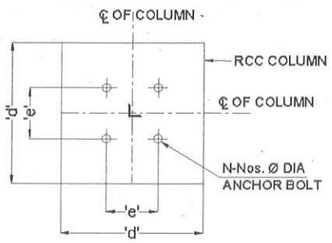
FOUNDATION BOLT



FOUNDATION BOLT



SECTION A–A



DETAIL AT–'X'
(FOR 4 NOS BOLTS)

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE GRADE SHALL BE M25 (1:1:2) AS PER TS.
3. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 500 CONFIRM TO IS:1786-1985.
5. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR BOTTOM, TOP & SIDE OF RAFT AND 50mm COVER FOR COLUMN.
4. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN LAYOUT.
6. IF FOUNDATION BOLTS FOUL WITH STIRRUPS, STIRRUPS SHALL BE ADJUSTED AT SITE.
7. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
8. NET BEARING CAPACITY IS CONSIDERED 9 T/sqm FOR 2.5M DEPTH AS PER SOIL INVESTIGATION REPORT.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. ALL HOOKS, BENDS AND SPLICES SHALL BE AS PER IS:456 AND IS:2502.
11. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.
12. GRADE OF FOUNDATION BOLT SHALL BE 5.6.

Power Development And Consultancy Wing

(Signature) (हस्ताक्षर) DGM(T) (Designation) (पदनाम) 20/1/22 (Date) (दिनांक)

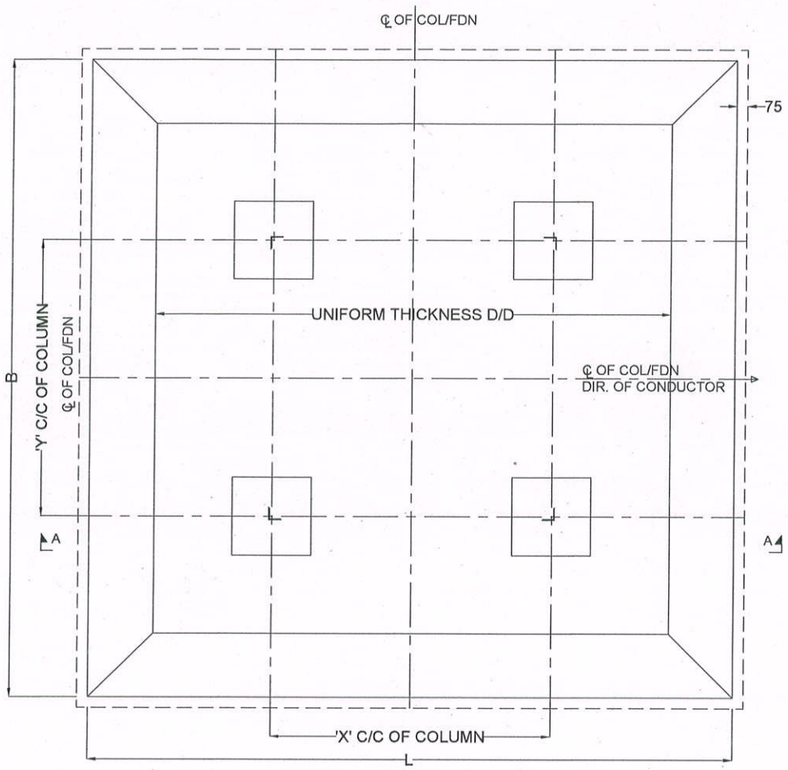
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FOUNDATION DRAWING CC & CD (9 PILLING) FOR 220kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/25 ✓
REV- 1 ✓	
SCALE	As shown in Drawing
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	AKASH	04.01.2022	
CHECKED BY	G.H	04.01.2022	
SUBMITTED BY	KDBIL	04.01.2022	

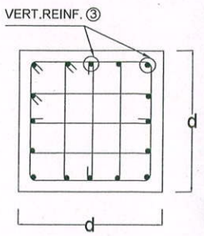
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

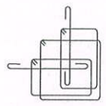
☐ More Information Date.....



FOUNDATION PLAN FOR TOWER

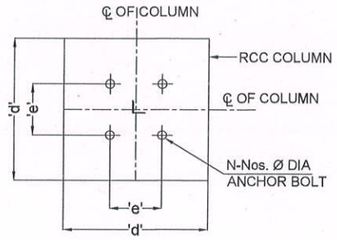


SECTION B-B



RINGS 8Ø @ 250 C/C

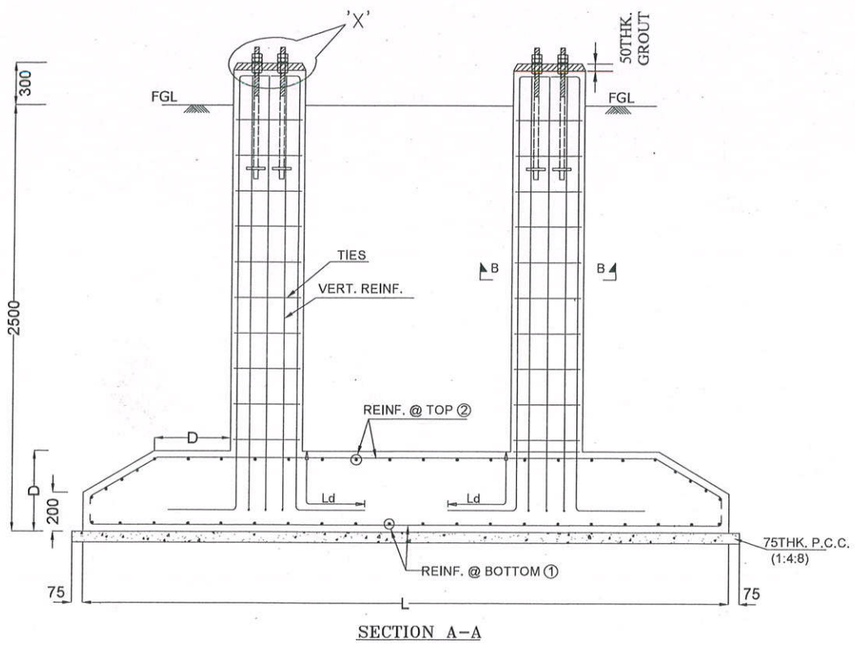
S.NO.	TOWER	L	B	'd'	D	(1)	(2)	(3)	'e'	N	X	Y	'Ø'
1	CTK	8400	8400	750	750	16Ø @ 150 C/C	16Ø @ 200 C/C	16-28Ø	280	4	3386	3386	56



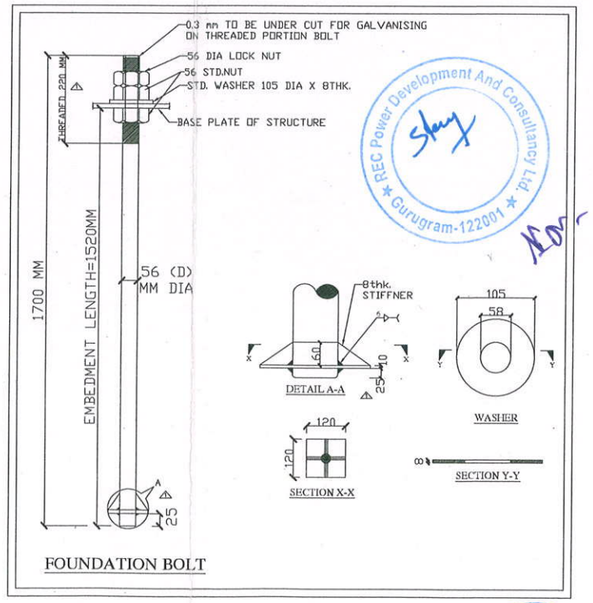
DETAIL AT-'X'

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE GRADE SHALL BE M25 (1:1:2) AS PER TS.
3. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 500 CONFIRM TO IS:1786-1985.
5. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR BOTTOM, TOP & SIDE OF RAFT AND 50mm COVER FOR COLUMN.
4. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN LAYOUT.
6. IF FOUNDATION BOLTS FOUL WITH STIRRUPS, STIRRUPS SHALL BE ADJUSTED AT SITE.
7. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
8. NET BEARING CAPACITY IS CONSIDERED 9T/sqm AS PER SOIL INVESTIGATION REPORT.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. ALL HOOKS, BENDS AND SPLICES SHALL BE AS PER IS:456 AND IS:2502.
11. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.
12. GRADE OF FOUNDATION BOLT SHALL BE 5.6.



SECTION A-A



FOUNDATION BOLT

Categories
Approved/ Issued for Fabrication
Subject to correction that
Please submit the revised
Issued for Fabrication
Subject to correction that
Please submit the revised
Approved
(Signature)
DGM(T)
(Designation)
20/1/22
(Date)

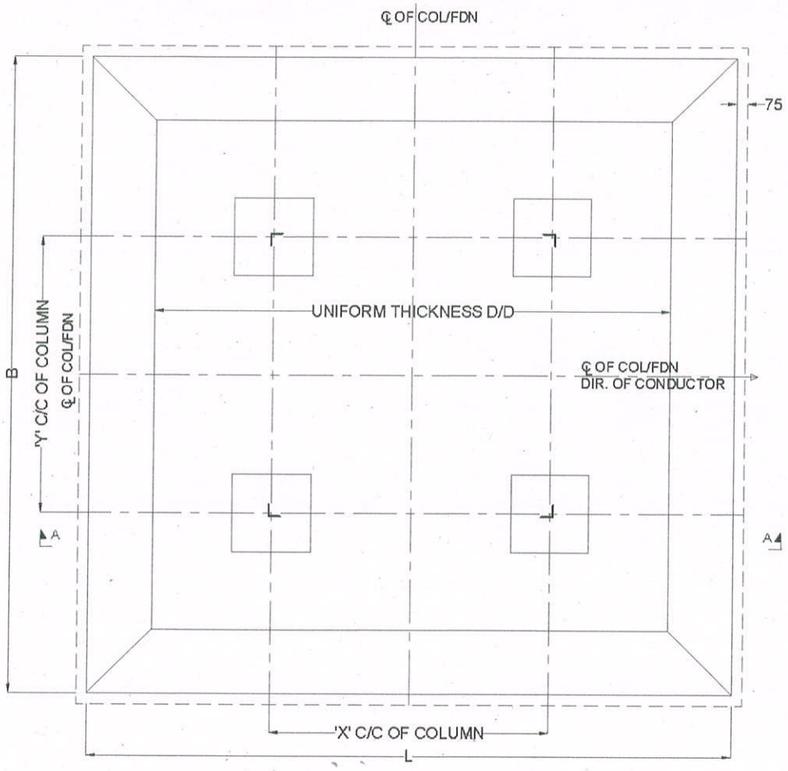
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FOUNDATION DRAWING CTK (0-FILLING) FOR 220kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/026 — REV- 1
SCALE	As shown in Drawing
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	AKASH	04.01.2022	
CHECKED BY	G.H	04.01.2022	
SUBMITTED BY	KDBIL	04.01.2022	

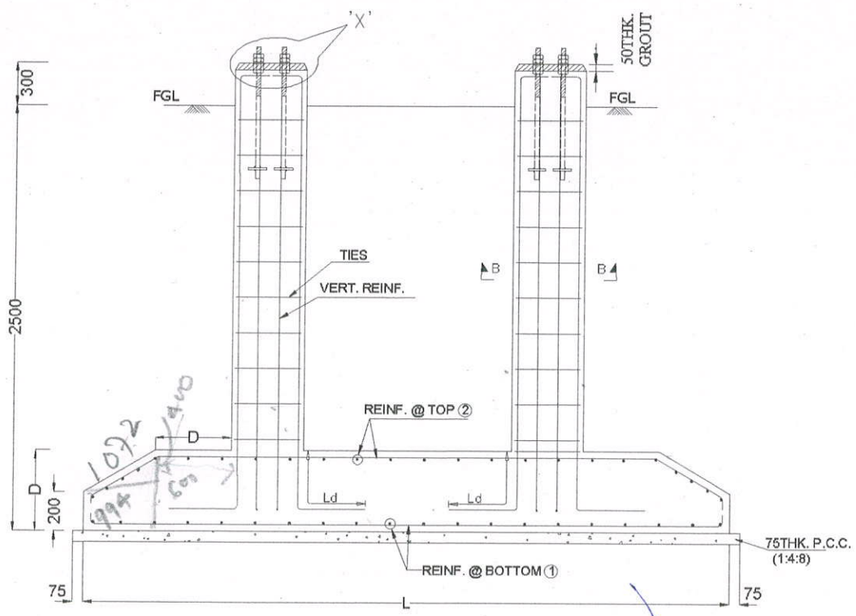
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

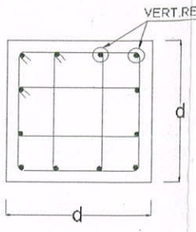
☐ More Information Date.....



FOUNDATION PLAN FOR TOWER



SECTION A–A

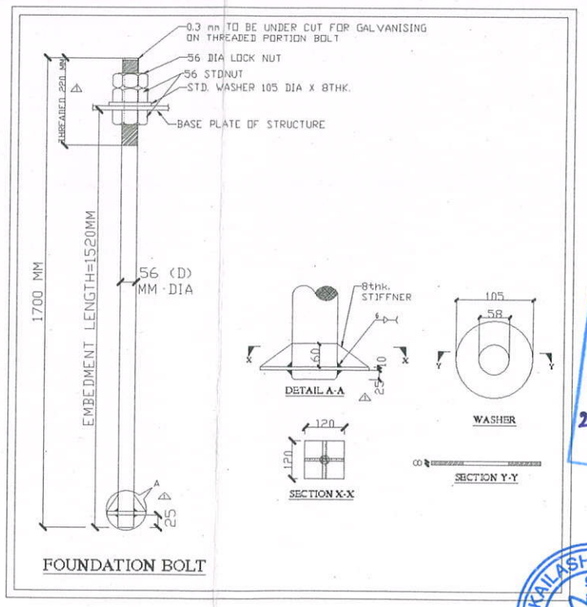


SECTION B–B

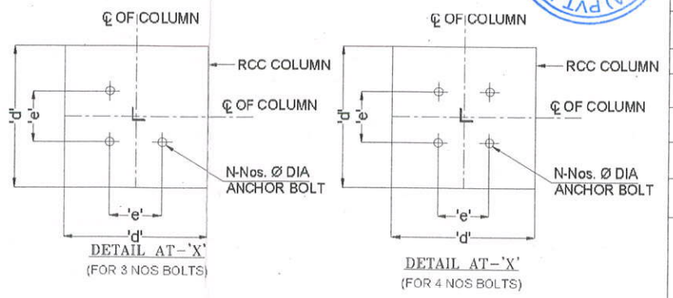
(FOR 12 NOS VERT. BARS)



RINGS 8Ø @ 250 C/C



FOUNDATION BOLT



DETAIL AT–'X' (FOR 3 NOS BOLTS)

DETAIL AT–'X' (FOR 4 NOS BOLTS)

S.NO.	TOWER	L	B	'd'	D	(1)	(2)	(3)	'e'	N	X	Y	'Ø'
1	CB	7200	6200	600	600	12Ø @ 150 C/C	12Ø @ 150 C/C	4-25Ø 8-20Ø	320	4	3413.8	2413.8	56
2	CTA	6600	5600	600	500	12Ø @ 175 C/C	12Ø @ 175 C/C	12-20Ø	320	3	3416.8	2416.8	56
3	CTB	7700	6700	600	600	16Ø @ 200 C/C	16Ø @ 250 C/C	12-25Ø	320	4	3410.8	2410.8	56

REC Power Development And Consultancy Ltd. Gurugram-122001

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE GRADE SHALL BE M25 (1:1:2) AS PER TS.
3. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 500 CONFIRM TO IS:1786-1985.
5. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR BOTTOM, TOP & SIDE OF RAFT AND 50mm COVER FOR COLUMN.
4. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN LAYOUT.
6. IF FOUNDATION BOLTS FOUL WITH STIRRUPS, STIRRUPS SHALL BE ADJUSTED AT SITE.
7. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
8. NET BEARING CAPACITY IS CONSIDERED 9T/sqm AS PER SOIL INVESTIGATION REPORT.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. ALL HOOKS, BENDS AND SPLICES SHALL BE AS PER IS:456 AND IS:2502.
11. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.
12. GRADE OF FOUNDATION BOLT SHALL BE 5.6.

(Signature) (हस्ताक्षर) DGM (T) (Designation) (पदनाम) 20/1/22 (Date) (तिथि)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA NO.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FOUNDATION DRAWING CTA,CTB & CB (0-FILLING) FOR 220kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/027 ✓
REV-	1 ✓
SCALE	As shown in Drawing
AREA	91.6 KANAL 46336.5 SQM

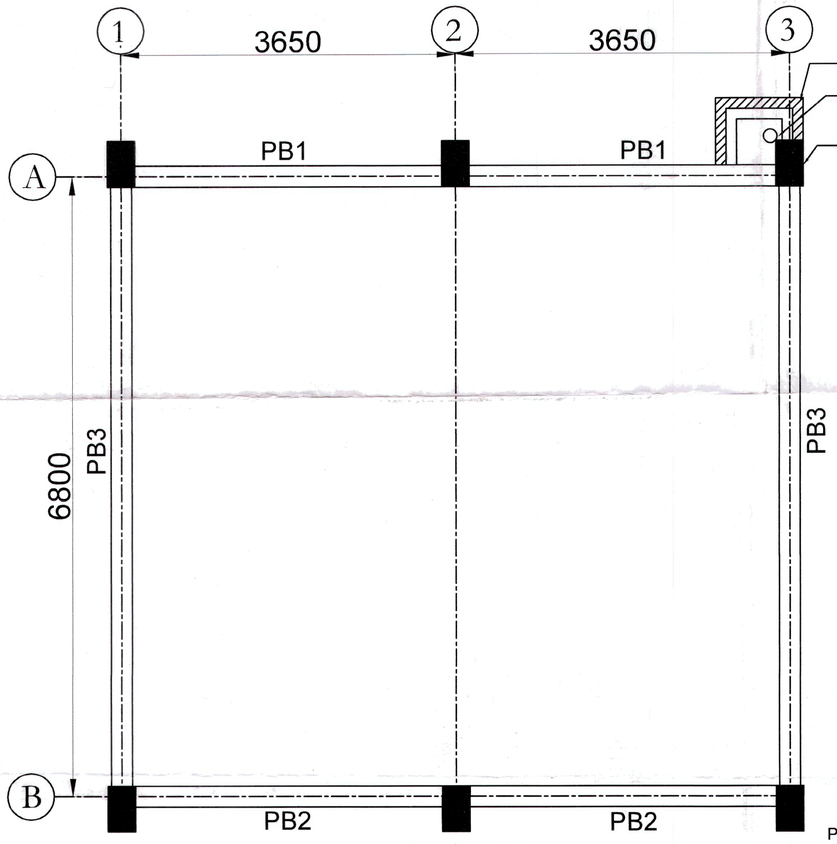
	NAME	DATE	SIGN
PREPARED BY	AKASH	04.01.2022	
CHECKED BY	G.H	04.01.2022	
SUBMITTED BY	KDBIL	04.01.2022	

Signature/Stamp...

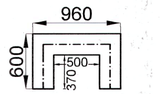
KAILASH DEVBUILD (INDIA) PVT. LTD.

☐ Approved ☐ Approved with comments ☐ Not Approved

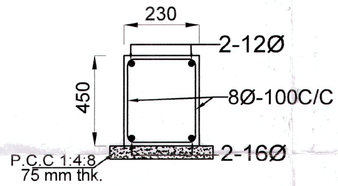
☐ More Information Date.....



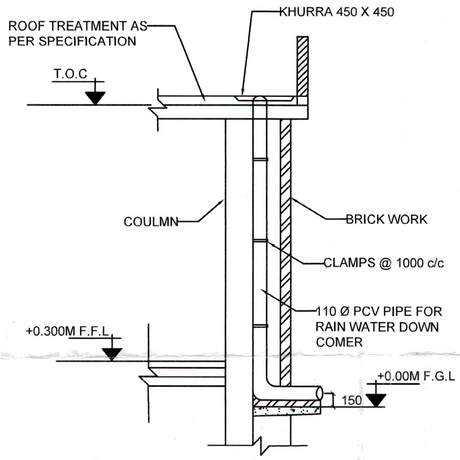
PLINTH BEAM PLAN (+0.300)



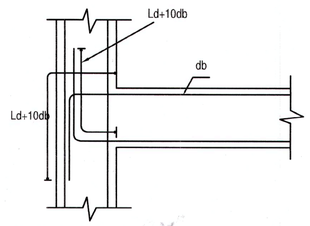
BEAM 'S' 230 X 450



TYPICAL SECTION FOR BEAM S



TYPICAL SECTION FOR RAIN WATER PIPE



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER

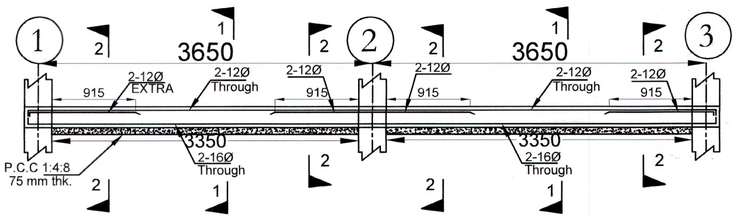
TYPICAL BEAM & COLUMN JUNCTION

SECTION 1-1

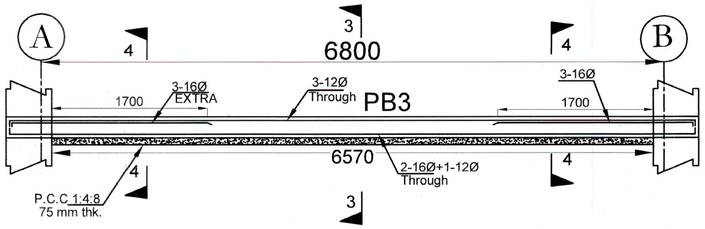
SECTION 2-2

SECTION 3-3

SECTION 4-4



PB1 (230X450) & PB2 (230X450) ON GRID A & B



PB3 (230X450)
ON GRID 1 & 3

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM
   d) BEAMS-25MM

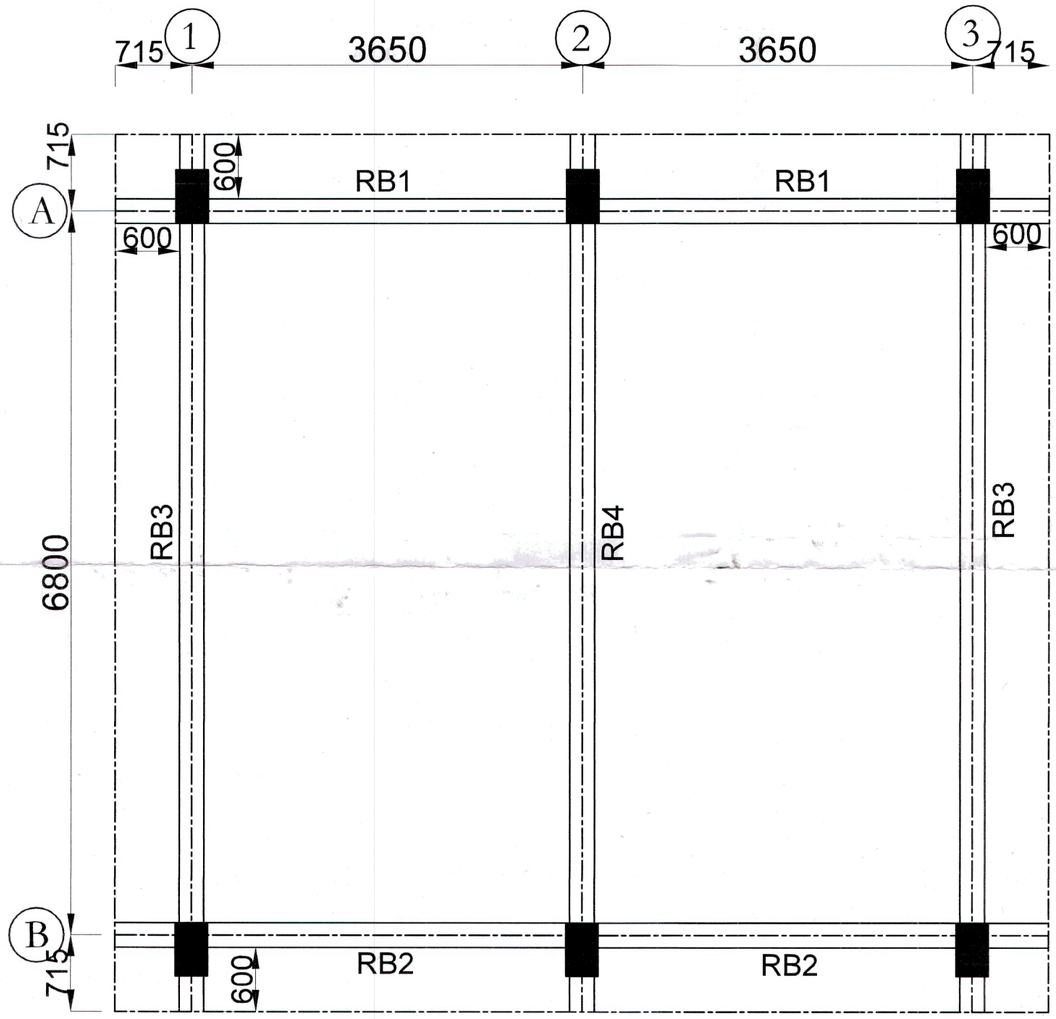
Categories
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing. Subject to condition that statements and comments are included.
III. Insert comments and submit again for approval.
IV. For information and record.
V. Not approved.
DGM (Designation) 25/9/21 (Date)

REC PDCL GURUGRAM

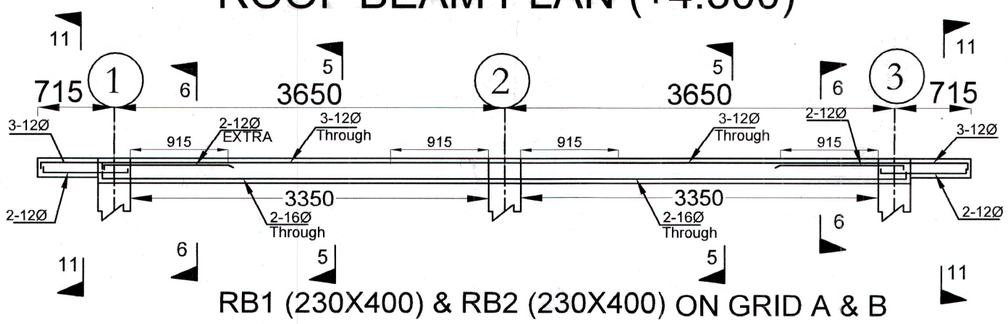
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	STRUCTURAL DRAWING FFPH OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/28		REV-1	
SCALE	As shown in Drawing		SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 6	
	NAME	DATE	SIGN	
PREPARED BY	AMIR	02.09.2021		R.C BANSAL
CHECKED BY	G.H	02.09.2021		
SUBMITTED BY	RACHIT	02.09.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

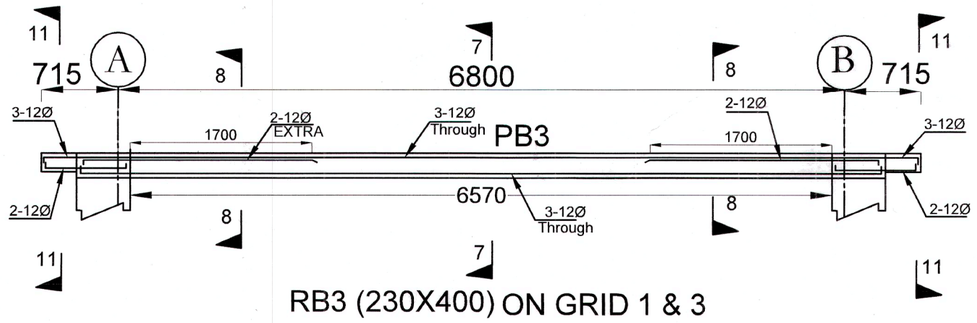
☐ More Information Date.....



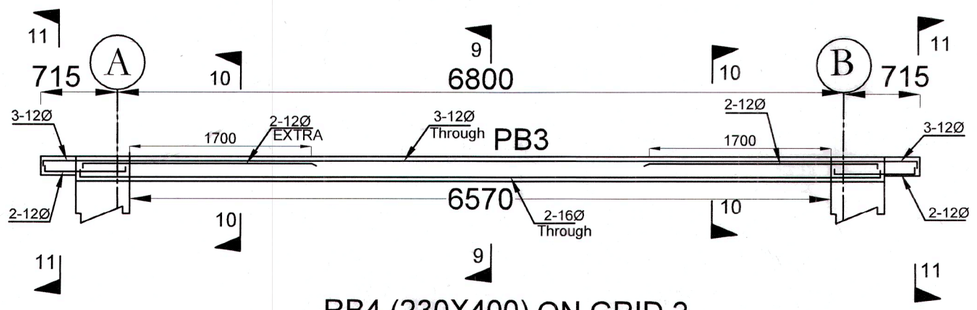
ROOF BEAM PLAN (+4.300)



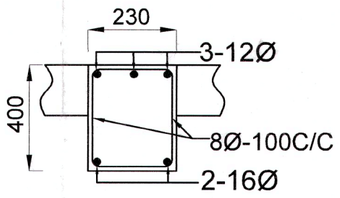
RB1 (230X400) & RB2 (230X400) ON GRID A & B



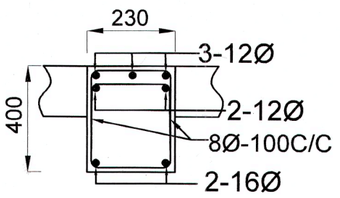
RB3 (230X400) ON GRID 1 & 3



RB4 (230X400) ON GRID 2



SECTION 5-5



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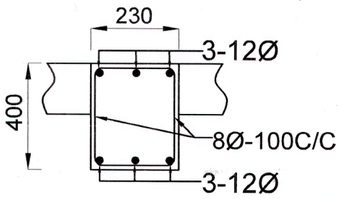
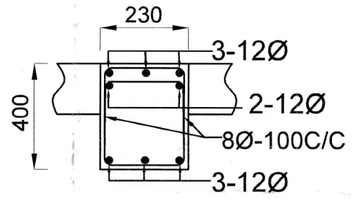
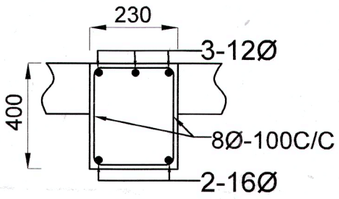


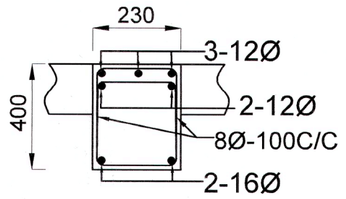
SECTION 7-7



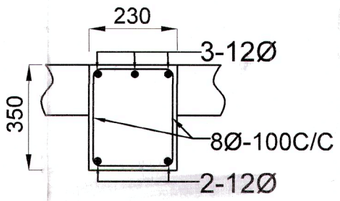
SECTION 8-8



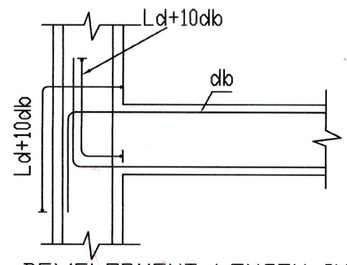
SECTION 9-9



SECTION 10-10



SECTION 11-11



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER

TYPICAL BEAM & COLUMN JUNCTION

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते दी गई
टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
DSM
(Designation) (पदनाम)
24/9/21
(Date) (दिनांक)

REC PDCL GURUGRAM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
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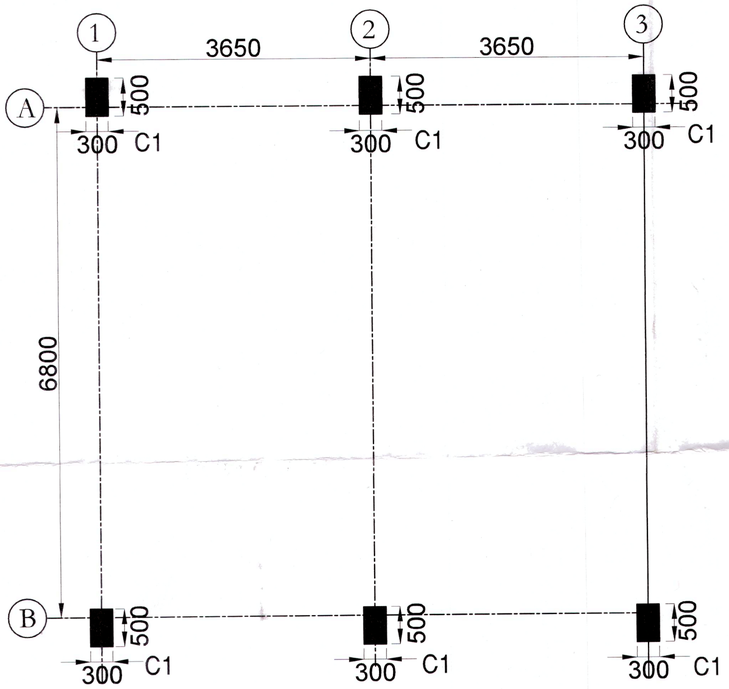
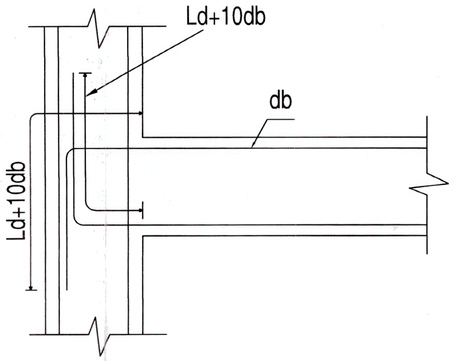
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	STRUCTURAL DRAWING FFPH OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/28		REV-1	
SCALE	As shown in Drawing		SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 2 OF 6	
	NAME	DATE	SIGN	
PREPARED BY	AMIR	02.09.2021		R.C BANSAL
CHECKED BY	G.H	02.09.2021		
SUBMITTED BY	RACHIT	02.09.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



TYPICAL COLUMN LAYOUT



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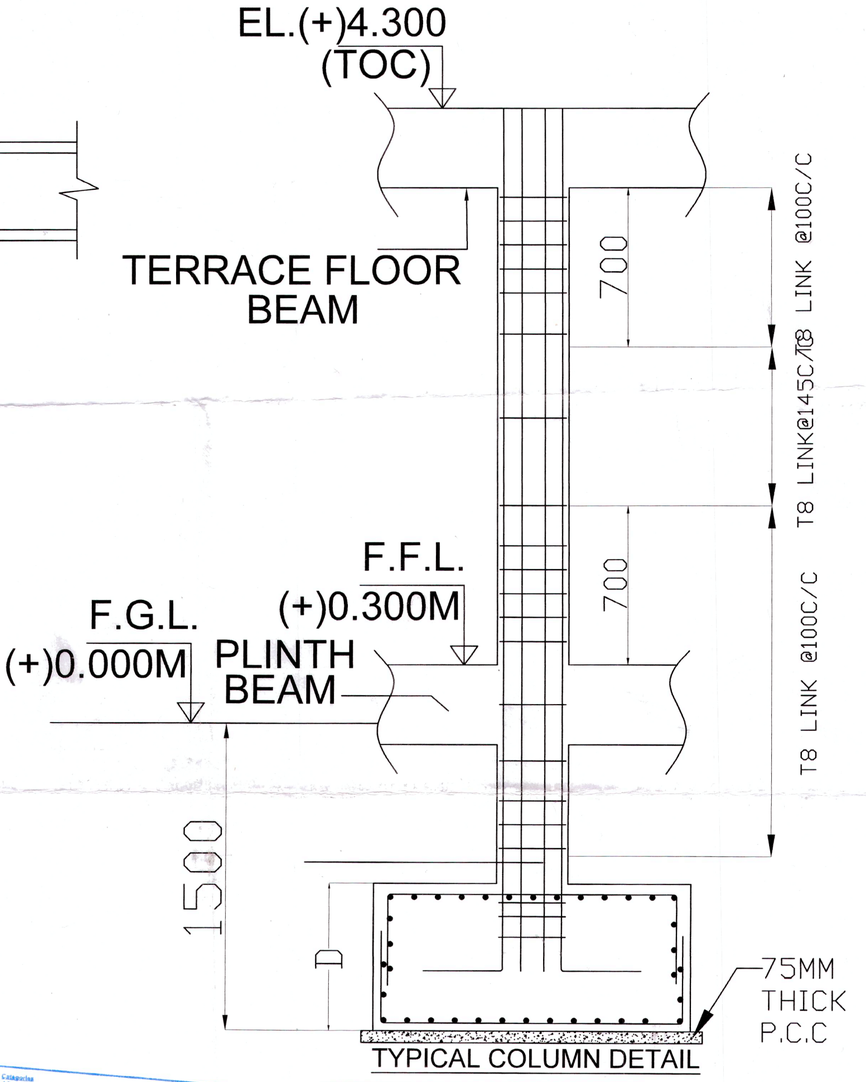
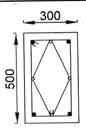
TYPICAL BEAM & COLUMN JUNCTION

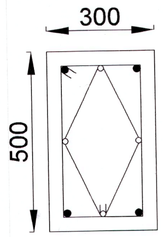


TYPICAL COLUMN DETAIL

S.NO.	COL. MKD.	QTY. COL. (NOS.)	COLUMN SIZE (mm)	MAIN REINFORCEMENT FOUNDATION TO TERRACE LEVEL
1	C1	6	300X500	●20Ø-4NOS. ○16Ø-4NOS.



TIES SCHEDULE		
ZONE		TIE GROUP
ZONE-A	OUTER	8Ø-100C/C
	INNER	8Ø-145C/C



RING ARRANGEMENT

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ONSITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
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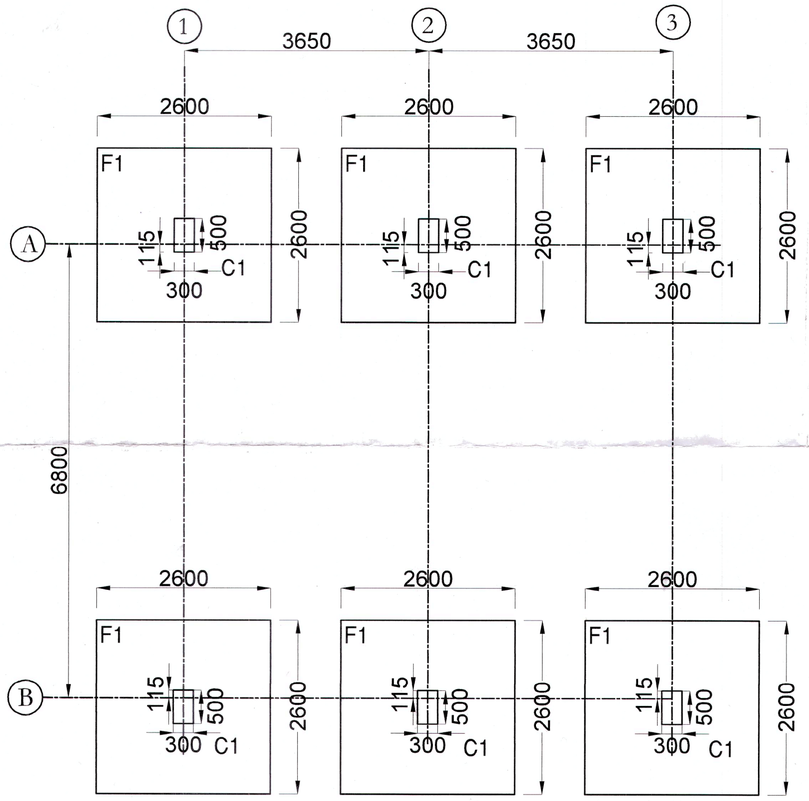
REC PDCL GURUGRAM

Categories
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
III. Insert comments and submit again for approval.
IV. For information and record.
V. Not approved.

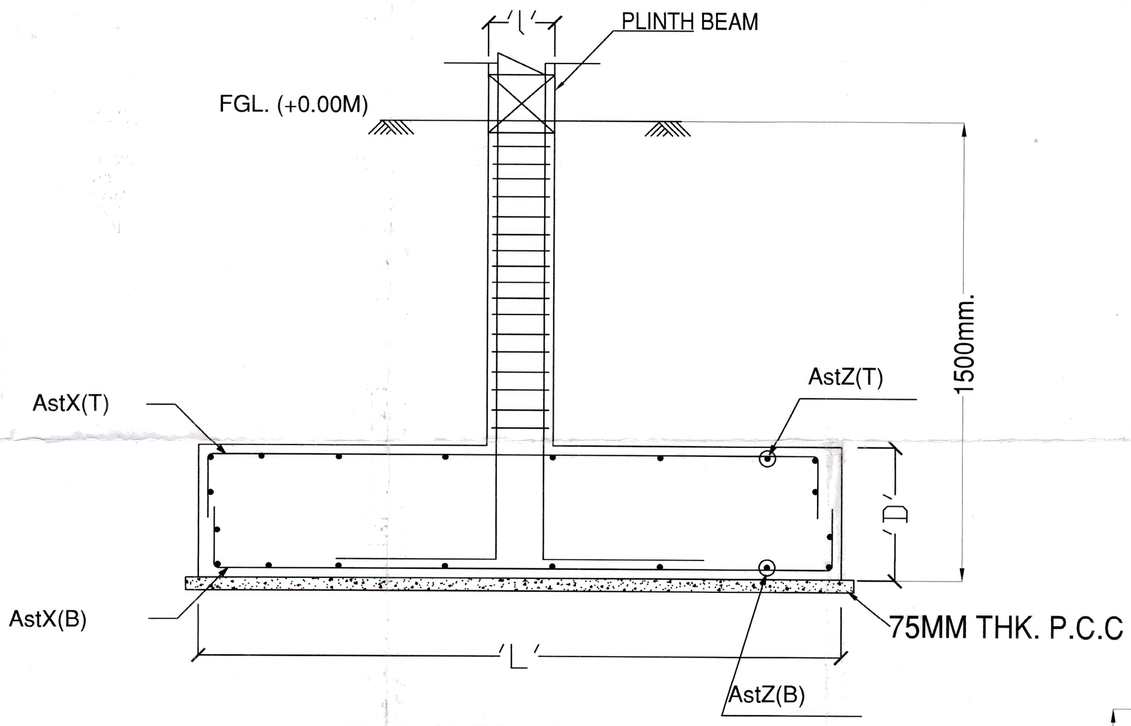
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	STRUCTURAL DRAWING FFPH OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/28		REV-1	
SCALE	As shown in Drawing		SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 3 OF 6	
	NAME	DATE	SIGN	
PREPARED BY	AMIR	02.09.2021		R.C BANSAL
CHECKED BY	G.H	02.09.2021		
SUBMITTED BY	RACHIT	02.09.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

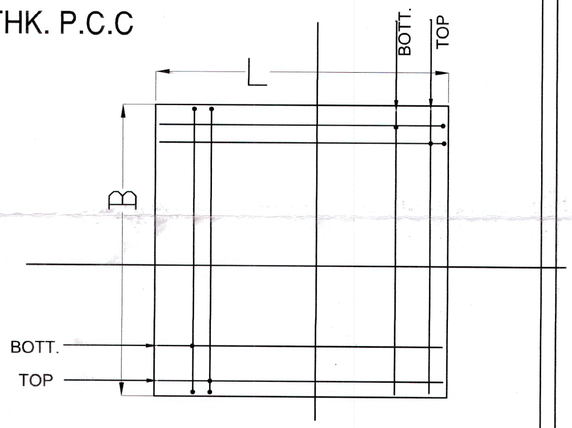
☐ More Information Date.....



FOUNDATION LAYOUT AND DETAIL



TYPICAL FOUNDATION DETAIL



FOOTING REINFORCEMENT KEY PLAN

LEGEND:

B.O.L = BOTTOM OF LINTEL
T.O.S = TOP OF SLAB
T.O.C = TOP OF CONCRETE
B.O.C = BOUNDARY OF CONCRETE

ISOLATED FOOTING SCHEDULE

Foundation Mark	Column Mark.	Column/Pedestal		Foundation			Cover (m)	Reinforcement			
								TOP		BOTTOM	
		l (m)	b (m)	L (m)	B (m)	D (m)		AstX(T)	AstZ(T)	AstX(B)	AstZ(B)
F1	C1	0.300	0.500	2.600	2.600	0.350	0.050	12mm @ 150 mm	12mm @ 150 mm	12mm @ 150 mm	12mm @ 150 mm

MARK	SIZE (IN MTR)
F1	2.600X2.600X0.350

GENERAL NOTES:

1. LOCATION OF COLUMN FOOTING SHALL BE AS PER GA/DWG. LATEST APPROVED AND SHALL BE REFERED FOR MARKING FOOTING BEFORE EXCAVATION.
2. LAYOUT SHALL BE MARKED ON SITE AND GOT APPROVED BY ENGINEER IN-CHARGE IN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
3. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
4. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
5. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
6. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
7. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM
8. P.C.C OF 1:4:8 GRADE SHALL BE WITH 40MM NOMINAL SIZE AGGREGATE.
9. The S.B.C OF SOIL AT 1.5M DEPTH IS 17.63 Tn/SQM.

REC PDCL GURUGRAM

Categories
Approved/ Issued/ for Fabrication/Construction/Manufacturing.
Approved/ Issued/ for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
III. Insert comments and submit again for approval.
IV. For information and record.
V. Not approved.
(Signature) (हस्ताक्षर) DGM (Designation) (पदनाम) 25/9/21 (Date) (तिथि)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
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OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	STRUCTURAL DRAWING FFPH OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/28	REV-1	
SCALE	As shown in Drawing	SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 4 OF 6	
	NAME / DATE	SIGN	
PREPARED BY	AMIR 02.09.2021		R.C BANSAL
CHECKED BY	G.H 02.09.2021		
SUBMITTED BY	RACHIT 02.09.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved
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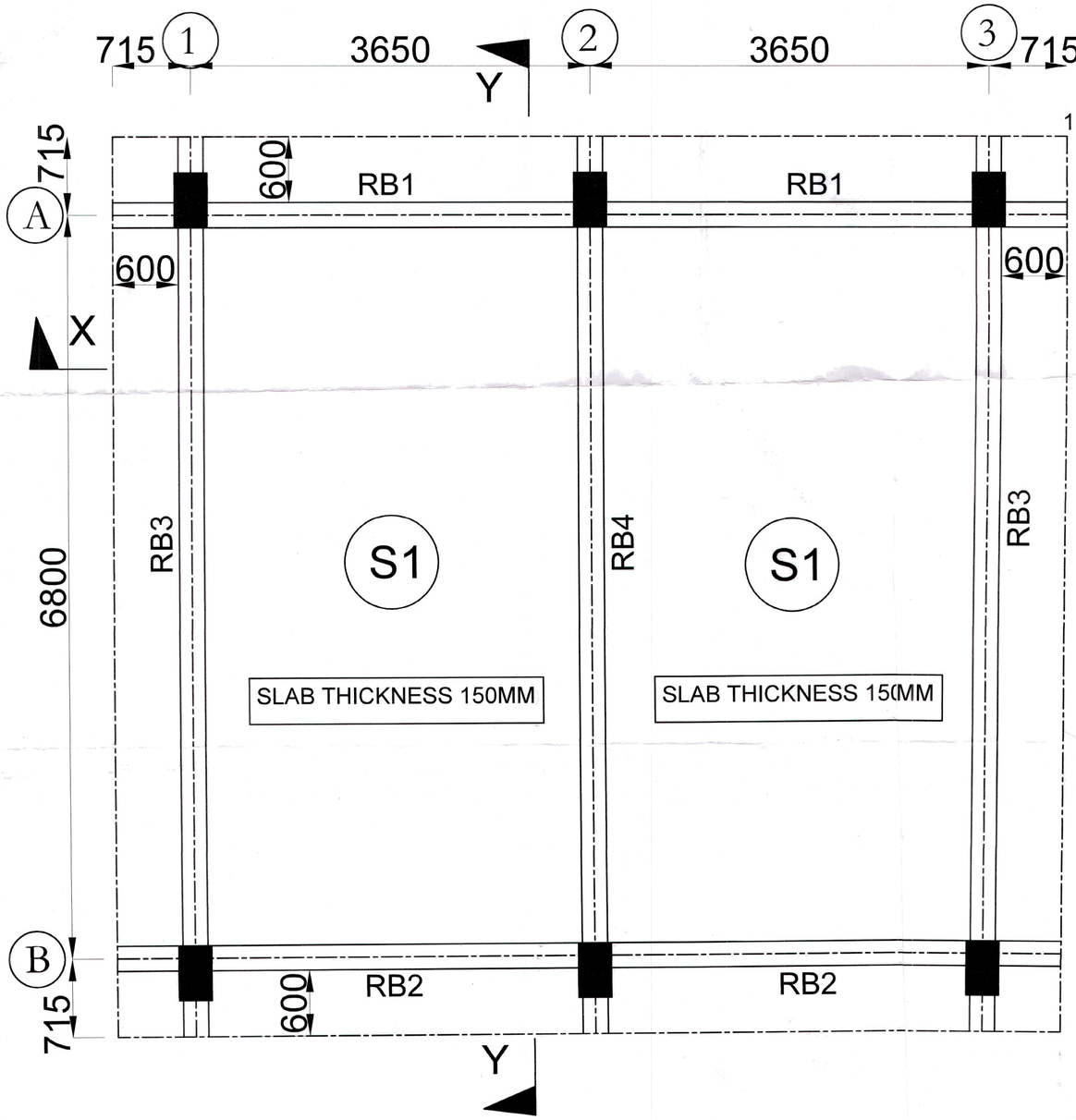
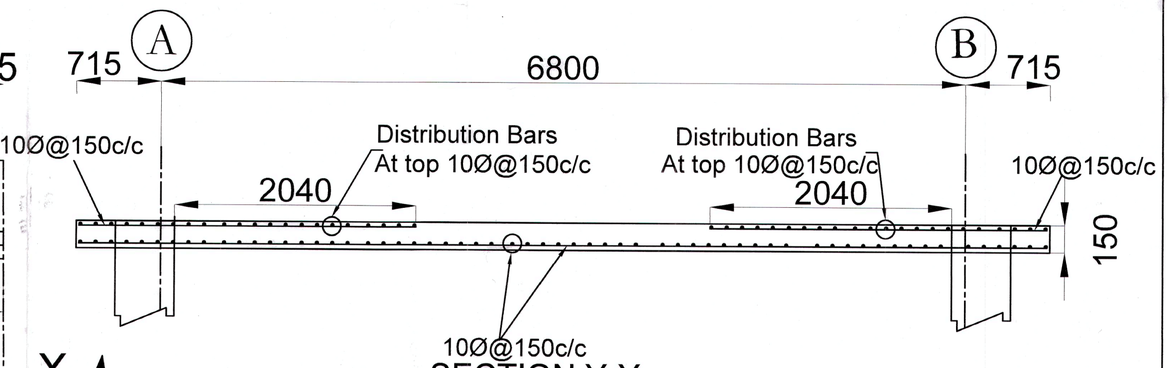


TERRACE PLAN



SECTION Y-Y

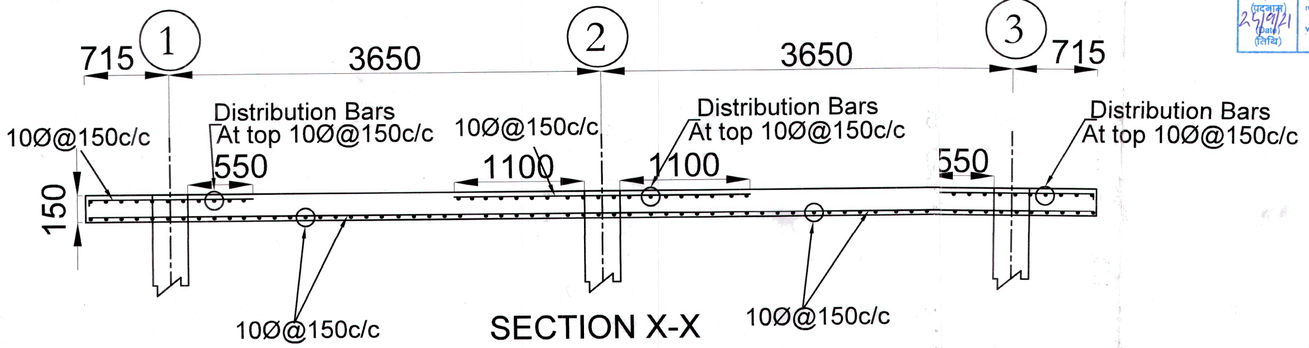
SLAB THICKNESS 150MM

SLAB REINFORCEMENT DETAILS

S.NO	SLAB TYPE	SHORT SPAN STEEL(BOT.)	LONG SPAN STEEL(BOT.)	SHORT SPAN STEEL(TOP)	LONG SPAN STEEL(TOP)
1.	S1	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c

NOTES:-
1. ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CLEAR COVER TO REINFORCEMENT SHALL BE AS GIVEN BELOW :-
   a) 40MM FOR COLUMN
   b) 50MM FOR FOOTING
   c) 25MM FOR BEAM
   d) 20MM FOR SLAB
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25. .
4. GRADE OF REINFORCEMENT SHALL BE Fe500 AS PER IS 1786.
5. LAP LENGTH SHALL BE 50-TIMES DIA OF BAR.
6. LINK AND LAPS SHALL BE TACK WELDED.
7. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF BARS SHALL BE AS PER IS:456-2000.

B.O.L = BOTTOM OF LINTEL
T.O.S = TOP OF SLAB
T.O.C = TOP OF CONCRETE
B.O.C = BOUNDARY OF CONCRETE



SECTION X-X

Categories
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
II. Approved/ Issued for Fabrication/ Construction/Manufacturing Subject to condition that ettelements and comments are included. Please submit the revised documents for approval.
III. Invent comments and submit again for approval.
IV. For Information and record.
V. Not approved.

(Signature) DSM (Designation) 2.9.21 (Date)

REC PDCL GURUGRAM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
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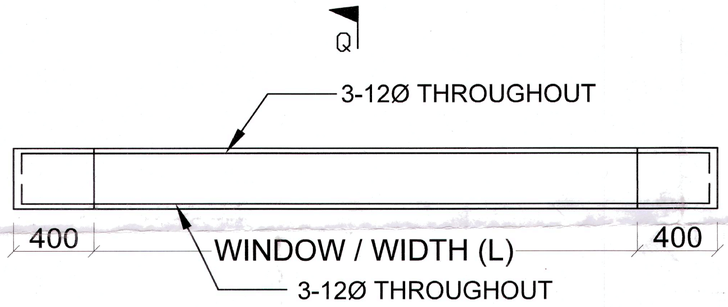
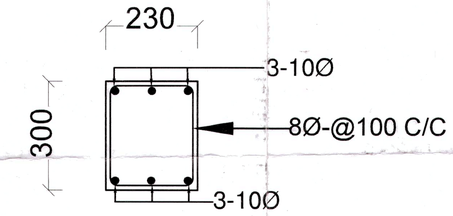
SCALE	As shown In Drawing	SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM	SH.NO. 5 OF 6	
	NAME DATE	SIGN	
PREPARED BY	AMIR 02.09.2021		R.C BANSAL
CHECKED BY	G.H 02.09.2021		
SUBMITTED BY	RACHIT 02.09.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

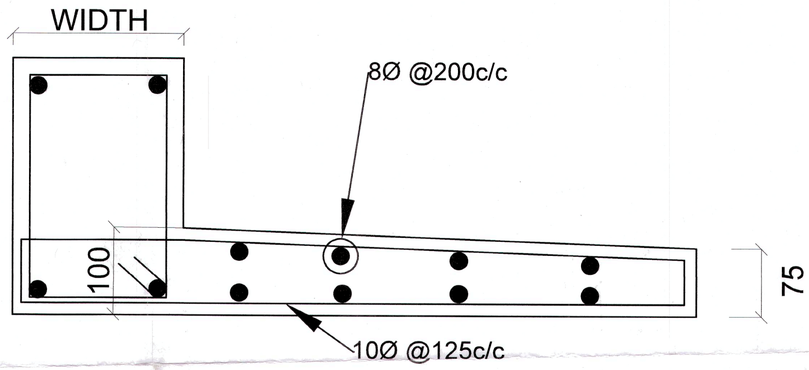
☐ More Information Date.....



BEAM 230X300
LINTEL BEAM FOR W2, W1 & D



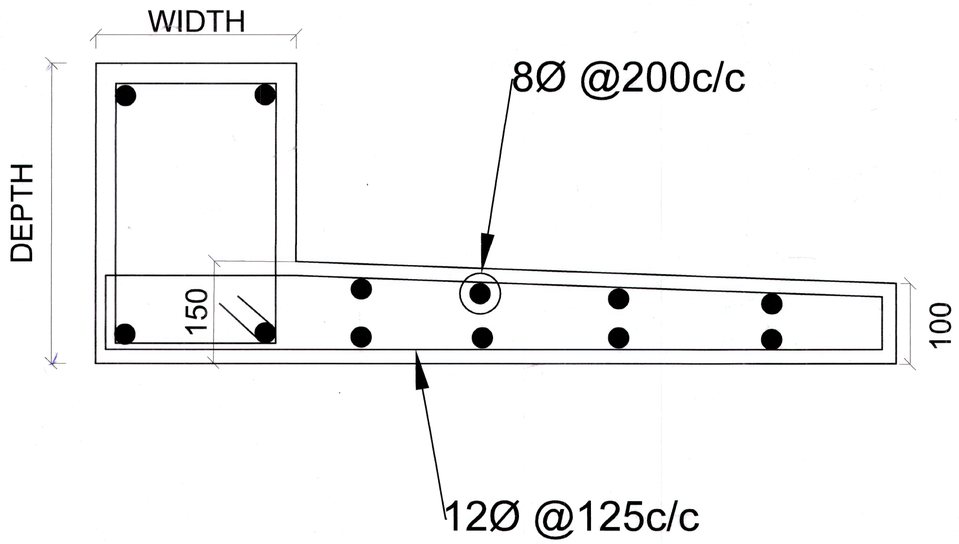
SECTION Q-Q



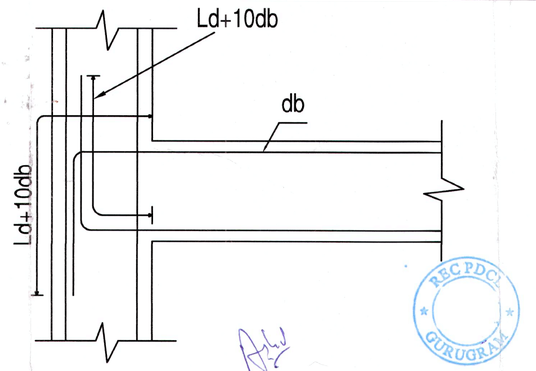
FOR WINDOW TYPICAL LINTAL
SECTION WITH SUNSHADE
PROJECTION OF 450 MM

NOTES:-
1. ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CLEAR COVER TO REINFORCEMENT SHALL BE AS GIVEN BELOW :-
   a) 40MM FOR COLUMN
   b) 50MM FOR FOOTING
   c) 25MM FOR BEAM
   d) 20MM FOR SLAB
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25. .
4. GRADE OF REINFORCEMENT SHALL BE Fe500 AS PER IS 1786.
5. LAP LENGTH SHALL BE 50-TIMES DIA OF BAR.
6. LINK AND LAPS SHALL BE TACK WELDED.
7. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF BARS SHALL BE AS PER IS:456-2000.

B.O.L = BOTTOM OF LINTEL
T.O.S = TOP OF SLAB
T.O.C = TOP OF CONCRETE
B.O.C = BOUNDARY OF CONCRETE



FOR DOOR TYPICAL LINTAL SECTION WITH SUNSHADE
PROJECTION OF 600 MM



Ld = DEVELOPMENT LENGTH
IN TENSION
Ld = 47db
db = BAR DIAMETER

TYPICAL BEAM
& COLUMN JUNCTION

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	STRUCTURAL DRAWING FFPH OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/28		REV-1	
SCALE	As shown in Drawing		SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 6 OF 6	
	NAME	DATE	SIGN	
PREPARED BY	AMIR	02.09.2021		R.C BANSAL
CHECKED BY	G.H	02.09.2021		
SUBMITTED BY	RACHIT	02.09.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

REC PDCL GURUGRAM

Design & Engineering by:- AUPTC

PROJECT	Construction of 2X50MVA, 220/33KV Nagrota (New) Substation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CSP/PA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathilal, Jabalpur-482001 (M.P.)
CONSULTANT	AUPTC Advanced Ultra Power Transmission Consultancy
TITLE	FOUNDATION LAYOUT OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/29 REV.- 07
SCALE	As shown in Drawing SHEET SIZE- A0
AREA	91.6 KANAL 4633.6.5 SQM

	NAME	DATE	SIGN
PREPARED BY	PAYAL	04.05.2023	
CHECKED BY	G.H	04.05.2023	
SUBMITTED BY	KDBIL	04.05.2023	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More information Date.....

NOTES

1. ALL DIMENSIONS ARE IN MM & LEVELS ARE IN METER.
2. FOUNDATION DETAILS SHOWN IN THIS DRAWING ARE INDICATIVE ONLY. FOR EXACT LOCATION AND DIMENSIONS OF RESPECTIVE FOUNDATIONS PLEASE REFER INDIVIDUAL DRAWING OF TOWERS.

LEGENDS

PRESENT SCOPE
FUTURE SCOPE
SUBJECT TO REVISION/HOLD

EQUIPMENT	SIZE IN MM		DEPTH
	LX	LY	
33KV ISO	2500	2000	AT 1.5M DEPTH
33KV TANDEM ISO (A)	2300	1800	AT 1.5M DEPTH
33KV TANDEM ISO (B)	2300	1800	AT 1.85M DEPTH
33KV TANDEM ISO (C)	3400	1000	AT 1.5M DEPTH

NAME	TYPE	QUANTITY	DETAILS	REV
220KV TOWER CTH, CTG (NO FILLING)	CTH, CTG	CTH- 1 Nos. CTG- 1 Nos.	KDBIL/250 PJ/20-21/D1/24	R1
220KV TOWER CC, (NO FILLING)	CC	CC- 1 Nos.	KDBIL/250 PJ/20-21/D1/25	R1
220KV TOWER CTK (NO FILLING)	CTK	CTK- 4 Nos.	KDBIL/250 PJ/20-21/D1/26	R1
220KV TOWER CTA, CTB, CB (NO FILLING)	CTA, CTB, CB	CTA- 5 Nos. CTB- 2 Nos. CB- 1 Nos.	KDBIL/250 PJ/20-21/D1/27	R1
220KV TOWER CC, (FILLING)	CC	1 Nos.	KDBIL/250 PJ/20-21/D1/72	R0
220KV TOWER CD, (FILLING)	CD	1 Nos.	KDBIL/250 PJ/20-21/D1/71	R0
220KV TOWER CTK, (FILLING)	CTK	1 Nos.	KDBIL/250 PJ/20-21/D1/67	R0
220KV TOWER CTH, (FILLING)	CTH	2 Nos.	KDBIL/250 PJ/20-21/D1/61	R0
220KV TOWER CTG (FILLING)	CTG	3 Nos.	KDBIL/250 PJ/20-21/D1/60	R0
220KV ISO	ISO	21 Nos.	KDBIL/250 PJ/20-21/D1/55	R2
220KV CB	CB	6 Nos.	KDBIL/250 PJ/20-21/D1/56	R0
220KV CT	CT	18 Nos.	KDBIL/250 PJ/20-21/D1/66	R0
220KV CVT	CVT	12 Nos.	KDBIL/250 PJ/20-21/D1/69	R0
220KV LA	LA	12 Nos.	KDBIL/250 PJ/20-21/D1/125	R0
220KV BPI	BPI	31 Nos.	KDBIL/250 PJ/20-21/D1/124	R0
220KV HBPI	HBPI	15 Nos.	KDBIL/250 PJ/20-21/D1/146	R0

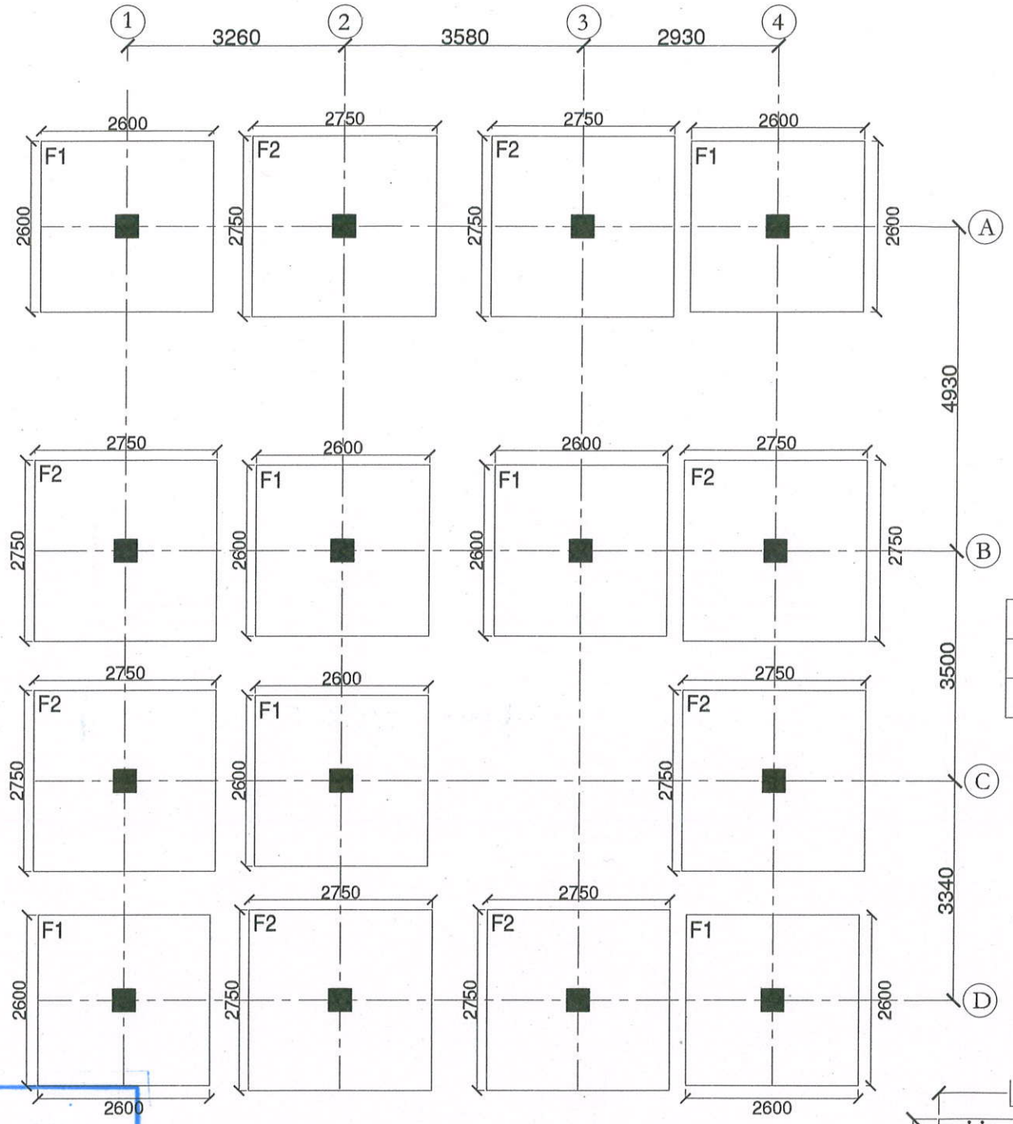
NAME	TYPE	QUANTITY	DETAILS	
33KV TOWER 3TBP/3TCP/3TD/3TE (FILLING)	3TBP 3TCP 3TD 3TE	3TBP- 6 Nos. 3TCP- 3 Nos. 3TD- 3 Nos. 3TE- 3 Nos.	KDBIL/250 PJ/20-21/D1/74	R0
33KV TOWER 3TGP, (FILLING)	3TGP	3TGP- 1 Nos.	KDBIL/250 PJ/20-21/D1/86	R0
33KV ISO	ISO	25 Nos.	KDBIL/250 PJ/20-21/D1/97	R0
33KV TENDEM ISO (A)	ISO (A)	11 Nos.	KDBIL/250 PJ/20-21/D1/150(A)	R0
33KV TENDEM ISO (B)	ISO (B)	07 Nos.	KDBIL/250 PJ/20-21/D1/150(B)	R0
33KV TENDEM ISO (C)	ISO (C)	03 Nos.	KDBIL/250 PJ/20-21/D1/150(C)	R0
33KV PT COMBINED	PT	02 Nos.	KDBIL/250 PJ/20-21/D1/93	R1
33KV COMBINED CT-LA	CT-LA	05 Nos.	KDBIL/250 PJ/20-21/D1/95	R0
33KV CT COMBINED	CT	03 Nos.	KDBIL/250 PJ/20-21/D1/91	R1
50 MVA TRF	TRF	02 Nos.	KDBIL/250 PJ/20-21/D1/77	R3
33KV BPI A (CUTTING)	BPI(A)	10 Nos.	KDBIL/250 PJ/20-21/D1/18A	R0
33KV BPI B (FILLING)	BPI(B)	06 Nos.	KDBIL/250 PJ/20-21/D1/18B	R0
33KV CB	CB	08 Nos.	KDBIL/250 PJ/20-21/D1/37	R0

NAME	TYPE	QUANTITY	DETAILS	
CONTROL ROOM BUILDING	CRB	01 Nos.	KDBIL/250 PJ/20-21/D1/34	R0
SBA QUARTER	SBA	02 Nos.	KDBIL/250 PJ/20-21/D1/07	R0
JE QUARTER	JE	01 Nos.	KDBIL/250 PJ/20-21/D1/98	R0
AE QUARTER	AE	01 Nos.	KDBIL/250 PJ/20-21/D1/30	R1
STORE ROOM	STORE	01 Nos.	KDBIL/250 PJ/20-21/D1/89	R0
FFPH	FFPH	01 Nos.	KDBIL/250 PJ/20-21/D1/28	R1

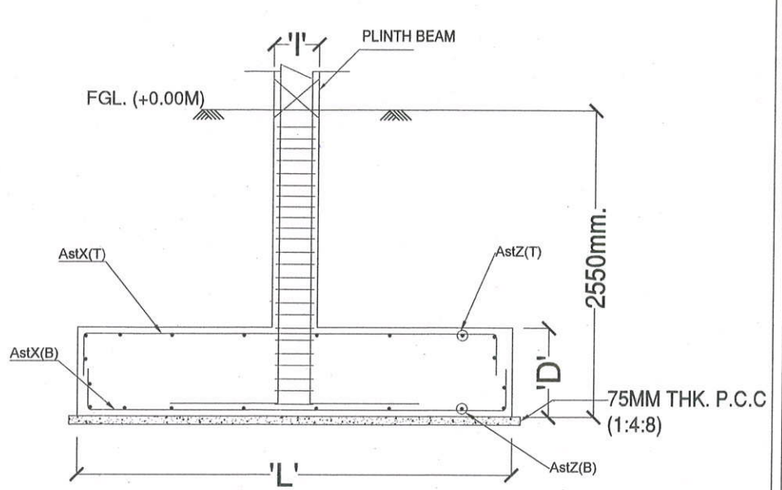
SCHEDULE OF TBM MARKING

TBM MARK	EASTING	NORTHING	LEVEL
TBM	5059.38	2226.51	350.396





FOUNDATION LAYOUT AND DETAIL



TYPICAL FOUNDATION DETAIL

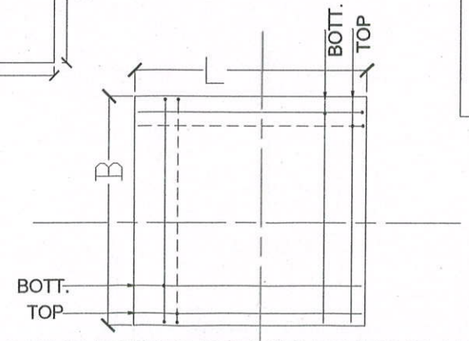
MARK	SIZE (IN MTR)
F1	2.600X2.600X0.350
F2	2.750X2.750X0.350

LEGEND:

B.O.L = BOTTOM OF LINTEL
T.O.S = TOP OF SLAB
T.O.C = TOP OF CONCRETE
B.O.C = BOUNDARY OF CONCRETE

GENERAL NOTES:

1. LOCATION OF COLUMN FOOTING SHALL BE AS PER GA/DWG. LATEST APPROVED AND SHALL BE REFERED FOR MARKING FOOTING BEFORE EXCAVATION.
2. LAYOUT SHALL BE MARKED ON SITE AND GOT APPROVED BY ENGINEER IN-CHARGE IN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
3. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
4. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
5. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
6. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
7. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM
8. P.C.C OF 1:4:8 GRADE SHALL BE WITH 40MM NOMINAL SIZE AGGREGATE.
9. The S.B.C OF SOIL AT 1.5M DEPTH IS 5 Tn/SQM.



FOOTING REINFORCEMENT KEY PLAN

ISOLATED FOOTING SCHEDULE

Foundation Mark	Column/Pedestal		Foundation			Cover (m)	Reinforcement			
							TOP		BOTTOM	
	l (m)	b (m)	L (m)	B (m)	D (m)		AstX(T)	AstZ(T)	AstX(B)	AstZ(B)
F1	0.350	0.350	2.600	2.600	0.350	0.050	10mm @ 150 mm	10mm @ 150 mm	12mm @ 150 mm	12mm @ 150 mm
F2	0.350	0.350	2.750	2.750	0.350	0.050	10mm @ 150 mm	10mm @ 150 mm	12mm @ 150 mm	12mm @ 150 mm

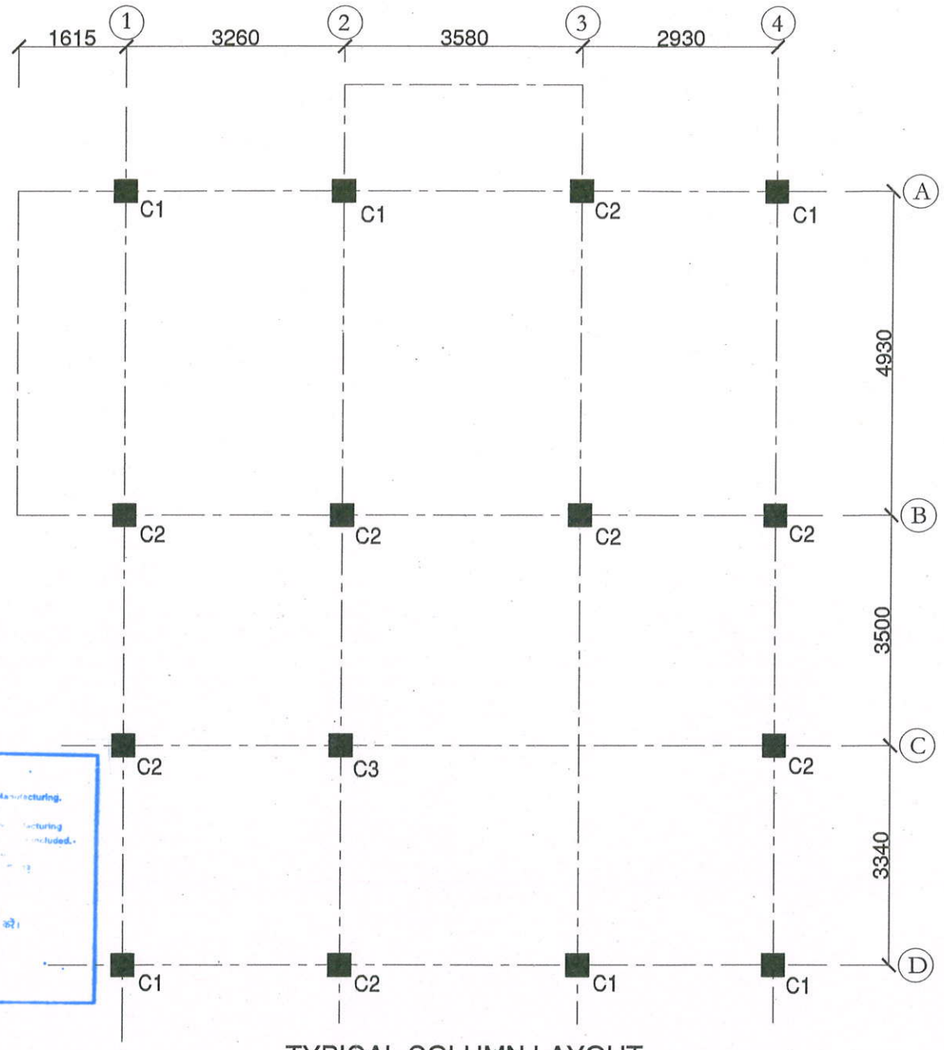
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	AE QUARTER FOUNDATION DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/30 — REV-1
SCALE	As shown in Drawing — SHEET SIZE: A2
AREA	91.6 KANAL 46336.5 SQM — SH.NO: 1 OF 1

	NAME	DATE	SIGN
PREPARED BY	AMIR	23.03.2022	
CHECKED BY	G.H	23.03.2022	
SUBMITTED BY	ANURAG	23.03.2022	

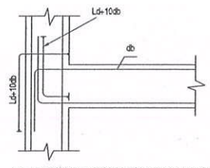
RECEIVED
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
स्वीकृत/जारी/निर्माण/विनिर्माण हेतु अनुमोदित जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing subject to condition that observations and comments are included.
Please submit the revised documents for approval.
स्वीकृत/जारी/निर्माण/विनिर्माण हेतु अनुमोदित जारी, बशर्ते टी गई टिप्पणियों को शामिल किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुन: अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (दिनांक)

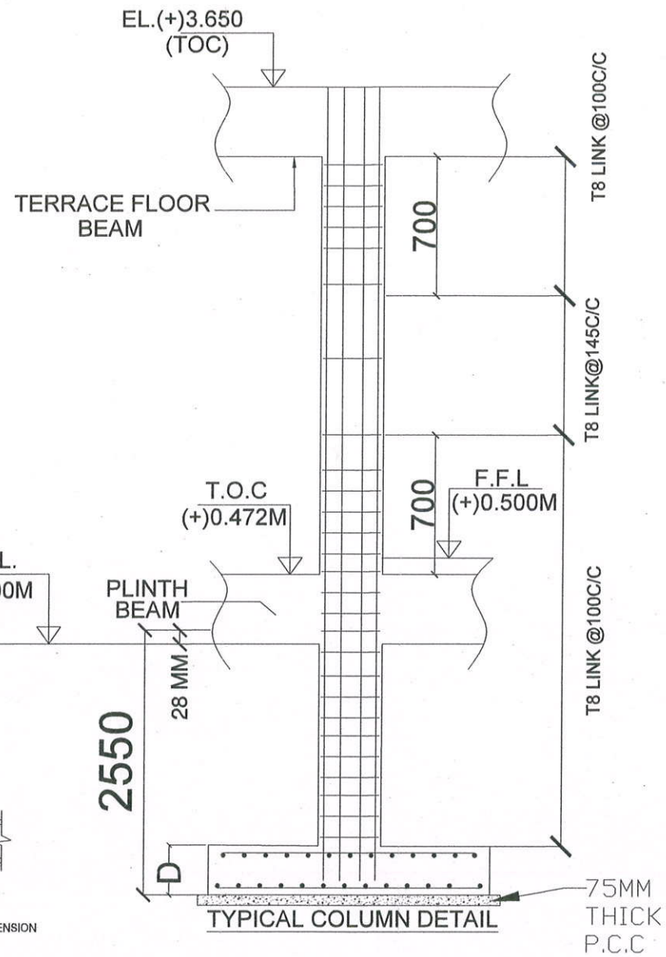


TYPICAL COLUMN LAYOUT



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER

TYPICAL BEAM & COLUMN JUNCTION



TYPICAL COLUMN DETAIL

S.NO.	COL. MKD.	QTY. COL. (NOS.)	COLUMN SIZE (mm)	MAIN REINFORCEMENT
				FOUNDATION TO TERRACE LEVEL
1	C1	6	350X350	●20Ø-4NOS. ○16Ø-4NOS.
2	C2	8	350X350	●20Ø-6NOS. ○16Ø-2NOS.
3	C3	1	350X350	●20Ø-8NOS.

TIES SCHEDULE		
ZONE		TIE GROUP
ZONE-A	OUTER	8Ø-100C/C
	INNER	8Ø-145C/C

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

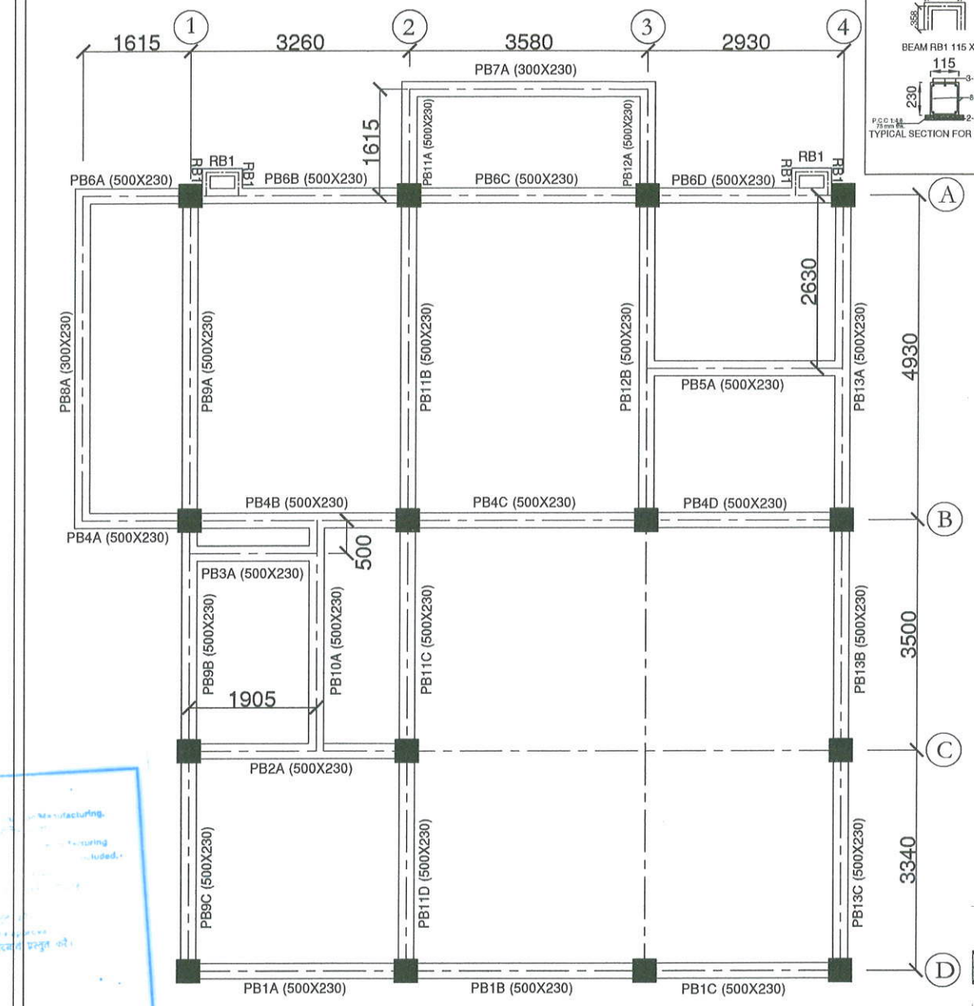
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-pladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	AE QUARTER COLUMN RCC DETAIL DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/31	REV-2	
SCALE	As shown in Drawing	SHEET SIZE: A1	
AREA	91.6 KANAL 46338.5 SQM	SH.NO.: 3 OF 4	
	NAME DATE SIGN		
PREPARED BY	AMIR 23.03.2022		
CHECKED BY	G.H 23.03.2022		
SUBMITTED BY	ANURAG 23.03.2022	Signature Stamp...	

☐ Approved ☐ Approved with comments ☐ Not Approved

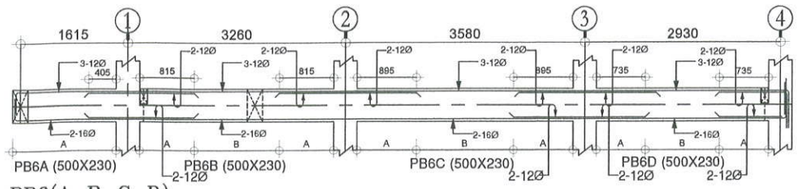
☐ More Information Date.....

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

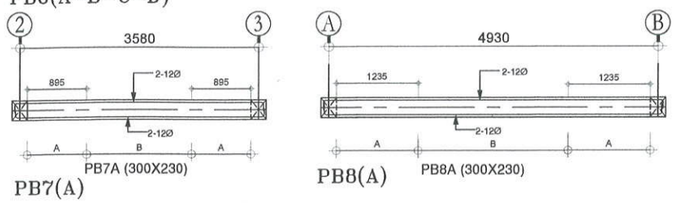
Signature (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)



PLINTH BEAM PLAN
T.O.C +0.472M

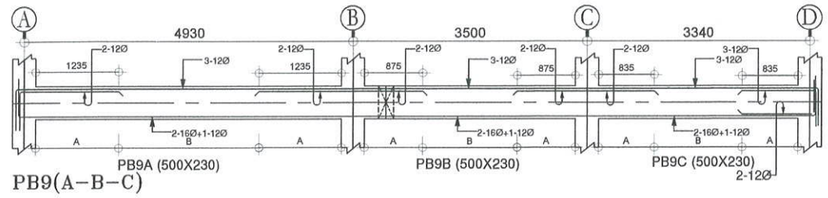


PB6(A–B–C–D)

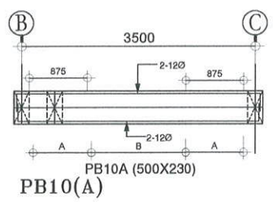


PB7(A)

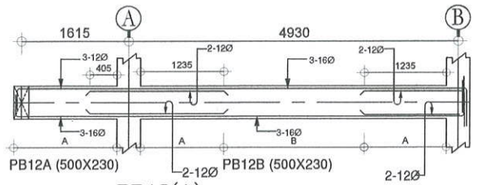
PB8(A)



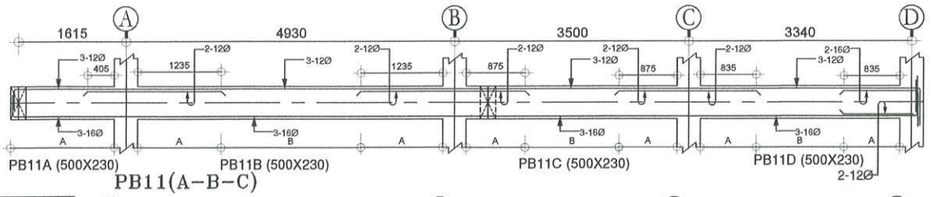
PB9(A–B–C)



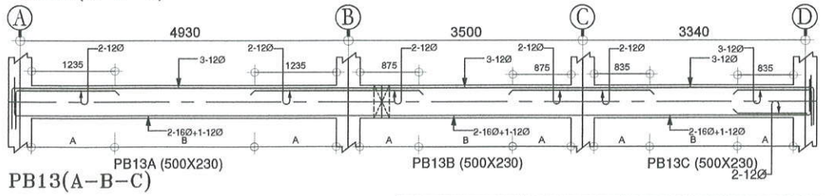
PB10(A)



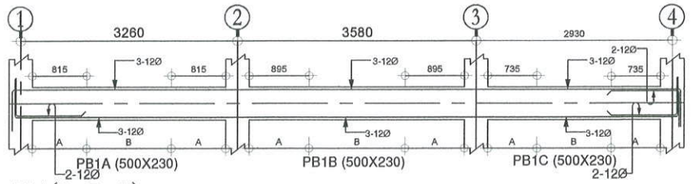
PB12(A)



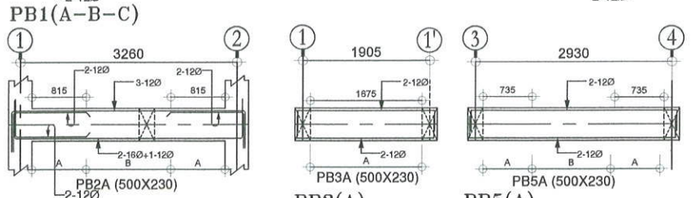
PB11(A–B–C)



PB13(A–B–C)



PB1(A–B–C)



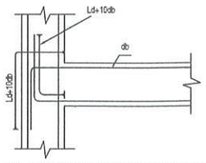
PB2(A)

PB3(A)

PB5(A)

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

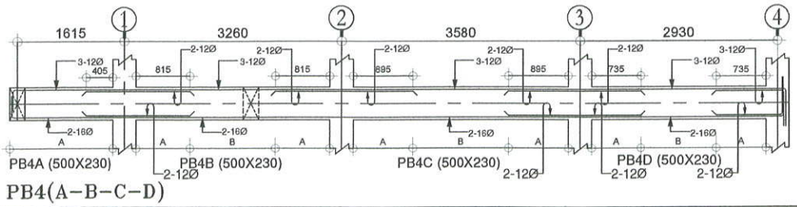


Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM & COLUMN JUNCTION



(TYPICAL BEAM DETAIL OF 500X230)

(TYPICAL BEAM DETAIL OF 300X230)



PB4(A–B–C–D)

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	AE QUARTER PLINTH BEAM RCC DETAIL DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/31 — REV-2
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 4

	NAME	DATE	SIGN
PREPARED BY	B.K	23.03.2022	
CHECKED BY	G.H	23.03.2022	
SUBMITTED BY	ANURAG	23.03.2022	

Signature/Stamp

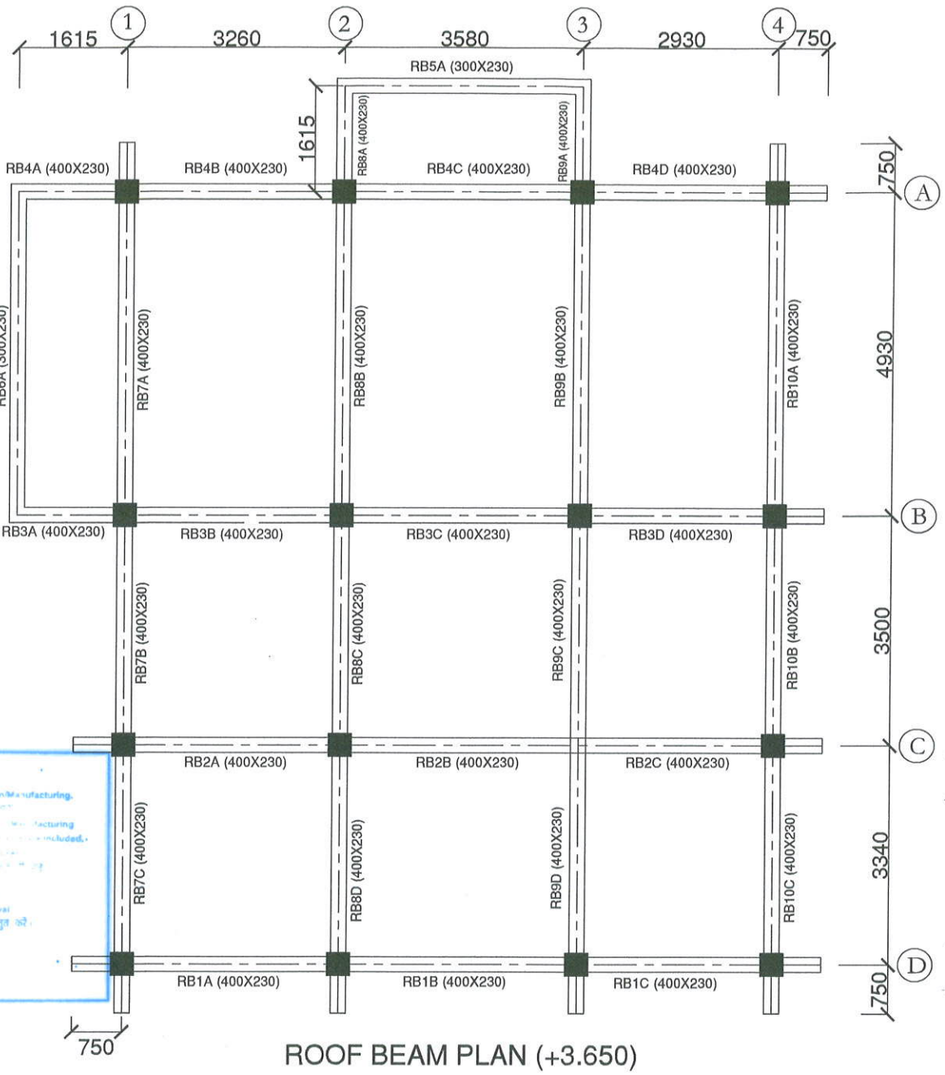
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

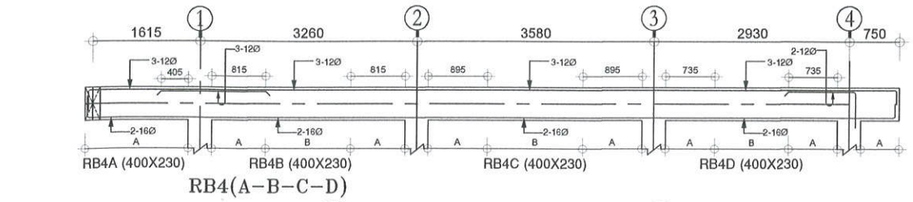
Categories
श्रेणियां
I. Approved/ issued for Fabrication/ Manufacturing.
स्वीकृत/जारी/निर्माण/विनिर्माण हेतु
II. Approved/ issued for Construction/ Erection/ Manufacturing.
स्वीकृत/जारी/निर्माण/विनिर्माण हेतु
III. Approved/ issued for Construction/ Erection/ Manufacturing subject to incorporation of comments.
टिप्पणियों को शामिल करने के अधीन स्वीकृत/जारी/निर्माण/विनिर्माण हेतु
Please submit revised drawings/ documents for approval.
कृपया संशोधित दस्तावेज अनुमोदन हेतु प्रस्तुत करें।
Resubmit with clearance of comments.
टिप्पणियों को शामिल किए जाने के पश्चात पुनः प्रस्तुत करें।
Insert comments and submit again.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदन हेतु प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

REC Power Development & Consultancy Ltd. Gurugram-122001

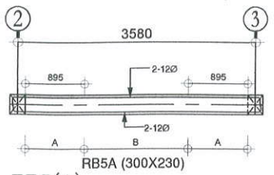
CV-45893
04/5/22



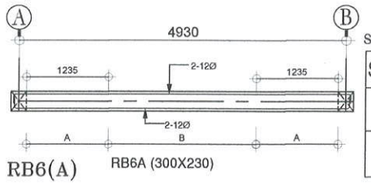
ROOF BEAM PLAN (+3.650)



RB4(A–B–C–D)



RB5(A)



RB6(A)

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
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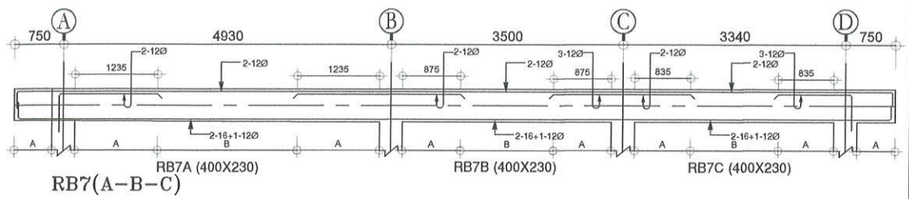
2.	B	8Ø-125C/C



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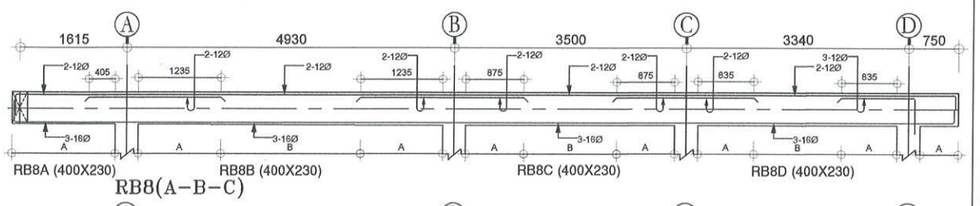
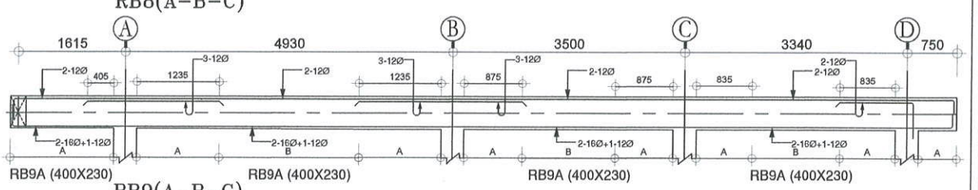
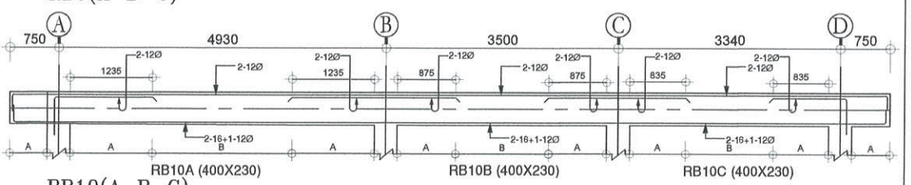


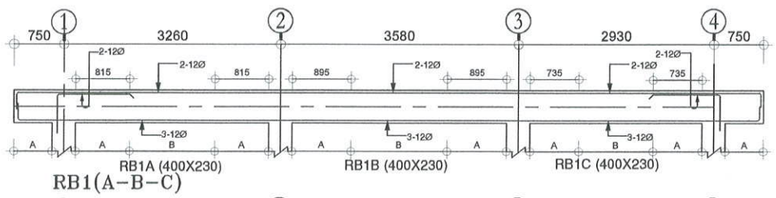
RB8(A–B–C)



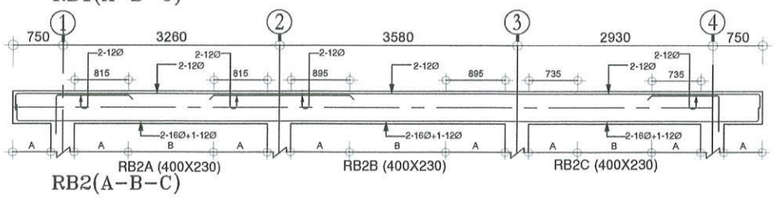
RB9(A–B–C)



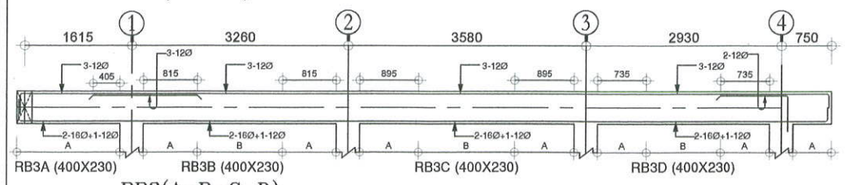
RB10(A–B–C)



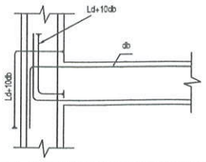
RB1(A–B–C)



RB2(A–B–C)

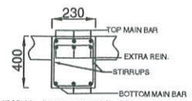


RB3(A–B–C–D)

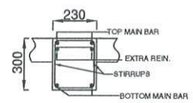


Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER

TYPICAL BEAM & COLUMN JUNCTION



(TYPICAL BEAM DETAIL OF 400X230)



(TYPICAL BEAM DETAIL OF 300X230)

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
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3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathilal, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	AE QUARTER ROOF BEAM RCC DETAIL DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/31	REV-2	
SCALE	As shown in Drawing	SHEET SIZE- A1	
AREA	91.8 KANAL 48336.5 SQM	SH.NO.: 2 OF 4	
	NAME DATE SIGN		
PREPARED BY	B.K 23.03.2022		
CHECKED BY	G.H 23.03.2022		
SUBMITTED BY	ANURAG 23.03.2022		

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

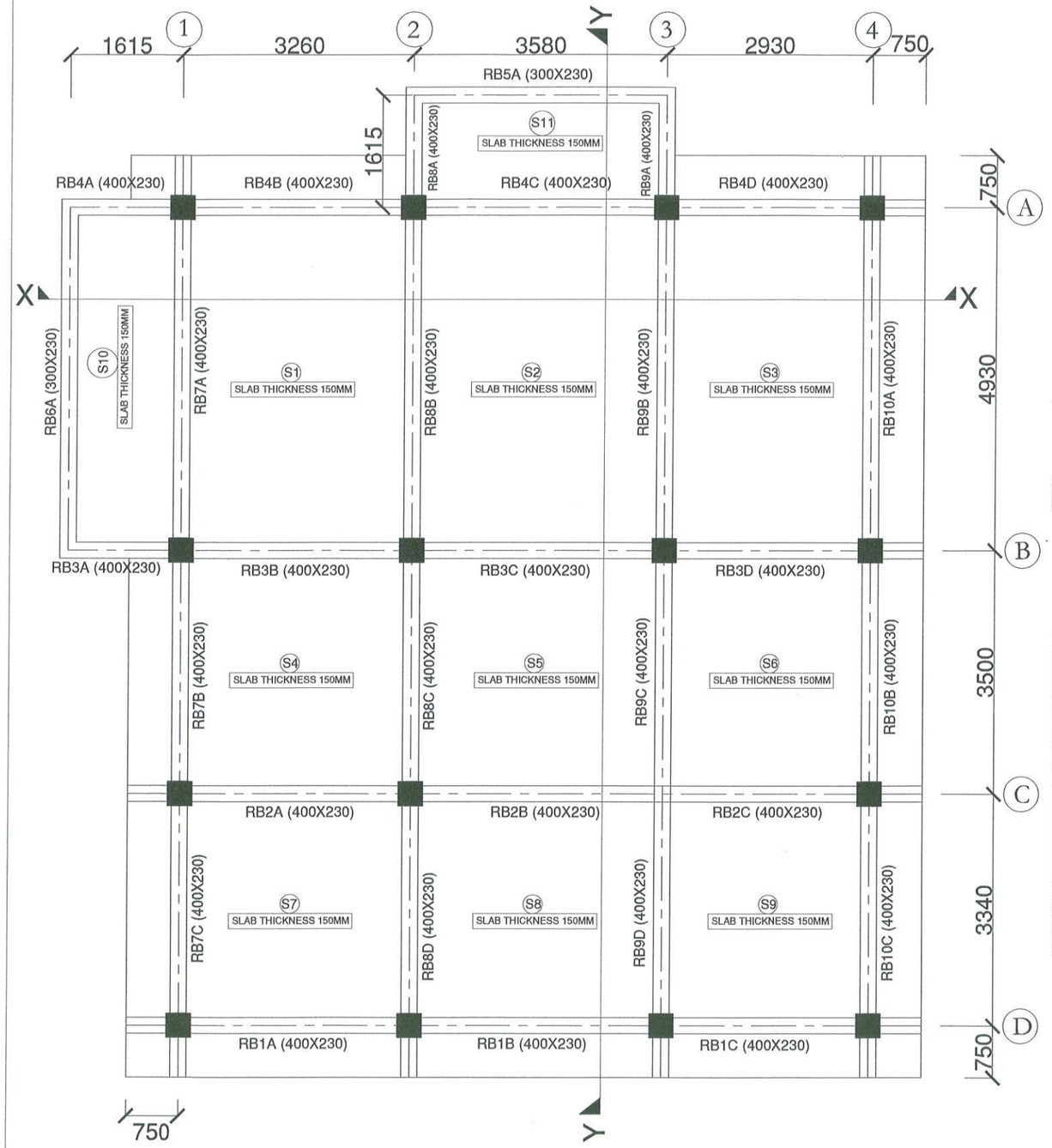
Signature/Stamp...

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

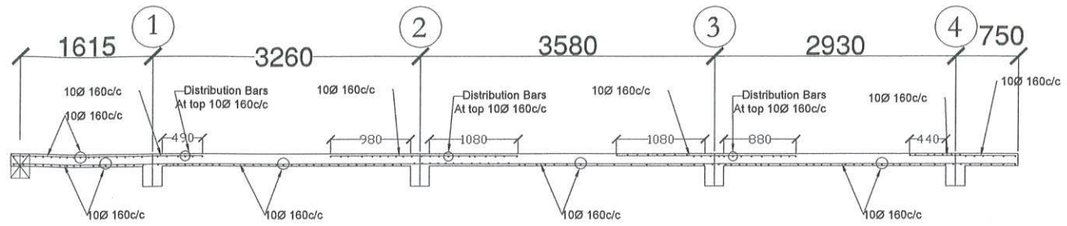
Category
Approved/ Issued for Fabrication / Construction/Manufacturing.
Approved/ Issued for Fabrication / Construction/Manufacturing subject to condition that sta... included.
Please submit a revised document for approval.
टिप्पणियों को समावेशित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
Insert comments and submit again for approval
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
For Information and record.
सूचना एवं रिकॉर्ड हेतु।
Not approved.
अनुमोदित नहीं।

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

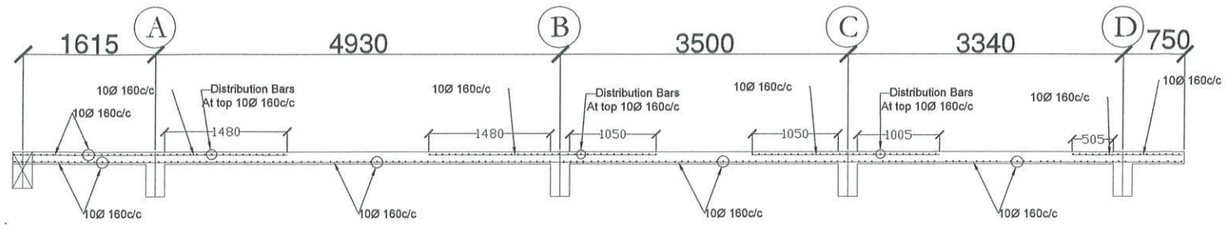
05.05.22



ROOF SLAB PLAN (+3.650)



SECTION X–X



SECTION Y–Y

SLAB THICKNESS 150MM

SLAB REINFORCEMENT DETAILS

S.NO	SLAB TYPE	SHORT SPAN STEEL (BOT.)	LONG SPAN STEEL (BOT.)	SHORT SPAN STEEL (TOP)	LONG SPAN STEEL (TOP)
1	S1	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
2	S2	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
3	S3	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
4	S4	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
5	S5	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
6	S6	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
7	S7	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
8	S8	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
9	S9	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
10	S10	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
11	S11	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c

Categories
श्रेणियां
I. Approved issued for Fabrication/Construction/Manufacturing.
निर्माण/निर्माण/विनिर्माण हेतु अनुमोदित जारी की गई।
II. Approved issued for Fabrication/Construction/Manufacturing subject to correction that stated. Please submit the revised documents for record purpose. Fabrication/Construction/Manufacturing may be included.
निर्माण/निर्माण/विनिर्माण हेतु अनुमोदित जारी की गई। कृपया संशोधित दस्तावेज अनुमोदनों हेतु प्रस्तुत करें।
III. Incorporate comments and submit again for approval.
टिप्पणियों को शामिल करें और अनुमोदन हेतु पुनः प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

GENERAL NOTES:

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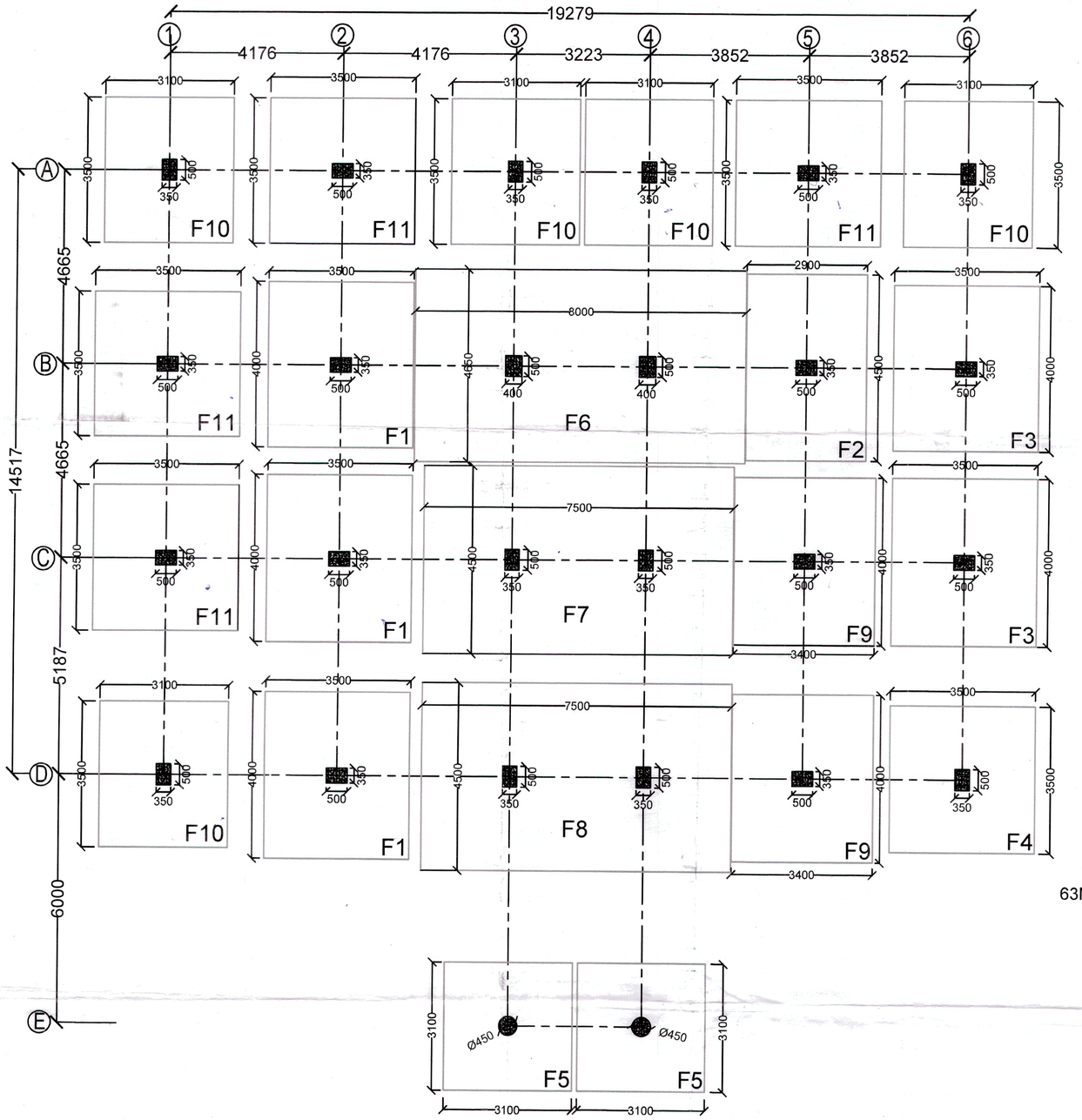
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation Including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	AE QUARTER SLAB RCC DETAIL DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/31		REV-0	
SCALE	As shown in Drawing		SHEET SIZE - A2	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 4 OF 4	
	NAME	DATE	SIGN	
PREPARED BY	B.K	23.03.2022		
CHECKED BY	G.H	23.03.2022		
SUBMITTED BY	ANURAG	23.03.2022		

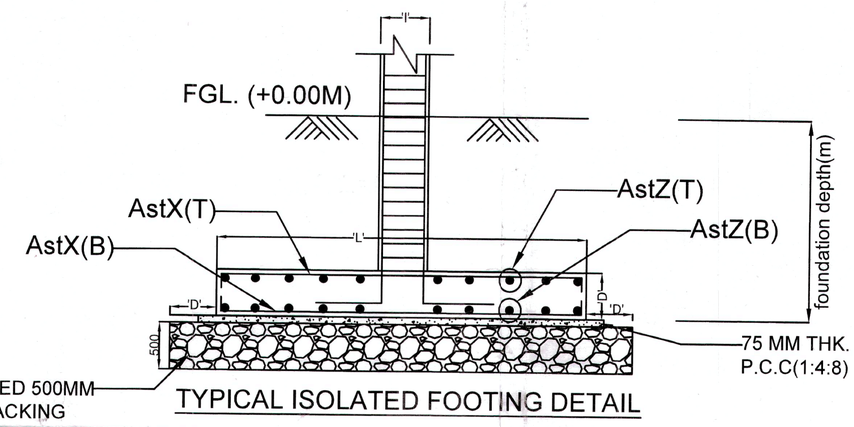
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Signature & Stamp

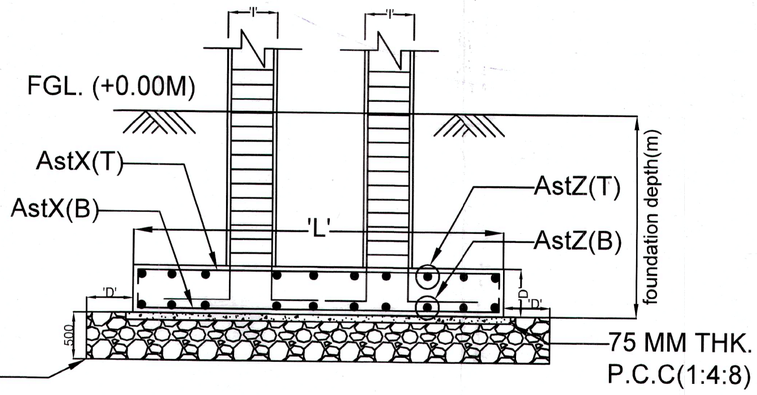


FOUNDATION PLAN



WELL COMPACTED 500MM THICK STONE PACKING SIZE 63 MM DOWN GRADE WITH GAP FILLED WITH LOCAL SAND

TYPICAL ISOLATED FOOTING DETAIL



WELL COMPACTED 500MM THICK STONE PACKING SIZE 63MM DOWN GRADE WITH GAP FILLED WITH LOCAL SAND.

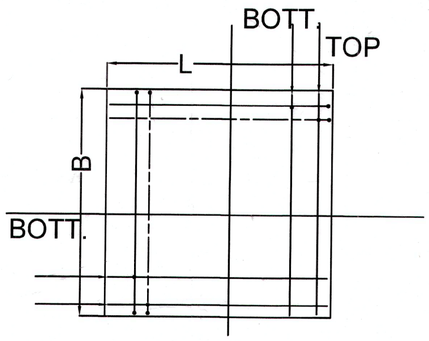
TYPICAL COMBINED FOOTING DETAIL

ISOLATED FOOTING SCHEDULE

Foundation Mark	Foundation depth(m)	Foundation			Cover (m)	Reinforcement			
						TOP		BOTTOM	
		L (m)	B (m)	D (m)		AstX(T)	AstZ(T)	AstX(B)	AstZ(B)
F1	2.500	3.500	4.000	0.450	0.050	12 mm @ 150 mm	12 mm @ 150 mm	12 mm @ 100 mm	12 mm @ 100 mm
F2	2.500	2.900	4.500	0.450	0.050	12 mm @ 150 mm	12 mm @ 150 mm	16 mm @ 150 mm	16 mm @ 150 mm
F3	2.500	3.500	4.000	0.450	0.050	12 mm @ 150 mm	12 mm @ 150 mm	12 mm @ 100 mm	12 mm @ 100 mm
F4	2.500	3.500	3.500	0.450	0.050	12 mm @ 150 mm	12 mm @ 150 mm	12 mm @ 100 mm	12 mm @ 100 mm
F5	2.500	3.100	3.100	0.450	0.050	12 mm @ 150 mm	12 mm @ 150 mm	12 mm @ 100 mm	12 mm @ 100 mm
F9	2.500	3.400	4.000	0.450	0.050	12 mm @ 150 mm	12 mm @ 150 mm	12 mm @ 100 mm	12 mm @ 100 mm
F10	2.000	3.100	3.500	0.400	0.050	12 mm @ 150 mm	12 mm @ 150 mm	12 mm @ 100 mm	12 mm @ 100 mm
F11	2.000	3.500	3.500	0.400	0.050	12 mm @ 150 mm	12 mm @ 150 mm	12 mm @ 100 mm	12 mm @ 100 mm

COMBINED FOOTING SCHEDULE

Foundation Mark	Foundation depth(m)	FOOTING TYPE	FOOTING (IN MTR)			Cover (m)	Reinforcement			
							TOP		BOTTOM	
			L (m)	B (m)	D (m)		AstX(T)	AstZ(T)	AstX(B)	AstZ(B)
F6	2.5	COMBINED	8.000	4.650	0.500	0.050	12 mm @ 100 mm	12 mm @ 100 mm	16 mm @ 100 mm	16 mm @ 100 mm
F7	2.5	COMBINED	7.500	4.500	0.500	0.050	12 mm @ 100 mm	12 mm @ 100 mm	16 mm @ 100 mm	16 mm @ 100 mm
F8	2.5	COMBINED	7.500	4.500	0.500	0.050	12 mm @ 100 mm	12 mm @ 100 mm	16 mm @ 100 mm	16 mm @ 100 mm



FOOTING REINFORCEMENT KEY PLAN

LEGEND:

B.O.L = BOTTOM OF LINTE
T.O.S = TOP OF SLAB
T.O.C = TOP OF CONCRETE
B.O.C = BOUNDARY OF CO

GENERAL NOTES:.

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS
2. NO DIMENSION SHALL BE SCALED FROM THE DRG. FOLLOW ONLY W DIMENSIONS.
3. READ THIS DRAWING TOGETHER WITH CORRESPONDING GA DRG.
4. GRADE OF CONCRETE FOR ALL RCC WORKS SHALL BE M25.
5. Y DENOTES HYSD BARS GRADE FE500.
6. DEVELOPMENT LENGTH LAP LENGTH SHALL BE 57XDIA OF BAR.
7. MINIMUM COVER TO REINFORCEMENT SHALL BE a) FOOTING-50MM b) COLUMN-40MM
8. P.C.C SHALL BE OF 40MM NOMINAL MIX 1:4:8.
9. NET SAFE BEARING CAPACITY AT 2.5M DEPTH BELOW FGL IS CONSID AS 5.0 T/M2.
10. NET SAFE BEARING CAPACITY AT 2M DEPTH BELOW NGL IS CONSIDR AS PER SOIL INVESTIGATION REPORT BH-03.
11. DETAILING OF ALL RCC MEMBER CONFIRMED TO DUCTILITY DETAILIN REQUIREMENT AS PER IS-13920.

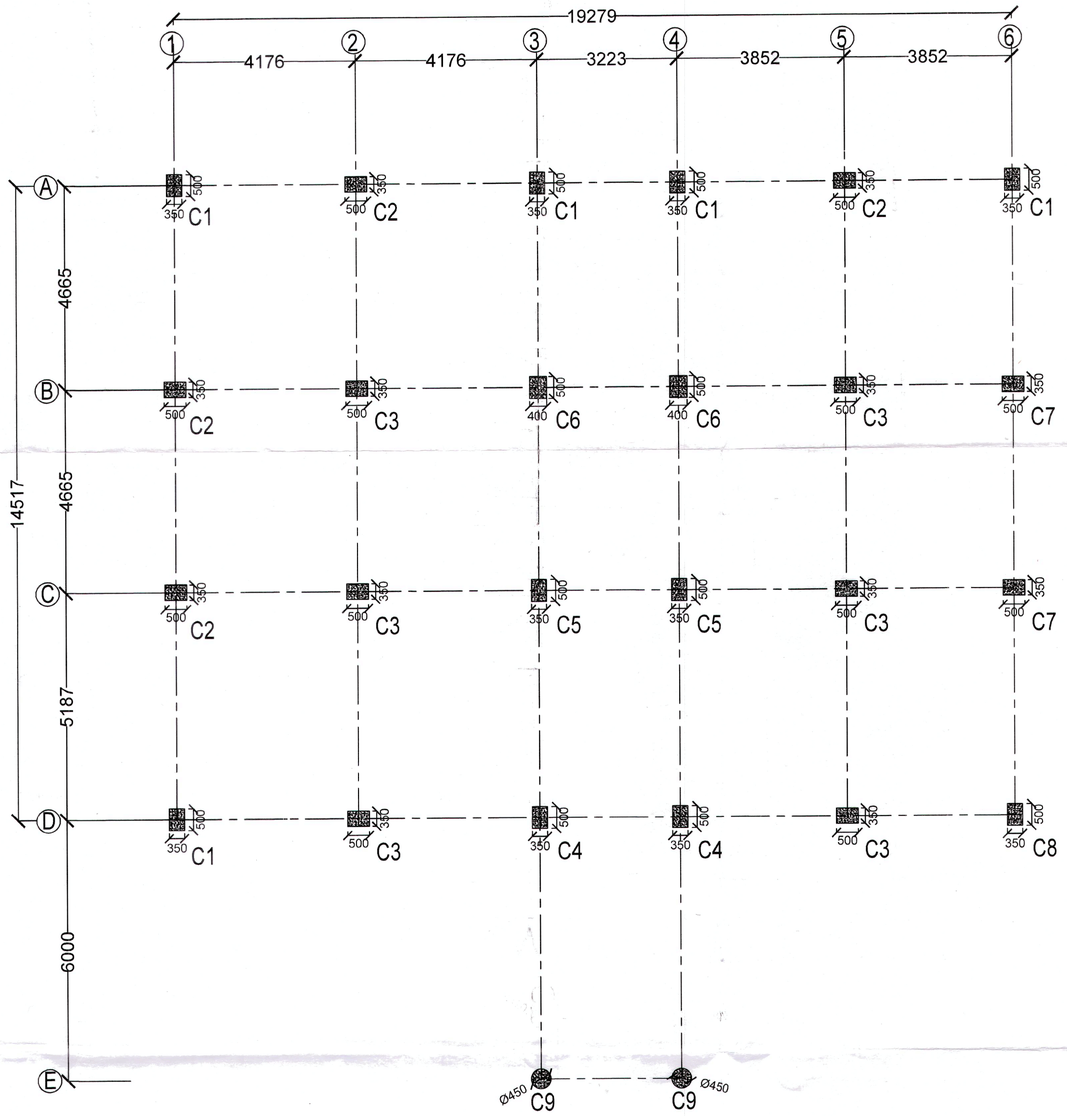
MARK	SIZE (IN MTR)
F1	3.500 X 4.000 X 0.450
F2	2.900 X 4.000 X 0.450
F3	3.500 X 4.000 X 0.450
F4	3.500 X 3.500 X 0.450
F5	3.100 X 3.100 X 0.450
F6	8.000 X 4.650 X 0.500
F7	7.500 X 4.500 X 0.500
F8	7.500 X 4.500 X 0.500
F9	3.400 X 4.000 X 0.450
F10	3.100 X 3.500 X 0.400
F11	3.500 X 3.500 X 0.400

PROJECT	Construction of 2x50MVA, 220/33KV Nagro SubStation including LILO of 220KV Kisher Udhampur-giadni S/C line on D/C Tower at Substation including Design, Engineering, Construction of Residential Staff Quaters & facilities at proposed Nagrota Substation u scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.20 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.20
OWNER	Jammu & Kashmir Power Transmission Corpora
CLIENT	REC Power Distribution Company Limited(RECP
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Co
TITLE	FOUNDATION DRAWING OF CRB, 220/33 kV Nagrota (J
DRG. NO.	KDBIL/250 PJ/20-21/D1/34
SCALE	As shown in Drawing
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	AMIR	21.09.2021	
CHECKED BY	G.H	21.09.2021	
SUBMITTED BY	Er. SANJAY	21.09.2021	

☐ Approved ☐ Approved with comments ☐ Not App

☐ More Information Date.....

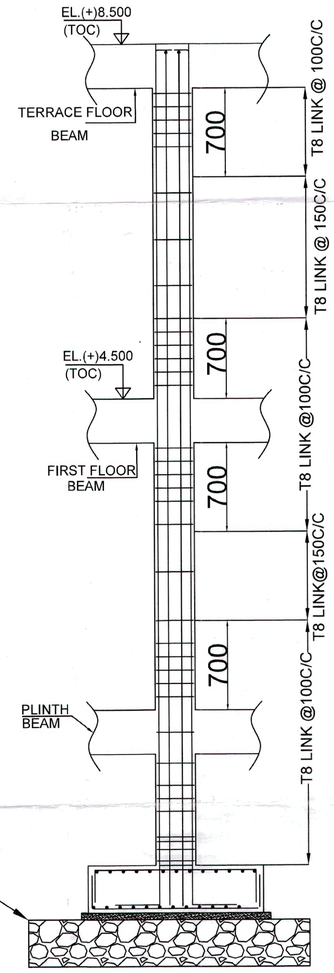


COLUMN LAYOUT PLAN

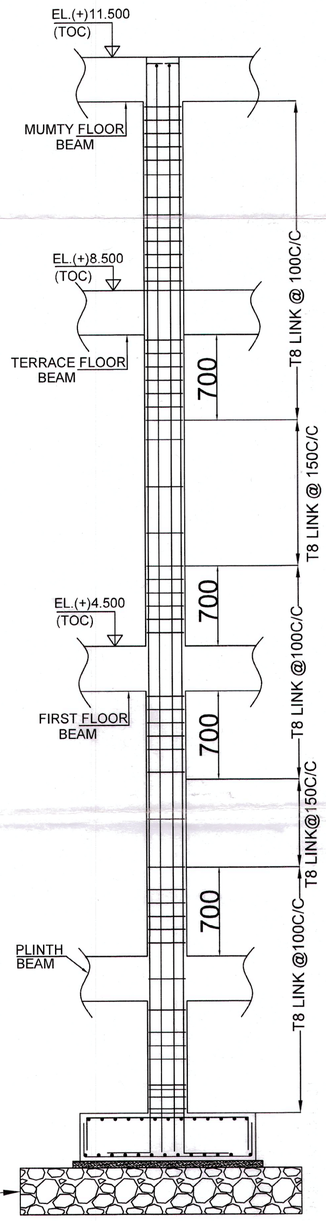
S.NO.	COL. MKD.	QTY. COL. (NOS.)	COLUMN SIZE (mm)	MAIN REINFORCEMENT	
				FOUNDATION TO FIRST FLOOR LEVEL	FIRST FLOOR LEVEL TO TERRACE LEVEL
1.	C1	5	350X500	●25Ø-8NOS.	●25Ø-4NOS. 12Ø-2NOS.
2.	C2	4	500X350	●25Ø-8NOS.	●25Ø-4NOS. 12Ø-2NOS.
3.	C3	6	500X350	●25Ø-8NOS.	●25Ø-4NOS. 12Ø-2NOS.
4.	C4	2	350X500	●25Ø-6NOS. ○ 20Ø-2NOS.	●25Ø-4NOS. ○ 12Ø-2NOS.
5.	C7	2	500X350	●25Ø-4NOS. ○ 16Ø-4NOS.	●25Ø-4NOS. 12Ø-2NOS.
6.	C8	1	350X500	●25Ø-4NOS. ○ 16Ø-4NOS.	●25Ø-4NOS. ○ 12Ø-2NOS.

S.NO.	COL. MKD.	QTY. COL. (NOS.)	COLUMN SIZE (mm)	MAIN REINFORCEMENT
				FOUNDATION TO FIRST FLOOR LEVEL
1.	C9	2	450 Ø	●20Ø-6NOS.

S.NO.	COL. MKD.	QTY. COL. (NOS.)	COLUMN SIZE (mm)	MAIN REINFORCEMENT	
				FOUNDATION TO FIRST FLOOR LEVEL	FIRST FLOOR LEVEL TO MUMTY LEVEL
1.	C5	2	350X500	●25Ø-4NOS. ○ 20Ø-4NOS.	●25Ø-4NOS. ○ 12Ø-2NOS.
2.	C6	2	400X500	●25Ø-8NOS. ○ 16Ø-2NOS.	●25Ø-4NOS. ○ 12Ø-4NOS.



TYPICAL COLUMN SECTION UPTO TERRACE LEVEL



TYPICAL COLUMN SECTION UPTO MUMTY LEVEL

GENERAL NOTES:.

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS .
2. NO DIMENSION SHALL BE SCALED FROM THE DRG. FOLLOW ONLY WRITTEN DIMENSIONS.
3. READ THIS DRAWING TOGETHER WITH CORRESPONDING GA DRG.
4. GRADE OF CONCRETE FOR ALL RCC WORKS SHALL BE M25.
5. Y DENOTES HYSD BARS GRADE FE500.
6. DEVELOPMENT LENGTH LAP LENGTH SHALL BE 57XDIA OF BAR.
7. MINIMUM COVER TO REINFORCEMENT SHALL BE
   a) FOOTING-50MM b) COLUMN-40MM
8. P.C.C SHALL BE OF 40MM NOMINAL MIX 1:4:8.
9. NET SAFE BEARING CAPACITY AT 2.5M DEPTH BELOW FGL IS CONSIDERED AS 5.0 T/M2.
10. NET SAFE BEARING CAPACITY AT 2M DEPTH BELOW NGL IS CONSIDRED AS 13.12 T/M2 AS PER SOIL INVESTIGATION REPORT BH-03.
11. DETAILING OF ALL RCC MEMBER CONFIRMED TO DUCTILITY DETAILING REQUIREMENT AS PER IS-13920.
12. PLINTH BEAM LEVEL SHALL BE PROVIDED IN BEAM RCC DETAIL DRAWING.

LEGEND:

B.O.L = BOTTOM OF LINTEL
T.O.S = TOP OF SLAB
T.O.C = TOP OF CONCRETE
B.O.C = BOUNDARY OF CONCRETE

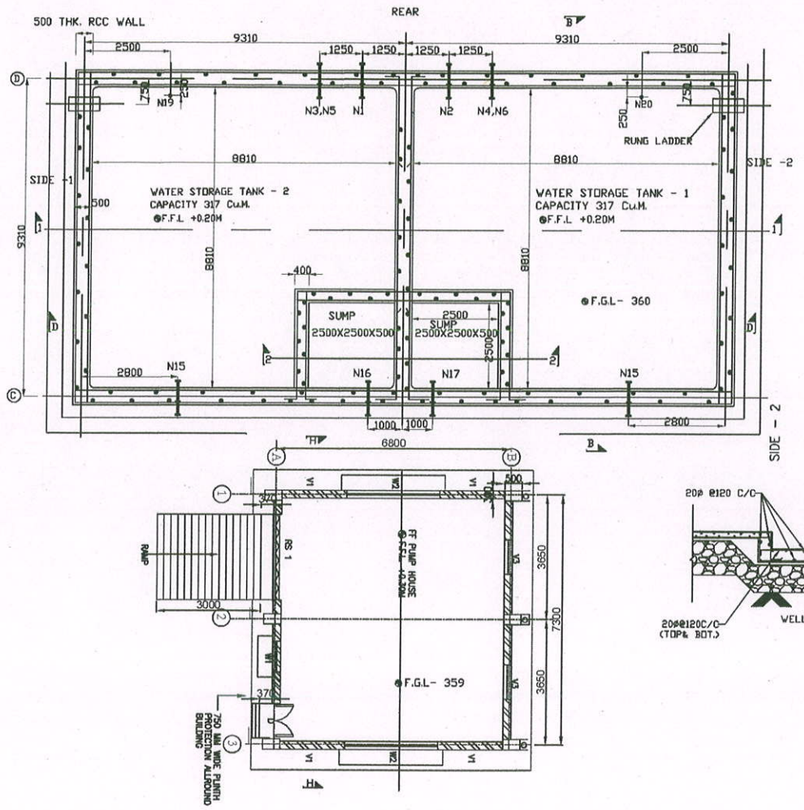
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	COLUMN RCC DETAIL DRAWING OF CRB, 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/35	REV- 0	
SCALE	As shown in Drawing	SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM	SH. NO.:- 1 OF 1	
	NAME / DATE / SIGN		
PREPARED BY	AMIR 29.09.2021	R.C BANSAL	
CHECKED BY	G.H 29.09.2021		
SUBMITTED BY	Er. SANJAY 29.09.2021	Signature/Stamp...	

☐ Approved ☐ Approved with comments ☐ Not Approved

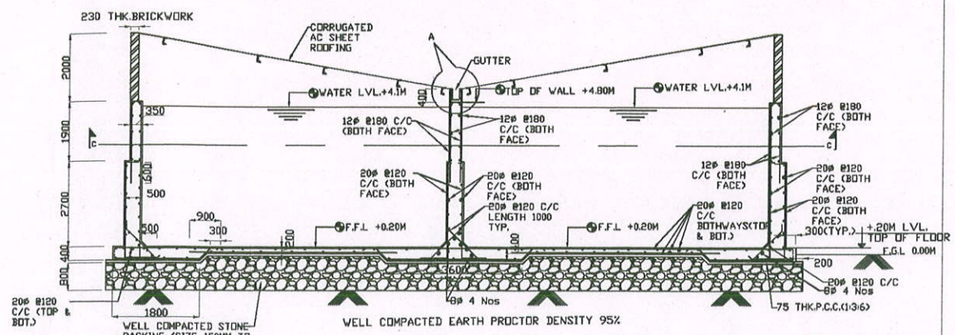
☐ More Information

Categories
1. Approved / Issued / for Fabrication / Construction / Manufacturing.
2. Approved / Issued / for Fabrication / Construction / Manufacturing. Conditional statements and cruste should be included.
3. Insert tips and submit again for approval.
4. For information and record.
5. Not approved.

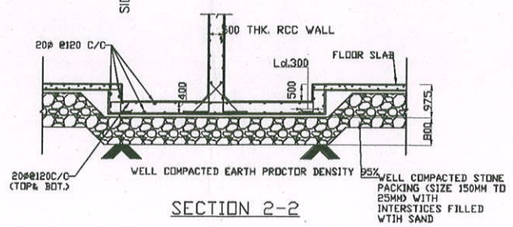
For and on behalf of ... New Delhi



GROUND FLOOR PLAN FOR FFPH & WATER TANK



SECTION 1-1



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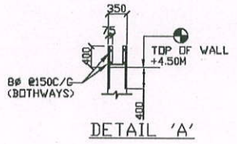
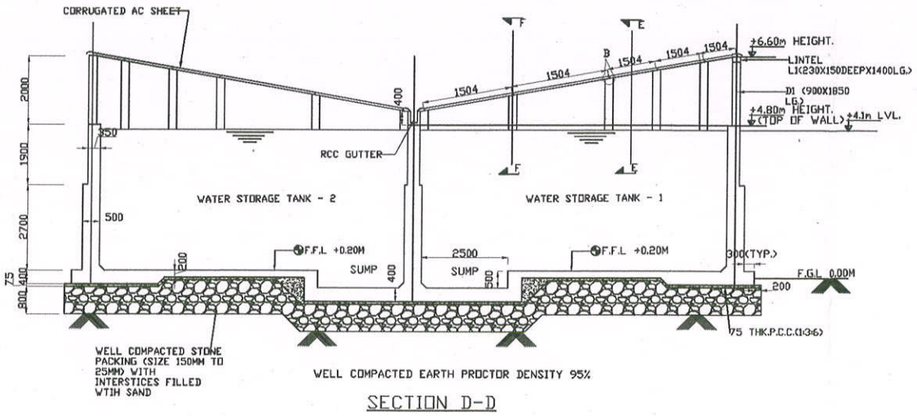
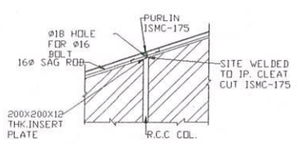


DETAIL 'A'



SECTION D-D



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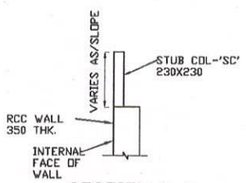
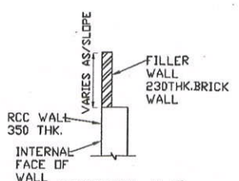


SECTION F-F



SECTION E-E

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE GRADE SHALL BE 25 .
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. PROVIDE THE CLEAR COVERTO REINFORCEMENT .
   A) 50 MM FOR BOTTOM , TOP AND SIDE REINFORCEMENT OF FOOTING.
   B) 40 MM FOR COLUMN.
   C) 25 MM FOR WALL.
6. LAP LENGHT SHALL BE 47 TIMES DIA. OF BAR.
7. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
8. ALL NOZZELS ,PIPES SLEEVES SHALL BE PLACED IN POSITION AS PER F.F REQUIREMENT BEFORE CONCRETING, USE MATERIAL FOR NOZZLES - COPPER ALLOYS AS PER IS 903-1993.
9. RCC JOINTS SHOULD BE FILLED WITH PVC/RUBBER WATER STOPPER.

REC PDCL GURUGRAM

Kailash Devbuild (India) Pvt. Ltd.

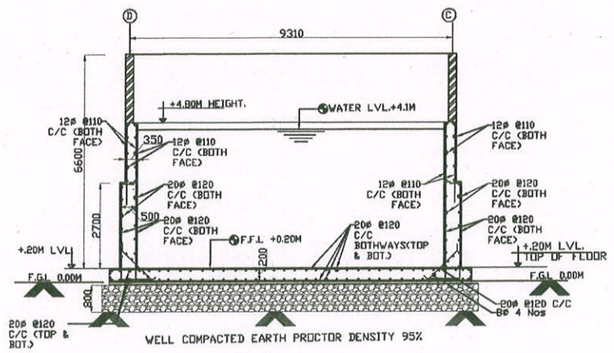
Categories
श्रेणियां
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

(Signature) (हस्ताक्षर) Dum(T)
(Designation) (पदनाम)
5/4/22 (Date) (तिथि)

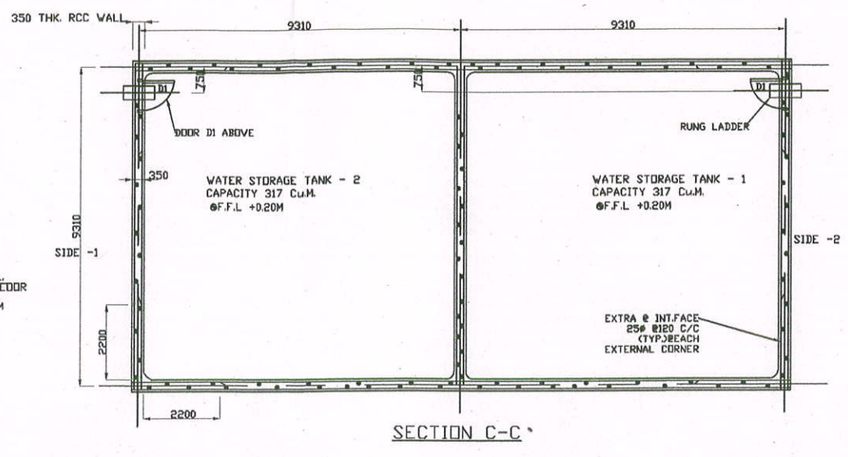
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Transmission Projects Company Limited(RECTPCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. B17, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	FFPH WATER TANK DETAIL DRAWING FOR 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/36			REV- 01
SCALE	As shown in Drawing			SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM			SH.NO.: 1 OF 2
	NAME	DATE	SIGN	
PREPARED BY	B.K.	09.03.2022		R.C BANSAL
CHECKED BY	G.H	09.03.2022		
SUBMITTED BY	MR. JITENDRA	09.03.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

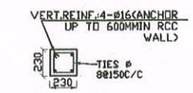
☐ More Information Date.....



SECTION B-B



SECTION C-C



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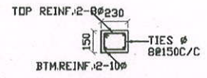

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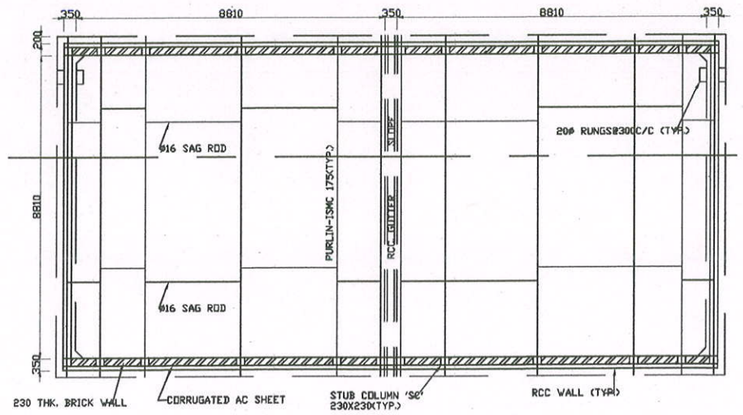
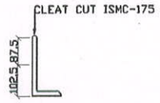
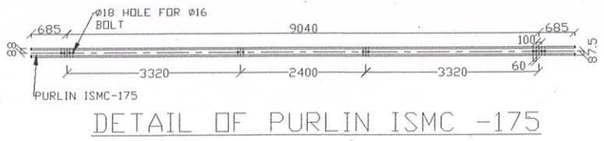


A.C. ROOF LEVEL PLAN

SL. NO.	NOZZEL NO.	SIZE	DESCRIPTION	BOTTOM OF PIPE ELEVATION
1.	N1,N2	100NB	WATER INLET	EL+4.1
2.	N3,N4	50NB	DRAIN	EL+0.45
3.	N5,N6	80NB	OVER FLOW	EL+4.1
4.	N7,N8	80NB	LVL.SWITCH	TOP
5.	N9,N10	25NB	LVL.INDICATOR	TOP
6.	N11,N12	25NB	LVL.INDICATOR	TOP
7.	N13,N14	25NB	LVL.INDICATOR	TOP
8.	N15	100NB	RECIRCULATION	EL+4.5
9.	N16	300NB	PUMP SUCTION	EL+0.919
10.	N17	300NB	PUMP SUCTION	EL+0.919

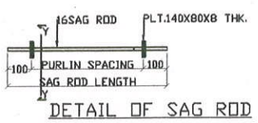


SECTION Z-Z

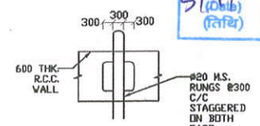


DETAIL OF PURLIN ISMC -175

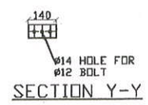
Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी/ बातें दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर) Dum(T)
(Designation) (पदनाम)
(Date) (तिथि) 5/4/22



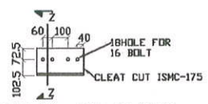
DETAIL OF SAG ROD



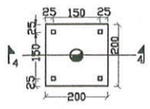
(TYP. DETAILS OF RUNG LADDER)



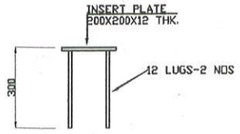
SECTION Y-Y



DETAIL OF CLEAT



PLAN



SECTION 4-4

SCHEDULE OF OPENING

	OPENING MARK	SIZE (MM)	CILL LVL.mts.	LINTEL LEVEL mts.	NOS.	DESCRIPTION
	DOOR (D1)	900X1850	+4.80	+6.45	02	STEEL DOOR - SINGLE SHUTTER MADE FROM HOT ROLLED SECTION

REC PDCL GURUGRAM

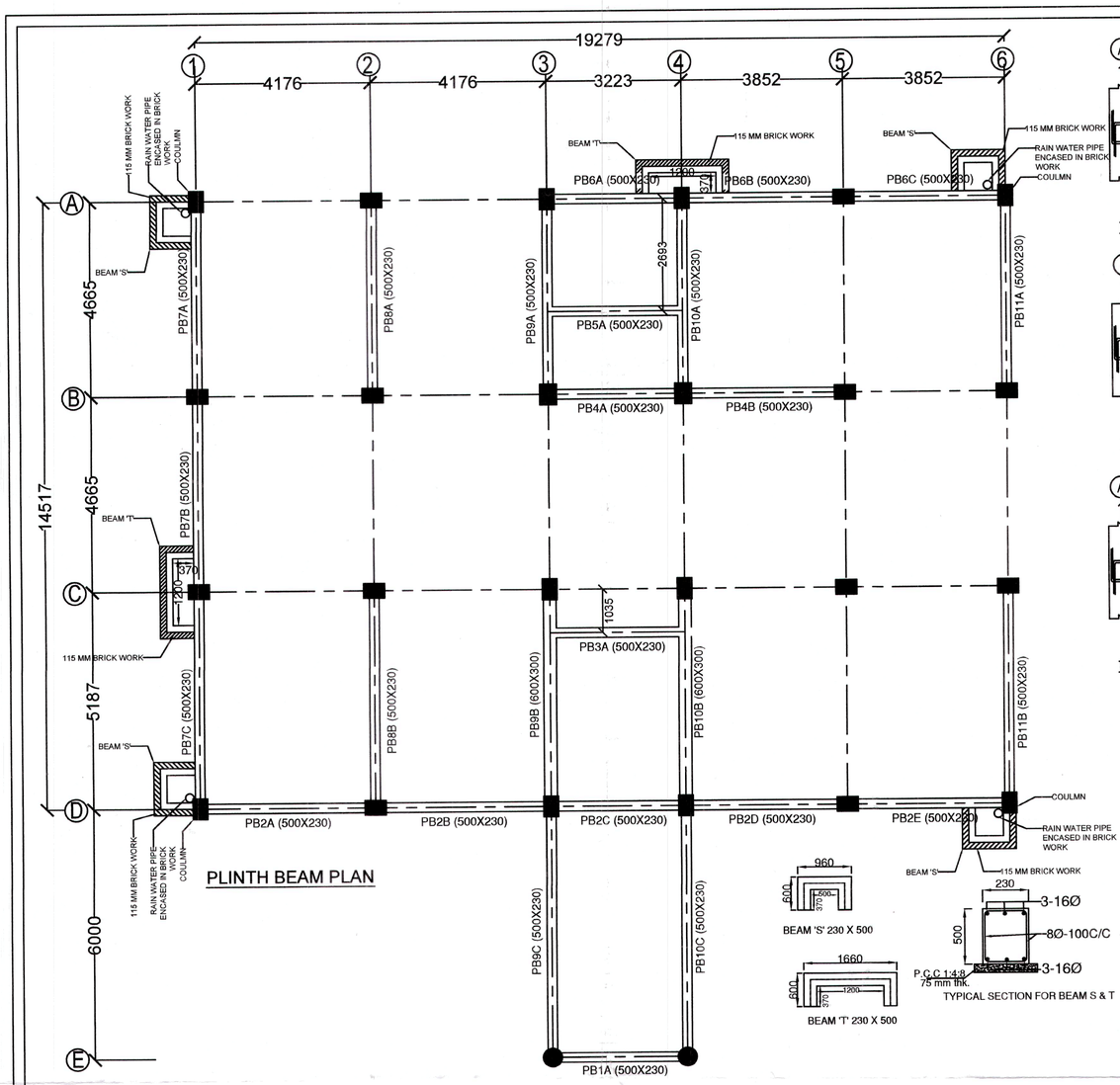
Kallash Devbuild (India) Pvt. Ltd.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Transmission Projects Company Limited(RECTPCL)
EPC COMPANY	Kallash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FFPH WATER TANK DRAWING FOR 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/36 — REV- 01
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 2 OF 2

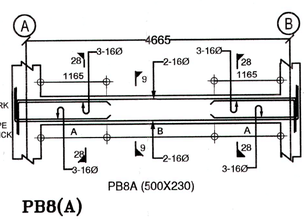
	NAME	DATE	SIGN	
PREPARED BY	B.K.	09.03.2022		R.C BANSAL
CHECKED BY	G.H	09.03.2022		
SUBMITTED BY	MR. JITENDRA	09.03.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

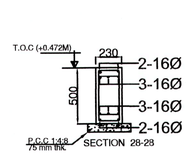
☐ More Information Date.....

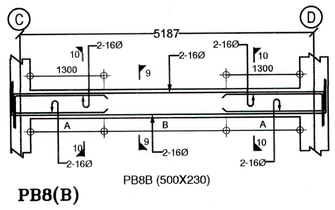


PLINTH BEAM PLAN

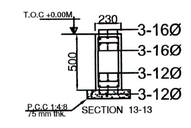


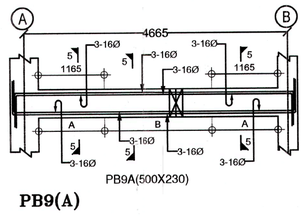
PB8(A)



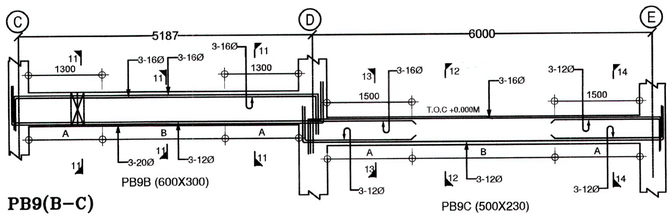


PB8(B)

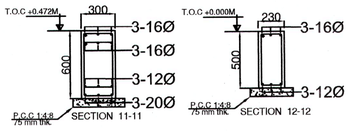


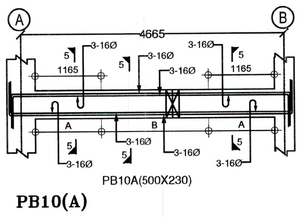


PB9(A)



PB9(B–C)





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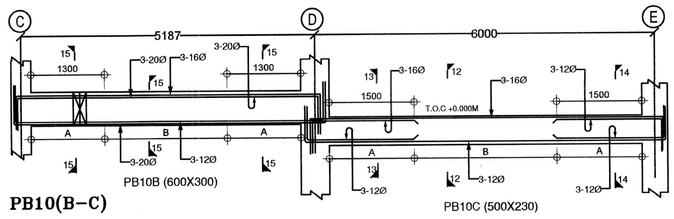
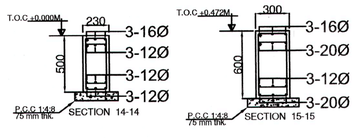
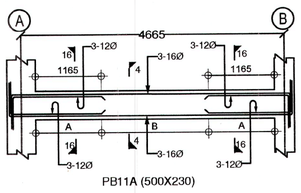
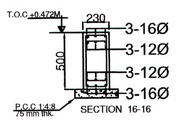


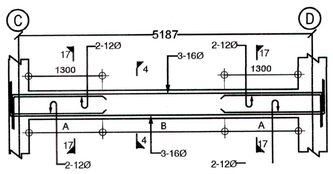
PB10(B–C)





PB11(A)





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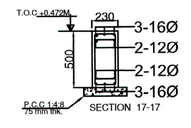
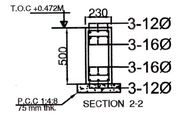
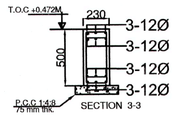
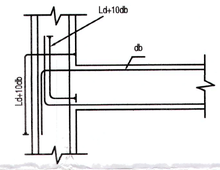




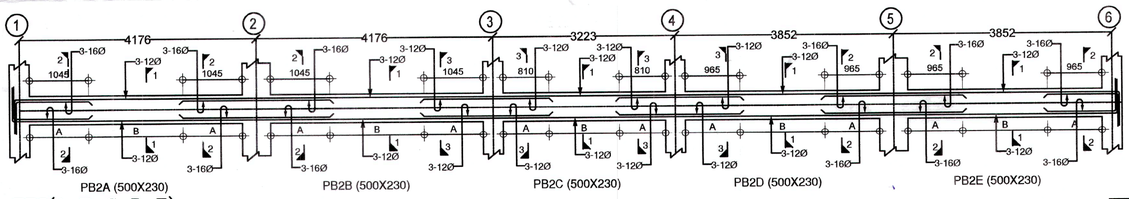




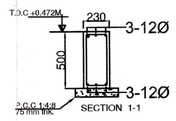
Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM
& COLUMN JUNCTION

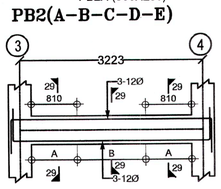
STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

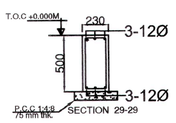


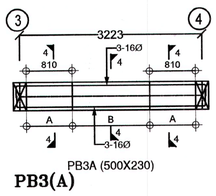
PB2(A–B–C–D–E)



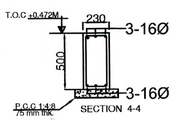


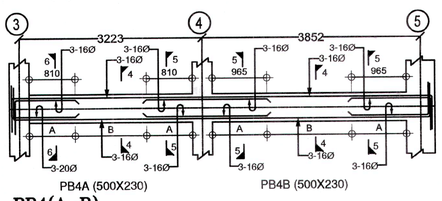
PB1(A)



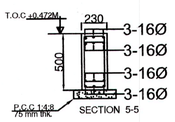


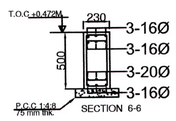
PB3(A)

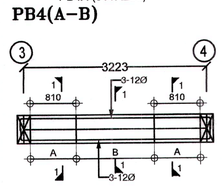




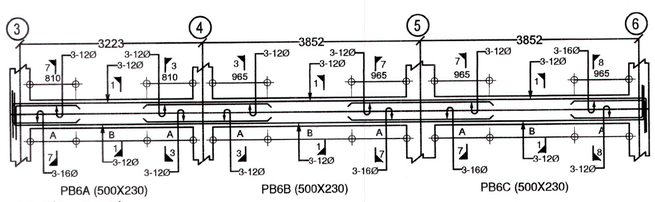
PB4(A–B)



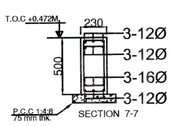


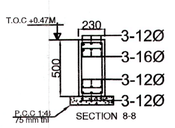


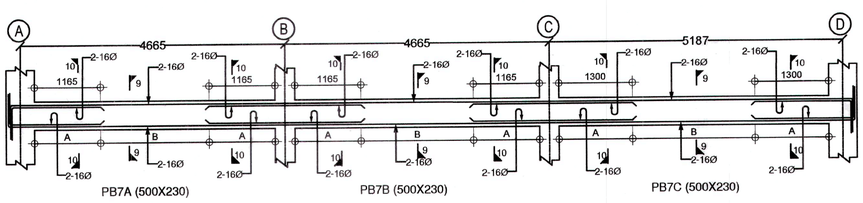
PB5(A)



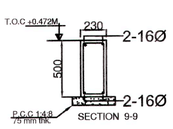
PB6(A–B–C)

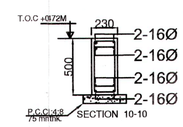


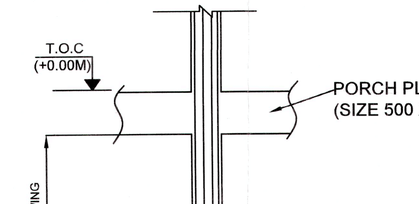




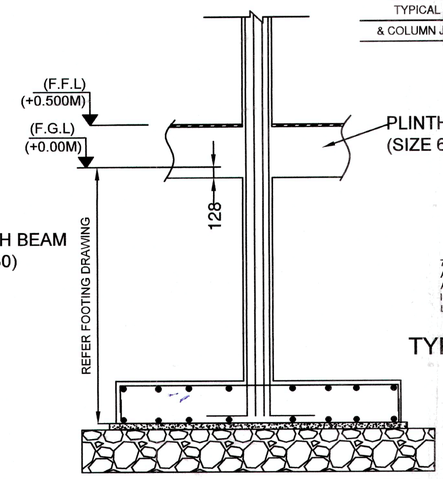
PB7(A–B–C)



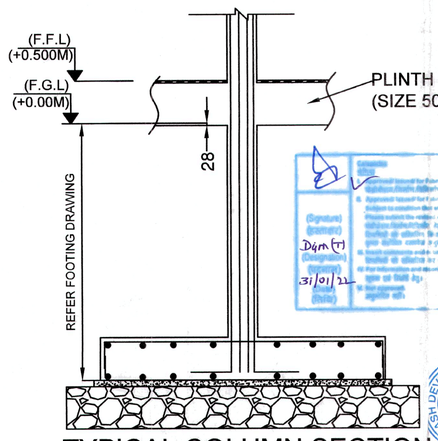




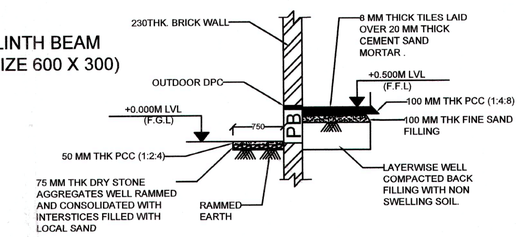
TYPICAL COLUMN SECTION



TYPICAL COLUMN SECTION



TYPICAL COLUMN SECTION



TYP. DETAILS OF PLINTH PROTECTION & FLOORING

GENERAL NOTES:

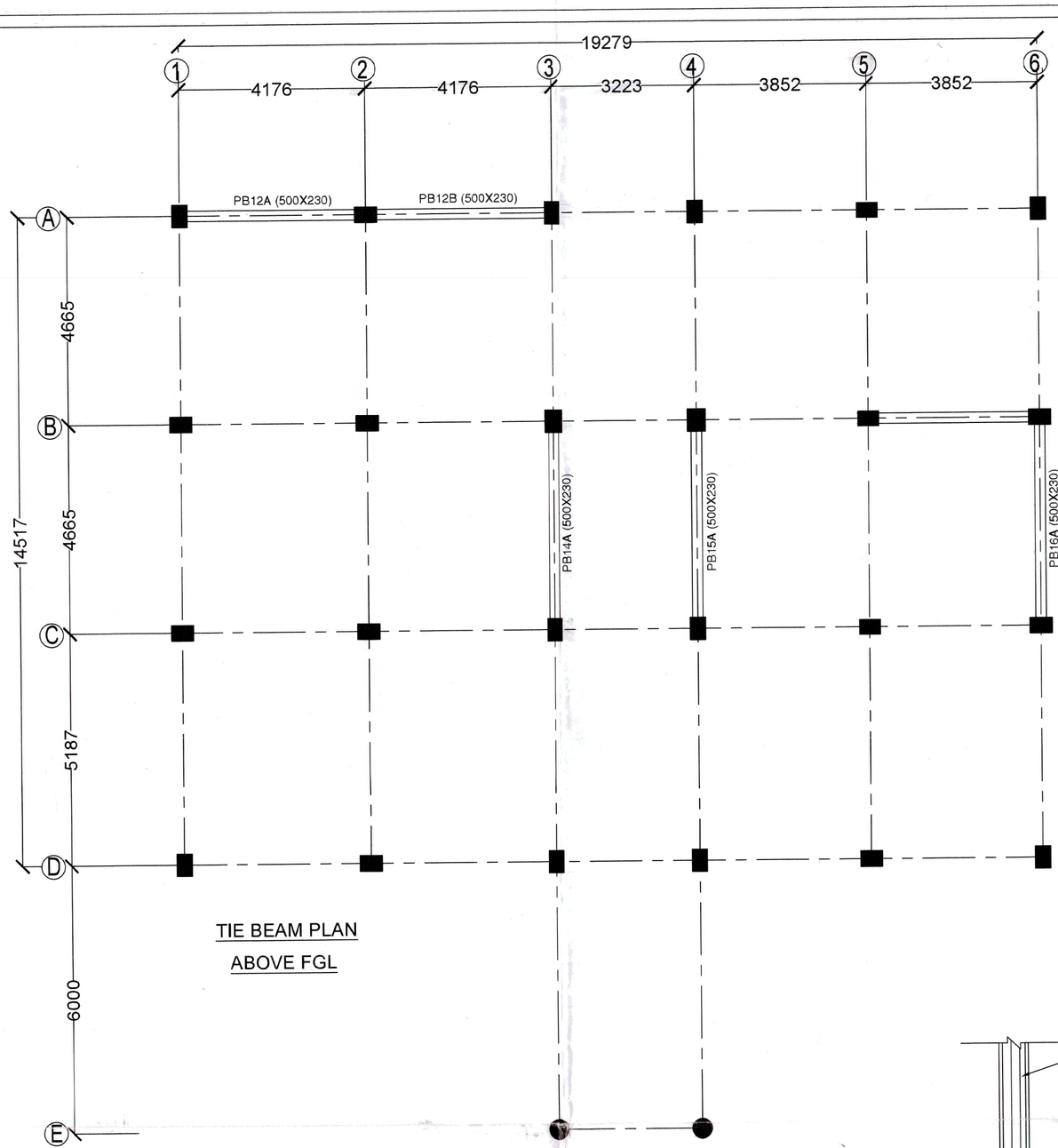
1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	PLINTH BEAM RCC DETAIL DRAWING OF CRB, 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/37		REV- 1
SCALE	As shown in Drawing		SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM		SH. NO.:- 1 OF 3

	NAME	DATE	SIGN	
PREPARED BY	AMIR	09.11.2021		R.C BANSAL
CHECKED BY	G.H	09.11.2021		
SUBMITTED BY	KDBIL	09.11.2021		Signature/Stamp...

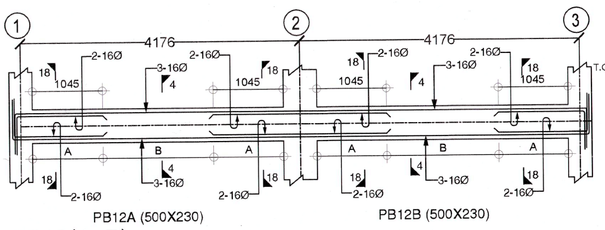
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

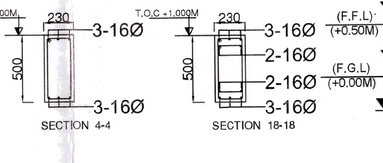


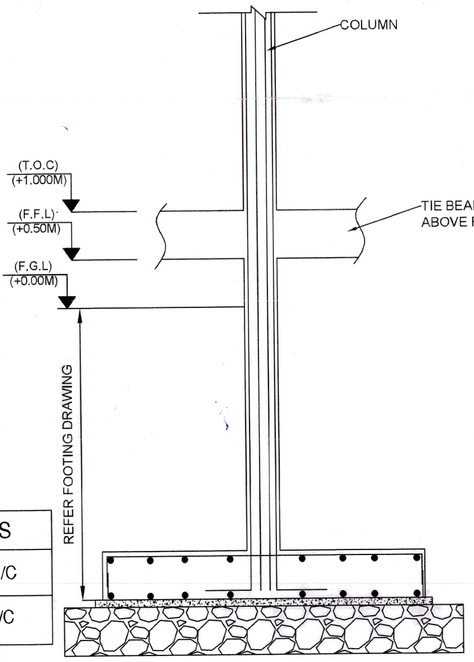
TIE BEAM PLAN

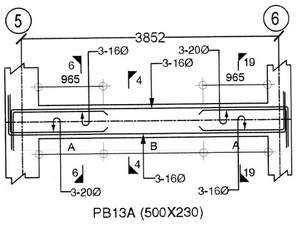
ABOVE FGL



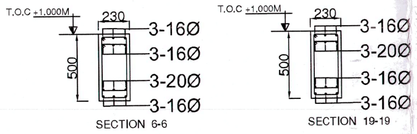
PB12(A-B)





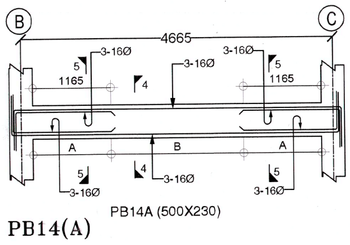


PB13(A)

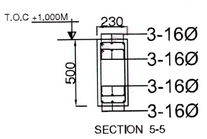


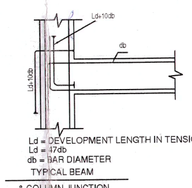
STIRRUPS SCHEDULE

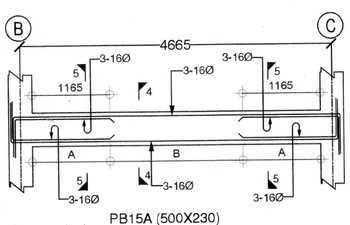
S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C



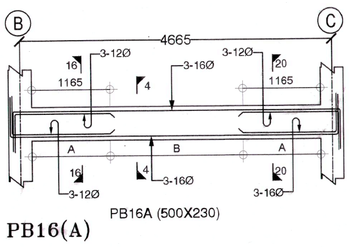
PB14(A)



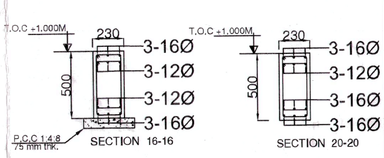




PB15(A)



PB16(A)



GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

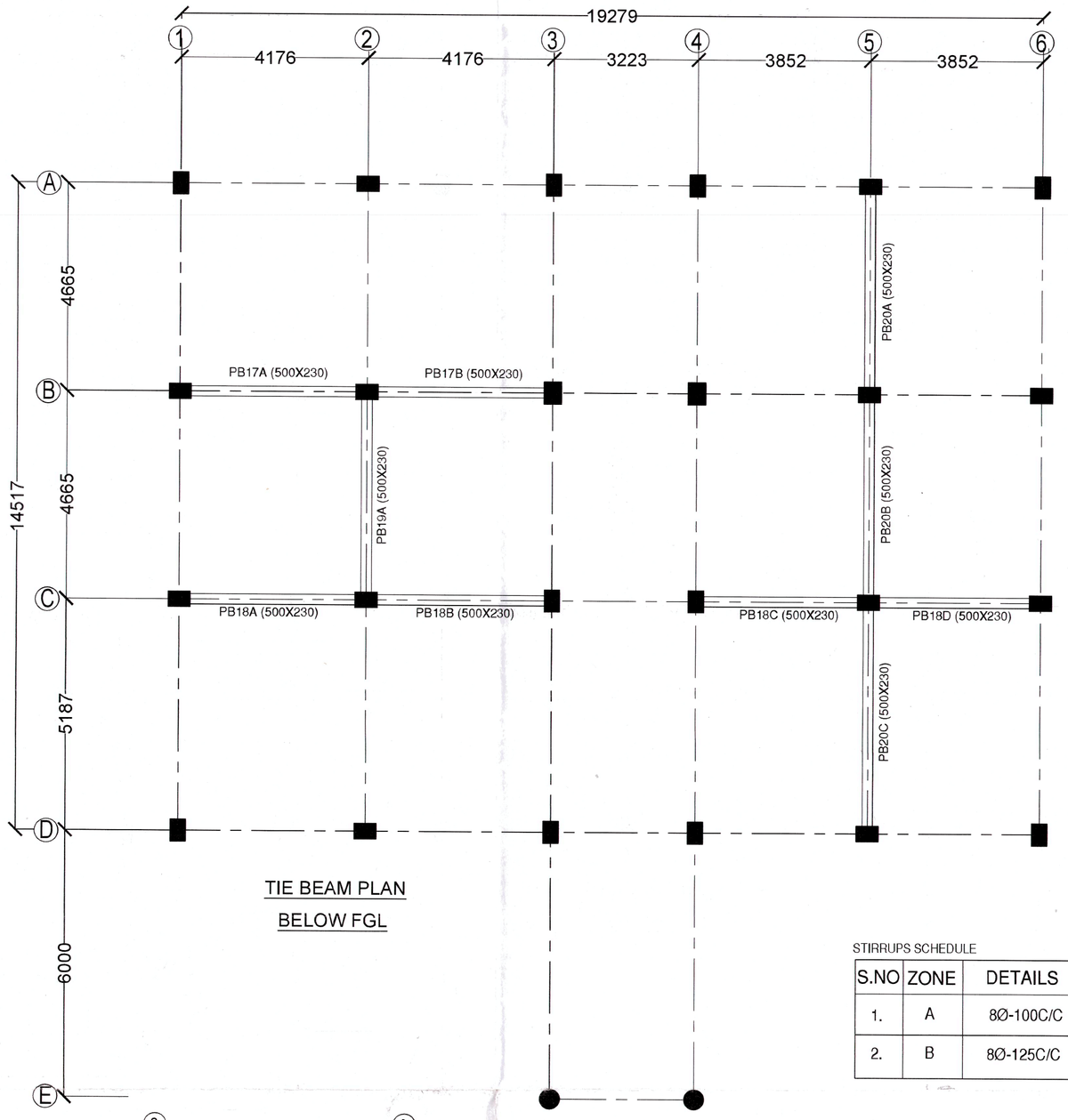
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-jiadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	1) CS/PSA/JKPTCL/Nagrota/55 & LILO-NNG-A/4105 Dt. 06.11.2020 2) CS/PSA/JKPTCL/Nagrota/55 & LILO-NNG-A/4106 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited(RECPDCL)		
EPC COMPANY	Kailash Deobuild (India) Pvt. Ltd. 817, Hathilal, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	TIE BEAM RCC DETAIL DRAWING OF CRB, 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBL/250 PJ/20-21/D1/37		REV- 1
SCALE	As shown in Drawing		SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM		SH. NO.- 2 OF 3
	NAME	DATE	SIGN
PREPARED BY	AMIR	09.11.2021	
CHECKED BY	G.H	09.11.2021	R.C BANSAL
SUBMITTED BY	KDBL	09.11.2021	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Comments
1. Approved Issued for Fabrication/Construction/Manufacturing. Fabrication/Manufacturing may start/continue.
2. Approved Issued for Fabrication/Construction/Manufacturing. Subject to condition that comments are included.
3. Fabrication/Manufacturing may start/continue, and it is done at owner's risk as per applicable regulations.
4. Resubmit with comments and submit again for approval.
5. For information and record.
6. Not approved.

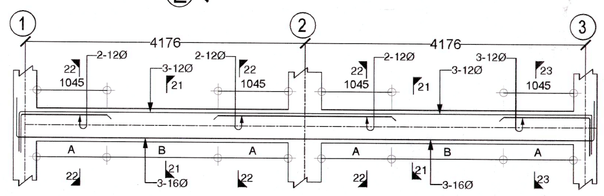
(Signature) DGM(T)
(Designation)
(Name)
31/01/22
(Date)



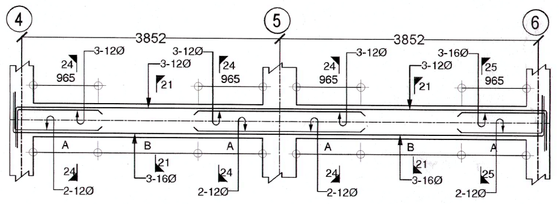
TIE BEAM PLAN
BELOW FGL

STIRRUPS SCHEDULE

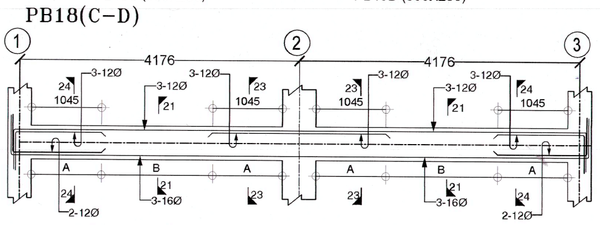
S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C



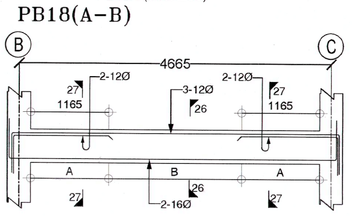
PB17(A-B)



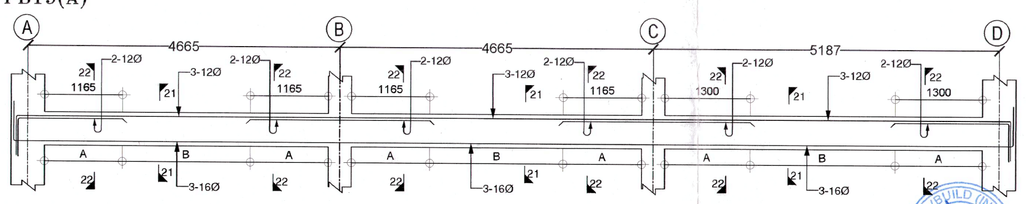
PB18(C-D)



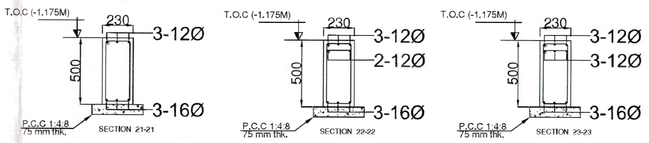
PB18(A-B)

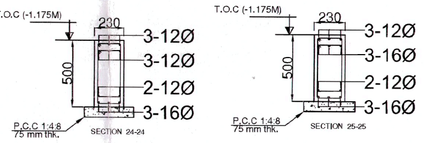


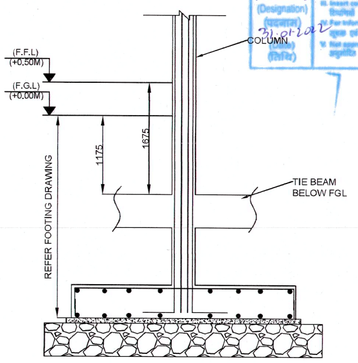
PB19(A)

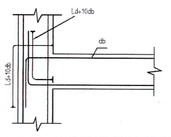


PB20(A-B-C)

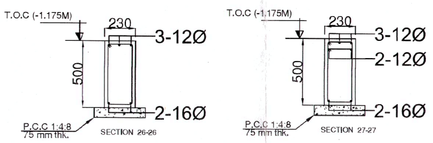








Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM
& COLUMN JUNCTION



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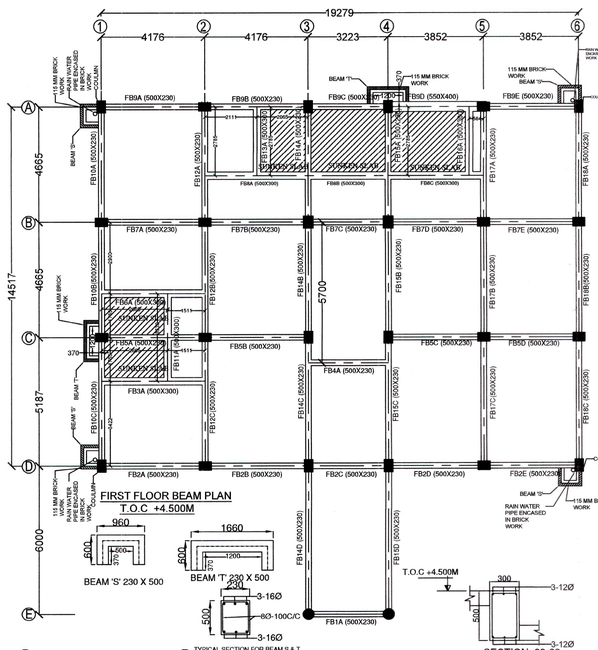
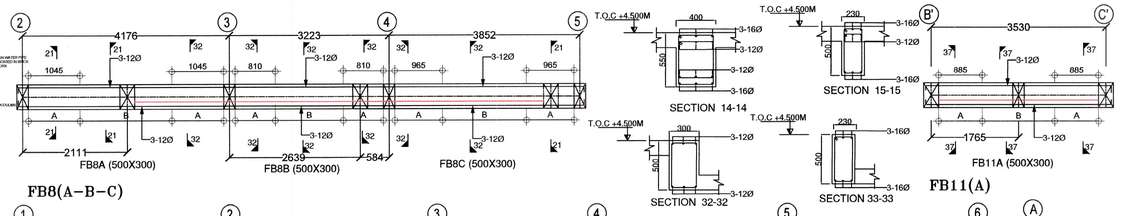
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	TIE BEAM RCC DETAIL DRAWING OF CRB, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/37 — REV- 1
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91,6 KANAL 46336,5 SQM — SH. NO.:- 3 OF 3

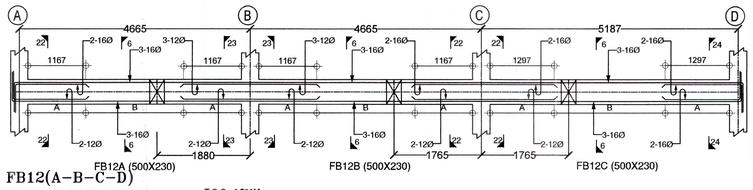
	NAME	DATE	SIGN	
PREPARED BY	AMIR	09.11.2021		R.C BANSAL
CHECKED BY	G.H	09.11.2021		
SUBMITTED BY	KDBIL	09.11.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....

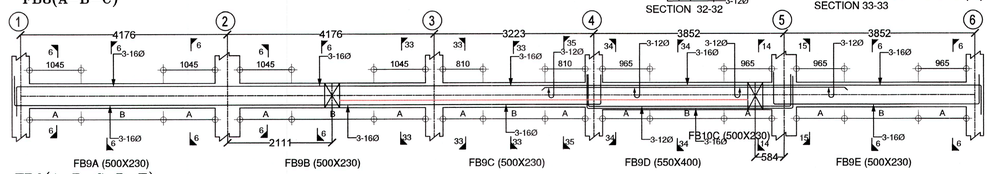




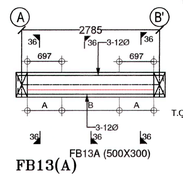
FB8(A–B–C)



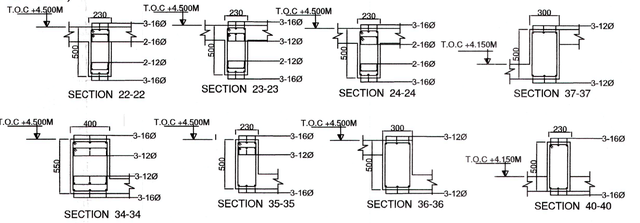
FB12(A–B–C–D)

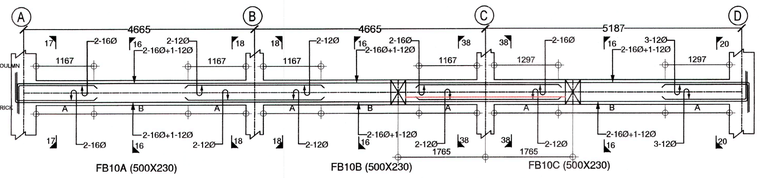


FB9(A–B–C–D–E)



FB13(A)





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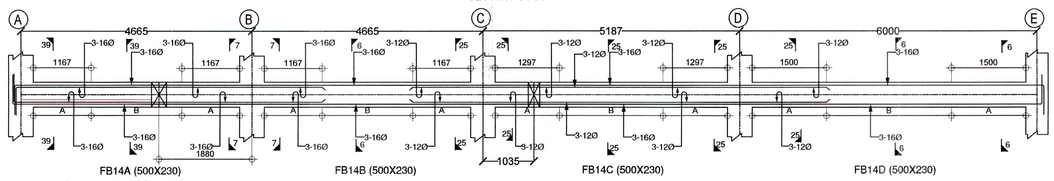
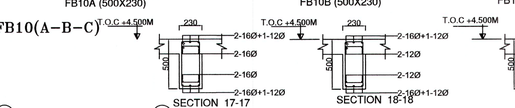
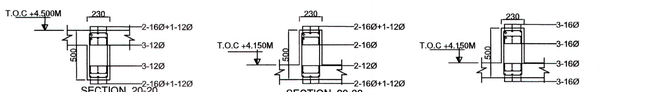
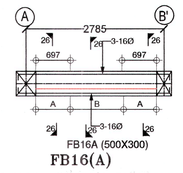


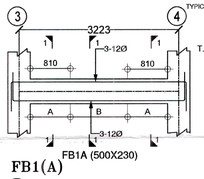
FB14(A–B–C–D)







FB16(A)



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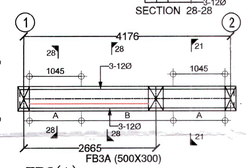
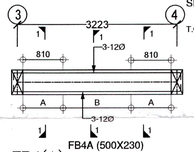
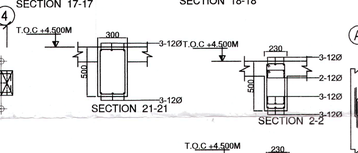
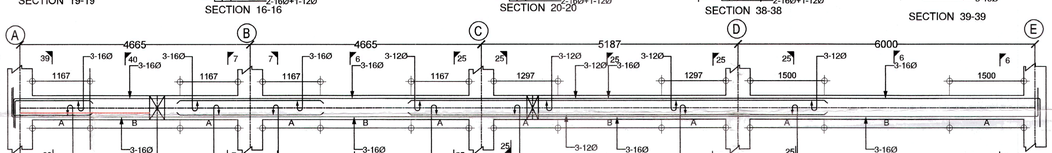


FB3(A)

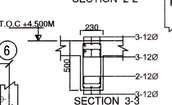


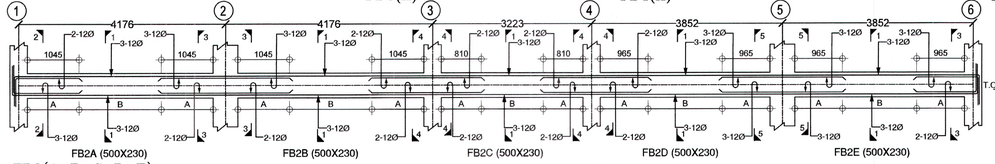
FB4(A)



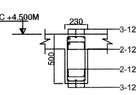


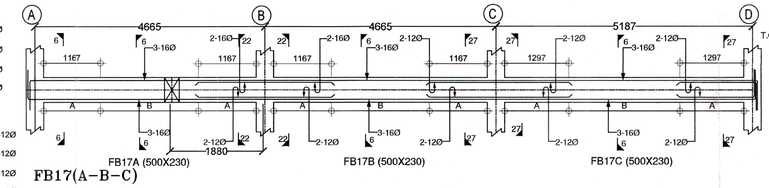
FB15(A–B–C–D)



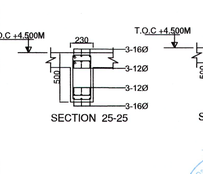


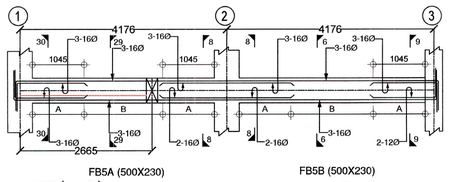
FB2(A–B–C–D–E)



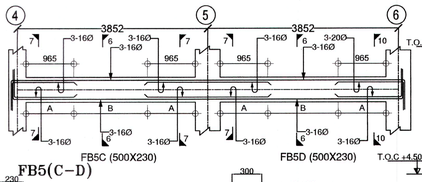


FB17(A–B–C)

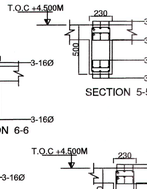


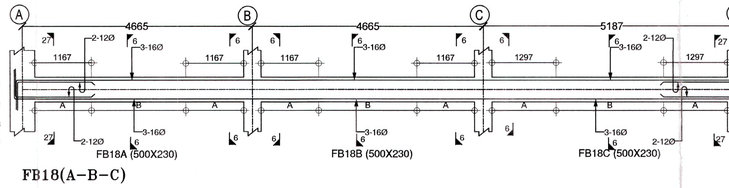


FB5(A–B)

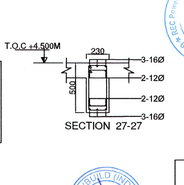


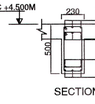
FB5(C–D)

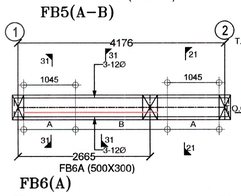




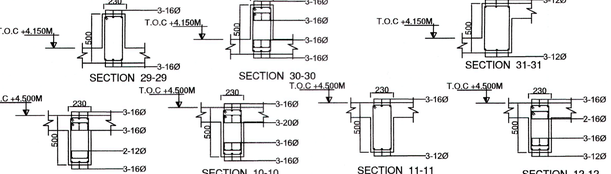
FB18(A–B–C)

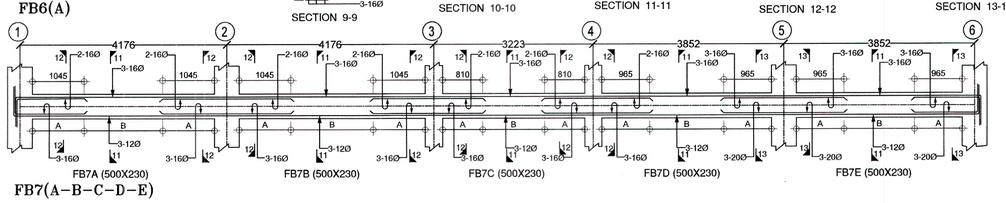




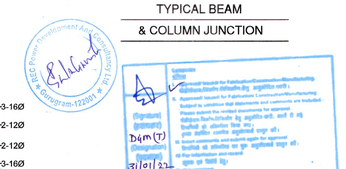


FB6(A)





FB7(A–B–C–D–E)



STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

GENERAL NOTES:

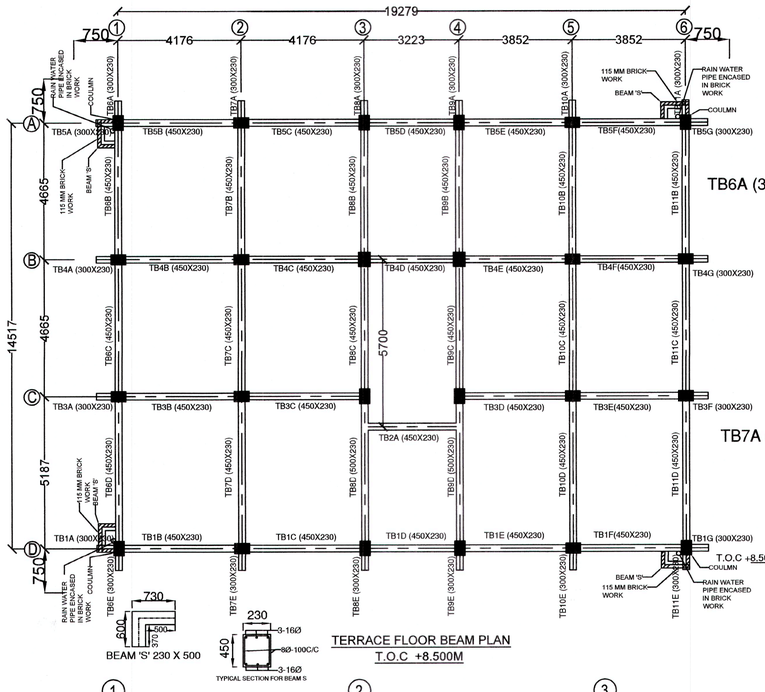
1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM
7. SHAFT FOR TOILET AND KITCHEN SHALL BE PRVIDED ONLY UPTO FIRST FLOOR .

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-jiadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at propposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 617, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FIRST FLOOR BEAM RCC DETAIL DRAWING OF CRB, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/A1 — REV- 1
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM — SH. NO :- 1 OF 3

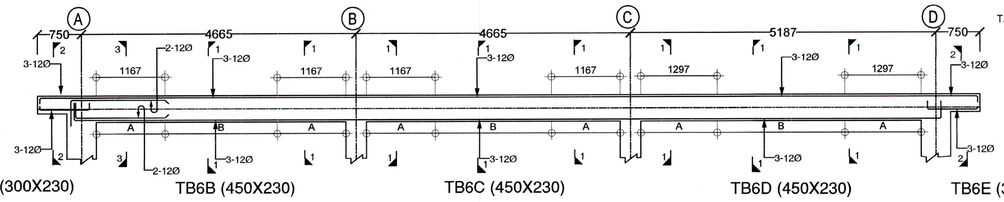
	NAME	DATE	SIGN	
PREPARED BY	A.B	09.11.2021		R.C BANSAL
CHECKED BY	G.H	09.11.2021		
SUBMITTED BY	KDBIL	09.11.2021		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

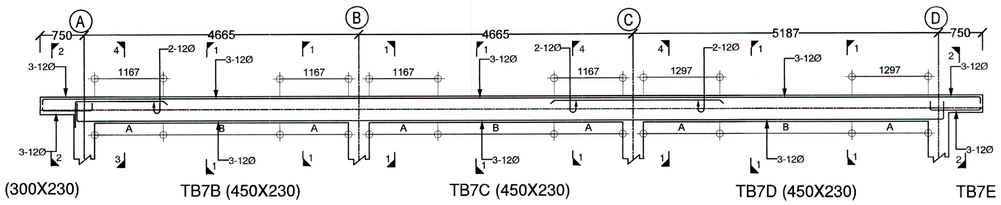


TERRACE FLOOR BEAM PLAN
T.O.C +8.500M



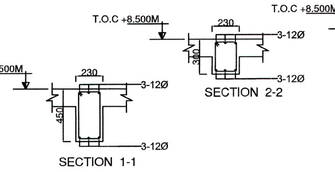
TB6A (300X230) TB6B (450X230) TB6C (450X230) TB6D (450X230) TB6E (300X230)

TB6(A–B–C–D–E)

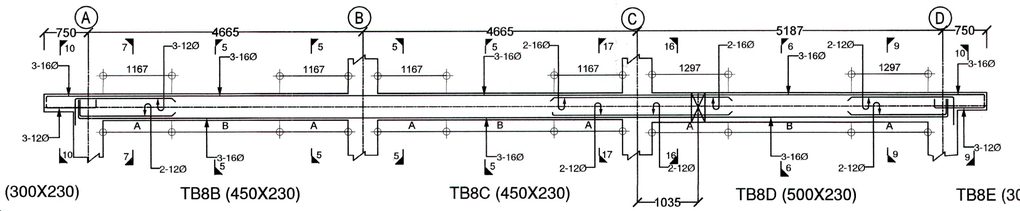


TB7A (300X230) TB7B (450X230) TB7C (450X230) TB7D (450X230) TB7E (300X230)

TB7(A–B–C–D–E)

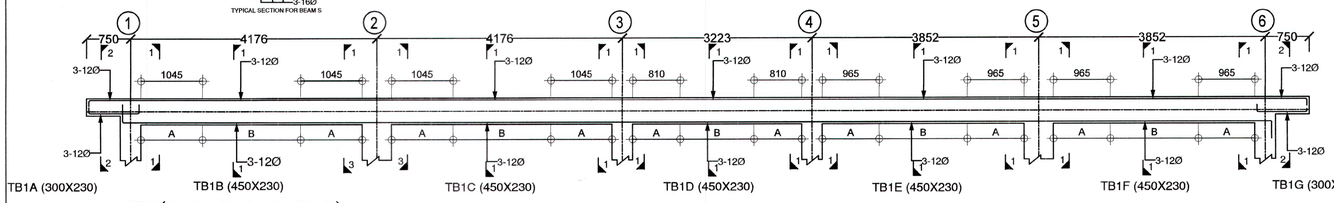


SECTION 1-1 SECTION 2-2 SECTION 3-3



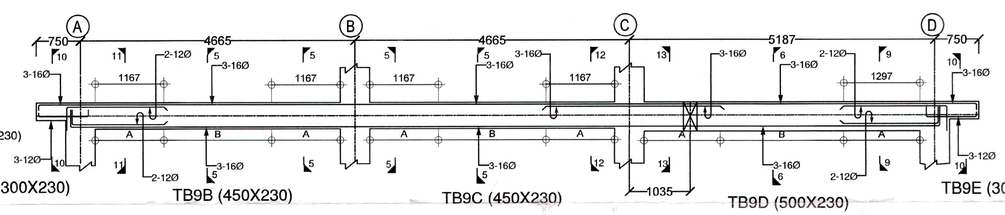
TB8A (300X230) TB8B (450X230) TB8C (450X230) TB8D (500X230) TB8E (300X230)

TB8(A–B–C–D–E)



TB1A (300X230) TB1B (450X230) TB1C (450X230) TB1D (450X230) TB1E (450X230) TB1F (450X230) TB1G (300X230)

TB1(A–B–C–D–E–F–G)



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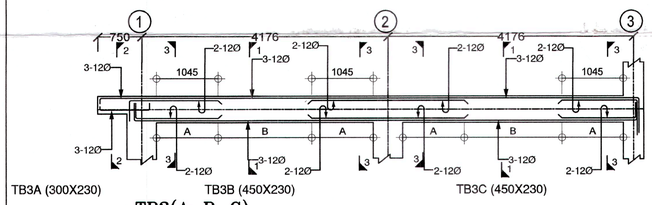
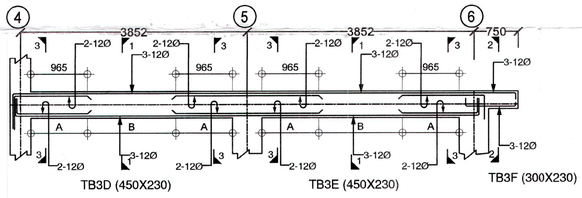
TB9(A–B–C–D–E)



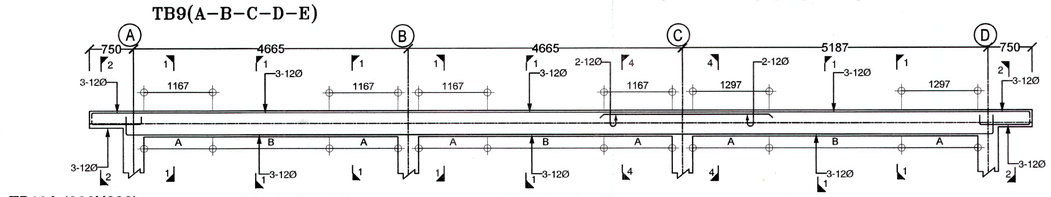
TB3A (300X230) TB3B (450X230) TB3C (450X230)

TB3(A–B–C)



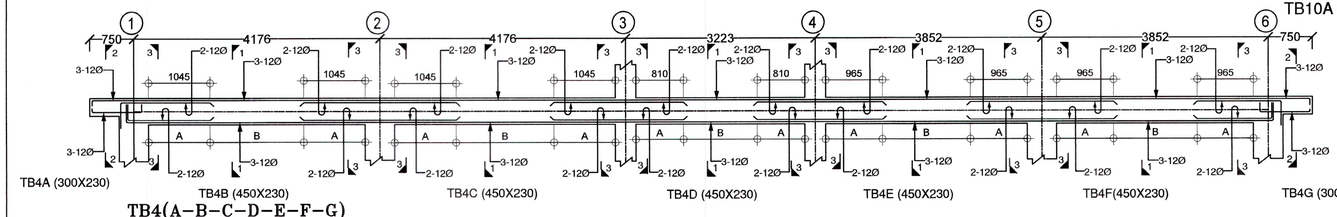
TB3D (450X230) TB3E (450X230) TB3F (300X230)

TB3(D–E–F)



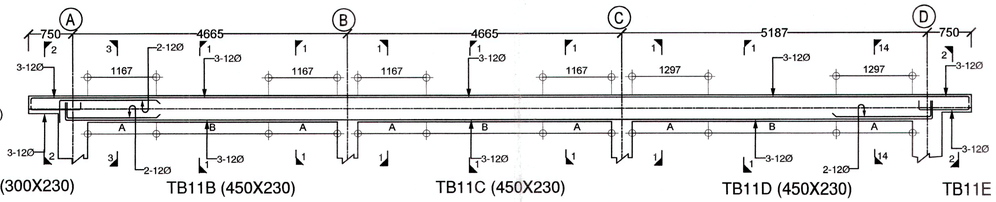
TB10A (300X230) TB10B (450X230) TB10C (450X230) TB10D (450X230) TB10E (300X230)

TB10(A–B–C–D–E)



TB4A (300X230) TB4B (450X230) TB4C (450X230) TB4D (450X230) TB4E (450X230) TB4F(450X230) TB4G (300X230)

TB4(A–B–C–D–E–F–G)



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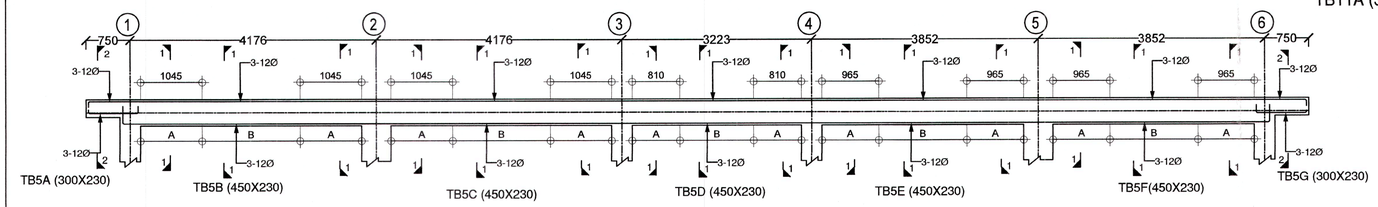
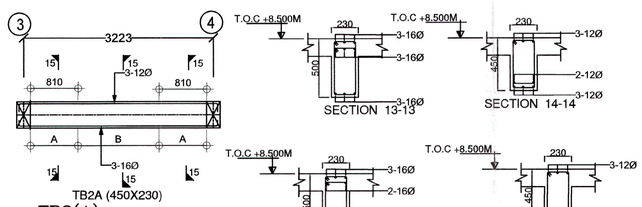
TB11(A–B–C–D–E)



TB5A (300X230) TB5B (450X230) TB5C (450X230) TB5D (450X230) TB5E (450X230) TB5F(450X230) TB5G (300X230)

TB5(A–B–C–D–E–F–G)



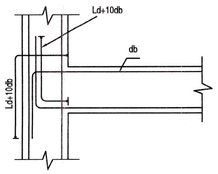
TB2A (450X230)

TB2(A)

SECTION 13-13 SECTION 14-14 SECTION 16-16 SECTION 15-15 SECTION 17-17

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM & COLUMN JUNCTION

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
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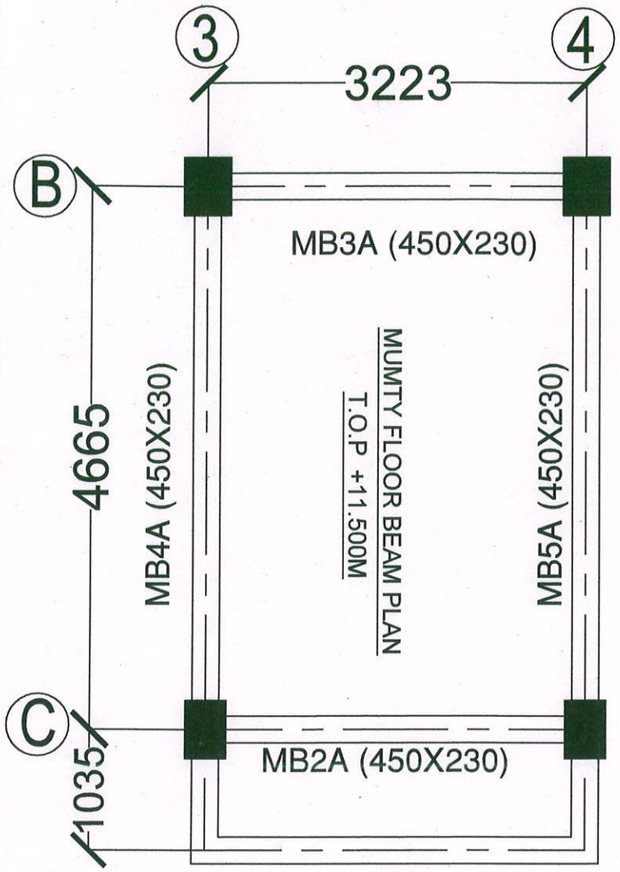
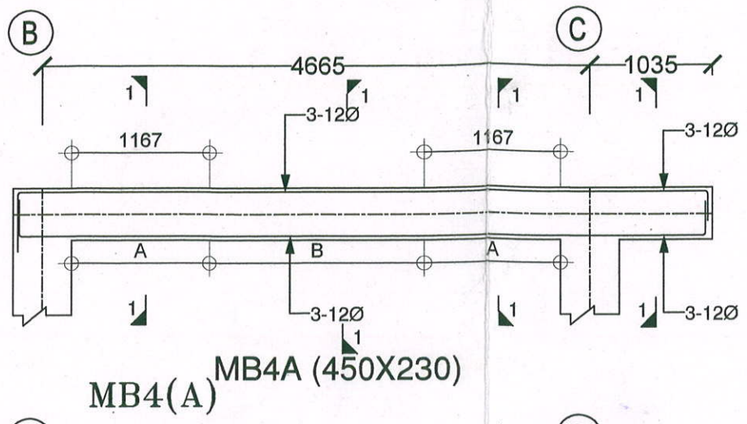
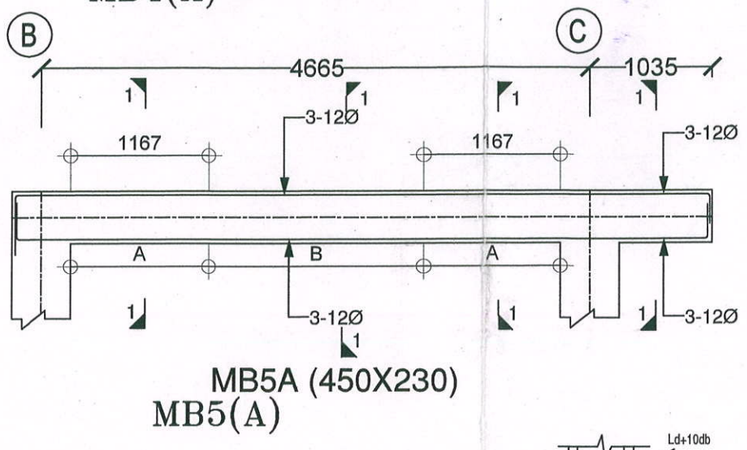
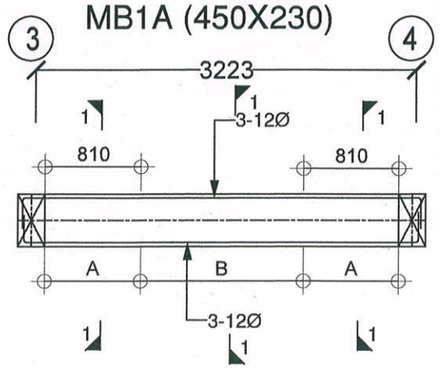
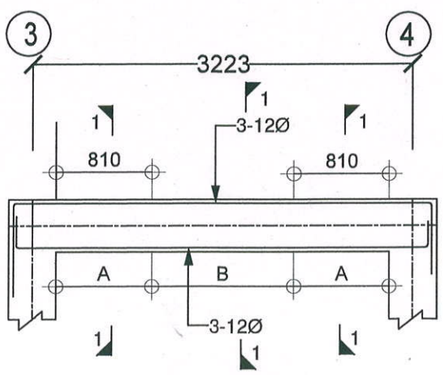
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	TERRACE BEAM RCC DETAIL DRAWING OF CRB, 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/41		REV- 1	
SCALE	As shown in Drawing		SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM		SH. NO.:- 2 OF 3	
	NAME	DATE	SIGN	
PREPARED BY	A.B	09.11.2021		R.C BANSAL
CHECKED BY	G.H	09.11.2021		Signature/Stamp...
SUBMITTED BY	KDBIL	09.11.2021		
☐ Approved ☐ Approved with comments ☐ Not Approved				
☐ More Information	Date.....			

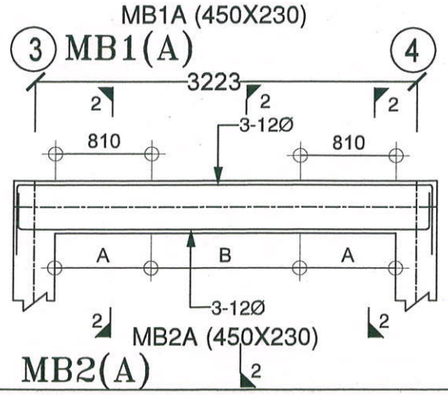


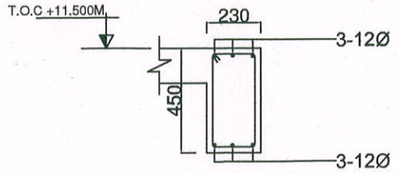




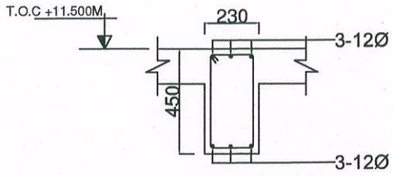




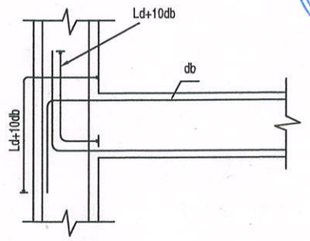




SECTION 1-1



SECTION 2-2



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER

TYPICAL BEAM & COLUMN JUNCTION

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
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PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	MUMTY BEAM RCC DETAIL DRAWING OF CRB, 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/41		REV- 1	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH. NO.:- 3 OF 3	
	NAME	DATE	SIGN	
PREPARED BY	A.B	09.11.2021		R.C BANSAL
CHECKED BY	G.H	09.11.2021		
SUBMITTED BY	KDBIL	09.11.2021		Signature/Stamp...

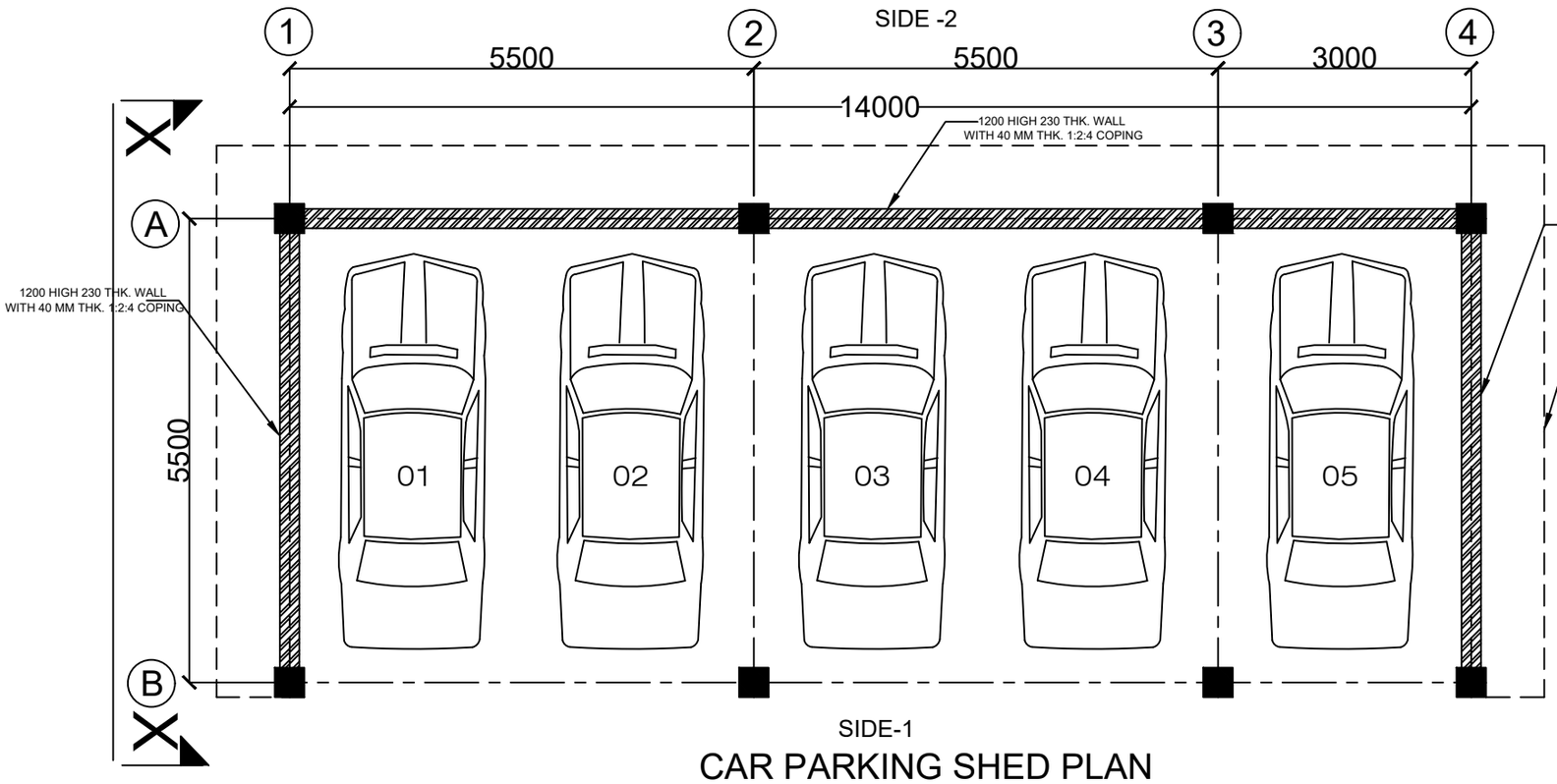
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

REC Power Development And Consultancy Ltd. Gurugram-122001

(Signature) (हस्ताक्षर) DGM(CT) (Designation) (पदनाम) 31.01.2022 (Date) (दिनांक)

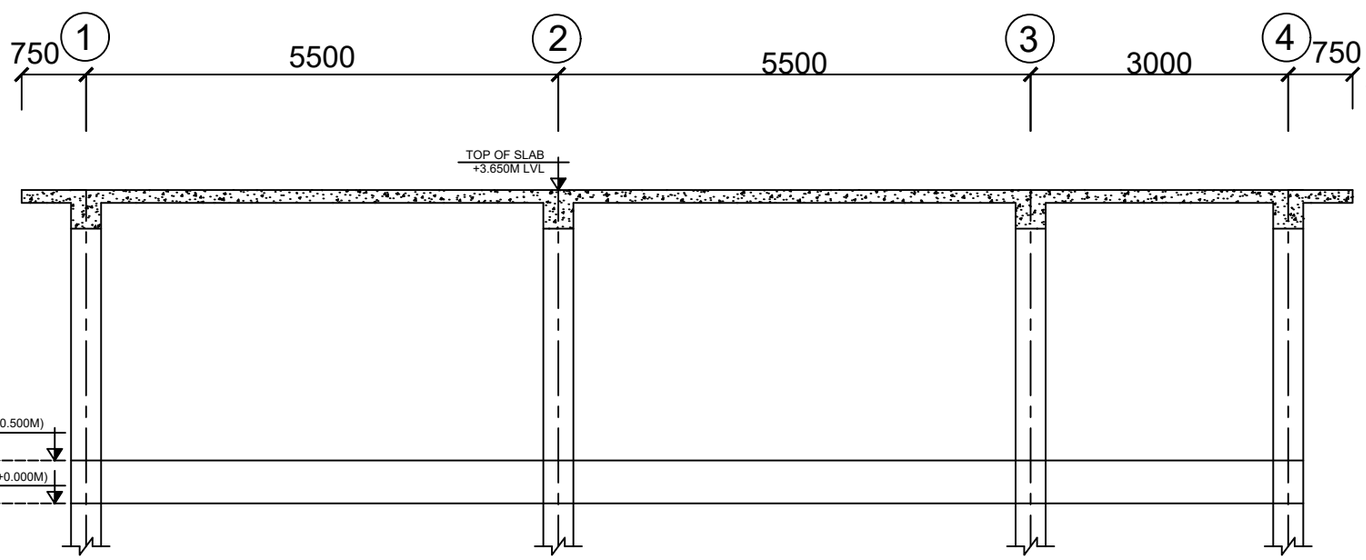
Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur



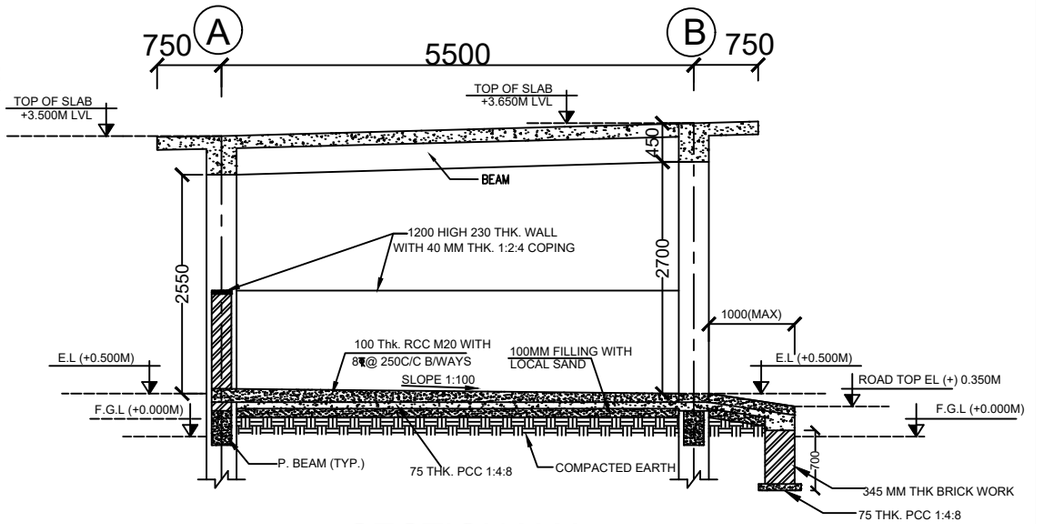
CAR PARKING SHED PLAN

Notes:-

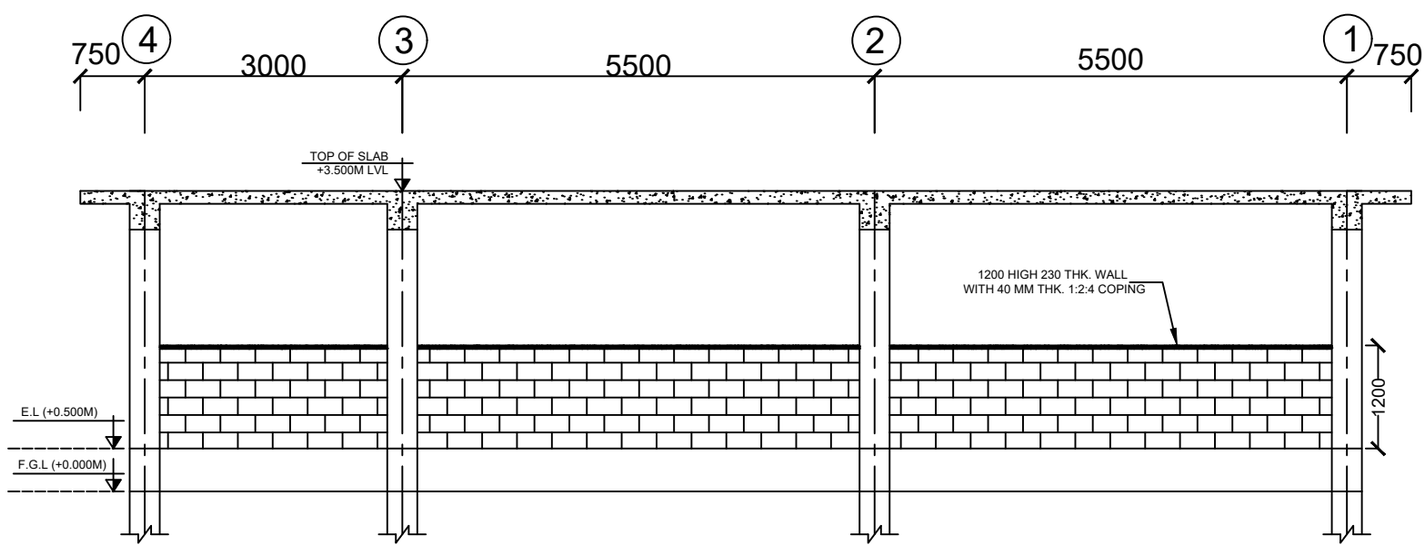
1. EXTERNAL SURFACE OF BUILDING SHALL HAVE 18 MM THICK PLASTER IN TWO LAYERS, WITH THE UNDER. LAYER 12 MM THICK 1:5 CEMENT SAND PLASTER AND THE TOP LAYER 6 MM THICK 1:6 CEMENT SAND PLASTER .INSIDE WALLS SURFACES SHALL HAVE 12/15 MM THICK 1:6 CEMENT SAND PLASTER. ROUGH SURFACES SHALL HAVE 15MM AND SMOOTH SURFACE SHALL HAVE 12 MM THICK CEMENT SAND PLASTER.
2. ALL R.C.C. CEILINGS SHALL BE PROVIDED WITH 6.0 MM THICK CEMENT SAND PLASTER IN 1:3 CEMENT SAND MORTAR (1CEMENT : 3 FINE SAND) EXCEPT FOR AREAS WITH FALSE CEILING .
3. ALL DIMENSIONS ARE IN MM.
4. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSIONS ONLY.
5. ALL DIMENSIONS SHALL BE CHECKED PRIOR TO EXECUTION
6. LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGE IN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
7. ANY DESCREPANCY IN DRAWING TO BE BROUGHT TO THE NOTICE OF SITE INCHARGE.
8. COLUMN SHOWN IN THE DRAWING ARE INDICATIVE, FOR EXACT COLUMN LOCATIONS REFER STRUCTURAL DRAWING.
9. DIMENSIONS OF COLUMN AND BEAM SUBJECT TO CHANGE.



ELEVATION SIDE 1



SECTION X-X



ELEVATION SIDE 2

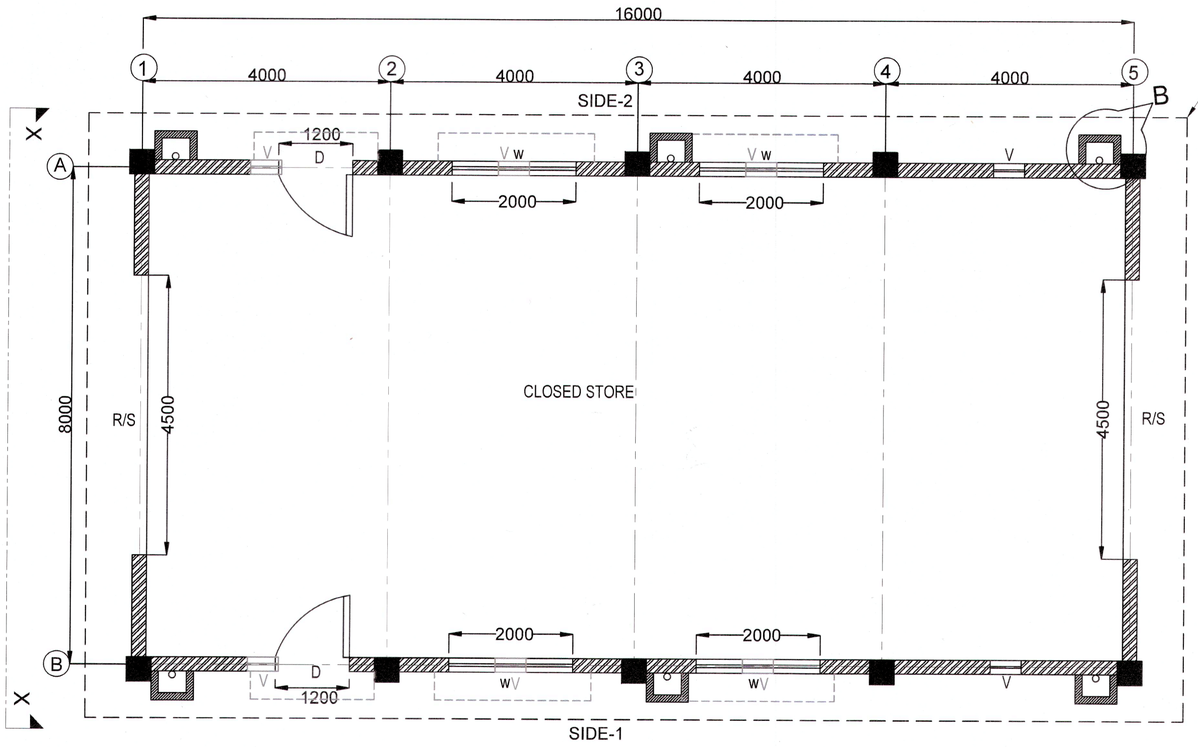
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	ARCHITECTURE CAR PARKING SHED OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/43		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1
	NAME	DATE	SIGN
PREPARED BY	AMIR	14.10.2021	
CHECKED BY	G.H	14.10.2021	
SUBMITTED BY	RACHIT	14.10.2021	

R.C BANSAL

Signature/Stamp...

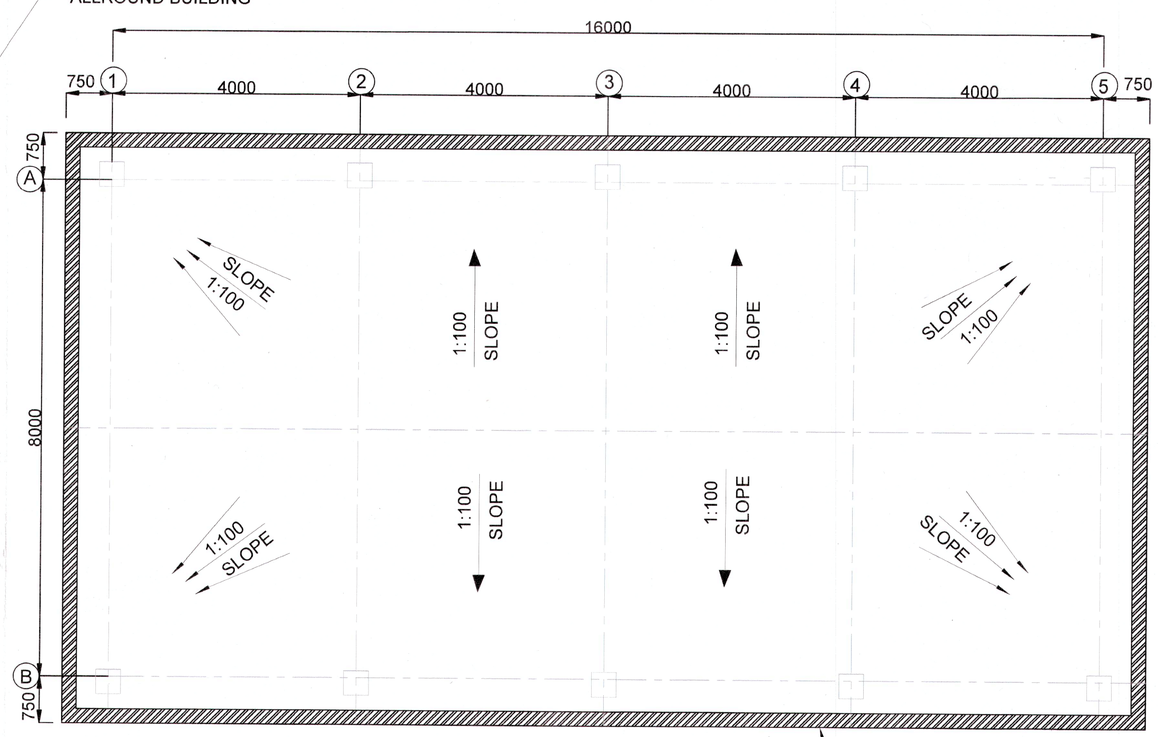
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



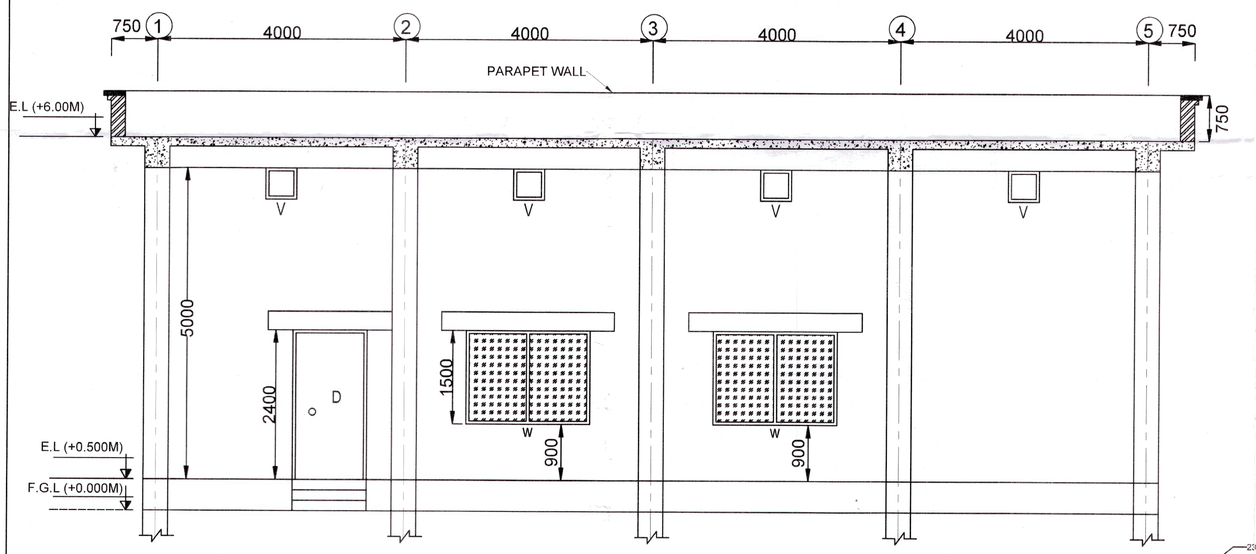
STORE ROOM PLAN +0.500M

750MM WIDE PLINTH PROTECTION
ALLROUND BUILDING

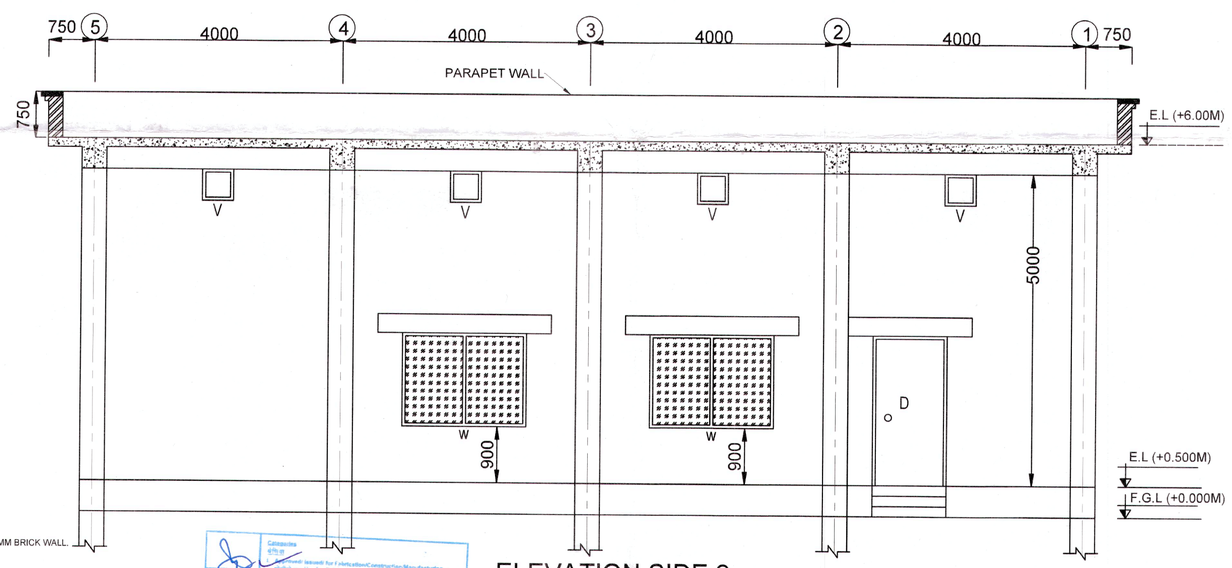


ROOF PLAN
AT EL. (+) 6.000 (T.O.C.)

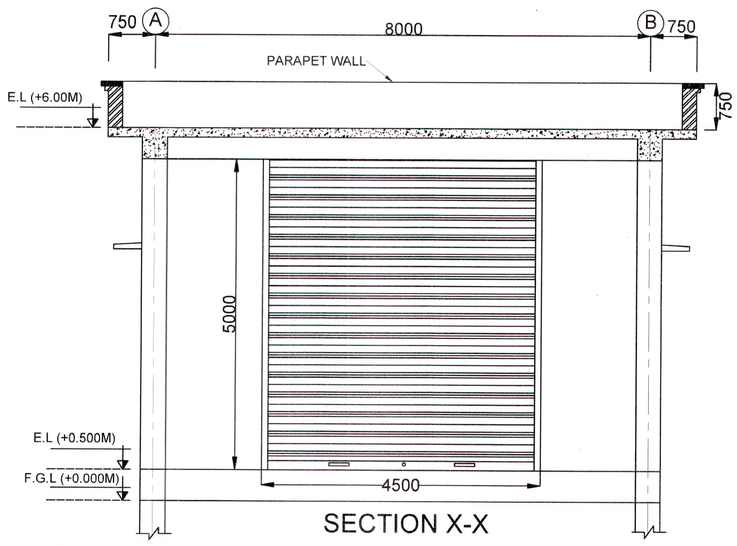
230MM THK PARAPET BRICK WALL
750 MM HIGH ALL AROUND (TYP)



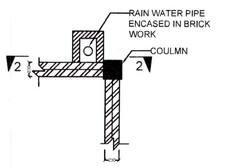
ELEVATION SIDE 1



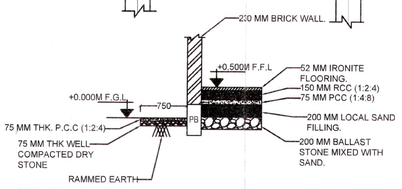
ELEVATION SIDE 2



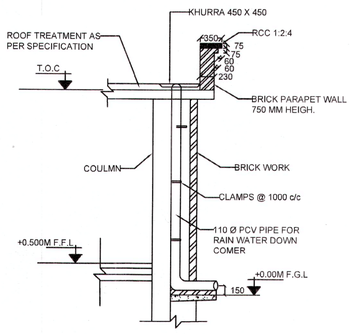
SECTION X-X



DETAIL-B



TYP. DETALIS OF PLINTH PROTECTION
& FLOORING



SECTION 2-2

Notes:-

1. EXTERNAL SURFACE OF BUILDING SHALL HAVE 18 MM THICK PLASTER IN TWO LAYERS, WITH THE UNDER. LAYER 12 MM THICK 1:5 CEMENT SAND PLASTER AND THE TOP LAYER 6 MM THICK 1:6 CEMENT SAND PLASTER .INSIDE WALLS SURFACES SHALL HAVE 12/15 MM THICK 1:6 CEMENT SAND PLASTER. ROUGH SURFACES SHALL HAVE 15MM AND SMOOTH SURFACE SHALL HAVE 12 MM THICK CEMENT SAND PLASTER.
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3. ALL DIMENSIONS ARE IN MM.
4. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSIONS ONLY.
5. ALL DIMENSIONS SHALL BE CHECKED PRIOR TO EXECUTION
6. LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGE IN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
7. ANY DESCREPANCY IN DRAWING TO BE BROUGHT TO THE NOTICE OF SITE INCHARGE.
8. COLUMN SHOWN IN THE DRAWING ARE INDICATIVE, FOR EXACT COLUMN LOCATIONS REFER STRUCTURAL DRAWING.
9. DIMENSIONS OF COLUMN AND BEAM SUBJECT TO CHANGE.

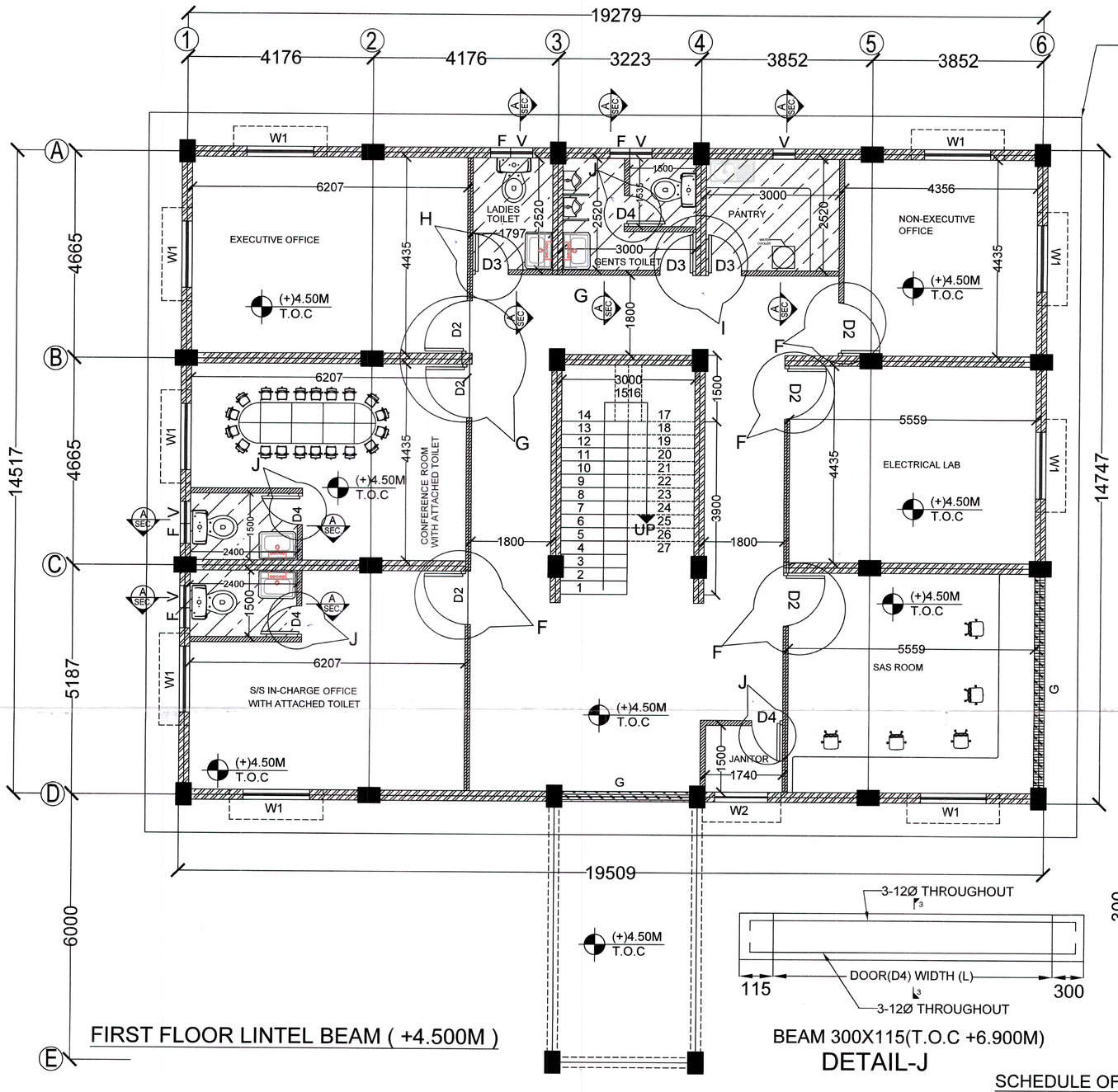
SCHEDULE OF DOOR & WINDOW

S.NO.	NAME	WIDTH	HEIGHT	SILL LEVEL WR. TO FFL	LINTEL LEVEL WR. TO FFL	NOS	DESCRIPTION
1.	ROLLING SHUTTER (R/S)	4500	5000	---	5.000 M	02	MS ROLLING SHUTTER
2.	WINDOW (W)	2000	1500	0.900 M	2.400 M	04	MS FRAME WINDOW WITH 10 MM SQ. BAR GRILLS AND 5.5 mm THK. GLASS GLAZING.
3.	VENTILATOR (V)	500	500	4.500 M	5.000 M	08	MS VENTILATORS WITH 5.5 mm THK. GLASS GLAZING.
4.	DOOR (D)	1200	2400	---	2.400 M	02	FLUSH DOOR SHUTTERS (35 mm) WITH COMMERCIAL PLY,DULY PAINTED SHALL BE PROVIDED.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	ARCHITECTURE STORE ROOM OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/45		REV- 1	
SCALE	As shown in Drawing		SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1	
	NAME	DATE	SIGN	
PREPARED BY	AMIR	25.02.2022		R.C BANSAL
CHECKED BY	G.H	25.02.2022		Signature/Stamp...
SUBMITTED BY	RACHIT	25.02.2022		

☐ Approved ☐ Approved with comments ☐ Not Approved

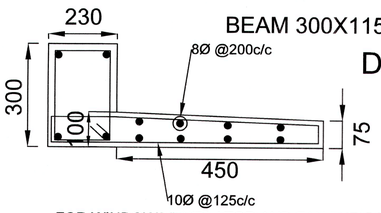
☐ More Information Date.....



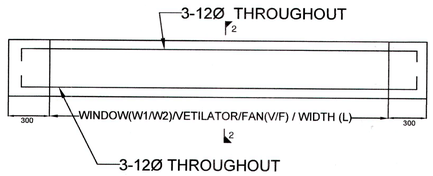
FIRST FLOOR LINTEL BEAM (+4.500M)

BEAM 300X115(T.O.C +6.900M)

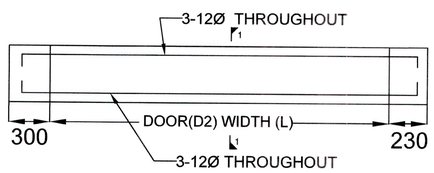
DETAIL-J



FOR WINDOW/VENTILATOR AND FAN TYPICAL LINTAL SECTION WITH SUNSHADE PROJECTION OF 450 MM



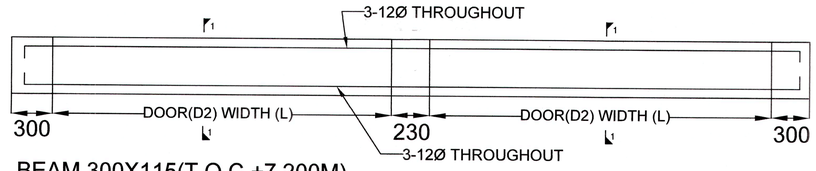
BEAM 300X230(T.O.C +7.200M)



BEAM 300X115(T.O.C +7.200M)

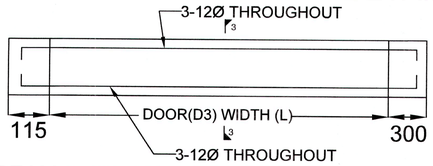
EXTERIOR WALL TYP. ELEVATION AND RCC DETAILS FOR LINTEL BEAM

DETAIL-F

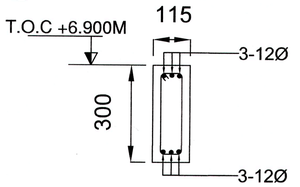


BEAM 300X115(T.O.C +7.200M)

DETAIL-G

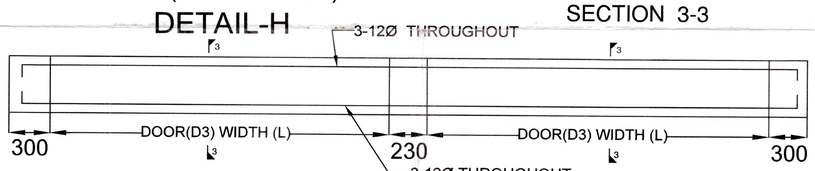


BEAM 300X115(T.O.C +6.900M)



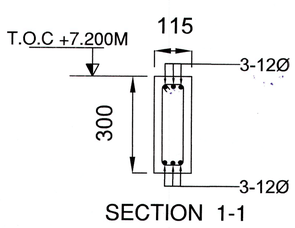
SECTION 3-3

DETAIL-H

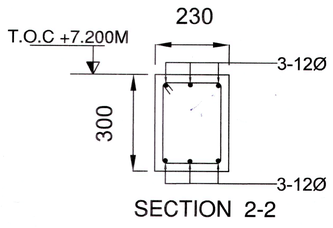


BEAM 300X115(T.O.C +6.900M)

DETAIL-I



SECTION 1-1



SECTION 2-2

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

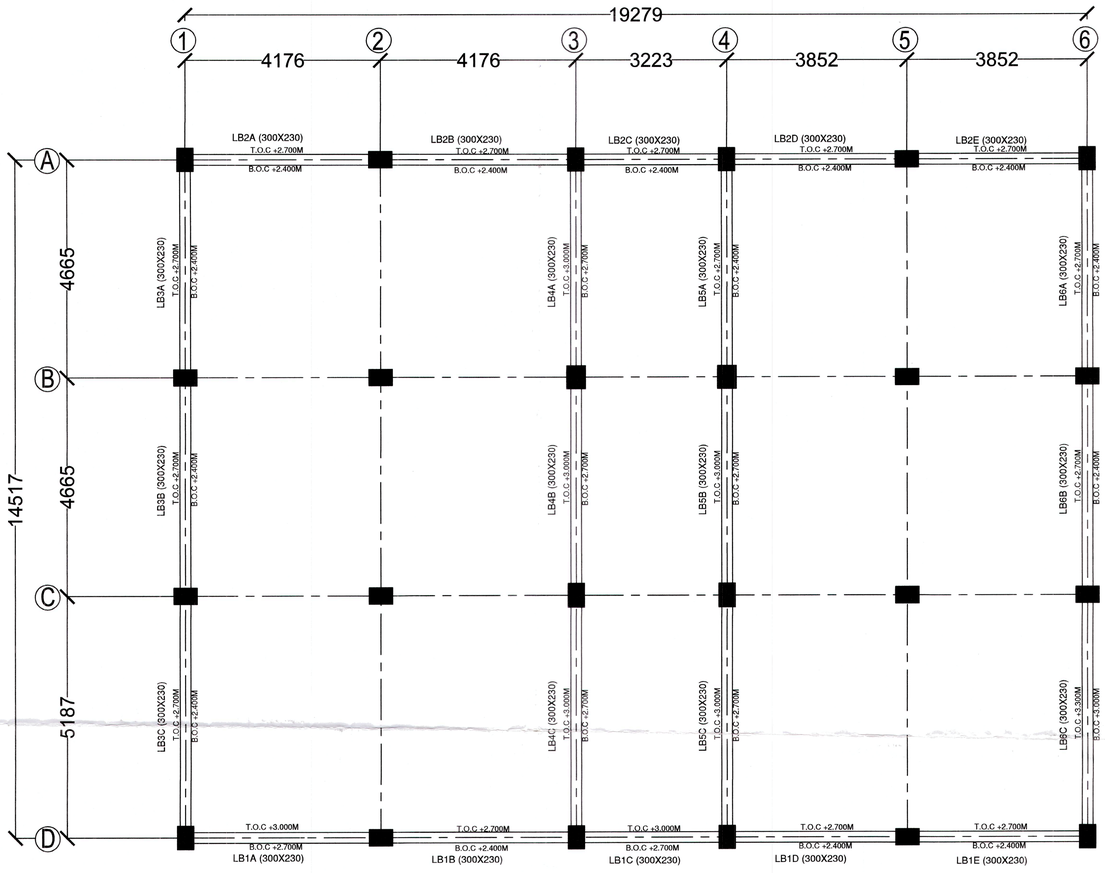
SCHEDULE OF DOORS & WINDOWS

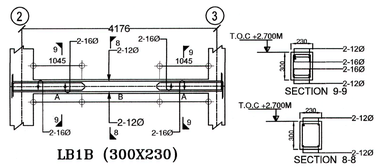
S.NO.	NAME	WIDTH	HEIGHT	SILL LEVEL WR.TO FFL	LINTEL LEVEL WR.TO FFL
1.	DOOR (2)	1200	2400	-----	6900
2.	DOOR (3)	800	2100	-----	6600
3.	DOOR (4)	700	2100	-----	6600
4.	WINDOW (W1)	1500	1500	5.400 M	6900
5.	WINDOW (W2)	1200	1500	5.400 M	6900
6.	VENTILATOR (V)	500	500	6.400 M	6900
7.	EXHAUST FAN(F)	450	500	6.400 M	6900

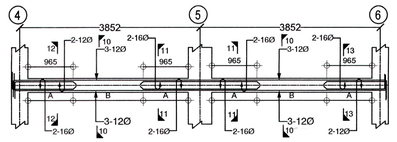
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	CRB LINTEL BEAM DETAIL DRAWING, 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/46		REV- 1	
SCALE	As shown in Drawing		SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM		SH. NO.:- 2 OF 2	
	NAME	DATE	SIGN	
PREPARED BY	A.B	09.11.2021		R.C BANSAL
CHECKED BY	G.H	09.11.2021		Signature/Stamp...
SUBMITTED BY	KDBIL	09.11.2021		

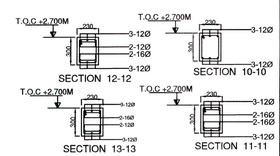
☐ Approved ☐ Approved with comments ☐ Not Approved

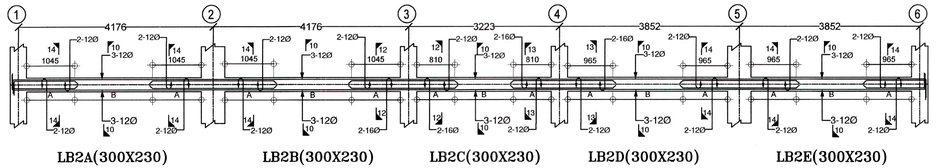
☐ More Information Date.....

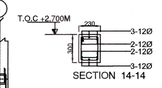


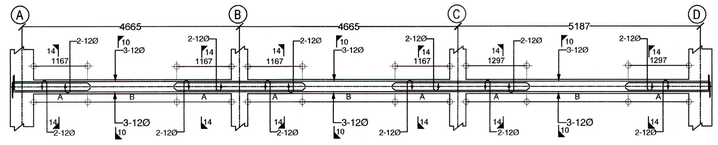


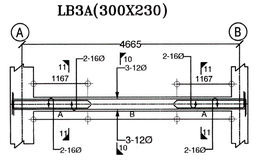


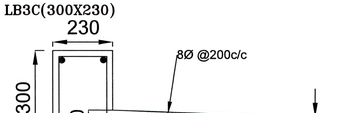




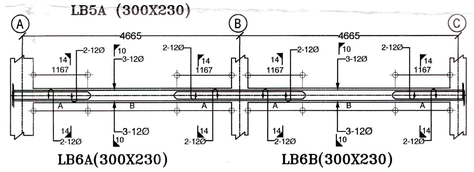


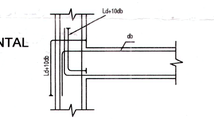




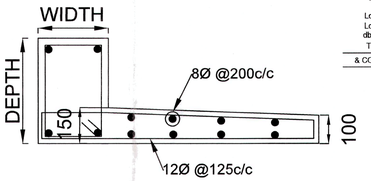


FOR WINDOW/VETILATOR AND FAN TYPICAL LINTAL SECTION WITH SUNSHADE PROJECTION OF 450 MM



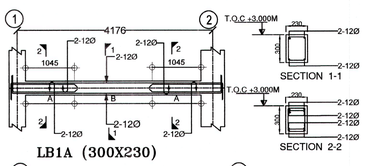


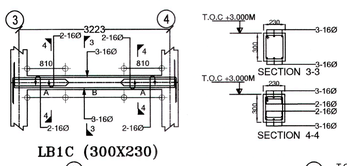
Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM & COLUMN JUNCTION

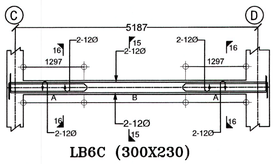


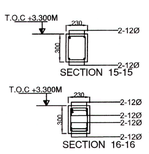
FOR ROLLING SHUTER & DOOR D1 TYPICAL LINTAL SECTION WITH SUNSHADE PROJECTION OF 600 MM

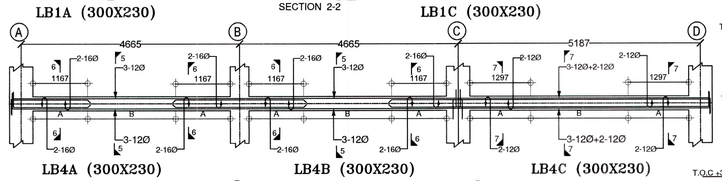
GROUND FLOOR LINTEL BEAM

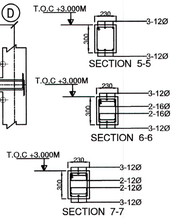


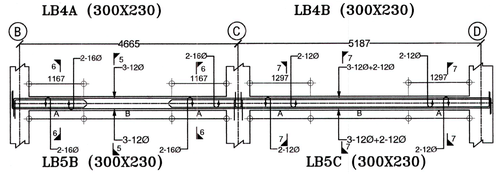


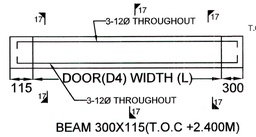














DETAIL-A

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

SCHEDULE OF DOORS & WINDOWS

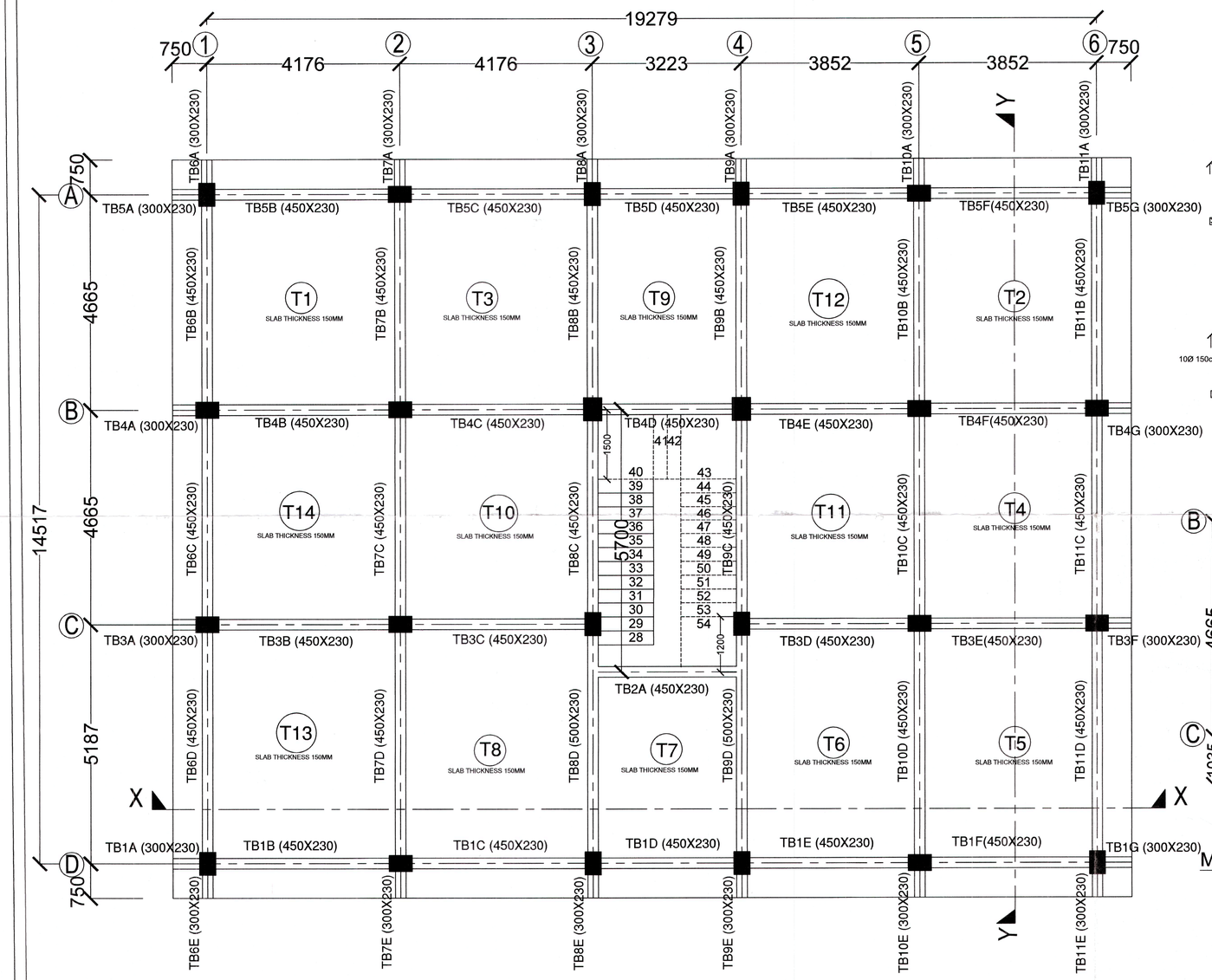
S.NO.	NAME	WIDTH	HEIGHT	SILL LEVEL WR.TO FFL	LINTEL LEVEL WR.TO FFL
1.	ROLLING SHUTTER (R/S)	2500	3000	-----	3000
2.	DOOR (1)	2000	2700	-----	2700
3.	DOOR (2)	1200	2400	-----	2400
4.	DOOR (3)	800	2100	-----	2100
5.	DOOR (4)	700	2100	-----	2100
6.	DOOR (5)	1200	2100	-----	2100
7.	WINDOW (W1)	1500	1500	0.900 M	2400
8.	VENTILATOR (V)	500	500	1.900 M	2400
9.	EXHAUST FAN(F)	450	500	1.900 M	2400

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Distribution Company Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	CRB LINTEL BEAM DETAIL DRAWING 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/46	REV- 1	
SCALE	As shown in Drawing	SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM	SH. NO.:- 1 OF 2	

	NAME	DATE	SIGN	
PREPARED BY	A.B	09.11.2021		R.C BANSAL
CHECKED BY	G.H	09.11.2021		Signature/Stamp...
SUBMITTED BY	KDBIL	09.11.2021		

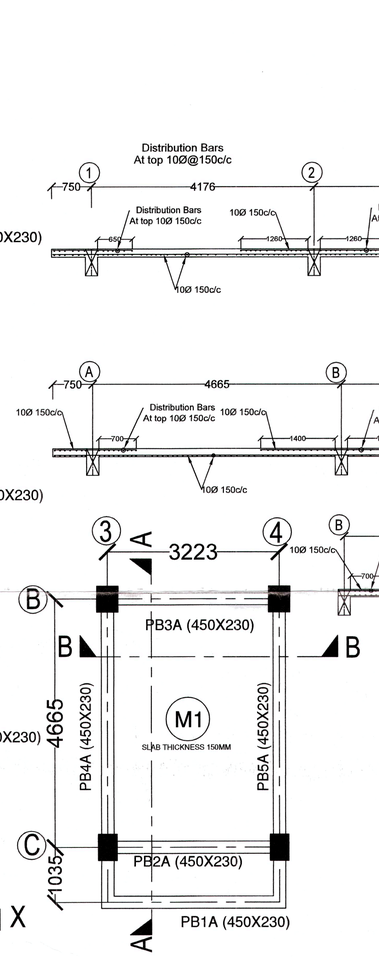
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



TERRACE FLOOR SLAB PLAN

T.O.C +8.500M



MUMTY FLOOR SLAB PLAN

T.O.C +11.500M

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

SLAB THICKNESS 150MM

SLAB REINFORCEMENT DETAILS

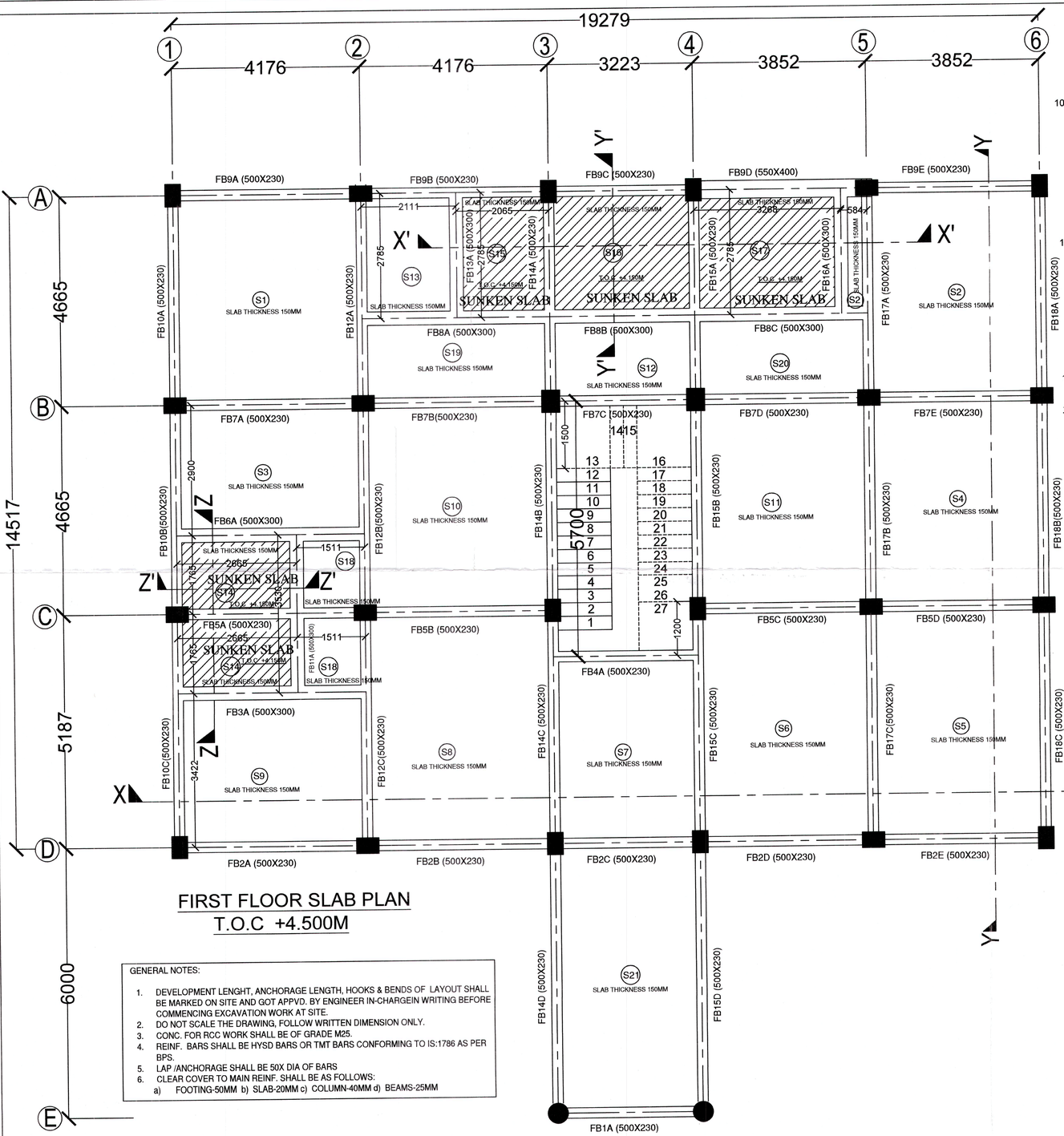
S.NO	SLAB TYPE	SHORT SPAN STEEL (BOT.)	LONG SPAN STEEL (BOT.)	SHORT SPAN STEEL (TOP)	LONG SPAN STEEL (TOP)
1	T1	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
2	T2	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
3	T3	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
4	T4	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
5	T5	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
6	T6	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
7	T7	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
8	T8	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
9	T9	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
10	T10	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
11	T11	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
12	T12	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
13	T13	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
14	T15	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
15	M1	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PAU/KPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PAU/KPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	TERRACE & MUMTY SLAB RCC DETAIL DRAWING OF CKB, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/50 — REV- 1
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM — SH. NO.:- 2 OF 2

	NAME	DATE	SIGN	
PREPARED BY	A.B	09.11.2021		R.C BANSAL
CHECKED BY	G.H	09.11.2021		Signature/Stamp...
SUBMITTED BY	KDBIL	09.11.2021		

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



FIRST FLOOR SLAB PLAN
T.O.C +4.500M

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

SLAB THICKNESS 150MM

SLAB REINFORCEMENT DETAILS

S.NO	SLAB TYPE	SHORT SPAN STEEL(BOT.)	LONG SPAN STEEL (BOT.)	SHORT SPAN STEEL(TOP)	LONG SPAN STEEL (TOP)
1	S1	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
2	S2	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
3	S3	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
4	S4	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
5	S5	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
6	S6	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
7	S7	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
8	S8	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
9	S9	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
10	S10	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
11	S11	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
12	S12	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
13	S13	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
14	S14	10Ø@100c/c	10Ø@100c/c	10Ø@100c/c	10Ø@100c/c
15	S15	10Ø@100c/c	10Ø@100c/c	10Ø@100c/c	10Ø@100c/c
16	S16	10Ø@100c/c	10Ø@100c/c	10Ø@100c/c	10Ø@100c/c
17	S17	10Ø@100c/c	10Ø@100c/c	10Ø@100c/c	10Ø@100c/c
18	S18	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
19	S19	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
20	S20	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
21	S21	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c

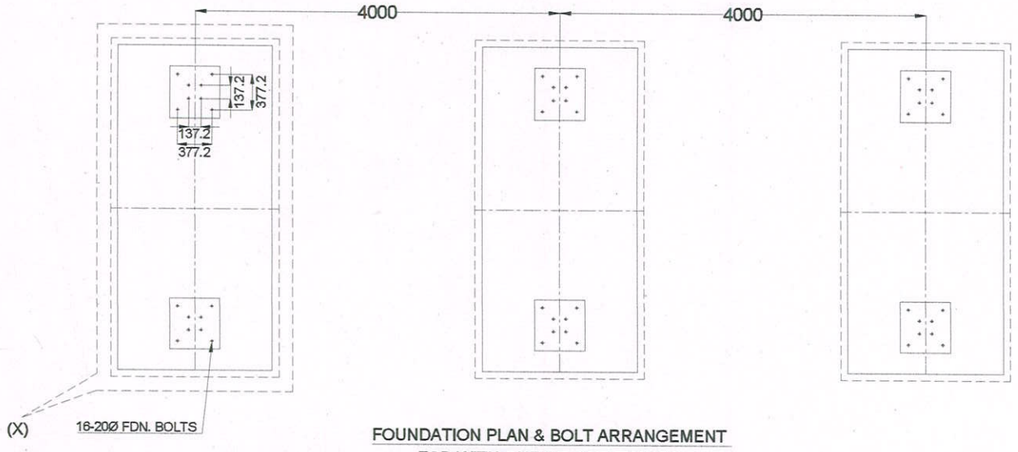
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Distribution Company Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FIRST FLOOR SLAB RCC DETAIL DRAWING OF CRB, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/50 — REV- 1
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM — SH. NO.:- 1 OF 2

	NAME	DATE	SIGN
PREPARED BY	A.B	09.11.2021	
CHECKED BY	G.H	09.11.2021	
SUBMITTED BY	KDBIL	09.11.2021	

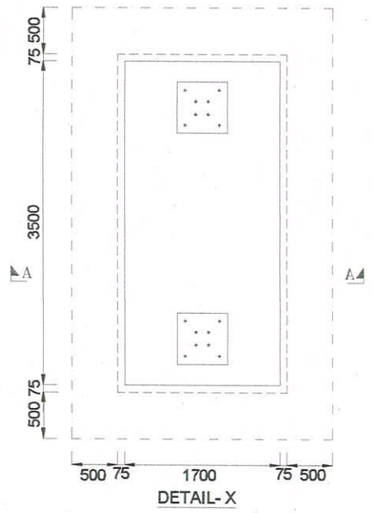
R.C BANSAL
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

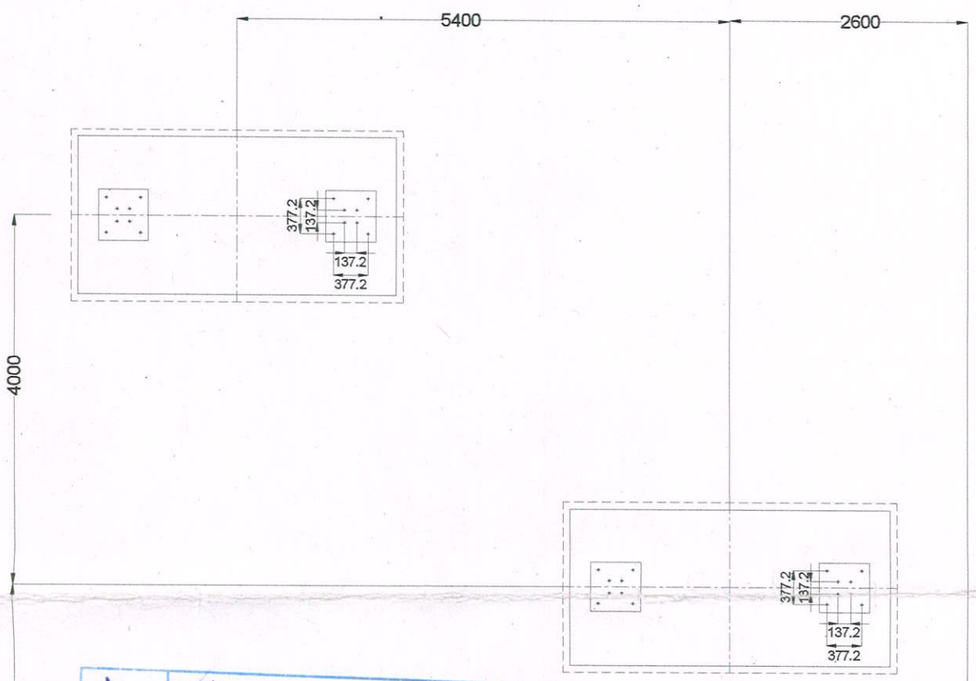
☐ More Information Date.....

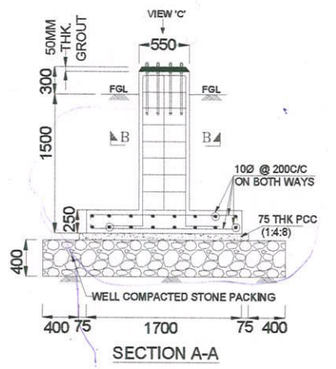


FOUNDATION PLAN & BOLT ARRANGEMENT
FOR WITH ONE E/S AND TWO E/S



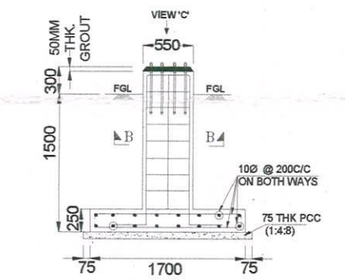
DETAIL- X





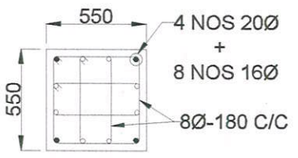
SECTION A-A

(NOTE:- IT IS APPLICABLE ONLY FOR FILLING AREA.)

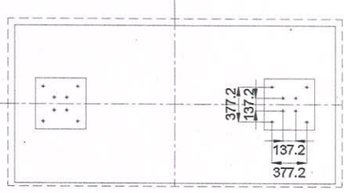


SECTION A-A

(NOTE:- IT IS APPLICABLE ONLY FOR CUTTING AREA.)



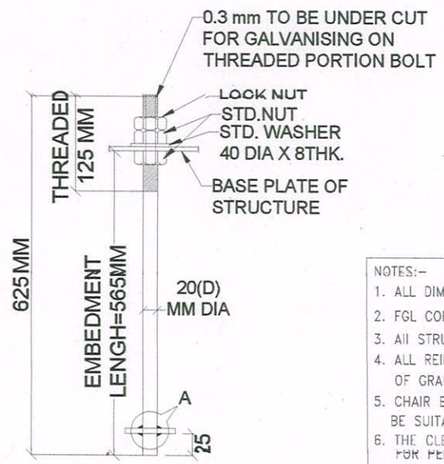
SECTION B-B
(ENLARGE)



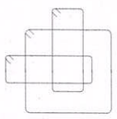
FOUNDATION PLAN & BOLT ARRANGEMENT
FOR TANDOM ISOLATOR

Categories
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
30/3/22 (Date) (तिथि)
I. Approved/ issued for Fabrication/Construction/Manufacturing. फैब्रीकेशन/निर्माण हेतु अनुमोदित जारी।
II. Approved/ issued for Fabrication/ Construction/ Manufacturing Subject to condition that statements and comments are included. Please submit the revised documents for approval. फैब्रीकेशन/निर्माण हेतु अनुमोदित शर्तों के साथ जारी, बातें दी गई टिप्पणियों को सम्मिलित किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval. टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record. सूचना एवं रिकॉर्ड हेतु।
V. Not approved. अनुमोदित नहीं।

REC PDCL GURUGRAM



FOUNDATION BOLT



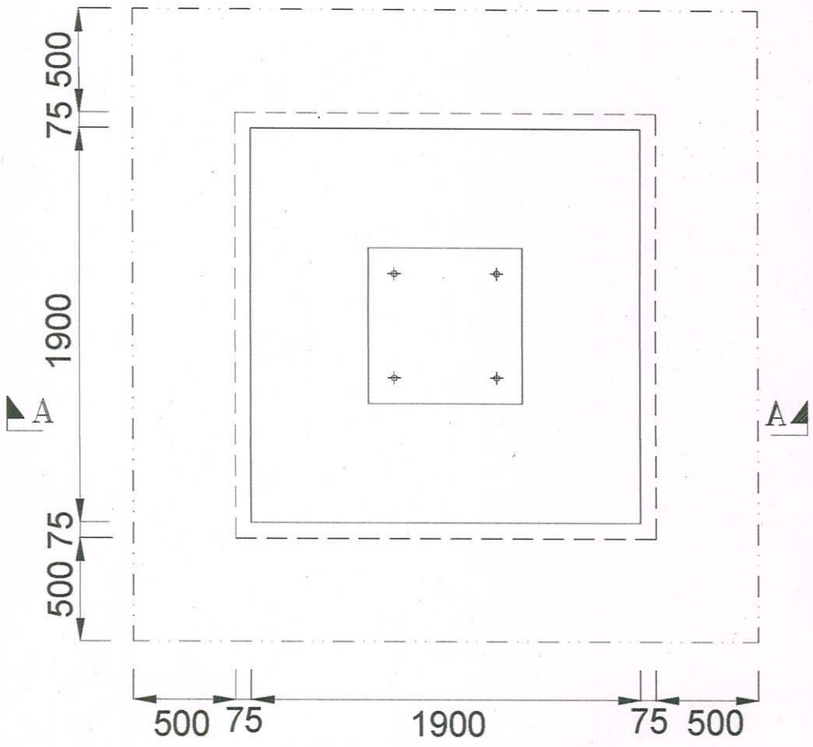
RING ARRANGEMENT

NOTES:-
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS.IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5 T/SQM AT 1.2MT DEPTH.

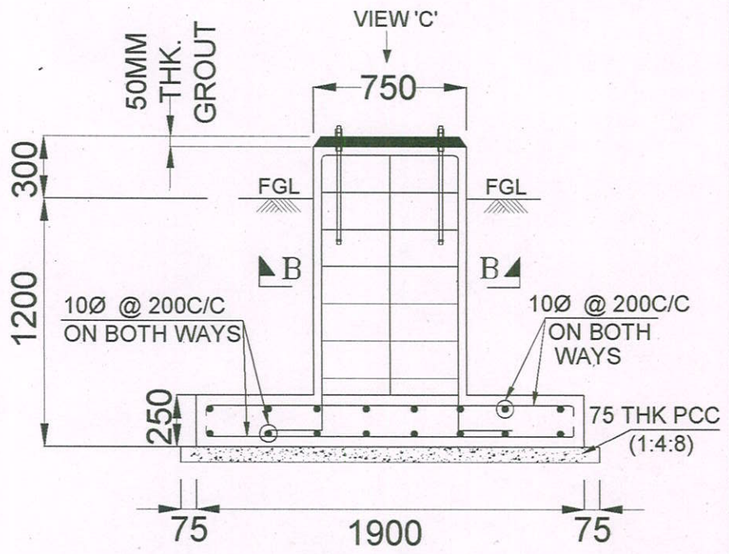
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	220KV ISO FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/55 ✓		REV- 2 ✓	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 3	
	NAME	DATE	SIGN	
PREPARED BY	RAVI R.K	04.03.2022		
CHECKED BY	G.H	04.03.2022		
SUBMITTED BY	ANURAG	04.03.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

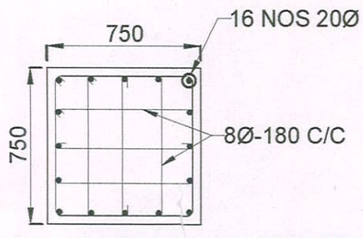


FOUNDATION PLAN

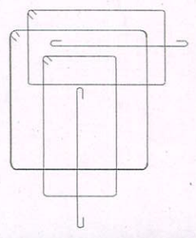


SECTION A-A

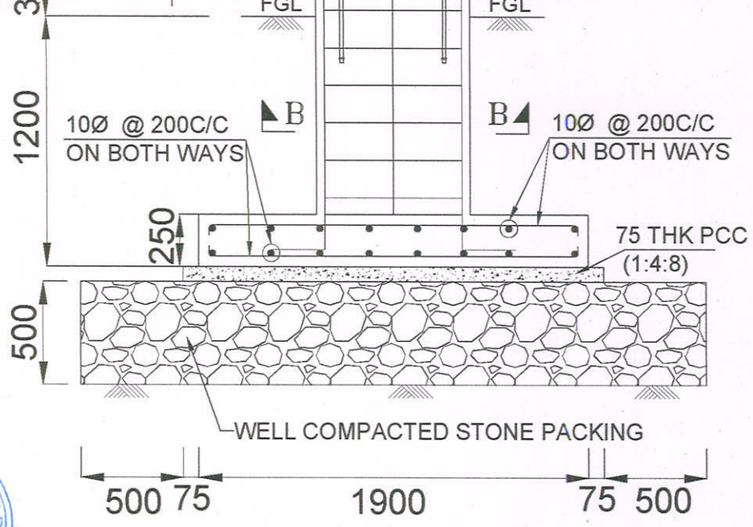
(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



SECTION B-B

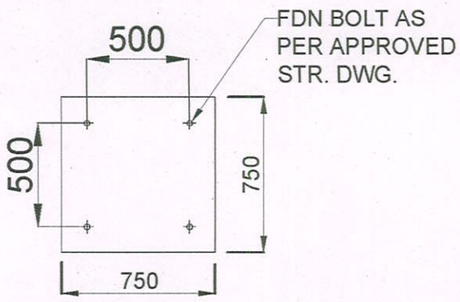


RING ARRANGEMENT



SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



VIEW 'C'

NOTES:–

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5 T/SQM AT 1.2MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	220KV CIRCUIT BREAKER FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/56		REV- 0	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1	
	NAME	DATE	SIGN	
PREPARED BY	RAVI	29.01.2022		
CHECKED BY	G.H	29.01.2022		
SUBMITTED BY	ANURAG	29.01.2022		Signature/Stamp...

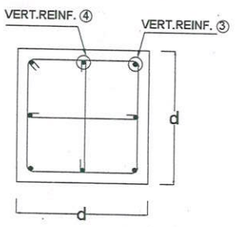
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

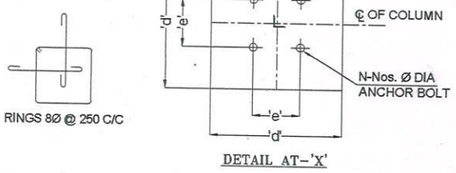
Categories
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are incorporated
III. Insert comments and submit again for approval.
IV. For information and record.
V. Not approved.

(Signature) (हस्ताक्षर)
DGM (T) (Designation) (पदनाम)
17.02.2022 (Date) (तिथि)

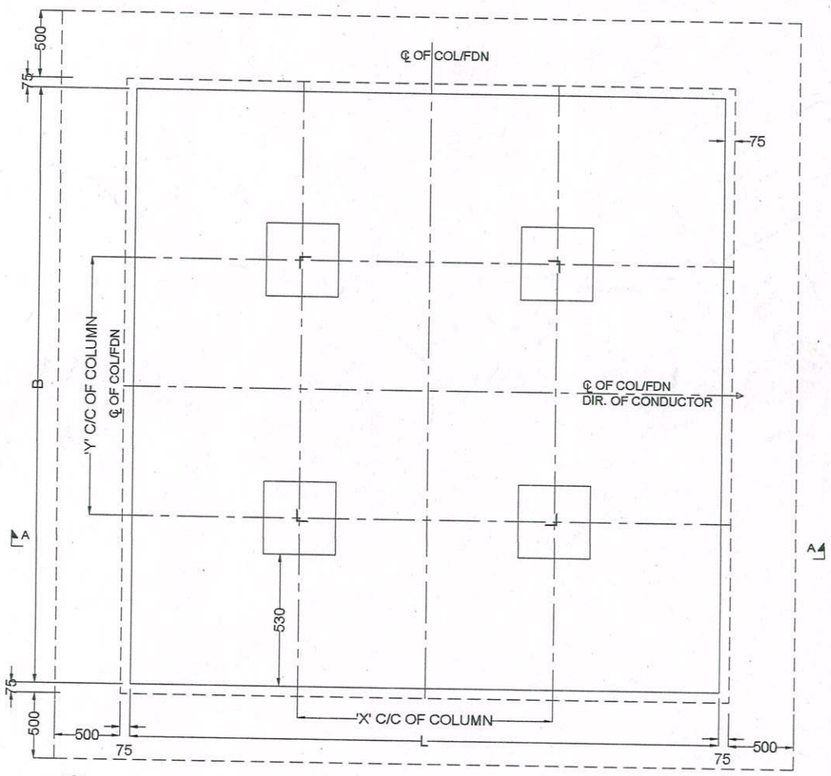
S.NO.	TOWER	L	B	'd'	D	(1)	(2)	(3)	(4)	'e'	N	X	Y	'Ø'
1	CTG	4800	4000	500	450	12Ø @ 200 C/C	12Ø @ 200 C/C	4-20Ø	4-20Ø	210	4	3440	2440	28



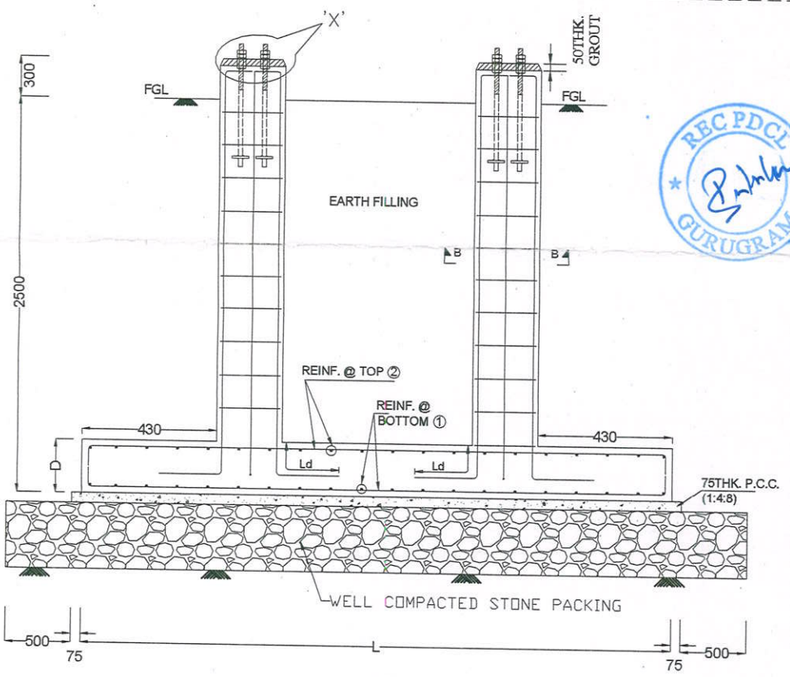
SECTION B-B



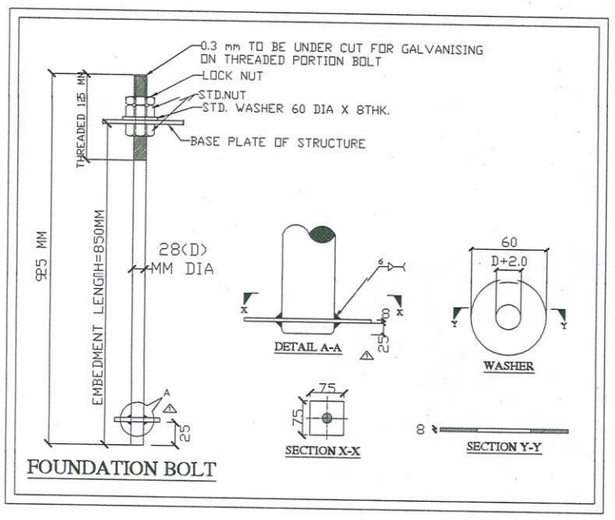
DETAIL AT-'X'



FOUNDATION PLAN FOR TOWER



SECTION A-A



FOUNDATION BOLT

REC PDCL GURUGRAM

Categories
श्रेणियाँ
I. Approved/ issued/ for Fabrication/Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण/हेतु अनुमोदित/जारी।
II. Approved/ issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included. - Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित जारी/ बातें दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

(Signature) (हस्ताक्षर) Dum(T)
(Designation) (पदनाम)
5/4/22 (Date) (तिथि)

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE GRADE SHALL BE M25 AS PER TS.
3. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 500 CONFIRM TO IS:1786-1985.
5. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR BOTTOM, TOP & SIDE OF RAFT AND 50mm COVER FOR COLUMN.
4. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN LAYOUT.
6. IF FOUNDATION BOLTS FOUL WITH STIRRUPS, STIRRUPS SHALL BE ADJUSTED AT SITE.
7. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
8. NET BEARING CAPACITY IS CONSIDERED 5 T/sqm.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. ALL HOOKS, BENDS AND SPLICES SHALL BE AS PER IS:456 AND IS:2502.
11. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Transmission Projects Company Limited(RECTPCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FOUNDATION DRAWING CTG (IN FILLING) FOR 220kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/60 ✓
SCALE	As shown in Drawing
REV-	0 ✓
AREA	91.6 KANAL 46336.5 SQM

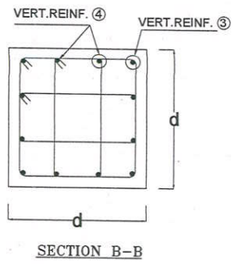
	NAME	DATE	SIGN
PREPARED BY	AKASH	17.08.2022	
CHECKED BY	G.H	17.08.2022	
SUBMITTED BY	Er. SANJAY	17.08.2022	

Signature/Stamp...

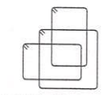
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

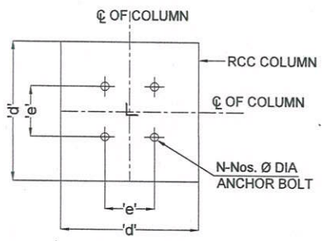
S.NO.	TOWER	L	B	'd'	D	(1)	(2)	(3)	(4)	'e'	N	X	Y	'Ø'
1	CTH	6700	4700	500	500	12Ø @ 175 C/C	12Ø @ 175 C/C	4-25Ø	8-20Ø	210	4	3426.6	2426.6	40



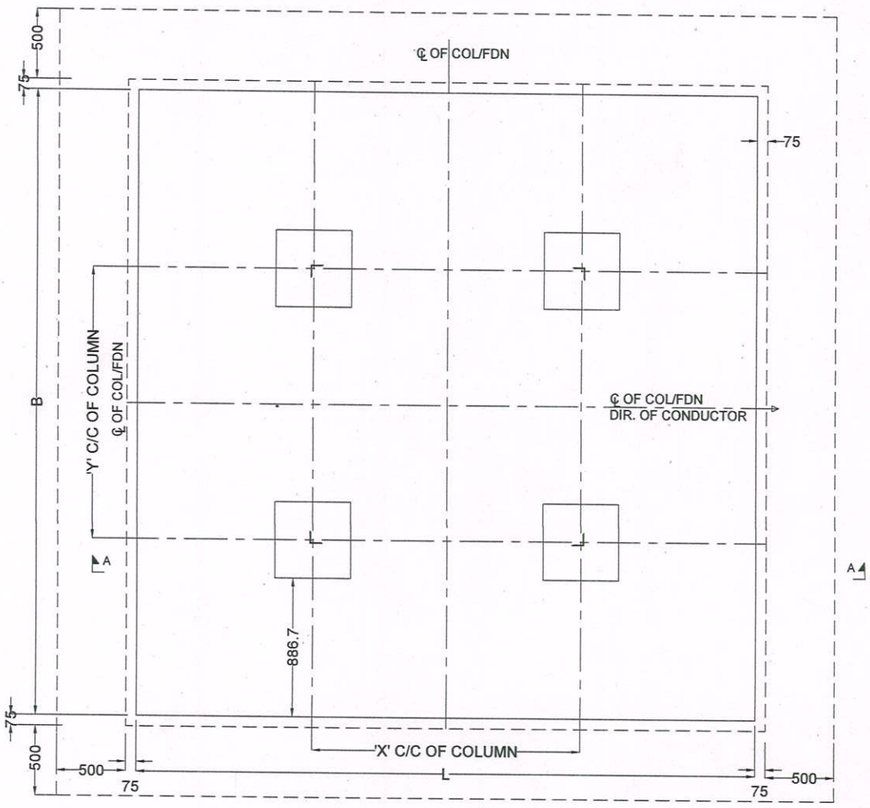
SECTION B–B



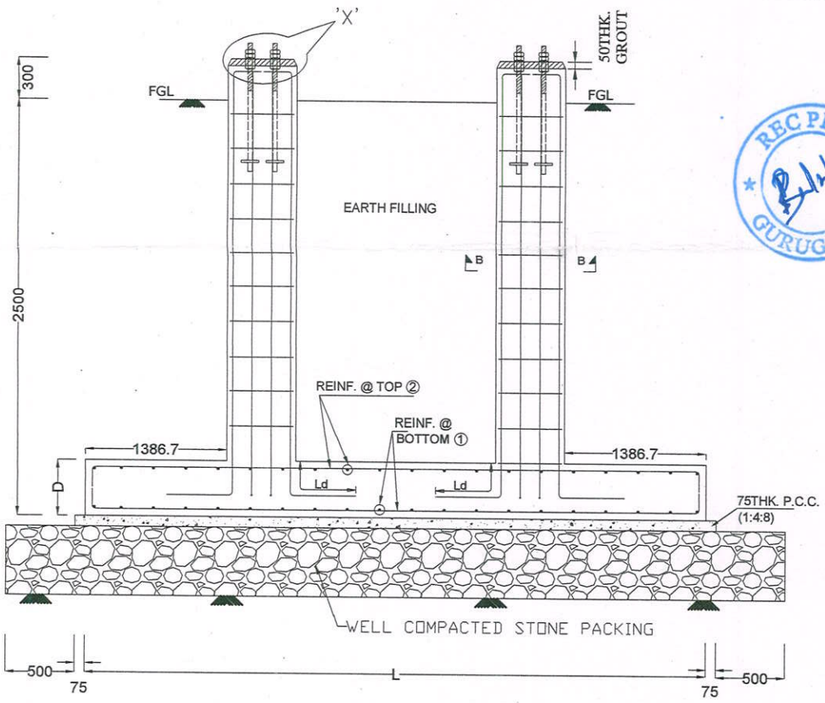
RINGS 8Ø @ 250 C/C



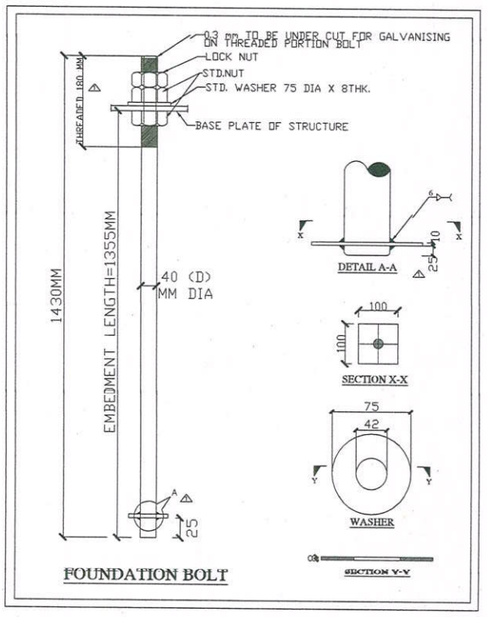
DETAIL AT–'X'



FOUNDATION PLAN FOR TOWER



SECTION A–A



REC PDCL GURUGRAM

(Signature) (हस्ताक्षर)
(Designation) (पदनाम) Dum(T)
(Date) (तिथि) 5/7/22

Categories
श्रेणियां
I. Approved/ issued/ for Fabrication/Construction/Manufacturing. फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.- Please submit the revised documents for approval. फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी/ कहीं दी गई टिप्पणियों को सम्मिलित किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval. टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record. सूचना एवं रिकॉर्ड हेतु।
V. Not approved. अनुमोदित नहीं।

NOTES:-

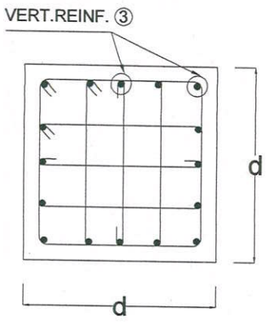
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE GRADE SHALL BE M25 AS PER TS.
3. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 500 CONFIRM TO IS:1786-1985.
5. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR BOTTOM, TOP & SIDE OF RAFT AND 50mm COVER FOR COLUMN.
4. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN LAYOUT.
6. IF FOUNDATION BOLTS FOUL WITH STIRRUPS, STIRRUPS SHALL BE ADJUSTED AT SITE.
7. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
8. NET BEARING CAPACITY IS CONSIDERED 5 T/sqm.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. ALL HOOKS, BENDS AND SPLICES SHALL BE AS PER IS:456 AND IS:2502.
11. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Transmission Projects Company Limited(RECTPCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	FOUNDATION DRAWING CTH (IN FILLING) FOR 220kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/61 ✓		REV- 0 ✓	
SCALE	As shown in Drawing			
AREA	91.6 KANAL 46336.5 SQM			
	NAME	DATE	SIGN	
PREPARED BY	AKASH AD	17.08.2022		Signature/Stamp...
CHECKED BY	G.H	17.08.2022		
SUBMITTED BY	Er. SANJAY	17.08.2022		

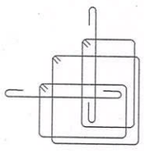
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

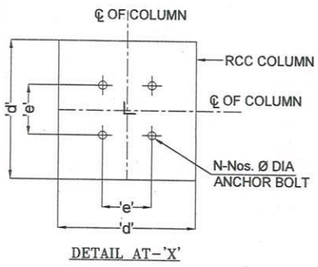
S.NO.	TOWER	L	B	'd'	D	(1)	(2)	(3)	'e'	N	X	Y	'Ø'
1	CTK	8400	8400	750	750	16Ø @ 150 C/C	16Ø @ 150 C/C	16-28Ø	280	4	3385.8	3385.8	56



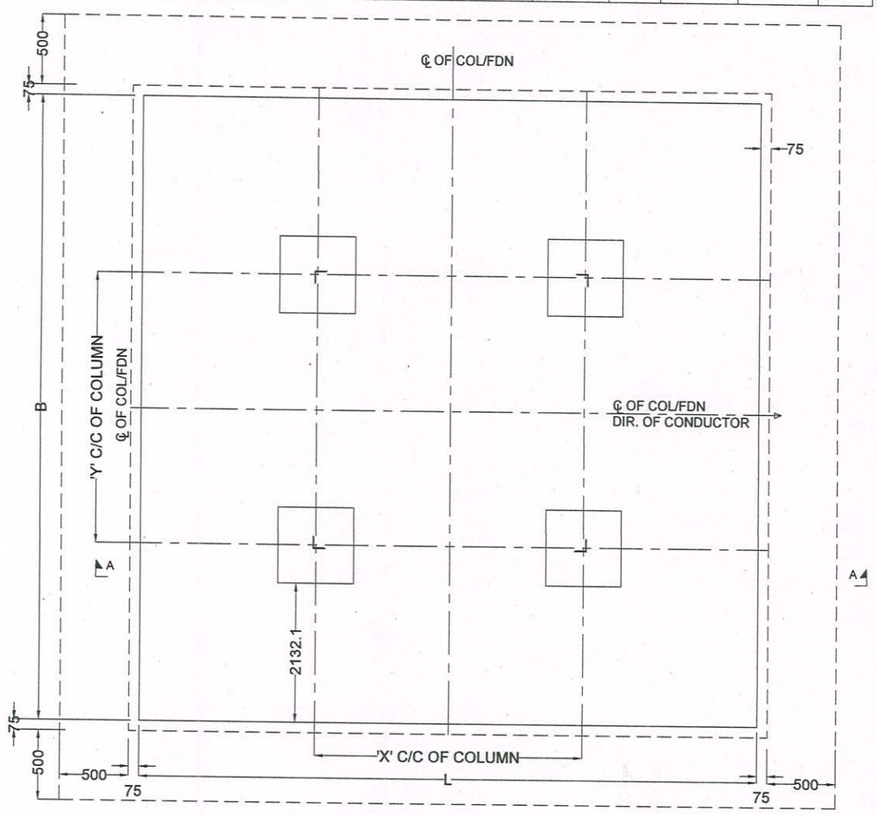
SECTION B–B



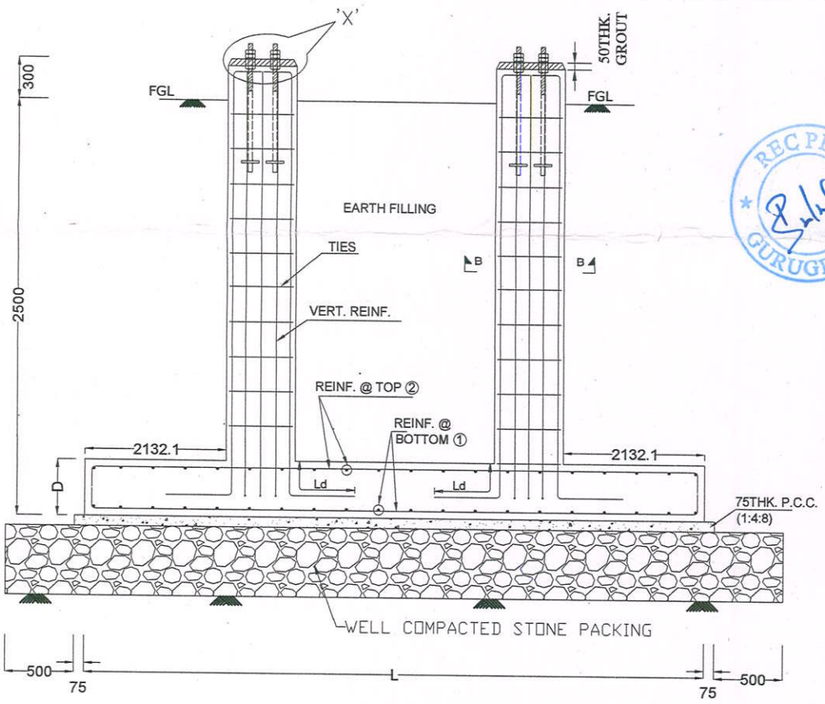
RINGS 8Ø @ 250 C/C



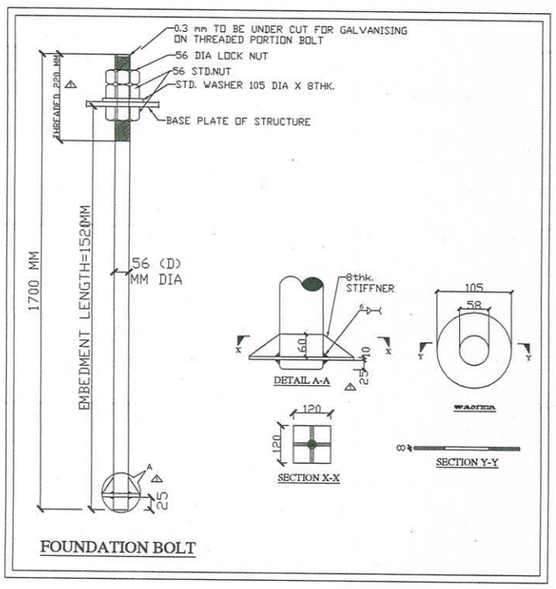
DETAIL AT–'X'



FOUNDATION PLAN FOR TOWER



SECTION A–A



FOUNDATION BOLT

REC PDCL GURUGRAM

Categories
I. Approved/ issued/ for Fabrication/Construction/Manufacturing.
II. Approved/ issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included. Please submit the revised documents for approval.
III. Insert comments and submit again for approval.
IV. For information and record.
V. Not approved.

(Signature) (हस्ताक्षर) DGM(T)
(Designation) (पदनाम)
5/4/22
(Date) (तिथि)

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE GRADE SHALL BE M25 AS PER TS.
3. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 500 CONFIRM TO IS:1786-1985.
5. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR BOTTOM, TOP & SIDE OF RAFT AND 50mm COVER FOR COLUMN.
4. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN LAYOUT.
6. IF FOUNDATION BOLTS FOUL WITH STIRRUPS, STIRRUPS SHALL BE ADJUSTED AT SITE.
7. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
8. NET BEARING CAPACITY IS CONSIDERED 5 T/sqm.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. ALL HOOKS, BENDS AND SPLICES SHALL BE AS PER IS:456 AND IS:2502.
11. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.
12. GRADE OF FOUNDATION BOLT SHALL BE 5.6.

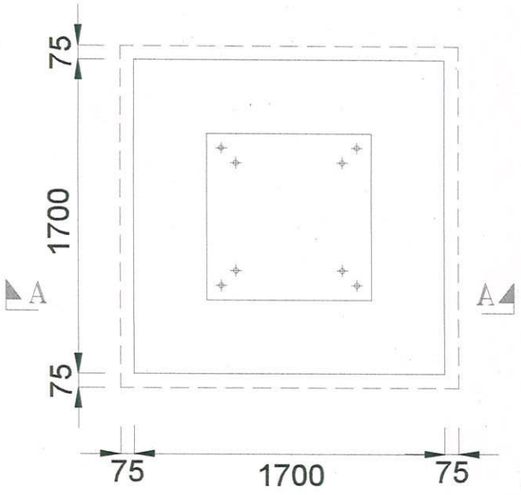
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FOUNDATION DRAWING CTK (IN FILLING) FOR 220kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/67 — REV- 0
SCALE	As shown in Drawing
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	AKASH	28.02.2022	
CHECKED BY	G.H	28.02.2022	
SUBMITTED BY	Er. ANURAG	28.02.2022	

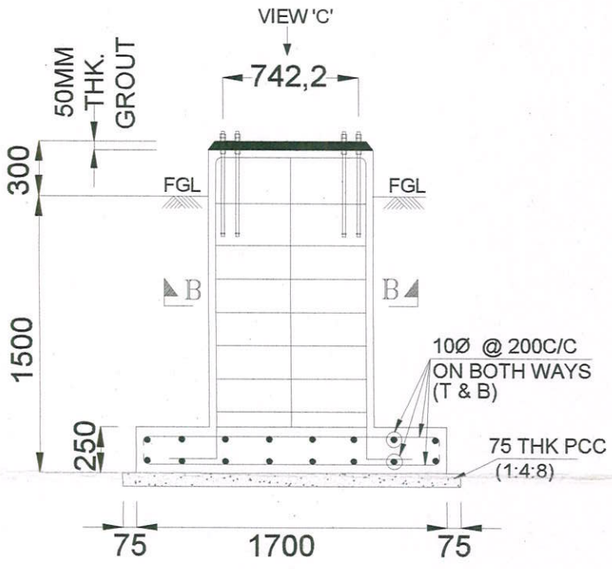
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

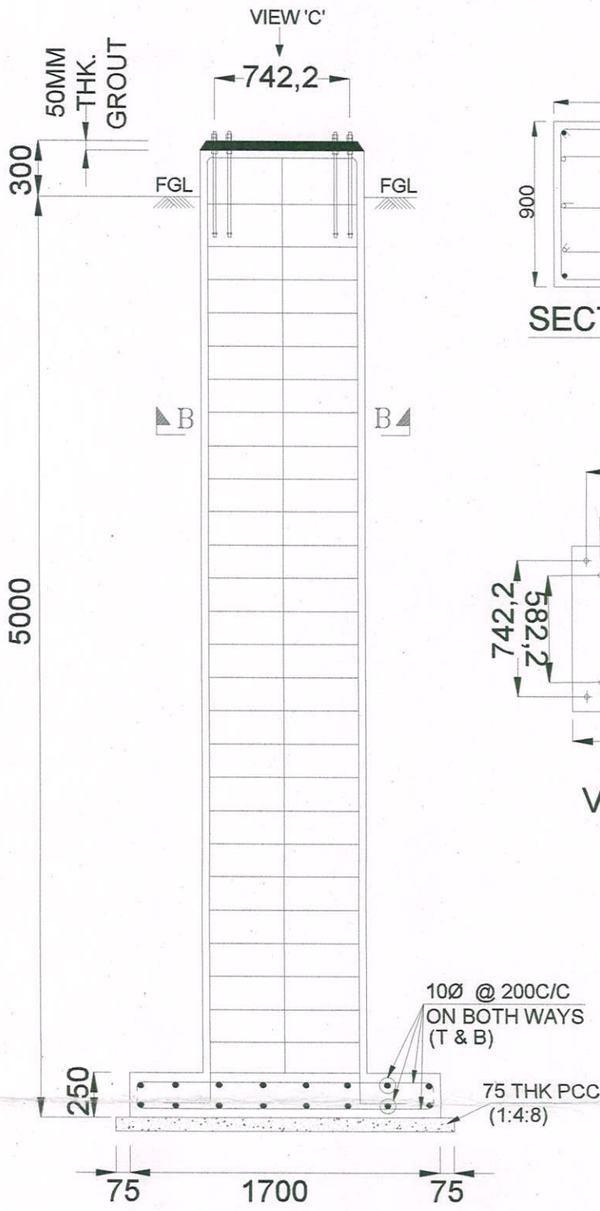


FOUNDATION PLAN



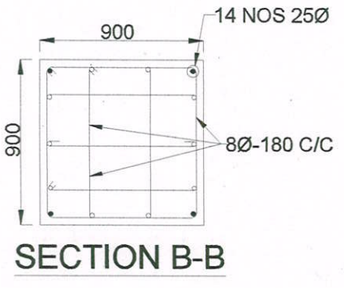
SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)

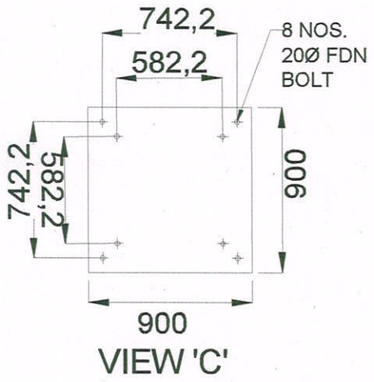


SECTION A-A

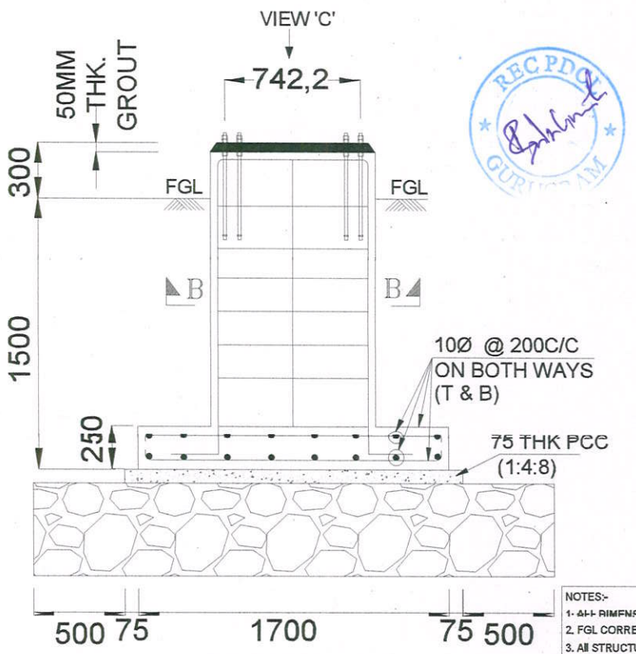
(NOTE :- IT IS APPLICABLE NEAR 2M RETAINING WALL)



SECTION B-B

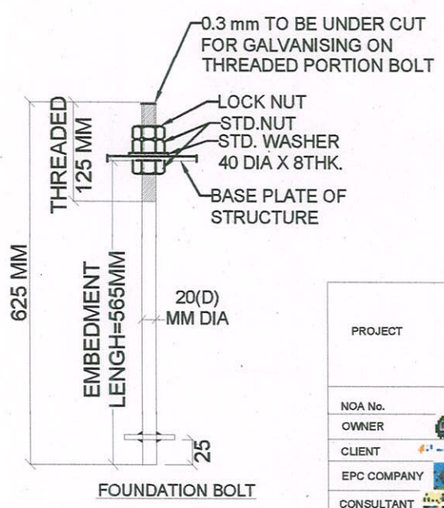


VIEW 'C'

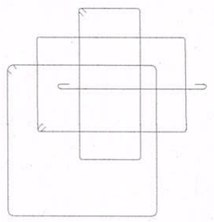


SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



FOUNDATION BOLT



RING ARRANGEMENT

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 15.16 T/SQM AT 1.5MT DEPTH.

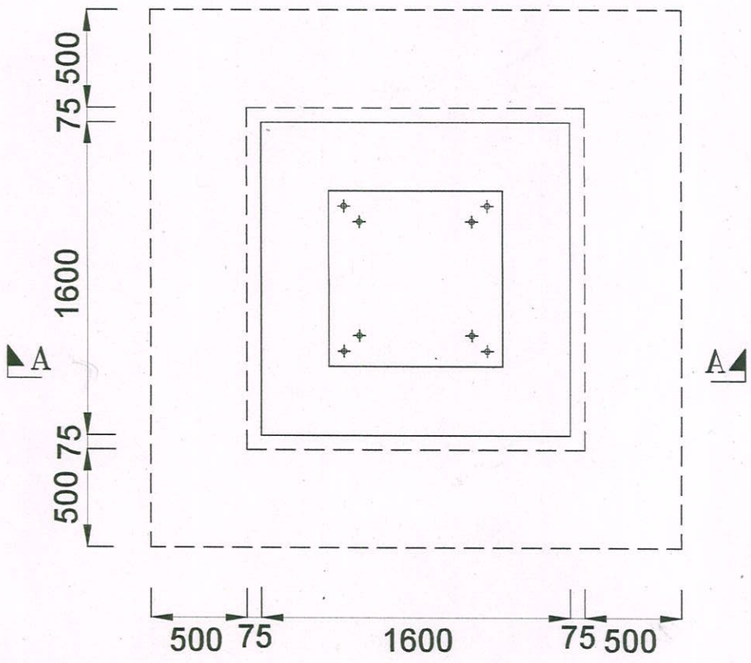
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-jiadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	220KV CT FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu ✓			
DRG. NO.	KDBIL/250 PJ/20-21/D1/68 ✓		REV- 0 ✓	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.8 KANAL 46838.5 SqM		SH.NO.: 1 OF 1	
	NAME	DATE	SIGN	
PREPARED BY	RAVI	02.03.2022		
CHECKED BY	G.H	02.03.2022		
SUBMITTED BY	ANURAG	02.03.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

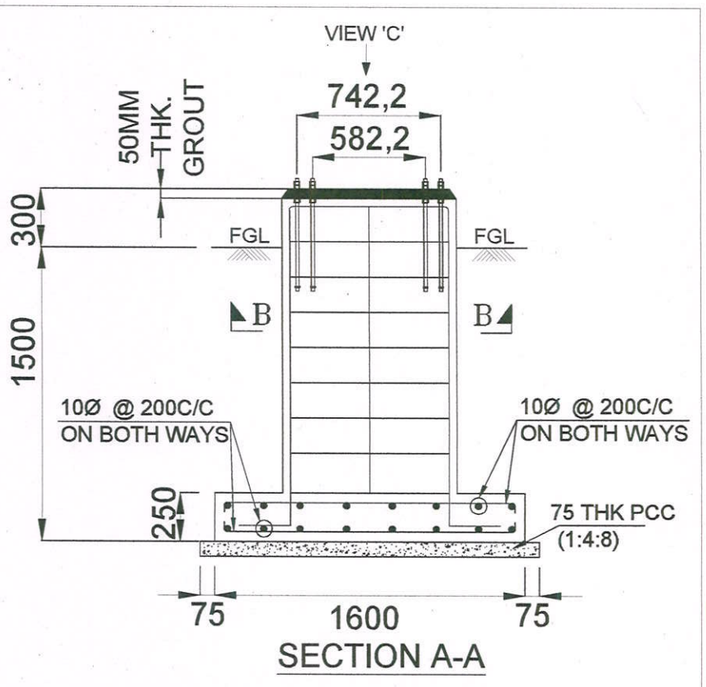
☐ More Information Date.....

(Signature) (हस्ताक्षर)
Dum(T)
(Designation) (पदनाम)
20/3/22
(Date) (तिथि)

Categories
श्रेणियां
I. Approved/ issued/ for Fabrication/Construction/Manufacturing.
संवीकृत/जारी/विनिर्माण/निर्माण/हेतु अनुमोदित/जारी।
II. Approved/ issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.- Please submit the revised documents for approval.
संवीकृत/जारी/विनिर्माण/निर्माण हेतु अनुमोदित/जारी, बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

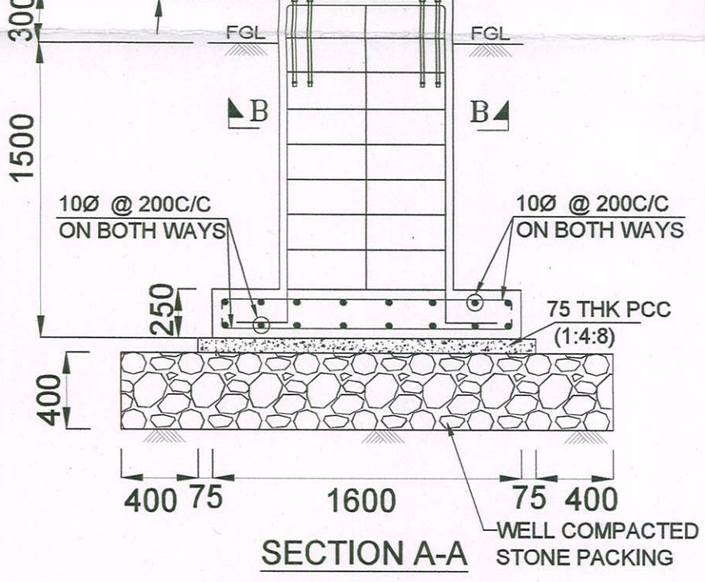


FOUNDATION PLAN



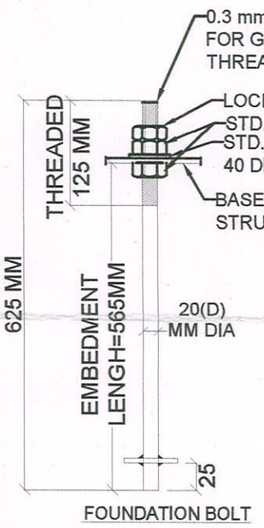
SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)

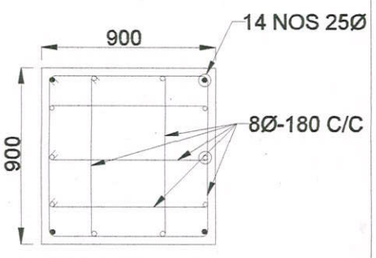


SECTION A-A

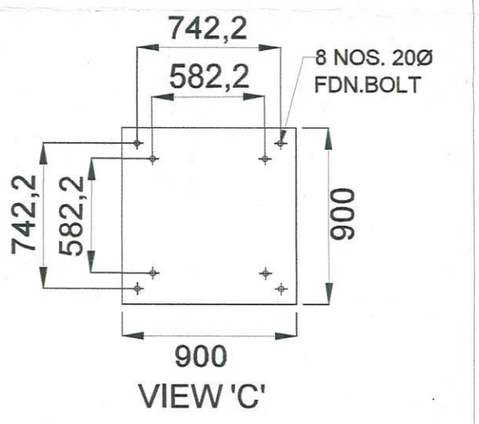
(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



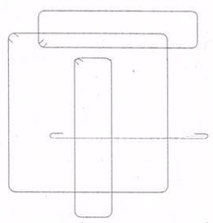
FOUNDATION BOLT



SECTION B-B



VIEW 'C'



RING ARRANGEMENT

NOTES:–

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (±)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5 T/SQM AT 1.2MT DEPTH.

REC PDCL GURUGRAM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	220KV CVT FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/69			REV- 0
SCALE	As shown in Drawing			SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM			SH.NO.: 1 OF 1
	NAME	DATE	SIGN	
PREPARED BY	RAVI	03.03.2022	—	
CHECKED BY	G.H	03.03.2022	—	
SUBMITTED BY	ANURAG	03.03.2022		Signature/Stamp...

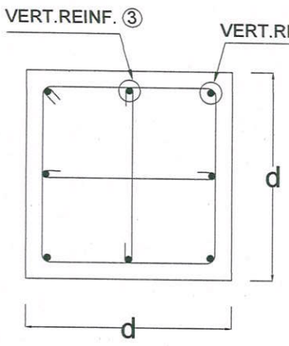
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

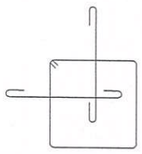
Categories
श्रेणियां
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued for Fabrication/ Construction/ Manufacturing Subject to condition that statements and comments are included.
निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बातें दी गई टिप्पणियों को सम्मिलित किया जाए।
III. Please submit the revised documents for approval.
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

(Signature) (हस्ताक्षर) Dhm (T)
(Designation) (पदनाम)
30/3/22
(Date) (तिथि)

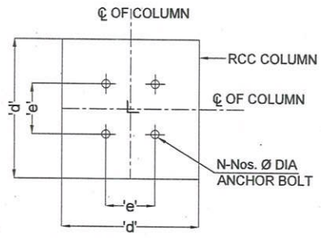
S.NO.	TOWER	L	B	'd'	D	(1)	(2)	(3)	'e'	N	X	Y	'Ø'
1	CD	6400	6400	500	500	12Ø @ 175 C/C	12Ø @ 175 C/C	8-32Ø	210	4	3428.2	3428.2	40



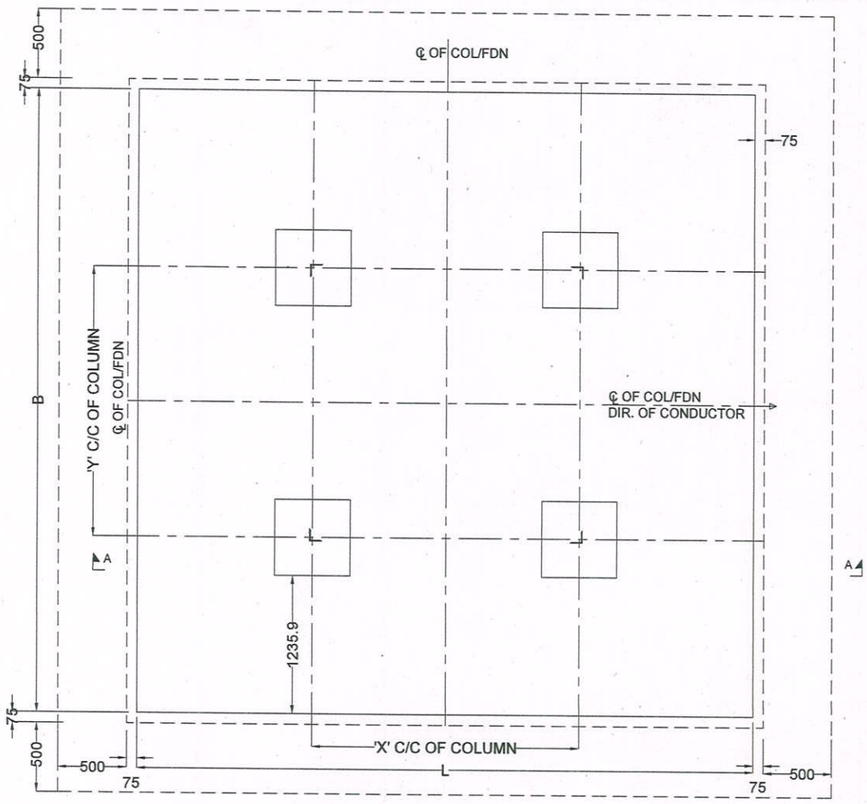
SECTION B–B



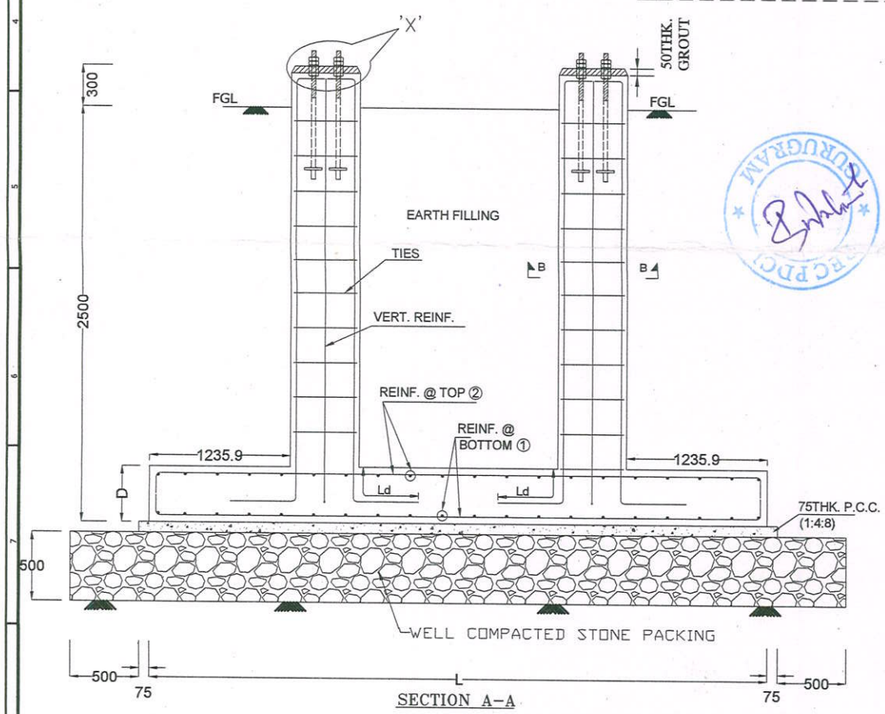
RINGS 8Ø @ 250 C/C



DETAIL AT–'X'



FOUNDATION PLAN FOR TOWER

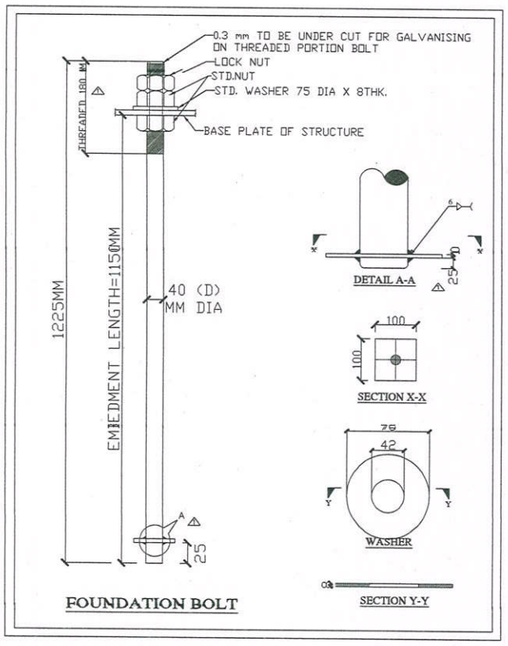


SECTION A–A

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included. - Please submit the revised documents for approval.
फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते टी गई टिप्पणियों को सम्मिलित किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित करके पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर) DWM (CT) (Designation) (पदनाम) 30/3/22 (Date) (तिथि)

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE GRADE SHALL BE M25 AS PER TS.
3. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 500 CONFIRM TO IS:1786-1985.
5. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR BOTTOM, TOP & SIDE OF RAFT AND 50mm COVER FOR COLUMN.
4. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN LAYOUT.
6. IF FOUNDATION BOLTS FOUL WITH STIRRUPS, STIRRUPS SHALL BE ADJUSTED AT SITE.
7. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
8. NET BEARING CAPACITY IS CONSIDERED 5 T/sqm.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. ALL HOOKS, BENDS AND SPLICES SHALL BE AS PER IS:456 AND IS:2502.
11. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.
12. GRADE OF FOUNDATION BOLT SHALL BE 5.6.



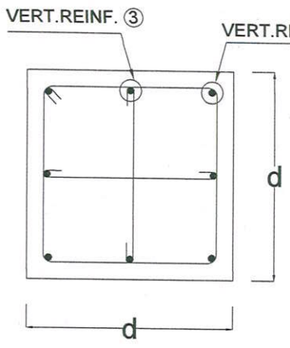
FOUNDATION BOLT

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)			
EPC COMPANY	Kailash Revlawild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	FOUNDATION DRAWING CD (IN FILLING) FOR 220kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/71	REV- 0		
SCALE	As shown in Drawing			
AREA	91.6 KANAL 46336.5 SQM			
	NAME	DATE	SIGN	
PREPARED BY	AKASH	09.03.2022		
CHECKED BY	G.H	09.03.2022		
SUBMITTED BY	Er. ANURAG	09.03.2022		Signature/Stamp...

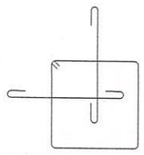
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

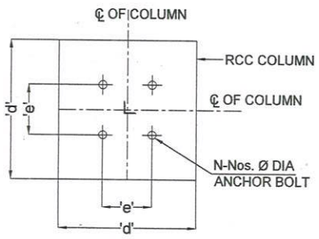
S.NO.	TOWER	L	B	'd'	D	(1)	(2)	(3)	'e'	N	X	Y	'Ø'
1	CC	5200	4200	500	500	12Ø @ 175 C/C	12Ø @ 175 C/C	8-25Ø	210	4	3444.8	2444.8	28



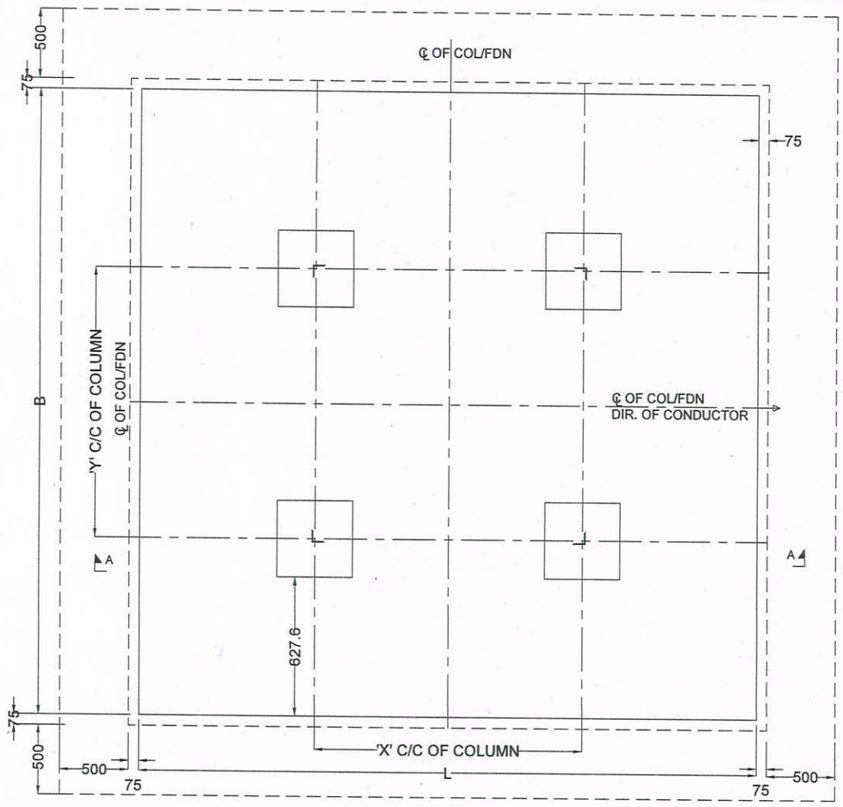
SECTION B–B



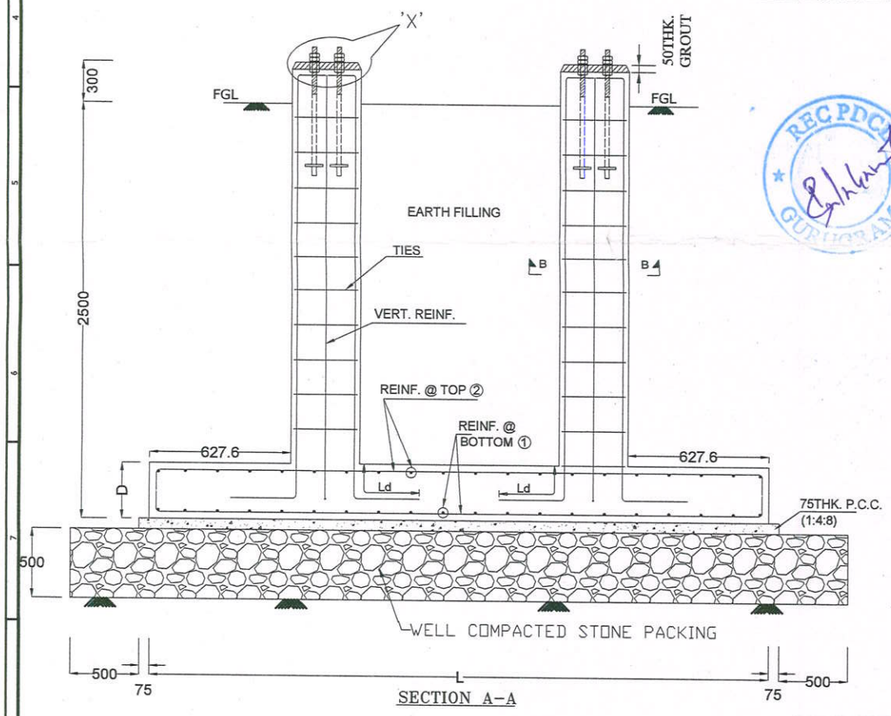
RINGS 8Ø @ 250 C/C



DETAIL AT–'X'



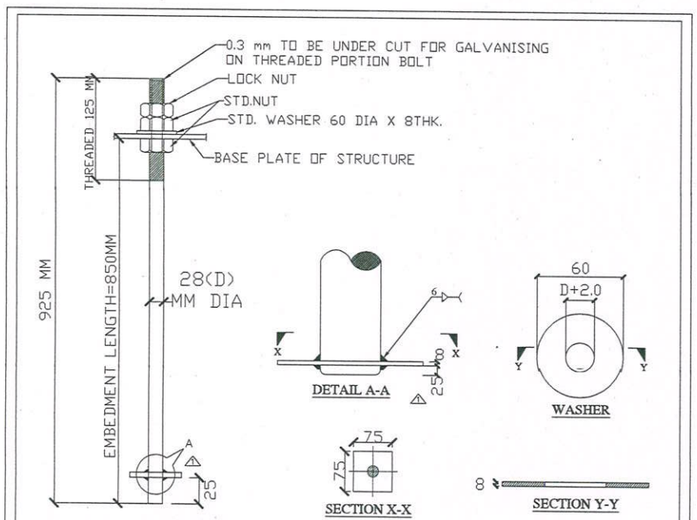
FOUNDATION PLAN FOR TOWER



SECTION A–A

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE GRADE SHALL BE M25 AS PER TS.
3. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 500 CONFIRM TO IS:1786-1985.
5. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR BOTTOM, TOP & SIDE OF RAFT AND 50mm COVER FOR COLUMN.
4. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN LAYOUT.
6. IF FOUNDATION BOLTS FOUL WITH STIRRUPS, STIRRUPS SHALL BE ADJUSTED AT SITE.
7. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
8. NET BEARING CAPACITY IS CONSIDERED 5 T/sqm.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. ALL HOOKS, BENDS AND SPLICES SHALL BE AS PER IS:456 AND IS:2502.
11. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.
12. GRADE OF FOUNDATION BOLT SHALL BE 5.6.



FOUNDATION BOLT

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	FOUNDATION DRAWING CC (IN FILLING) FOR 220kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/72		REV- 0	
SCALE	As shown in Drawing			
AREA	91.6 KANAL 46336.5 SQM			
	NAME	DATE	SIGN	
PREPARED BY	AKASH AD	09.03.2022		
CHECKED BY	G.H	09.03.2022		
SUBMITTED BY	Er. ANURAG	09.03.2022		Signature/Stamp...

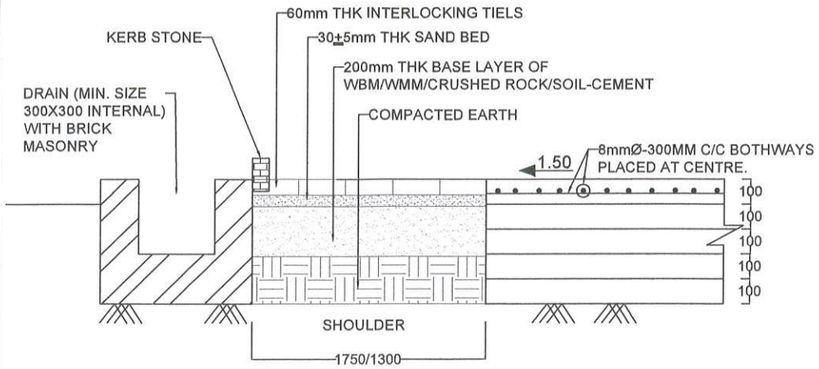
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

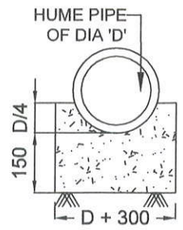
REC PDCL GURUGRAM

Categories
श्रेणियां
I. Approved/ issued/ for Fabrication/Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण/हेतु अनुमोदित/जारी।
II. Approved/ issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.- Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

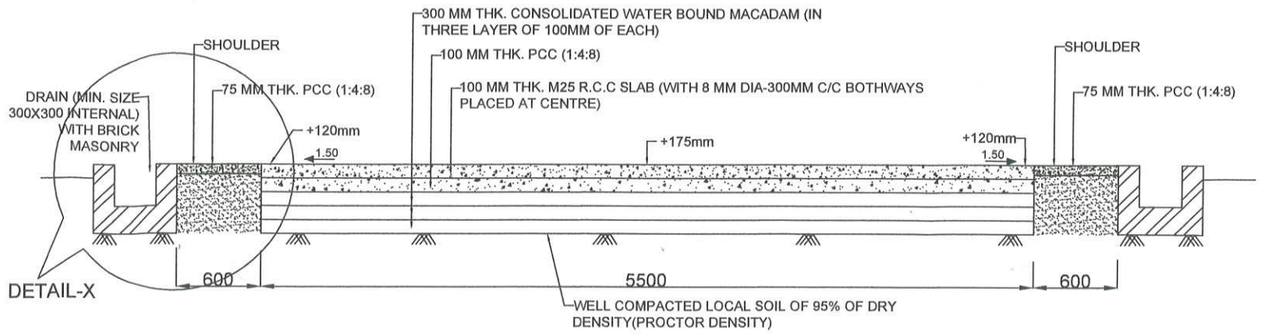
(Signature) (हस्ताक्षर) Dim LT
(पदनाम) (Date) (तिथि) 3/3/22



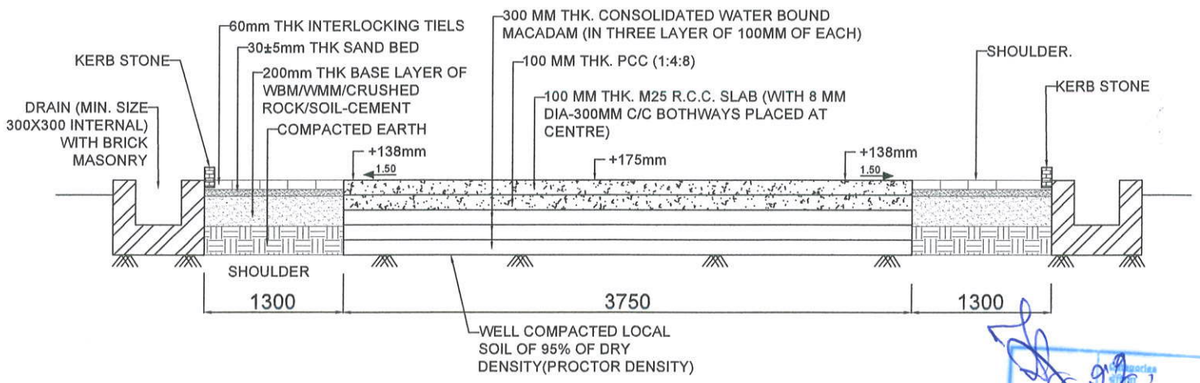
DETAIL-Y



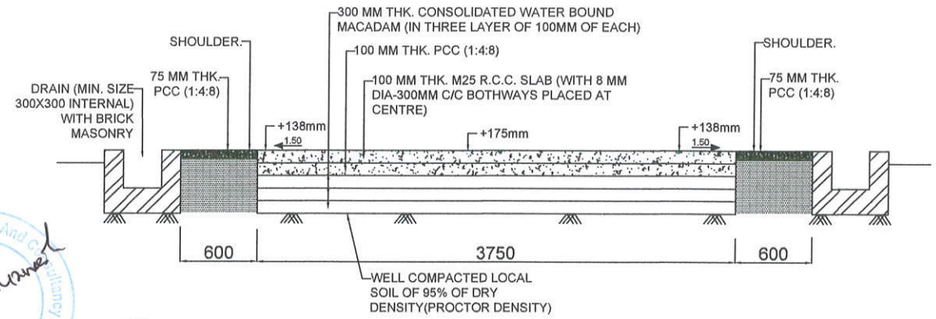
BEDDING FOR HUME PIPE



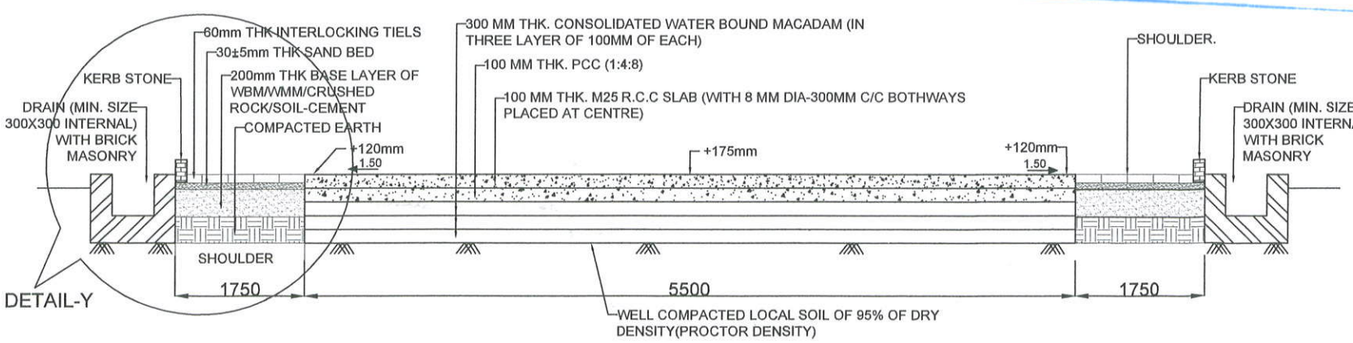
TYP. CROSS SECTION OF 5.5 M WIDE ROAD WITHIN SWITCHYARD AREA



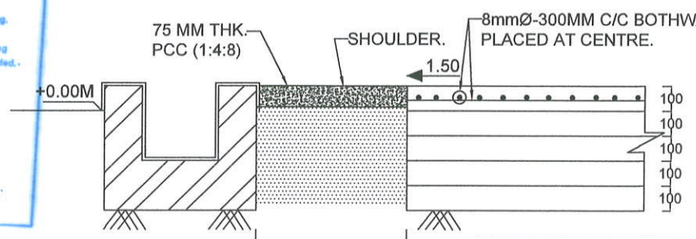
TYP. CROSS SECTION OF 3.75 M WIDE ROAD OUTSIDE THE SWITCHYARD



TYP. CROSS SECTION OF 3.75 M WIDE ROAD WITHIN SWITCHYARD AREA



TYP. CROSS SECTION OF 5.5 M WIDE ROAD OUTSIDE THE SWITCHYARD



PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/705 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	DETAILED DRAWING OF 5.5m & 3.75 m ROAD FOR 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/73 — REV- 01
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	AKASH	20.04.2022	
CHECKED BY	G.H	20.04.2022	
SUBMITTED BY	Er. ANURAG	20.04.2022	

Signature/Stamp:...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

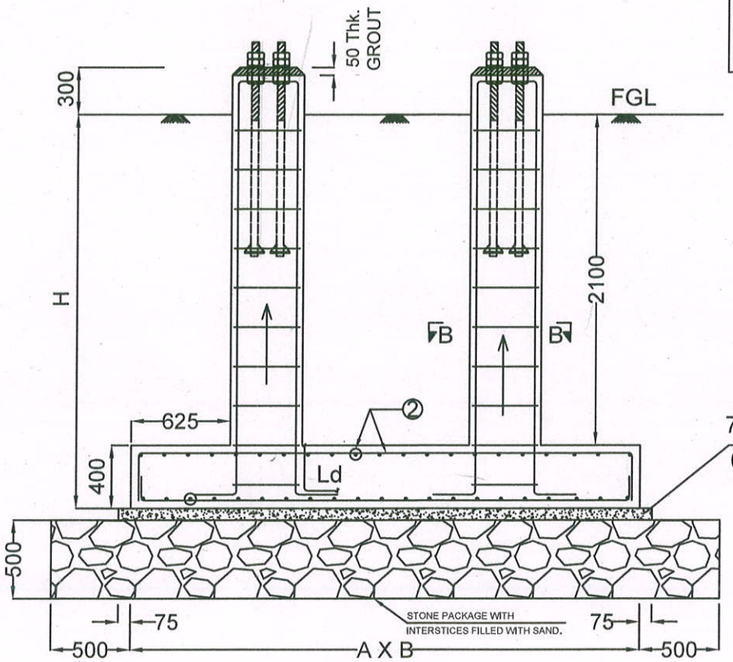
LEGEND:

FGL	FINISHED GROUND LEVEL
FFL	FINISHED FLOOR LEVEL
TYP	TYPICAL
℄	CENTER LINE
R	INNER RADIUS OF ROAD

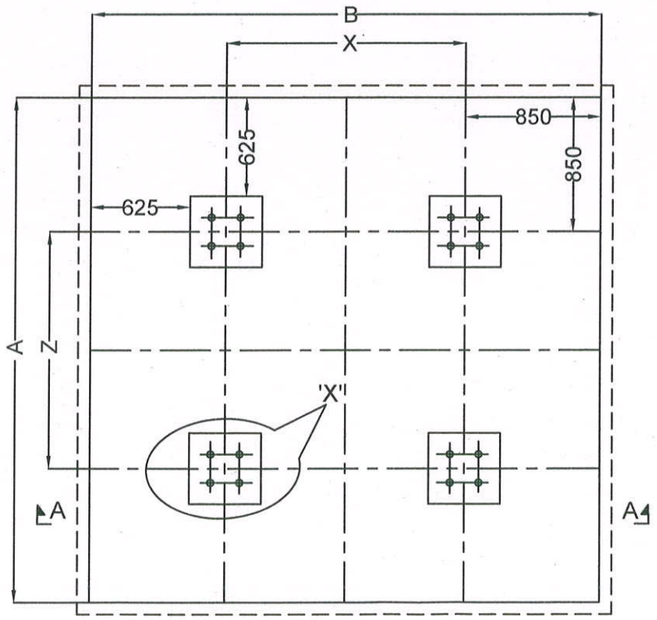
NOTES:-

1. ALL DIMENSION ARE IN MM UNLESS NOTED OTHERWISE.
2. CAMBER OF 1.50 SHALL BE PROVIDED.
3. EXPANSION JOINT (12MM THK.) SHALL BE PROVIDED AT EVERY 8.0M EXPENSION JOINT SHALL ALSO BE PROVIDED AT CENTRE.
4. POLYTHENE SHEET OF 125 MICRONS SHALL BE PLACED BETWEEN THE PCC AND RCC SLAB (TOP SLAB).
5. 100MM DIA RCC HUME PIPE(NP-3) SHALL BE PLACED ACROSS THE ROAD AT EVERY 100M INTERVAL ALONG THE ROAD.
6. FINISHED TOP OF ROAD CREST SHALL BE 175 MM (MIN.) ABOVE F.G.L. (SWITCHYARD FORMATION LEVEL)

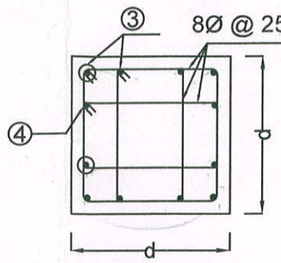
S.NO.	TOWER	H	A	B	X	Z	'dxd'	(1)	(2)	(3)	(4)
1	3TBP/3TCP /3TD/3TE	2500	3200	3200	1500	1500	450x450	12Ø @ 150 C/C	12Ø @ 150 C/C	8-20Ø	4-16Ø



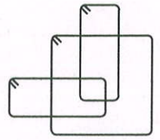
SECTION A-A



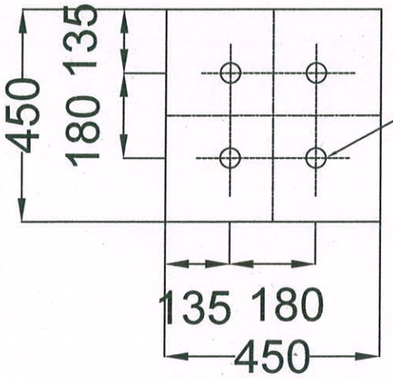
FOUNDATION PLAN



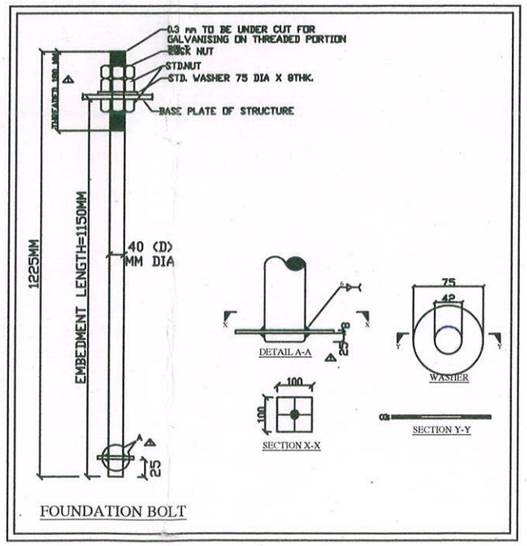
SECTION B-B



STIRRUPS 8Ø @ 250 C/C



DETAILS-'X'



FOUNDATION BOLT

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE SHALL BE AS PER BPS.
3. ALL LEAN CONCRETE SHALL BE 75mm Thk. AND OF GRADE (1:4:8) (1 CEMENT: 4 COURSE SAND: 8 GRADED STONE AGGREGATE OF 40mm NOMINAL SIZE).
4. ALL REINFORCEMENT STEEL BARS (DENOTED AS Ø) SHALL CONFORM TO IS:1786-1985 OF GRADE Fe500 OR TMT BARS OF EQUAL GRADE.
5. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN LAYOUT.
6. IF FOUNDATION BOLTS FOUL WITH STIRRUPS, STIRRUPS SHALL BE ADJUSTED AT SITE.
7. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
8. NET BEARING CAPACITY IS CONSIDERED AS 50KN/Sq.m AT 2.5m DEPTH.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. LAP LENGTH SHALL BE 50 TIMES DIA OF BAR.
11. FOUNDATION BOLT DETAILS AS PER APPROVED STRUCTURE DRAWING.
12. PROVIDED REINFORCEMENT IS SIMILAR IN BOTH DIRECTION OF FOOTING.
13. DETAILING SHALL BE DONE AS PER SP:34

REC PDCL GURUGRAM

Kailash Devbuild (India) Pvt. Ltd.

Odisha (Signature) (हस्ताक्षर) Dam(T) (Designation) (पदनाम) 13/4/22 (Date) (तिथि)
I. Approved/ Issued for Fabrication/Construction/Manufacturing. फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued for Fabrication/Construction/Manufacturing Subject to condition that state... Please submit the revised dr... फैब्रीकेशन/निर्माण/विनिर्माण हेतु ... दिशानिर्देशों को अनुमोदित किया ... कृपया संशोधित ड्राइंग प्रस्तुत ...
III. Insert comments and submit ... टिप्पणियां डालें और प्रस्तुत ...
IV. For Information and record. सूचना एवं रिकॉर्ड हेतु।
V. Not approved. अनुमोदित नहीं।

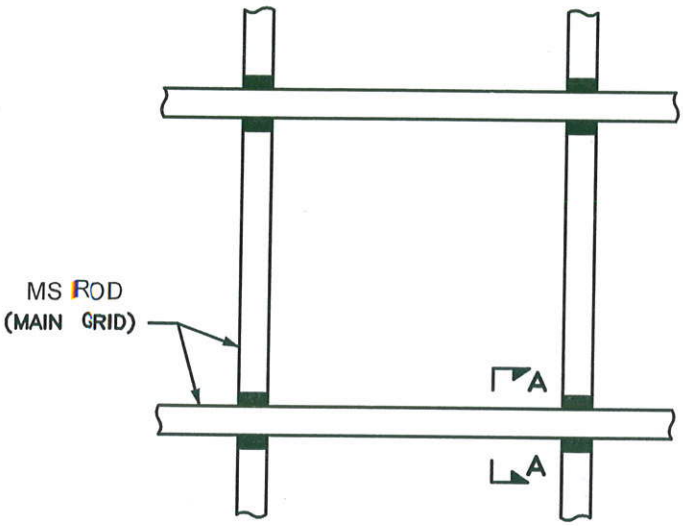
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Transmission Projects Company Limited(RECTPCL)			
EPC COMPANY	Kallash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	FOUNDATION DRAWING OF 33KV TOWER(3TBP/3TCP/3TD/3TE) , Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/74		REV- 0	
SCALE	As shown in Drawing			
AREA	91.6 KANAL 46336.5 SQM			
	NAME	DATE	SIGN	
PREPARED BY	DEEPAK	14.03.2022		Signature/Stamp...
CHECKED BY	G.H	14.03.2022		
SUBMITTED BY	Er. SANJAY	14.03.2022		

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

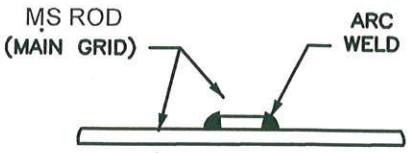
Typical Earthing details

KDBIL/250PJ/2021/D1/75 (Rev.-01)

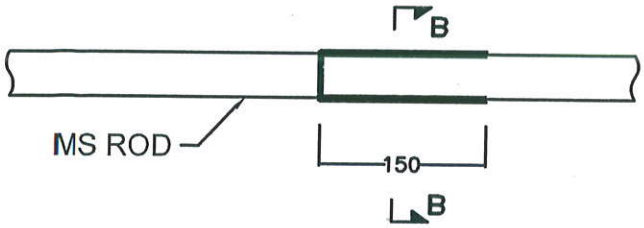


PLAN

DETAIL OF CROSS JOINT

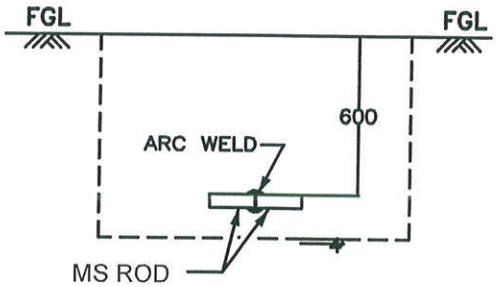


SECTION A – A

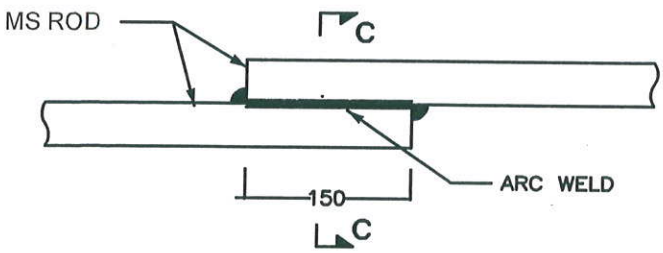


ELEVATION

(CONDUCTORS KEPT ON SIDES)

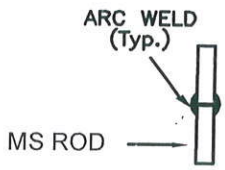


SECTION B – B



ELEVATION

(CONDUCTORS ONE ABOVE THE OTHER)



SECTION C – C

DETAIL OF LAP JOINT

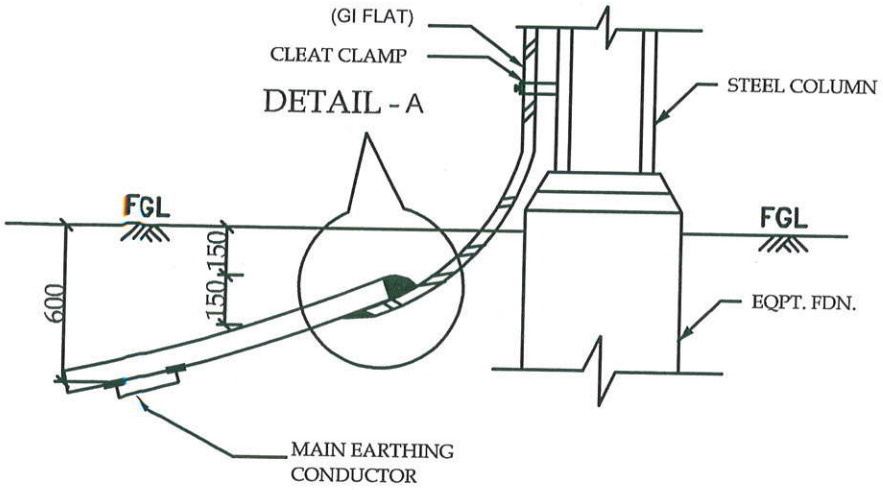
(Signature) (हस्ताक्षर)	I. Approved/ issued/ for Fabrication/Construction/Manufacturing. अनुमोदित/जारी। II. Approved/ issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included. Please submit the revised documents for approval. टिप्पणियों को सम्मिलित किया जाए। पुनः संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें। III. Re-submit comments and submit again for approval. टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें। IV. For information and record. सूचना एवं रिकॉर्ड हेतु। V. Not approved. अनुमोदित नहीं।
(Designation) (पदनाम)	
(Date) (तिथि)	

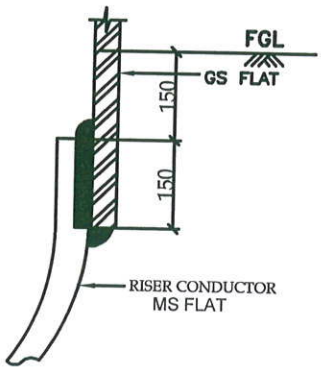
REC Power Development And Consultancy Ltd. * Gurugram-122001 *

CN: 18248 dated: 21/3/22

Kailash Devbuild (India) Pvt. Ltd. * Jabalpur *

DETAILS FOR RISER

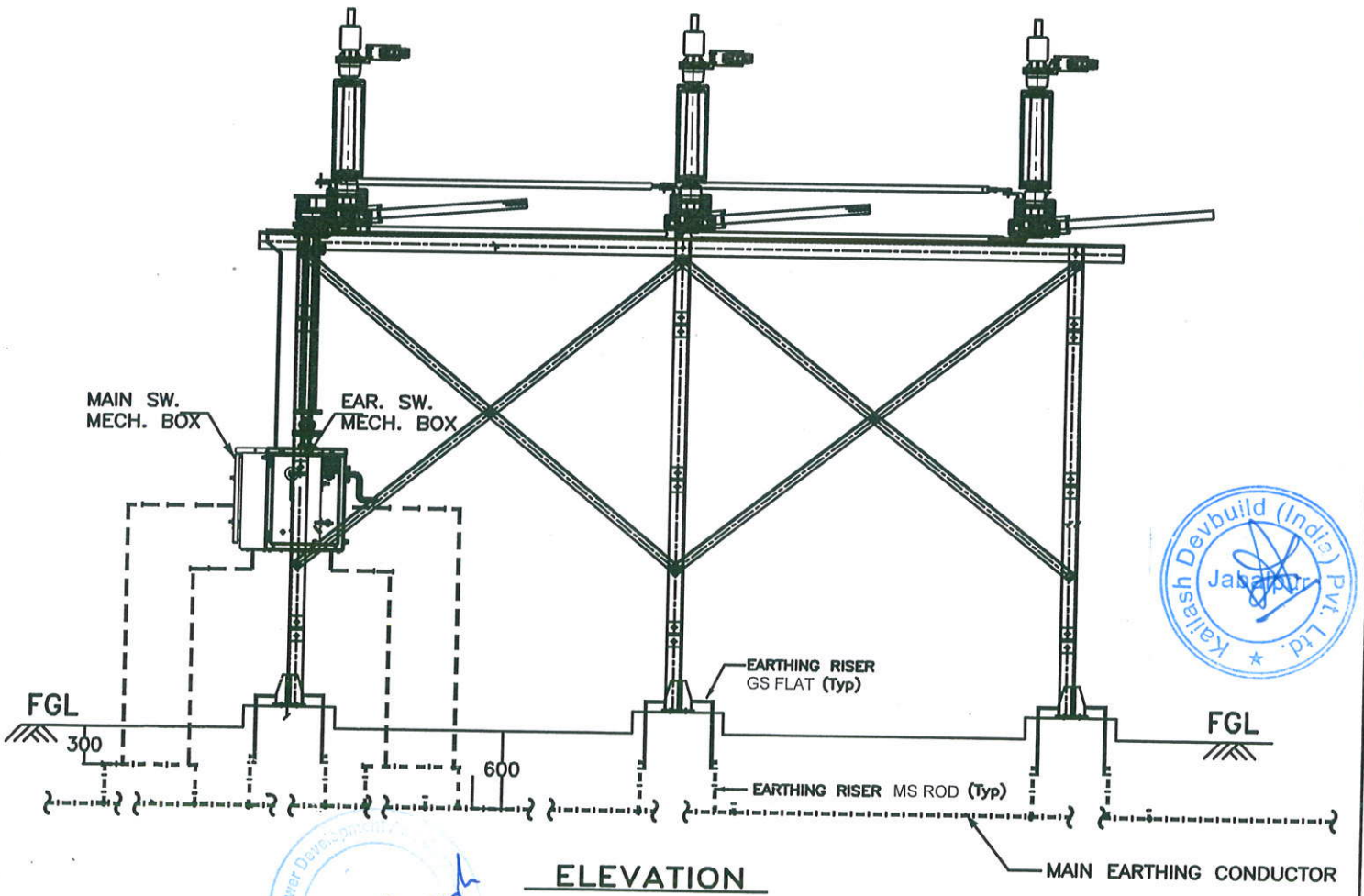




ELEVATION

DETAIL - A

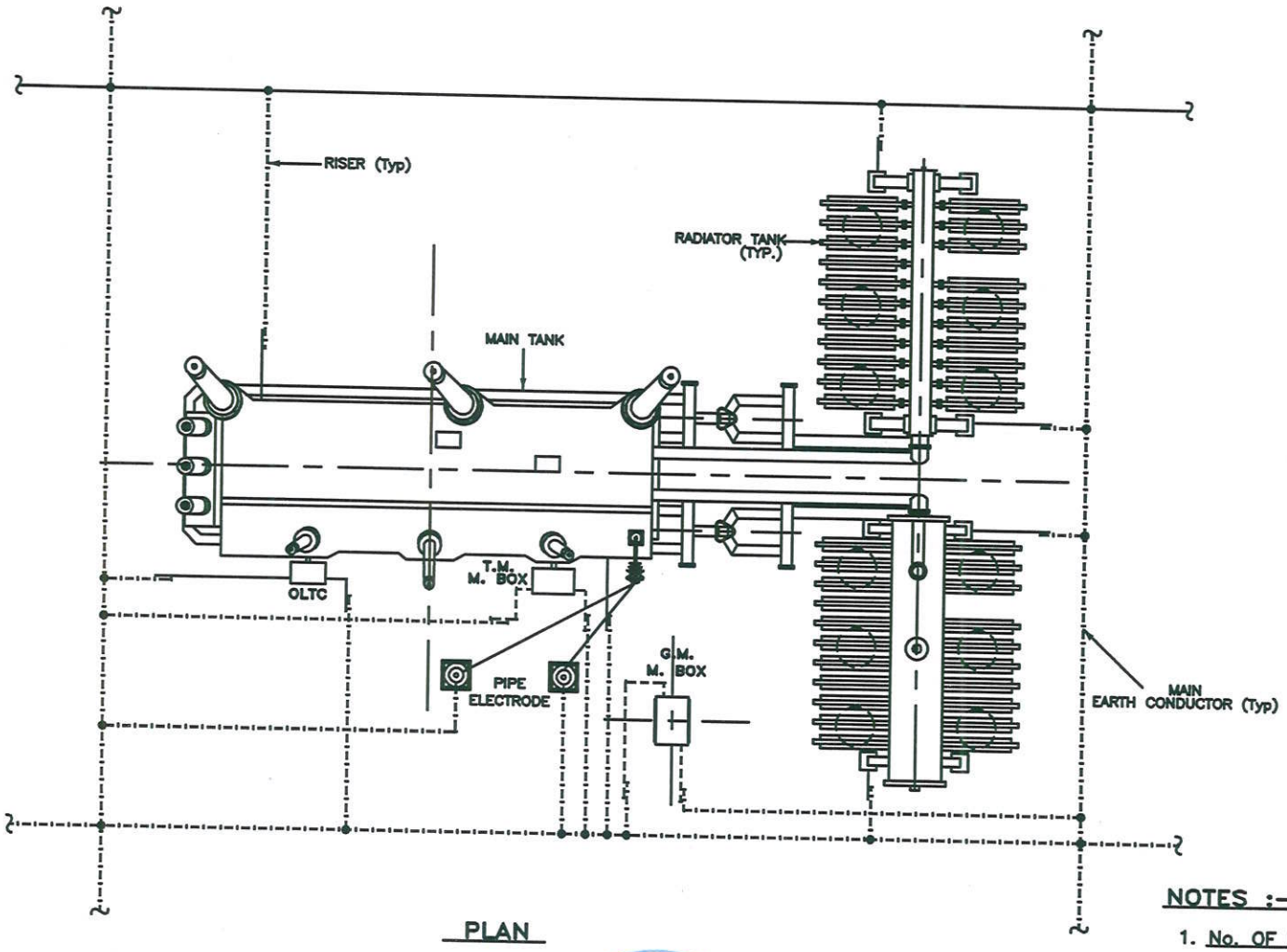
EARTHING FOR ISOLATORS



ELEVATION

Kailash Devbuild (India) Pvt. Ltd. Jabalpur
REC Power Development & Consultancy Ltd. Gurugram-122001

EARTHING OF TRANSFORMER/ REACTOR



PLAN

NOTES :-

1. No. OF RISERS :-

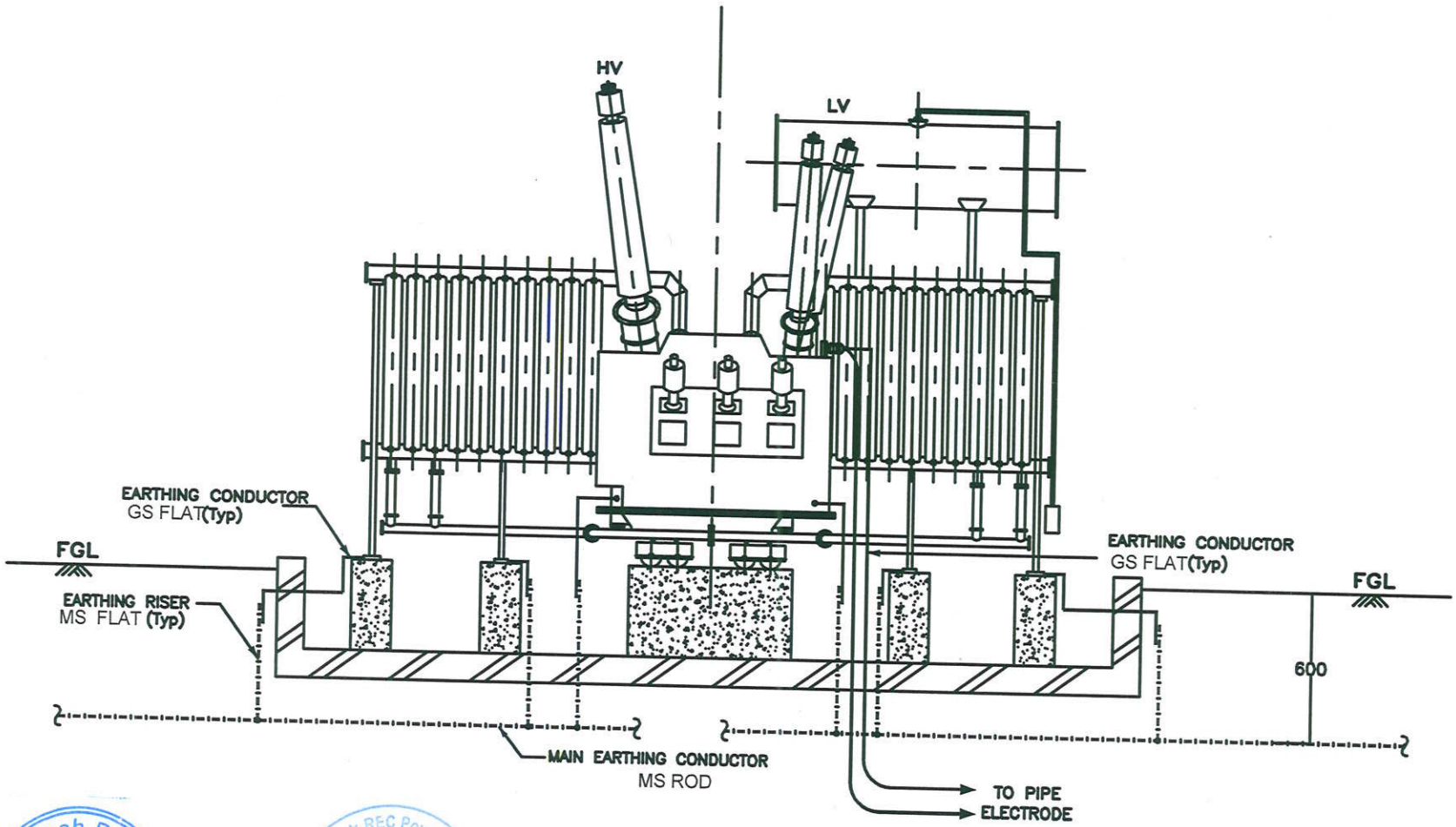
MAIN TANK	–	2 Nos.
RADIATOR TANK	–	4 Nos.
OLTC	–	2 Nos. (ICT only)
M. BOX	–	2 Nos./M. BOX
NEUTRAL EARTH ELECTRODE	–	2 Nos.

2. No. OF PIPE ELECTRODE REQUIRED = 2 Nos.
3. PYLON SUPPORTS SHALL BE EARTHED TO THE MAIN EARTHING CONDUCTOR BY GS FLAT.

Kailash Devbuild (India) Pvt. Ltd.

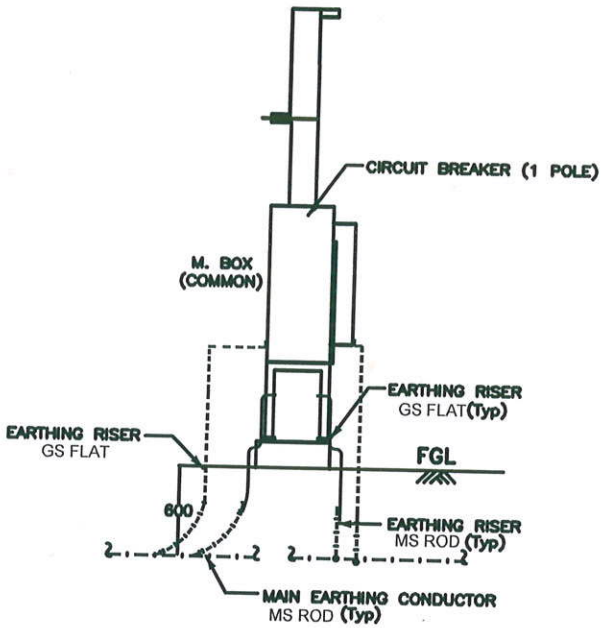
REC Power Development and Consultancy Ltd. Gurgaon-122001

EARTHING OF TRANSFORMER/ REACTOR



END VIEW

EARTHING OF CIRCUIT BREAKER



ELEVATION

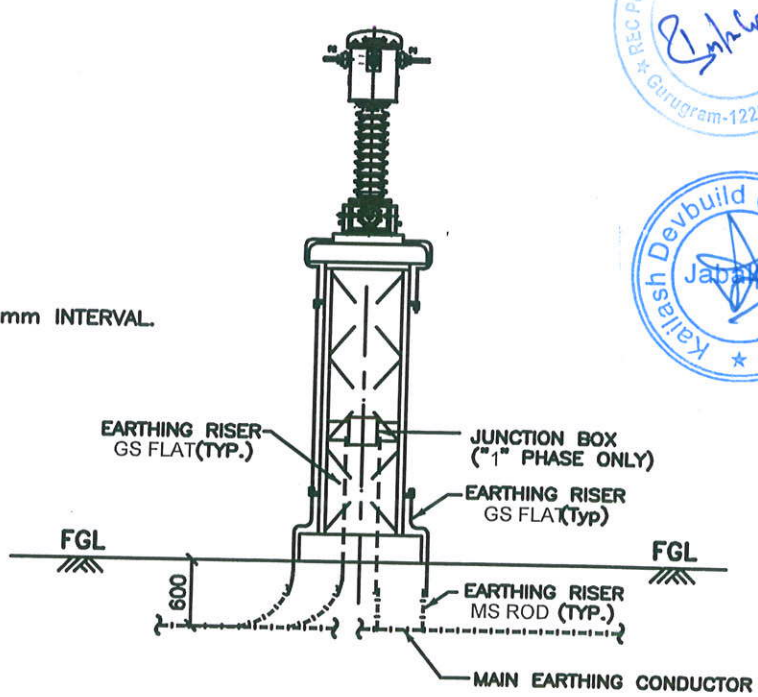
NOTES :-

1. No. OF RISERS FOR CIRCUIT BREAKER = 2 Nos. / PHASE
1. No. OF RISERS FOR LADDER (IF Applicable) = 2 Nos.
2. No. OF RISERS FOR MAR. BOX = 2 Nos.
3. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

EARTHING OF CURRENT TRANSFORMER (1 PH)

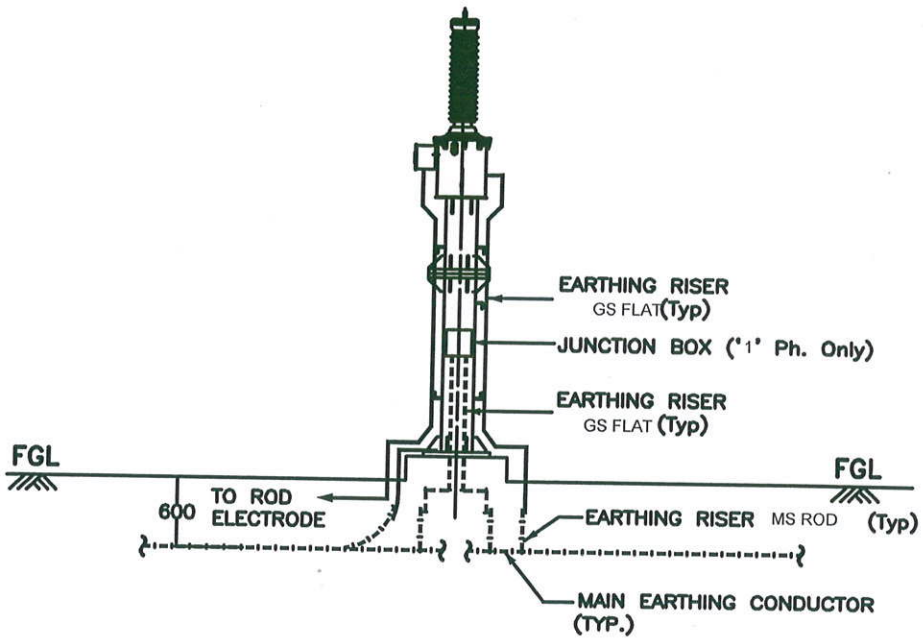
NOTES :-

1. No. OF RISERS = 2 Nos. / PHASE.
2. No. OF RISERS FOR JUN. BOX = 2 Nos.
3. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.



ELEVATION

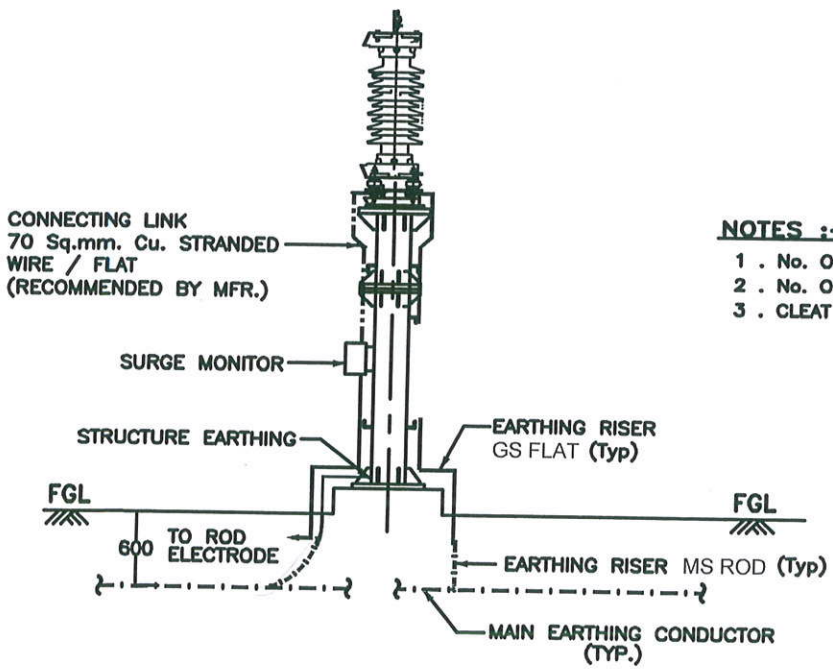
EARTHING OF CAPACITIVE VOLTAGE TRANSFORMER (1 PH)



NOTES :-

1. No. OF RISERS = 3 Nos. / PHASE.
2. No. OF RISERS FOR J. BOX = 2 Nos.
3. No. OF ROD ELECTRODE REQUIRED = 1 No. / PHASE.
4. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

EARTHING OF SURGE ARRESTER (1PH)

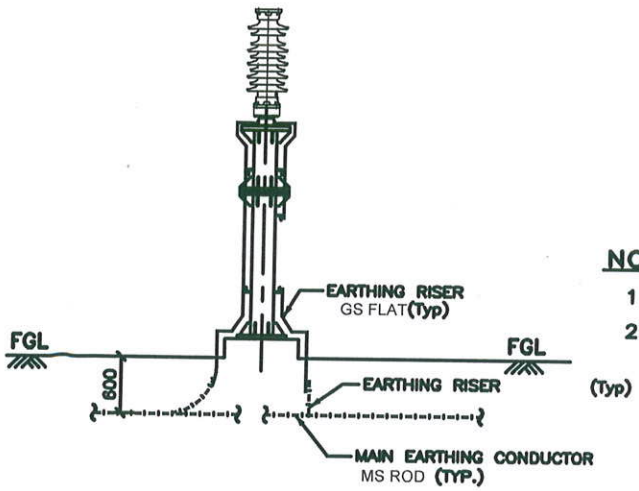


NOTES :-

1 . No. OF RISERS = 3 Nos. / PHASE.
2 . No. OF ROD ELECTRODE REQUIRED = 1 No. / PHASE.
3 . CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

ELEVATION

EARTHING OF POST INSULATOR (1PH)



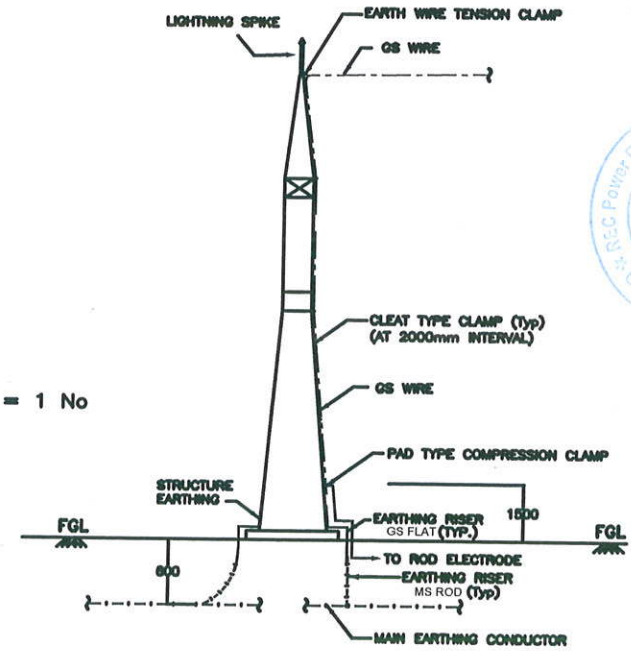
NOTES :-

1. No. OF RISERS = 2 Nos. / PHASE.
2. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

EARTHING OF TOWER WITH PEAK

NOTES :-

1. No. OF RISERS = 3 Nos.
2. No. OF ROD ELECTRODE REQUIRED = 1 No
3. No. OF PAD TYPE CLAMP = 1 No.

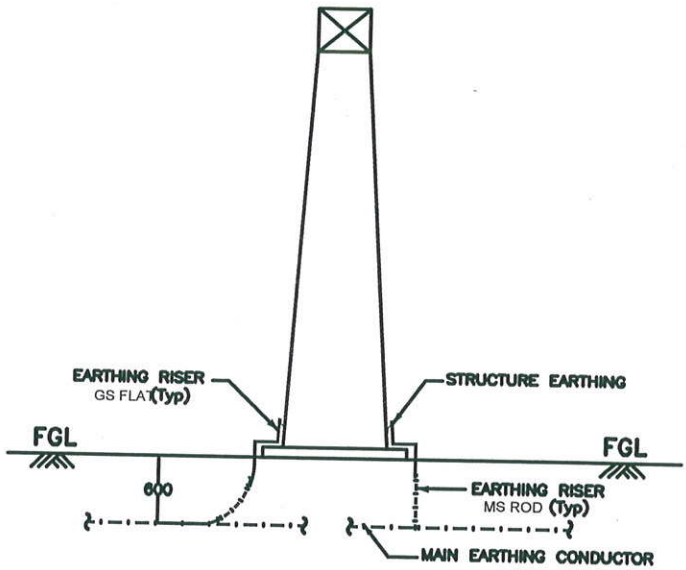


ELEVATION

EARTHING OF TOWER WITHOUT PEAK

NOTES :-

1. No. OF RISERS = 2 Nos.

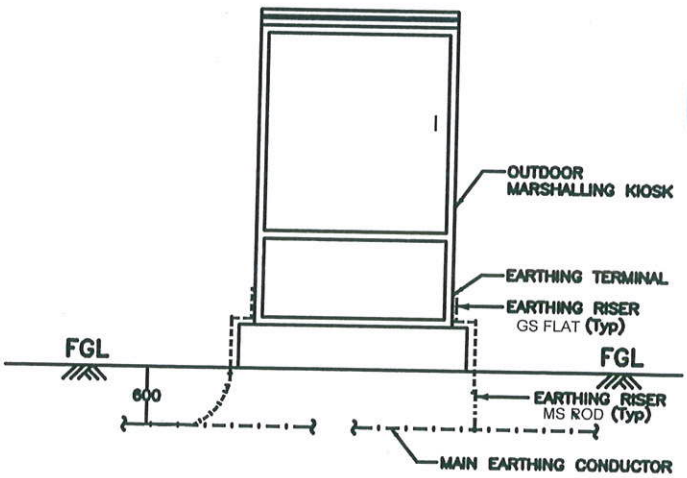


ELEVATION

EARTHING OF BAY MARSHALLING BOX

NOTES :-

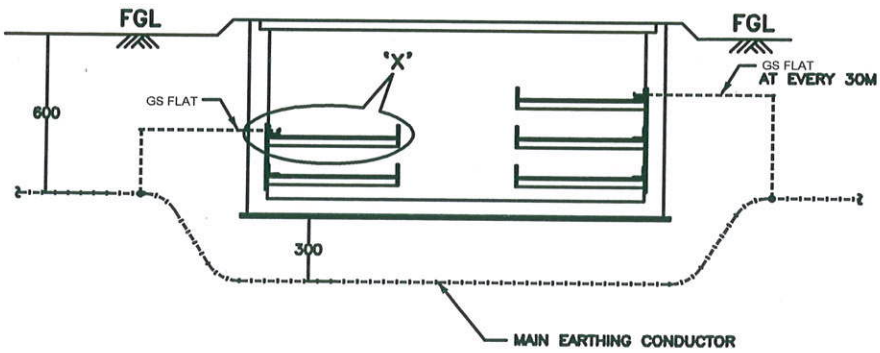
1. No. OF RISERS = 2 Nos.



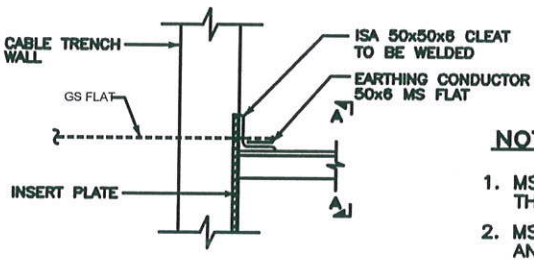
ELEVATION

REC Power Development And ... Gurugram-122001
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

EARTHING OF CABLE TRENCH



TYPICAL CROSS SECTION OF CABLE TRENCH

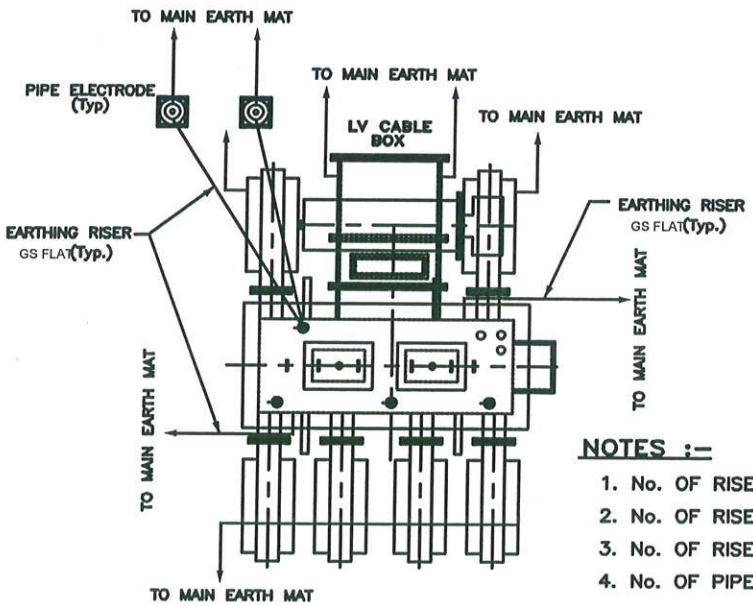


DETAIL – X

NOTES :-

1. MS FLAT SHALL RUN ON TOP TIER ALL ALONG THE CABLE TRENCHES & WELDED TO EACH OF THE RACKS
2. MS FLAT SHALL BE EARTHED AT 30M INTERVAL AND ALSO AT BOTH ENDS.

EARTHING OF LT TRANSFORMER



PLAN

NOTES :-

1. No. OF RISERS FOR MAIN TANK & T.M. MAR. BOX = 4 Nos.
2. No. OF RISERS FOR LV CABLE BOX & RADIATOR = 4 Nos.
3. No. OF RISERS FOR PIPE ELECTRODE = 2 Nos.
4. No. OF PIPE ELECTRODES REQUIRED = 2 Nos.

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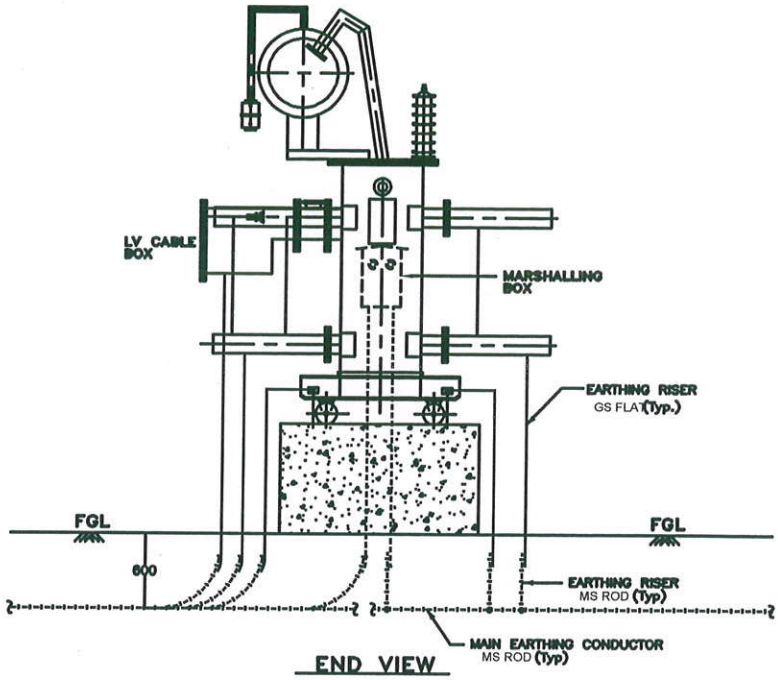
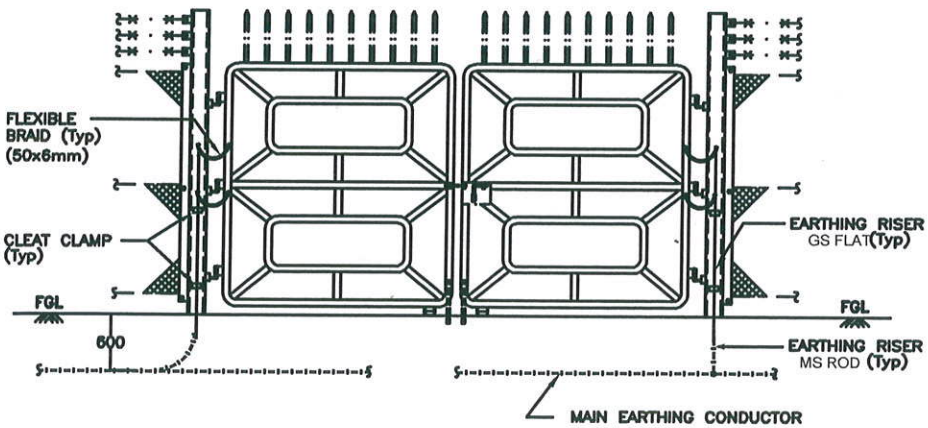
EARTHING OF LT TRANSFORMER

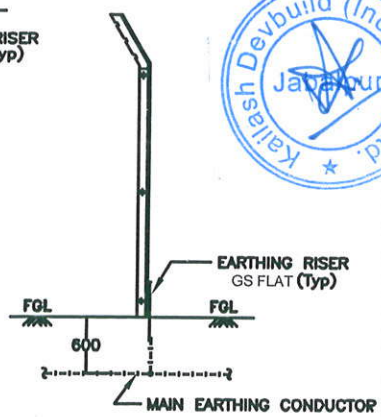


END VIEW

EARTHING OF GATES



MAIN GATE



FENCE POST
(ALTERNATE FENCE POST)

NOTES :-

	FENCE POST	MAIN GATE
1 . No. OF RISERS REQUIRED	1	2
2 . No. OF FLEXIBLE BRAID	–	4

3. ALL GATES & EVERY ALTERNATE FENCE SHALL BE CONNECTED TO EARTHING GRID.

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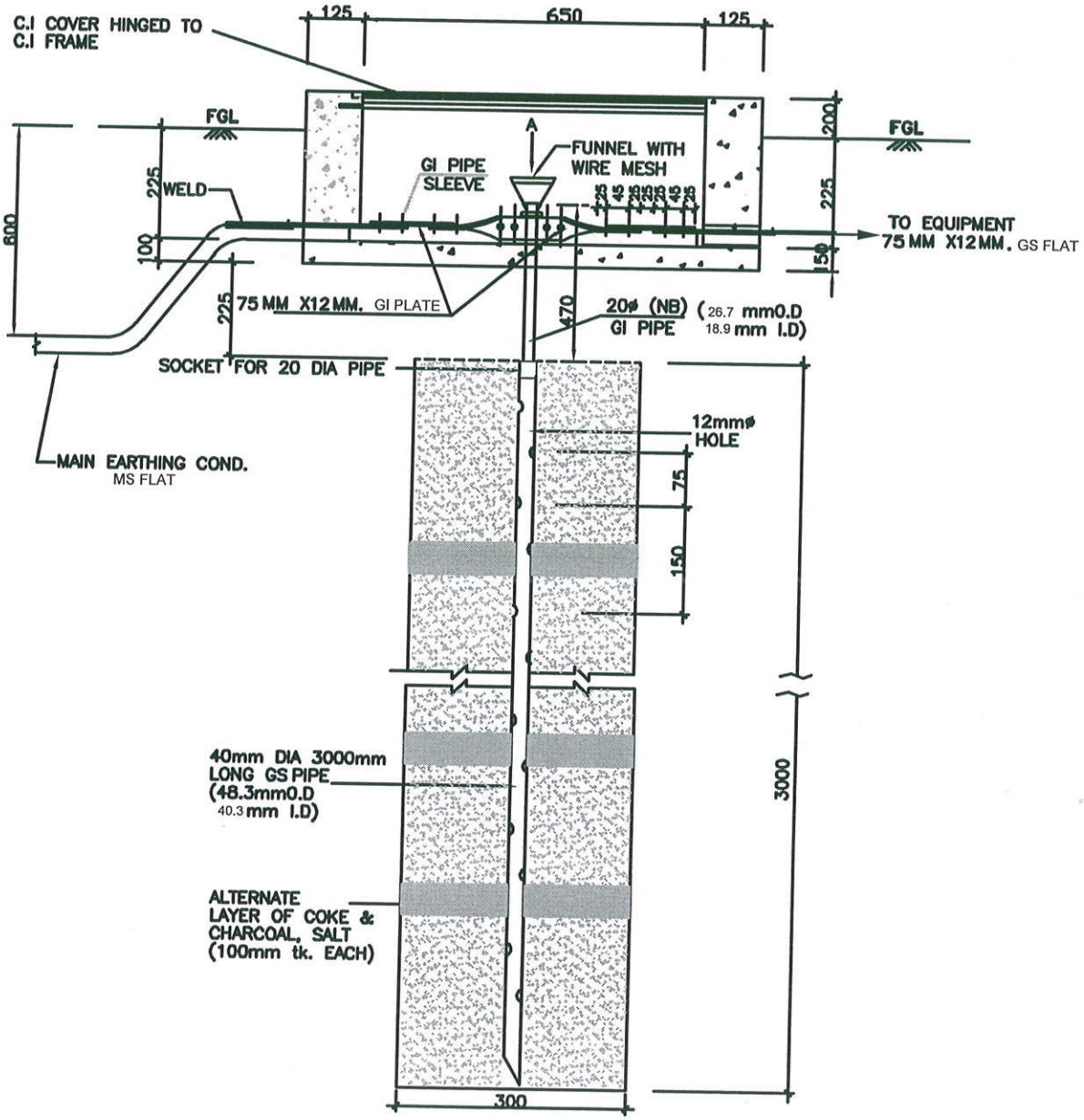
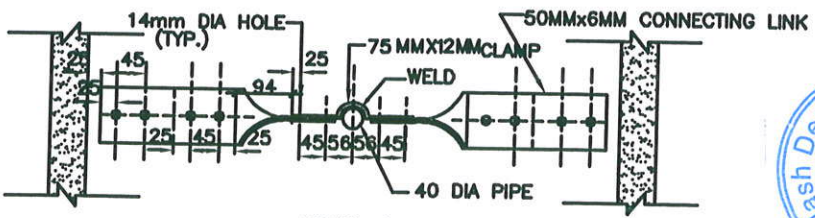
PIPE ELECTRODE

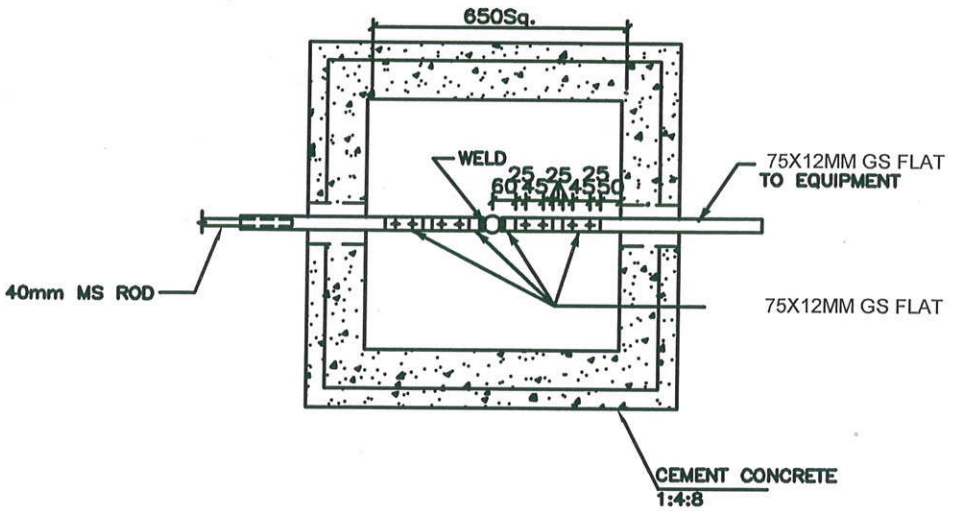




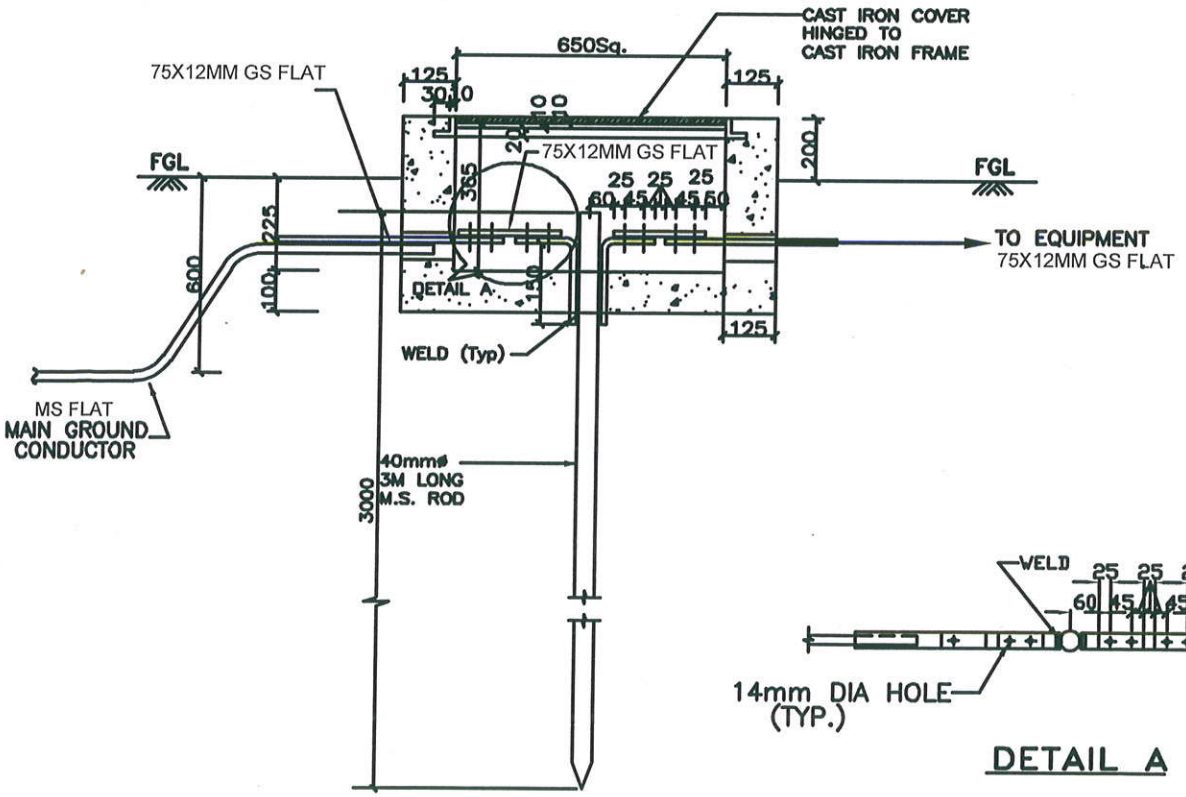
VIEW–A

Kailash Devbuild (India) Pvt. Ltd. Jabalpur
REC Power Development And Consultancy Ltd. Gurugram-122001

ROD ELECTRODE



PLAN

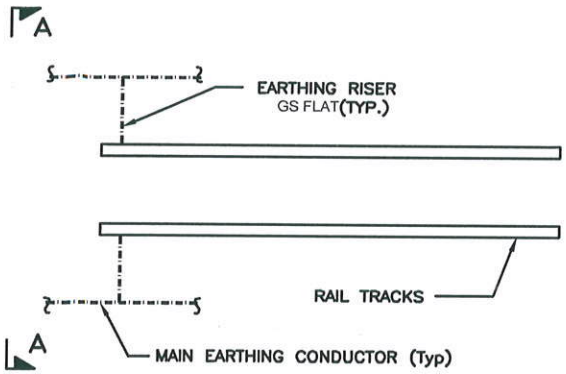


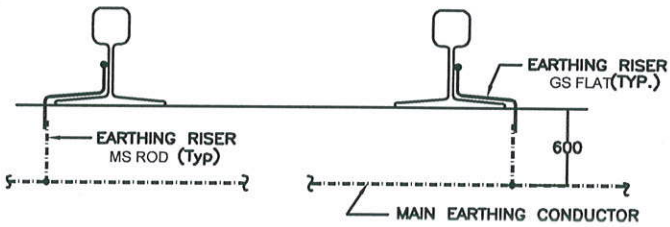
ELEVATION

DETAIL A

Kailash Devbuild (India) Pvt. Ltd.
Jabalpur
REC Power Development And Consultancy Ltd.
Gurugram-122001

EARTHING OF RAIL TRACK





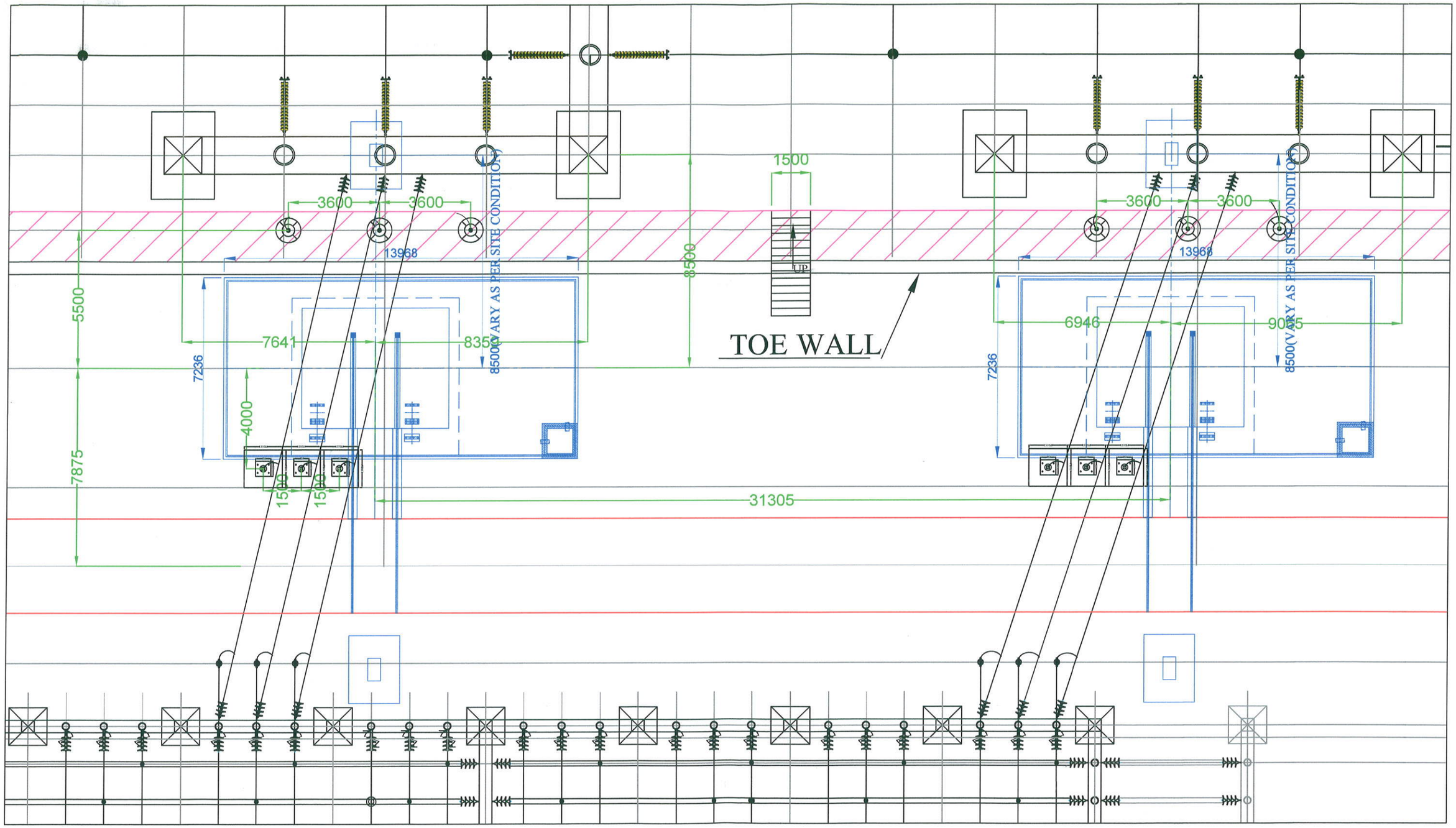
SECTION A – A

NOTES :–

1. EACH RAIL SHALL BE EARTHED AT 30M INTERVAL AND ALSO AT BOTH ENDS.

REC Power Development And Consultancy Ltd. Gurugram-122001

Kailash Devbuild (India) Pvt. Ltd. Jabalpur



KEY PLAN FOR 50MVA TRANSFORMER

REC Power Development And Consultancy Ltd. Gurugram-122001

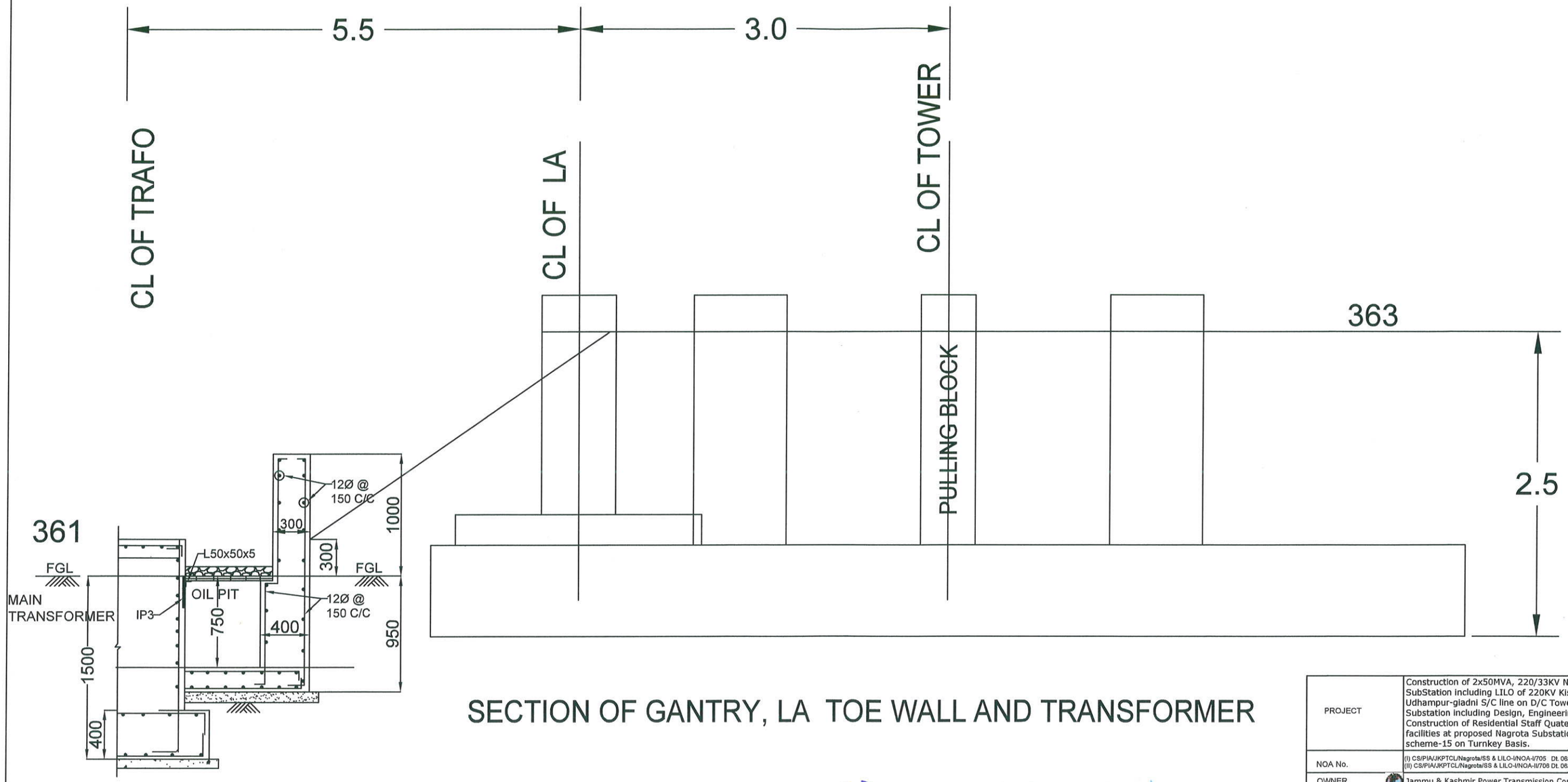
CN-16870 25/5/22

Category: B
Approved/ issued/ for Fabrication/Construction/Manufacturing.
फैब्रीकेशन /निर्माण /विनिर्माण हेतु अनुमोदित/जारी।
Approved/ issued/ for Fabrication/ Construction/Manufacturing subject to condition that statements and comments are included.
उपरोक्त टिप्पणी/निर्माण हेतु अनुमोदित/जारी। बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (दिनांक)
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V Not approved
अस्वीकृत की।

NOTES:-
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 11.8 T/SQM AT 1.5MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS &LILO-I/NOA-I/705 Dt. 04.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/704 Dt. 04.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited (RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathila, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	50 MVA TRF. FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D177	REV- 3	
SCALE	As shown in Drawing	SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM	SHEET 1 OF 6	
	NAME DATE SIGN		
PREPARED BY	RAVI 06.05.2022		
CHECKED BY	G.H 06.05.2022		
SUBMITTED BY	ANURAG 06.05.2022	Signature	
☐ Approved ☐ Approved with comments ☐ Not Approved			
☐ More Information	Date.....		

KDBIL (India) Pvt. Ltd. Jabalpur



SECTION OF GANTRY, LA TOE WALL AND TRANSFORMER

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	50 MVA TRF. FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/77		REV- 3
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 2 OF 6
	NAME	DATE	SIGN
PREPARED BY	RAVI	06.05.2022	Ravi
CHECKED BY	G.H	06.05.2022	
SUBMITTED BY	ANURAG	06.05.2022	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

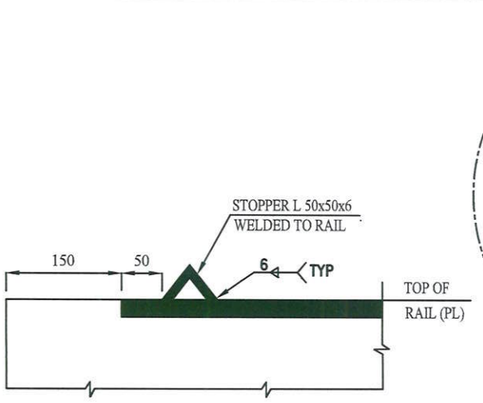
☐ More Information Date.....

REC Power Development And Consultancy Ltd. Gurugram-122001

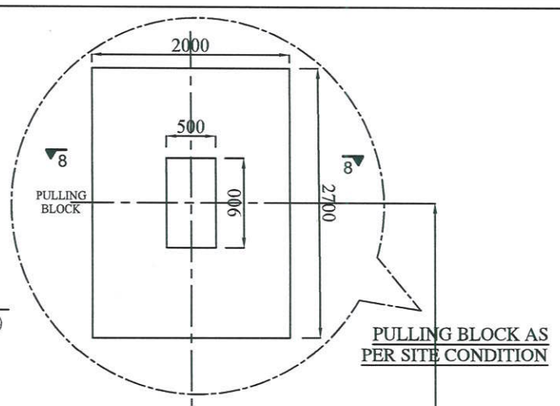
Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण/हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी/ बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved
अनुमोदित नहीं

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

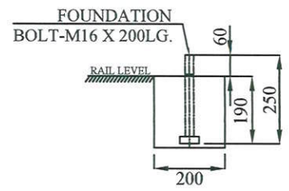
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

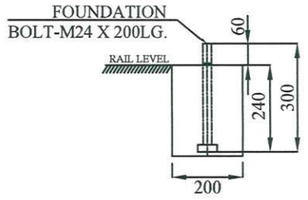


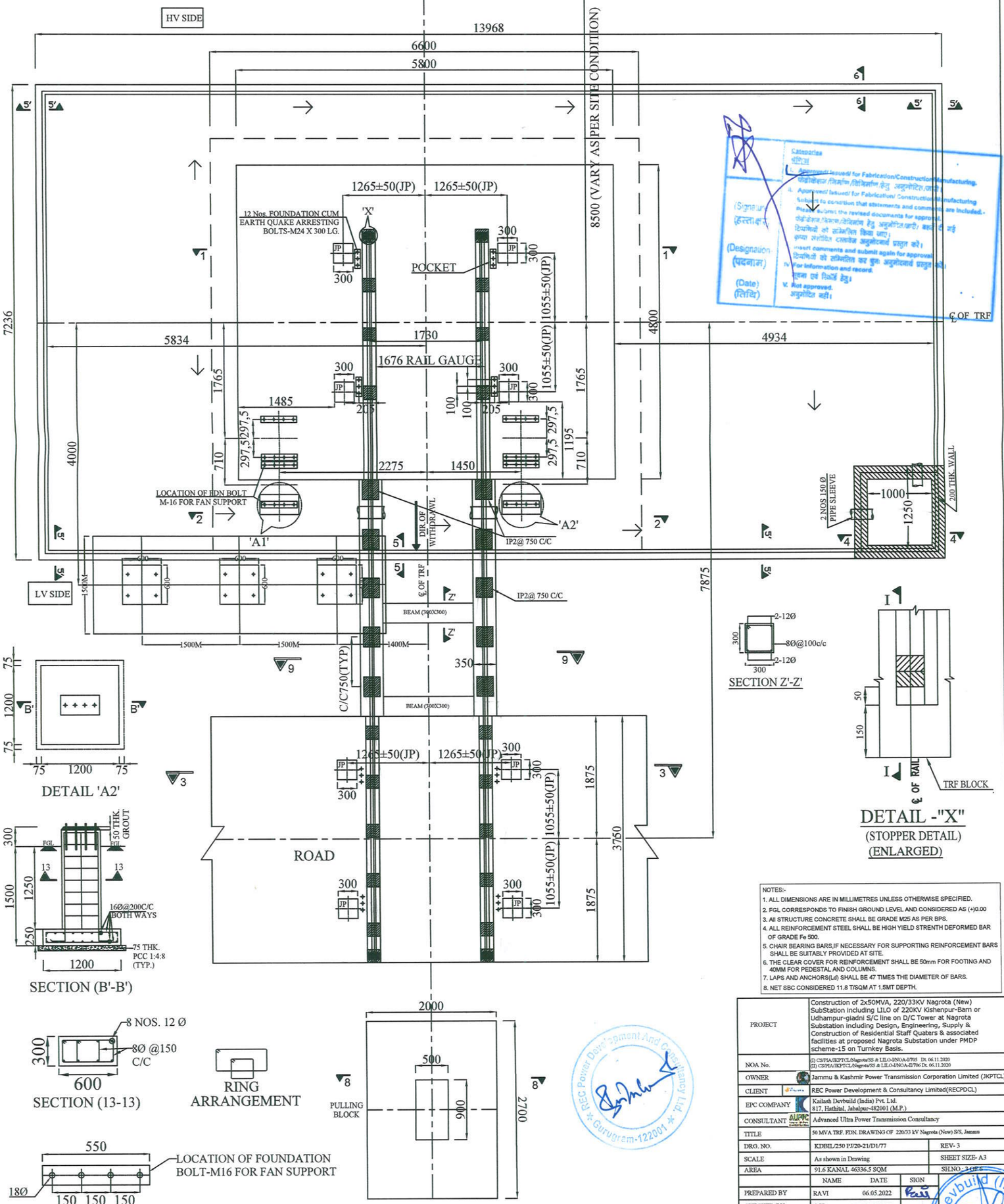
VIEW I-I



PULLING BLOCK AS
PER SITE CONDITION







Categories
श्रेणियां
i. Approved/ Issued for Fabrication/Construction/Manufacturing.
निर्माण/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
ii. Approved/ Issued for Fabrication/ Construction/ Manufacturing subject to condition that statements and comments are included. Please submit the revised documents for approval.
निर्माण/निर्माण/विनिर्माण हेतु अनुमोदित/जारी। बशर्ते कि नई टिप्पणियों को सम्मेलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
iii. Insert comments and submit again for approval
टिप्पणियों को सम्मेलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
iv. For information and record.
सूचना एवं रिकॉर्ड हेतु।
v. Not approved.
अनुमोदित नहीं।
(Signature)
(हस्ताक्षर)
(Designation)
(पदनाम)
(Date)
(तिथि)

NOTES:-
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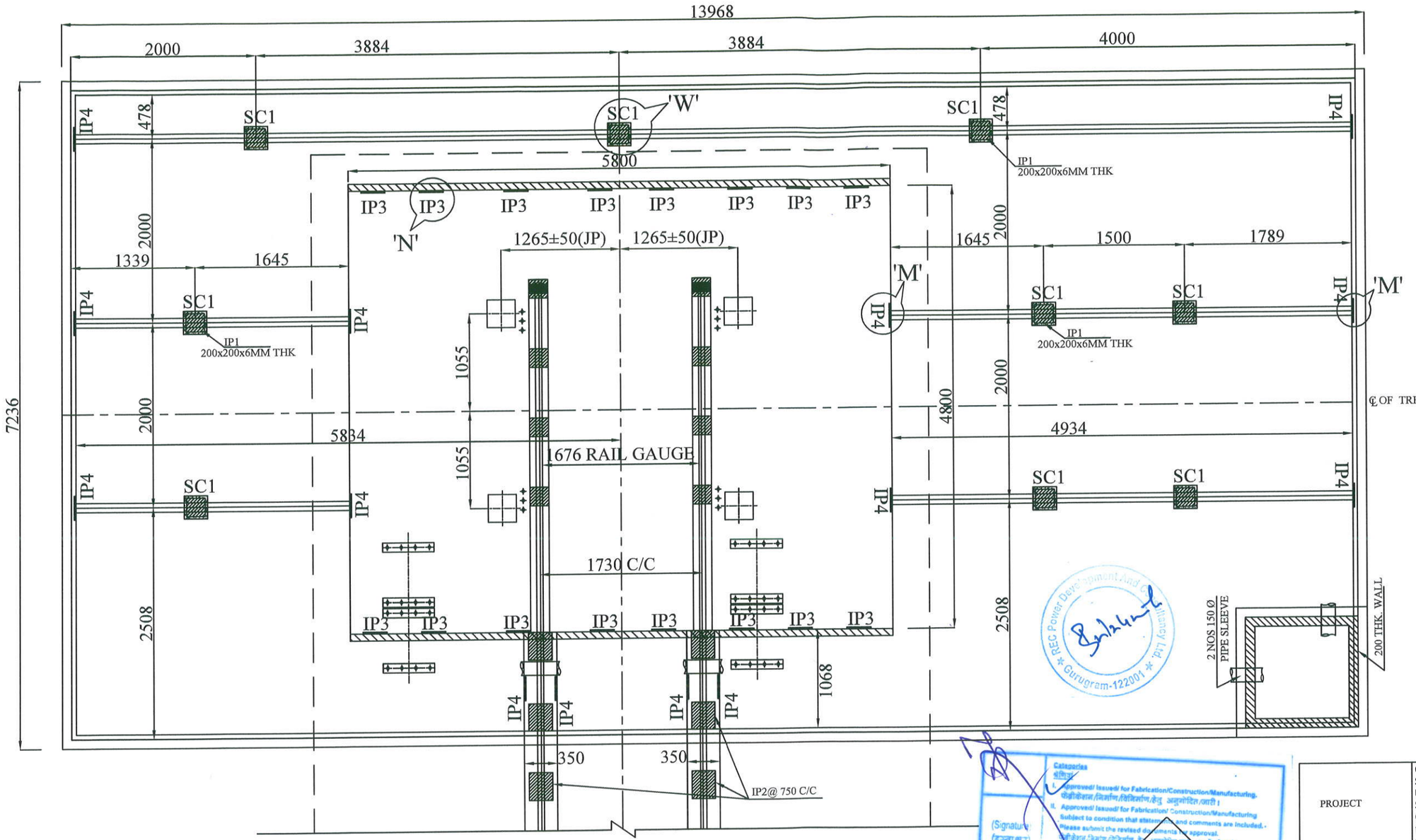
NOA No.	(I) CSP/IA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CSP/IA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	50 MVA TRF. FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/77 — REV- 3
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SHNO.- 2 OF 6

	NAME	DATE	SIGN
PREPARED BY	RAVI	06.05.2022	
CHECKED BY	G.H	06.05.2022	
SUBMITTED BY	ANURAG	06.05.2022	

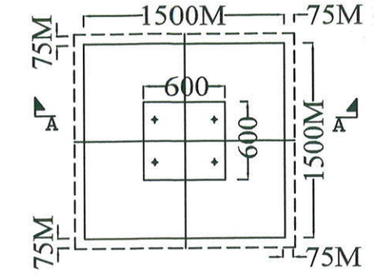
☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....

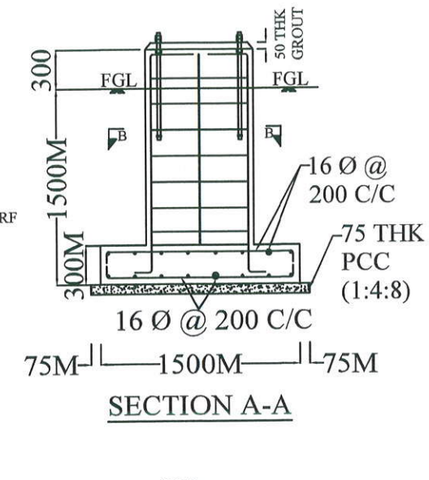
REC Power Development And Consultancy Ltd. Gurugram-122001

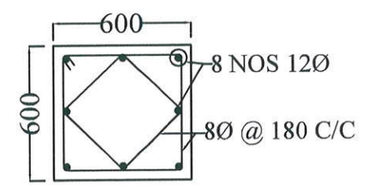
Kailash Devbuild (India) Pvt. Ltd. Jabalpur
Signature/Stamp

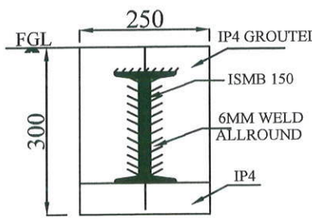


GRATING PLAN FOR 50MVA TRANSFORMER

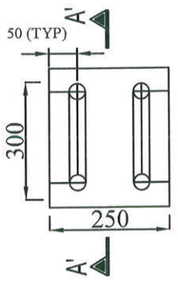


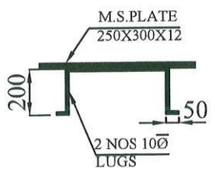




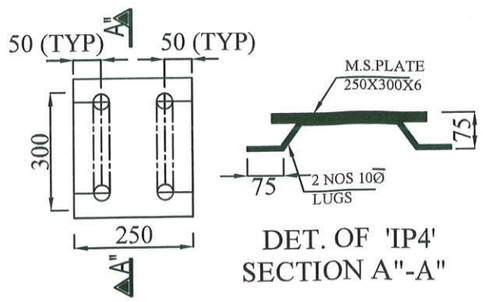


DETAIL 'M'
TYP. DETAILS
OF FIXING IP4





DET. OF 'IP2'
SECTION A'-A'



DET. OF 'IP4'
SECTION A"-A"

8 Ø @ 180mm FOR
SECTION B-B
RING ARRANGEMENT

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 11.8 T/SQM AT 1.5MT DEPTH.

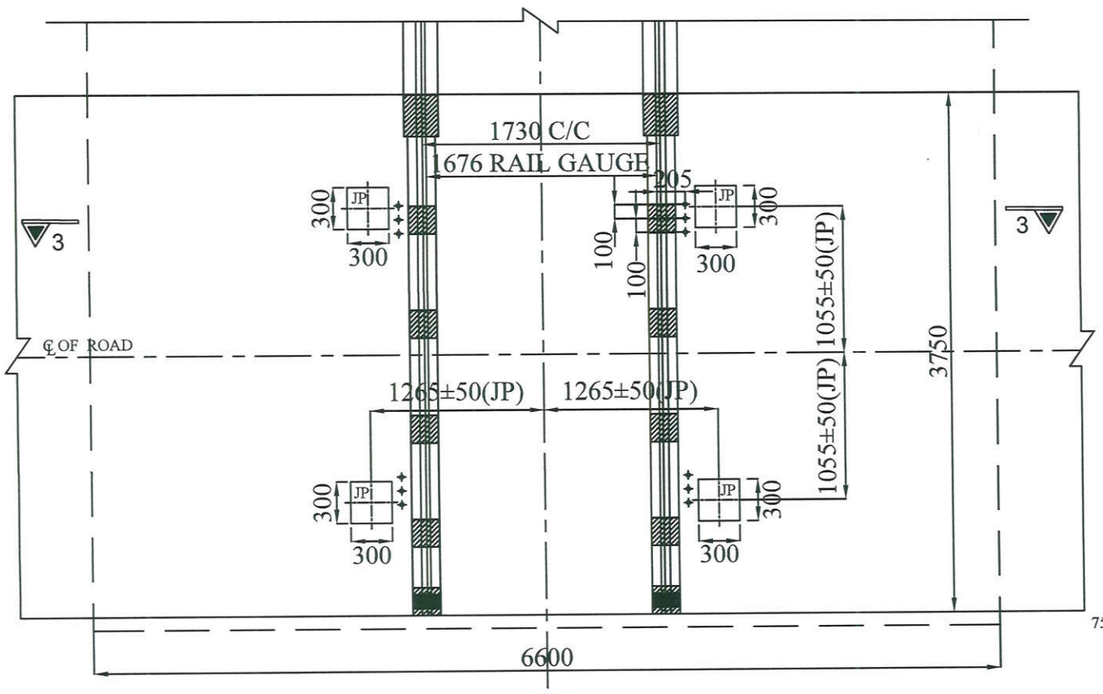
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	50 MVA TRF. FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/77	REV- 3	
SCALE	As shown in Drawing	SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 4 OF 6	

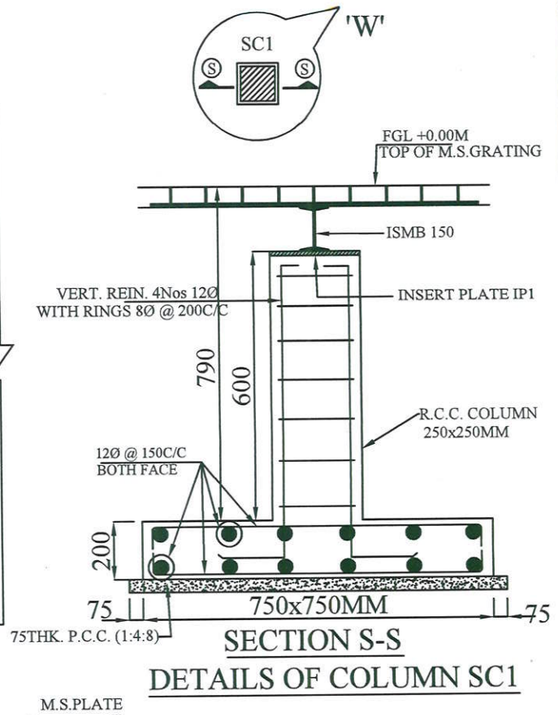
	NAME	DATE	SIGN
PREPARED BY	RAVI	06.05.2022	
CHECKED BY	G.H	06.05.2022	
SUBMITTED BY	ANURAG	06.05.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

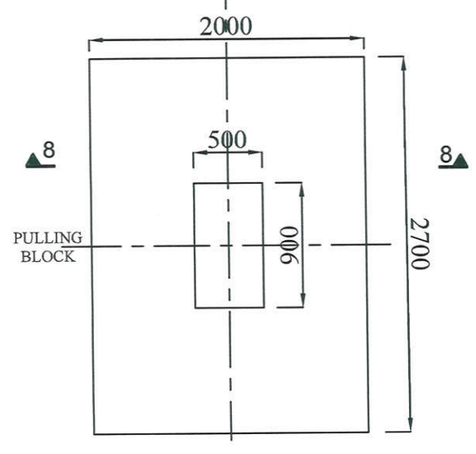
Signature/Stamp....





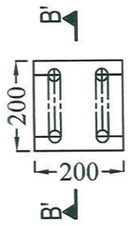
SECTION S-S

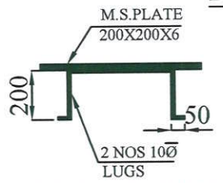
DETAILS OF COLUMN SC1



RAIL-CUM-ROAD & UNLOADING PLATFORM

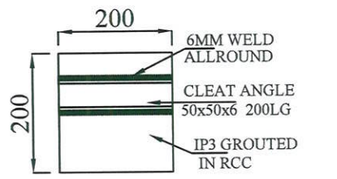
PLAN FOR 50MVA TRANSFORMER





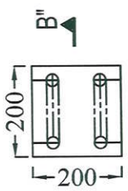
DET. OF 'IP1'

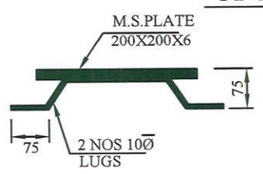
SECTION B'-B'



DETAIL 'N' TYP. DETAILS

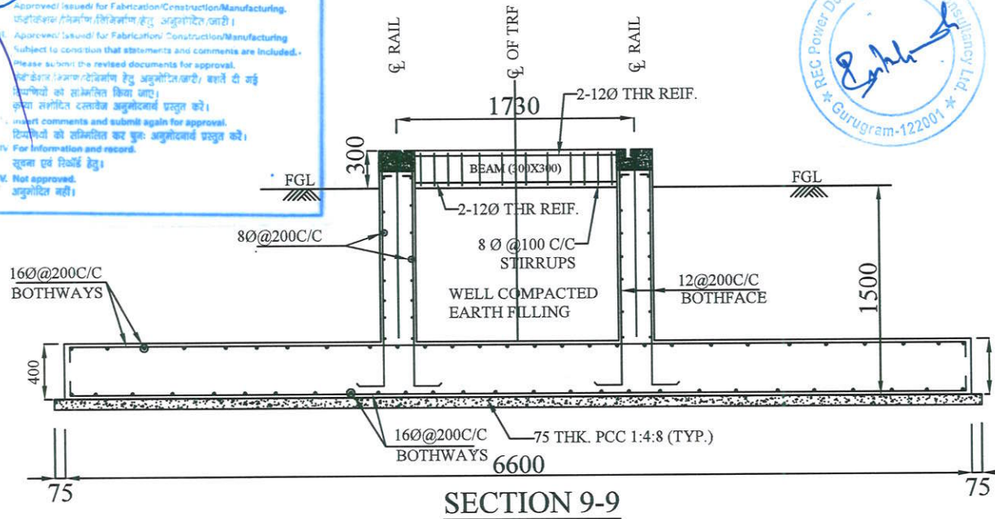
OF FIXING IP3



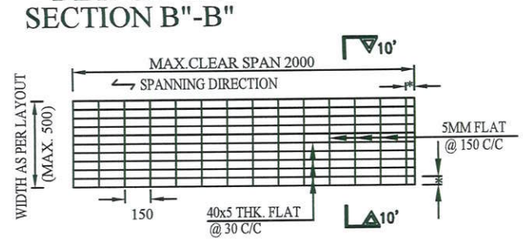


DET. OF 'IP3'

SECTION B"-B"

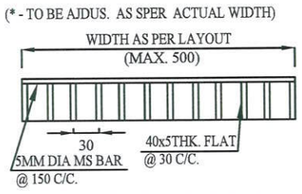


SECTION 9-9

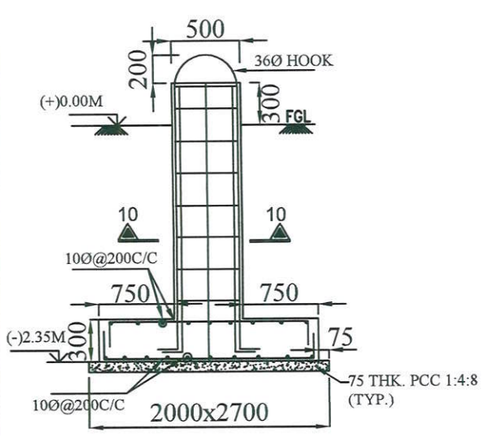


PLAN

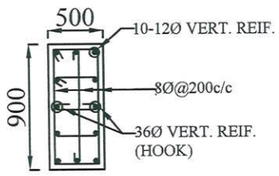
TYPICAL DETAILS OF GRATING PANEL



SECTION 10'-10'



SECTION 8-8



SECTION 10-10

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
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4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 11.8 T/SQM AT 1.5MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	50 MVA TRF. FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/77		REV- 3
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 5 OF 6
	NAME	DATE	SIGN
PREPARED BY	RAVI	06.05.2022	
CHECKED BY	G.H	06.05.2022	
SUBMITTED BY	ANURAG	06.05.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

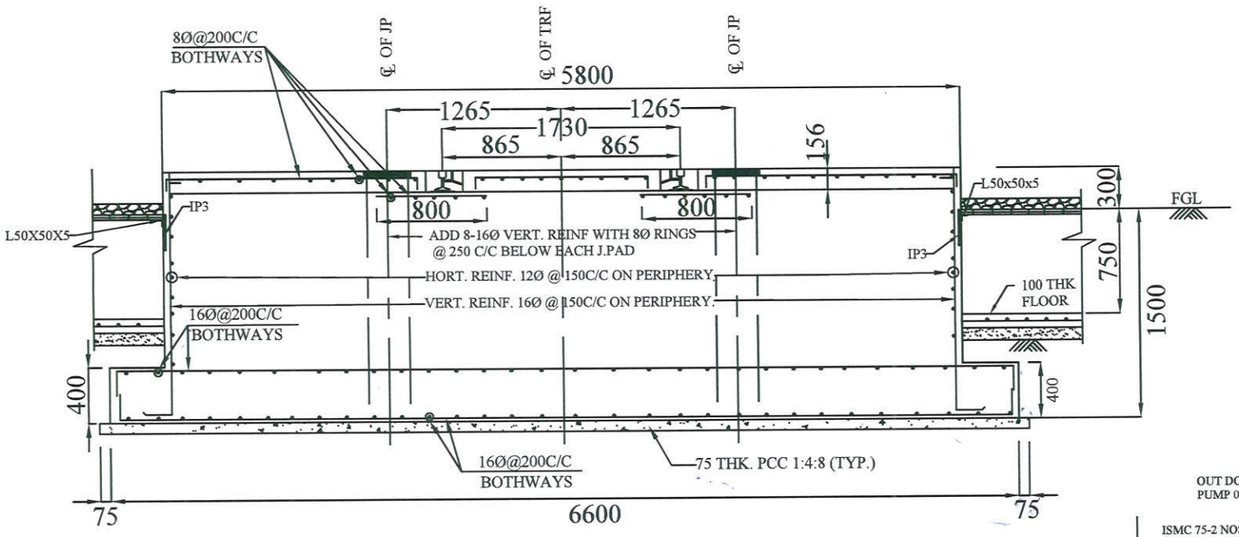
Signature/Stamp

Kailash Devbuild (India) Pvt. Ltd.

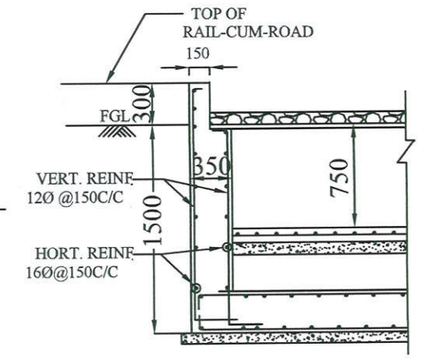
Catholics
SE
(Signature)
(हस्ताक्षर)
(Designation)
(पदनाम)
(Date)
(तिथि)

I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
एतद्वारा निर्माण/तैयारीकरण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing subject to condition that statements and comments are included.
Please submit the revised documents for approval.
दिये शर्तों/कथन/टीकाओं हेतु अनुमोदित/जारी/ करते दी गई टिप्पणियों को शामिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

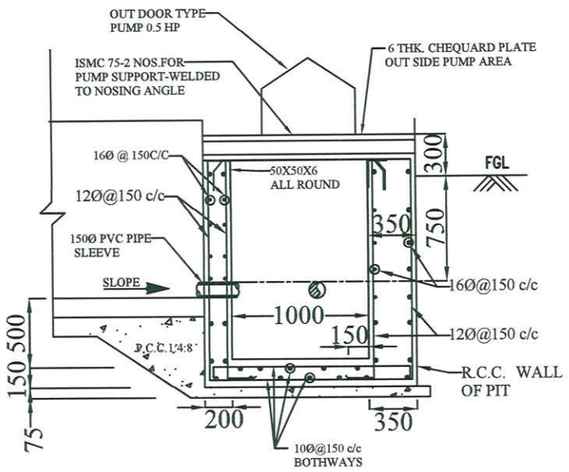
REC Power Development And Consultancy Ltd. * Gurugram-122001 *



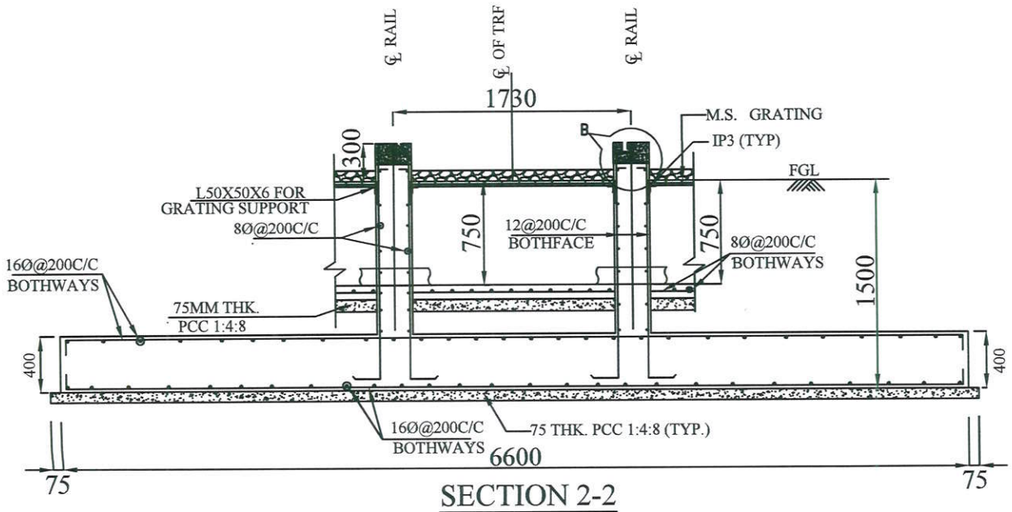
SECTION 1-1



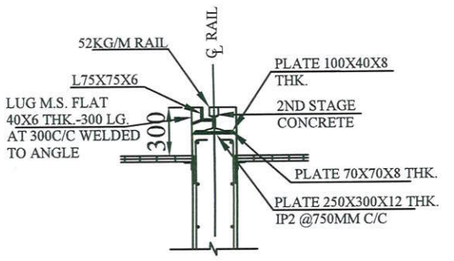
SECTION 5-5



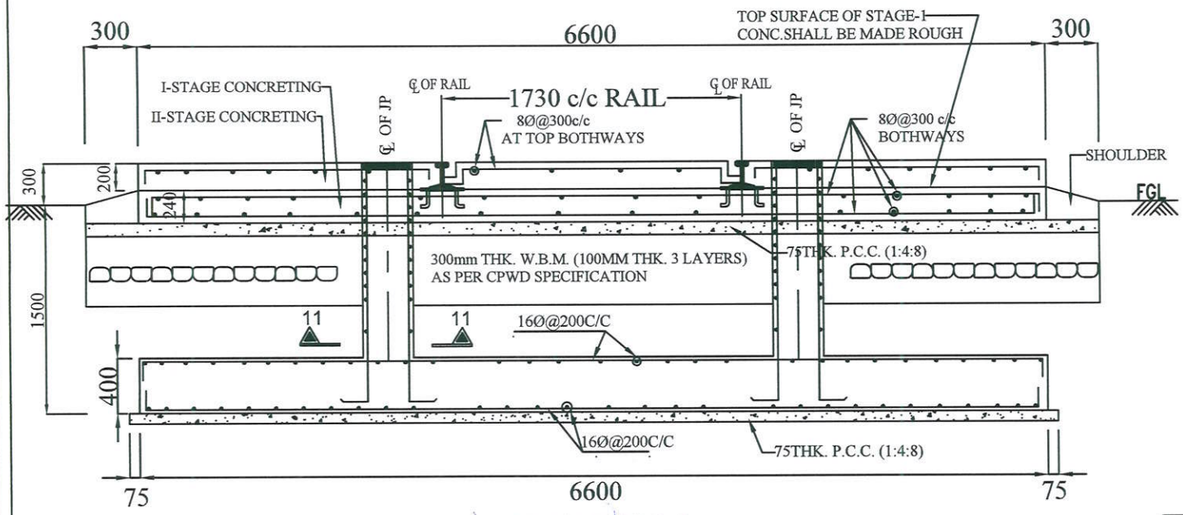
SECTION 4-4



SECTION 2-2



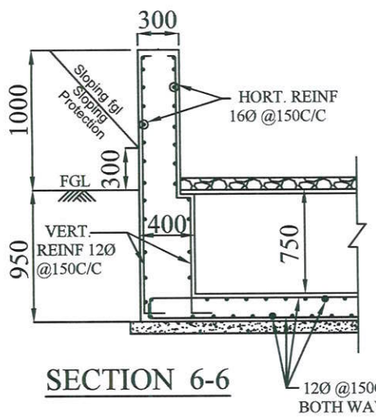
DETAIL -B



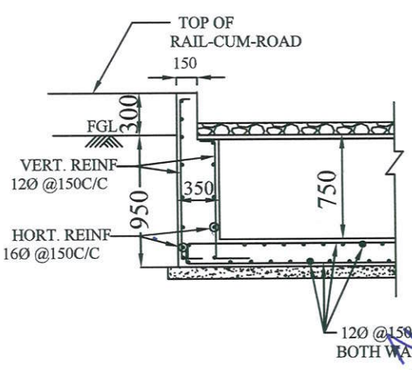
SECTION 3-3

NOTES:-

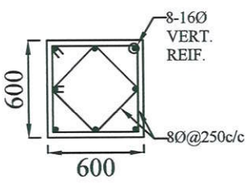
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 11.8 T/SQM AT 1.5MT DEPTH.



SECTION 6-6



SECTION 5'-5'



SECTION 11-11

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	50 MVA TRF. FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/77		REV- 3
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 6 OF 6
	NAME	DATE	SIGN
PREPARED BY	RAVI	06.05.2022	
CHECKED BY	G.H	06.05.2022	
SUBMITTED BY	ANURAG	06.05.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....

Signature/Stamp

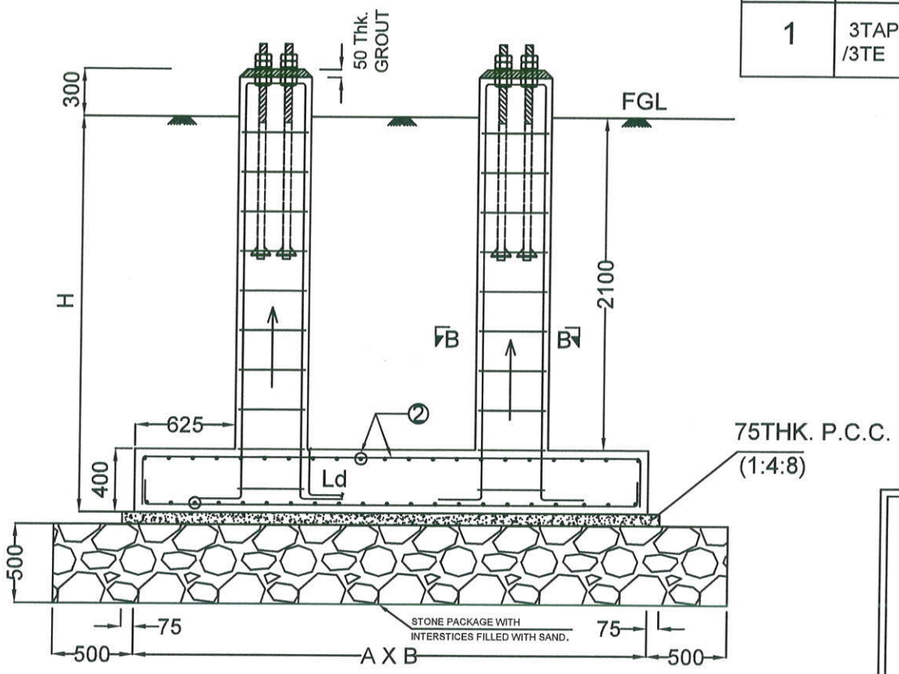
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

REC Power Development & Consultancy Ltd. Gurugram-122001

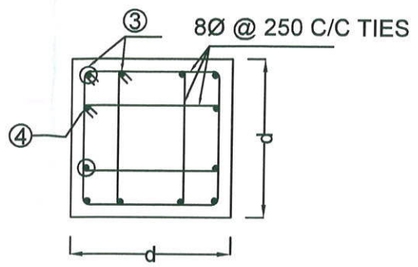
Classification: Approved/ Issued/ for Fabrication/Construction/Manufacturing. Approved/ Issued/ for Fabrication/ Construction subject to condition that statements and comments are included. Please re-limit the revised documents for approval. Insert comments and submit again for approval. For Information and record. Not approved.

(Signature) (हस्ताक्षर) (Designation) (पदनाम) (Date) (तिथि)

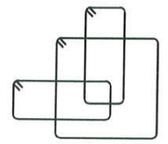
S.NO.	TOWER	H	A	B	X	Z	'dxd'	(1)	(2)	(3)	(4)
1	3TAP/3TD /3TE	2500	3200	3200	1500	1500	450x450	12Ø @ 150 C/C	12Ø @ 150 C/C	8-20Ø	4-16Ø



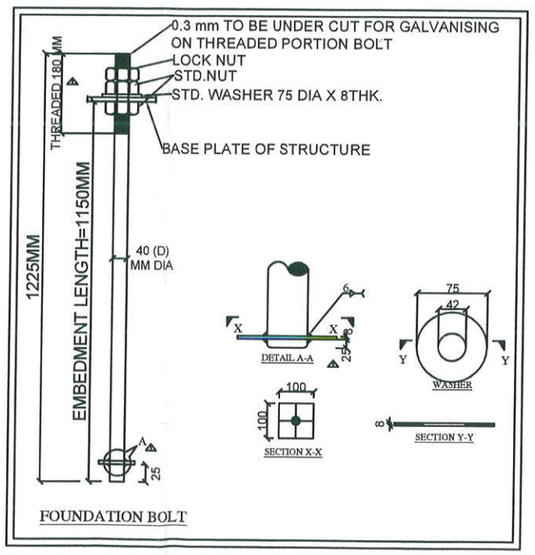
SECTION A-A

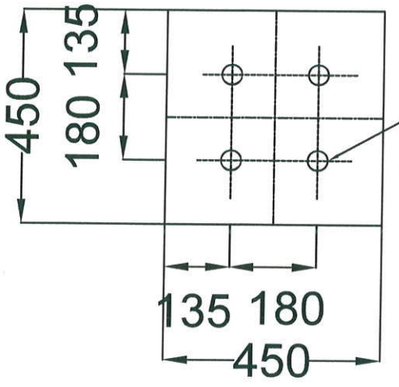


SECTION B-B

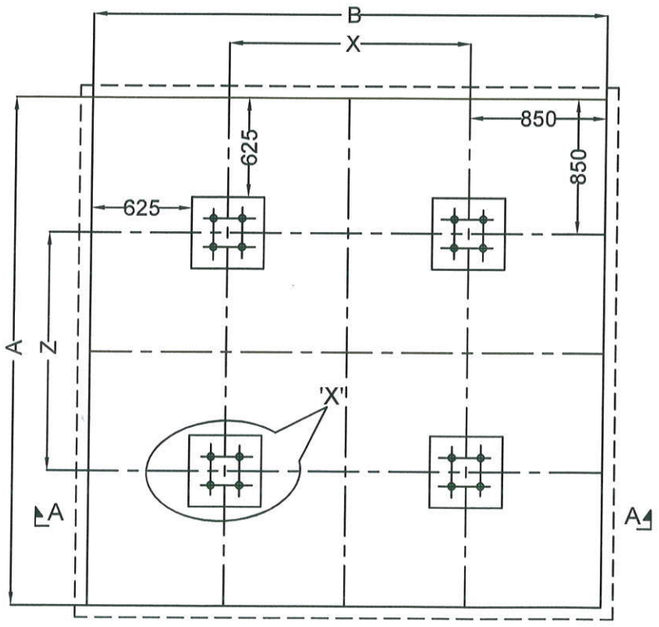


STIRRUPS 8Ø @ 250 C/C





DETAILS-'X'



FOUNDATION PLAN

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE SHALL BE AS PER BPS.
3. ALL LEAN CONCRETE SHALL BE 75mm Thk. AND OF GRADE (1:4:8) (1 CEMENT: 4 COURSE SAND: 8 GRADED STONE AGGREGATE OF 40mm NOMINAL SIZE).
4. ALL REINFORCEMENT STEEL BARS (DENOTED AS Ø) SHALL CONFORM TO IS:1786-1985 OF GRADE Fe500 OR TMT BARS OF EQUAL GRADE.
5. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN LAYOUT.
6. IF FOUNDATION BOLTS FOUL WITH STIRRUPS, STIRRUPS SHALL BE ADJUSTED AT SITE.
7. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
8. NET BEARING CAPACITY IS CONSIDERED AS 50KN/Sq.m AT 2.5m DEPTH.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. LAP LENGTH SHALL BE 50 TIMES DIA OF BAR.
11. FOUNDATION BOLT DETAILS AS PER APPROVED STRUCTURE DRAWING.
12. PROVIDED REINFORCEMENT IS SIMILAR IN BOTH DIRECTION OF FOOTING.
13. DETAILING SHALL BE DONE AS PER SP:34

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FOUNDATION DRAWING OF 33KV TOWER(3TAP/3TD/3TE), Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/83 — REV- 0
SCALE	As shown in Drawing
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	DEEPAK	05.04.2022	Deepak
CHECKED BY	G.H	05.04.2022	
SUBMITTED BY	KDBIL	05.04.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Kailash Devbuild (India) Pvt. Ltd. Jabalpur Signature/Stamp...

REC Power Development And Consultancy Ltd. Gurugram-122001

CW-16371 dt 25/05/2022

Catagory श्रेणि

I. Approved/ Issued/ for Fabrication/Construction/Manufacturing. पोषीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/ जारी।

II. Approved/ Issued/ for Fabrication/Construction/Manufacturing Subject to condition that statements and comments are included. - Please submit the revised documents for approval. पोषीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/ जारी, बशर्ते ये गई टिप्पणियों को सम्मिलित किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।

III. Insert comments and submit again for approval. टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।

IV. For information and record. सूचना एवं रिकॉर्ड हेतु।

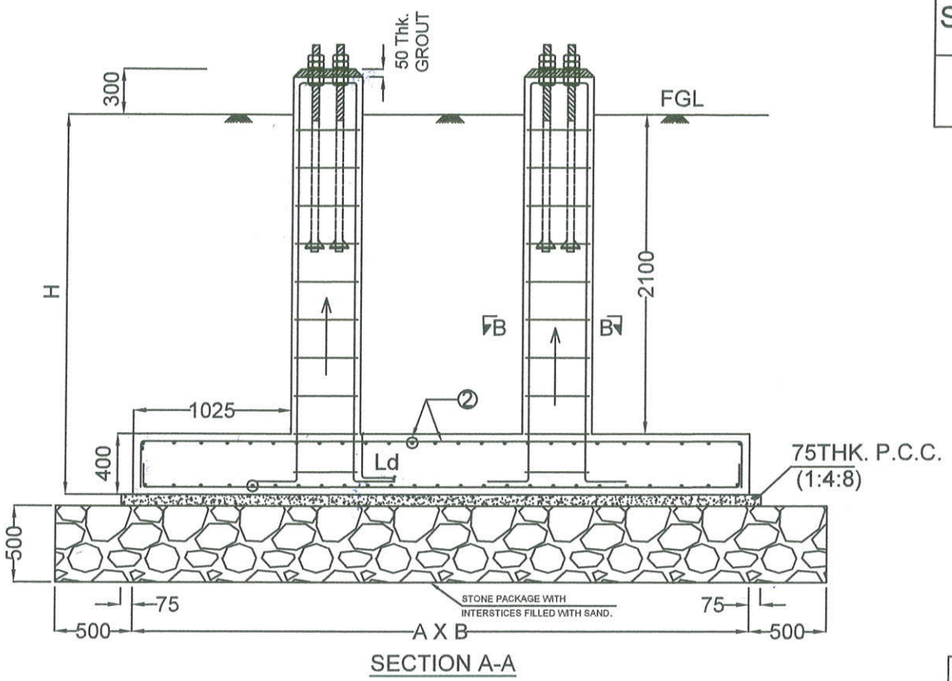
V. Not approved. अनुमोदित नहीं।

(Signature) (हस्ताक्षर)

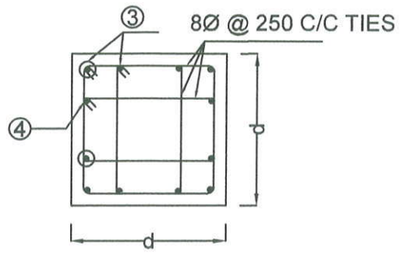
(Designation) (पदनाम)

(Date) (तिथि)

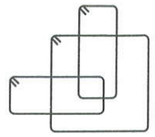
S.NO.	TOWER	H	A	B	X	Z	'dxd'	(1)	(2)	(3)	(4)
1	3TGP	2500	4000	4000	1500	1500	450x450	12Ø @ 150 C/C	12Ø @ 150 C/C	8-25Ø	4-16Ø



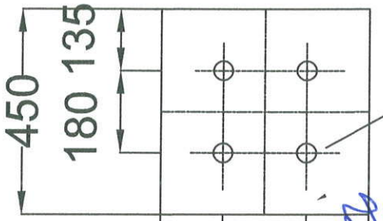
SECTION A-A



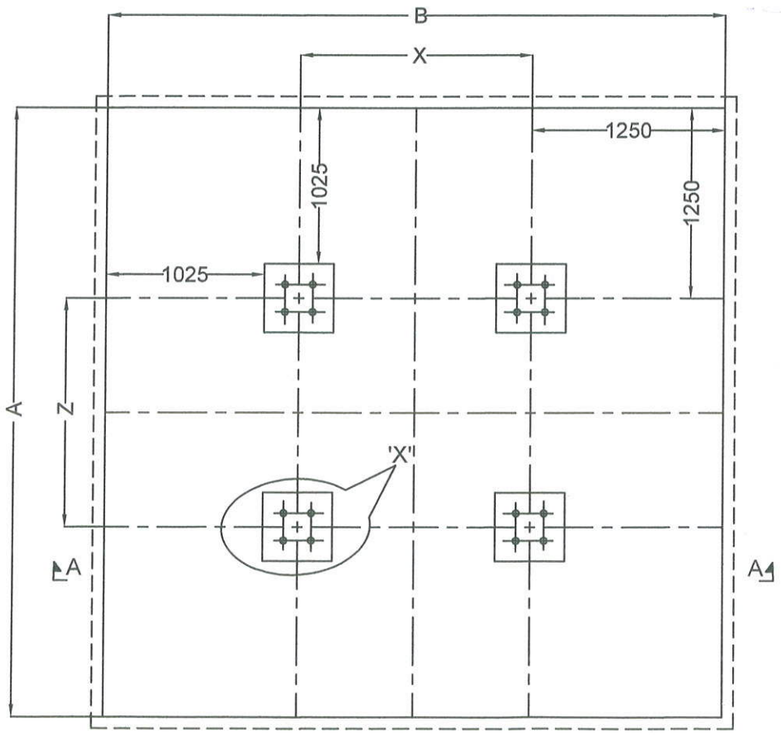
SECTION B-B



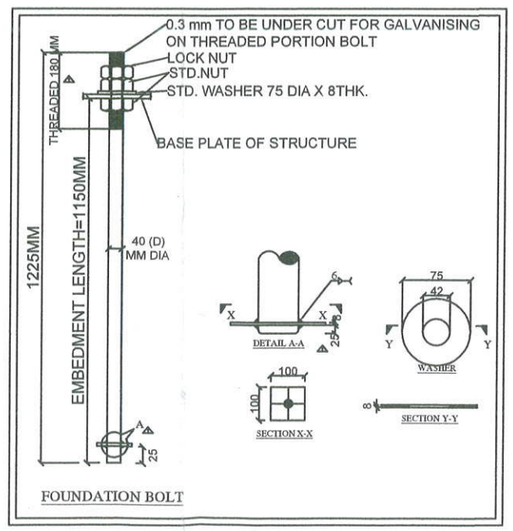
STIRRUPS 8Ø @ 250 C/C



DETAILS-'X'



FOUNDATION PLAN



NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE SHALL BE AS PER BPS.
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8. NET BEARING CAPACITY IS CONSIDERED AS 50KN/Sq.m AT 2.5m DEPTH.
9. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
10. LAP LENGTH SHALL BE 50 TIMES DIA OF BAR.
11. FOUNDATION BOLT DETAILS AS PER APPROVED STRUCTURE DRAWING.
12. PROVIDED REINFORCEMENT IS SIMILAR IN BOTH DIRECTION OF FOOTING.
13. DETAILING SHALL BE DONE AS PER SP:34

REC Power Development And Consultancy Ltd. Gurugram-122001

Cr-15570 dt 5/7/22

05.05.22

Categories/श्रेणियाँ:
i. Approved/ Issued/ for Fabrication/Construction/Manufacturing. फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
ii. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included. Please submit the revised documents for approval. फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी। शर्तों के साथ टिप्पणियों को सम्मिलित किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
iii. Insert comments and submit again for approval. टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
iv. For Information and record. सूचना एवं रिकॉर्ड हेतु।
v. Not approved. अनुमोदित नहीं।

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FOUNDATION DRAWING OF 33KV TOWER(3TGP) , Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/86
SCALE	As shown in Drawing
REV-	0
AREA	91.6 KANAL 46336.5 SQM

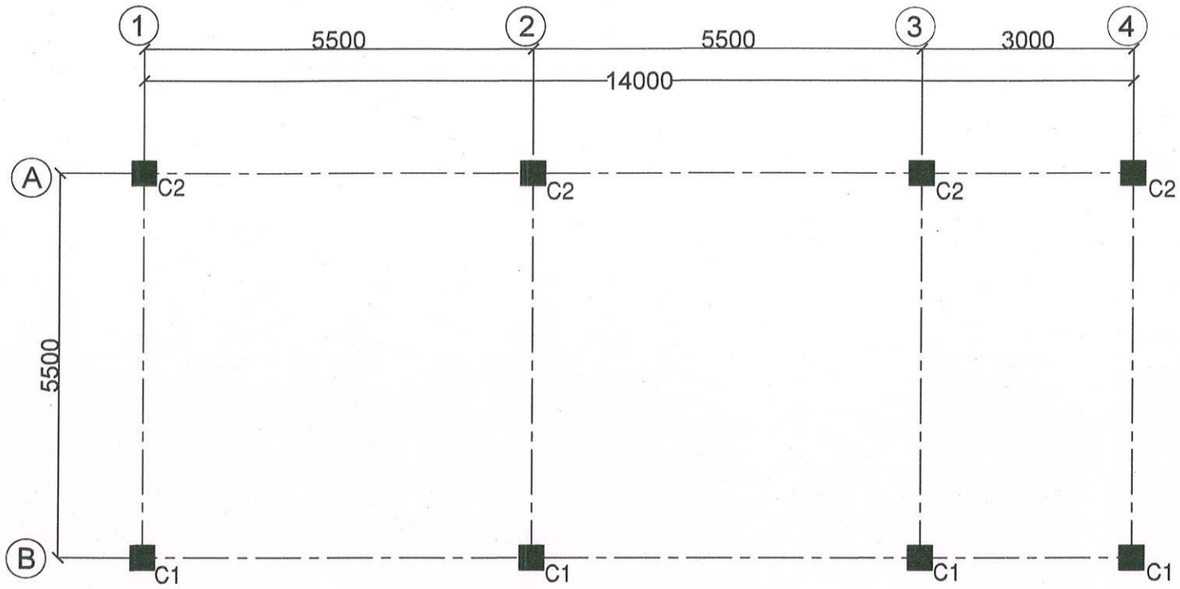
	NAME	DATE	SIGN
PREPARED BY	DEEPAK	23.04.2022	Deepak
CHECKED BY	G.H	23.04.2022	
SUBMITTED BY	KDBIL	23.04.2022	

Signature/Stamp...

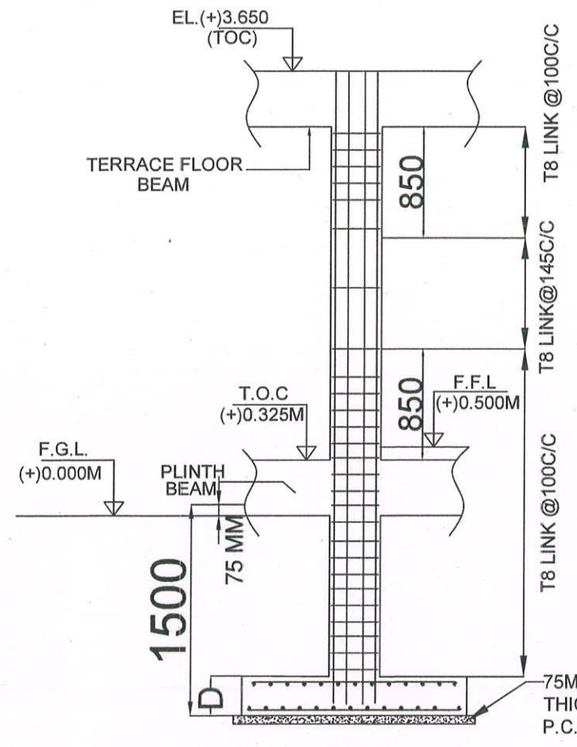
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

☐ Approved ☐ Approved with comments ☐ Not Approved

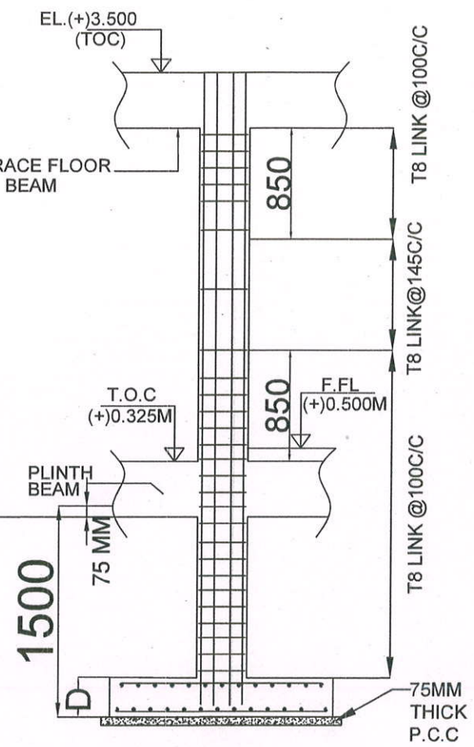
☐ More Information Date.....



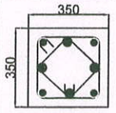
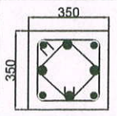
TYPICAL COLUMN LAYOUT PLAN

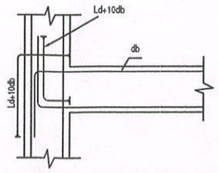


TYPICAL COLUMN DETAIL - C1



TYPICAL COLUMN DETAIL - C2

S.NO.	COL. MKD.	QTY. COL. (NOS.)	COLUMN SIZE (mm)	MAIN REINFORCEMENT
				FOUNDATION TO TERRACE LEVEL
1	C1	4	350X350	 ●16Ø-8NOS.
2	C2	4	350X350	 ●16Ø-8NOS.



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM
& COLUMN JUNCTION

TIES SCHEDULE		
ZONE		TIE GROUP
ZONE-A	OUTER	8Ø-100C/C
	INNER	8Ø-145C/C

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	COLUMN RCC DETAIL DRAWING OF CAR PARKING SHED OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/87		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 3 OF 5
	NAME	DATE	SIGN
PREPARED BY	B.K.	28.04.2022	
CHECKED BY	G.H	28.04.2022	
SUBMITTED BY	ANURAG	28.04.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Signature/Stamp

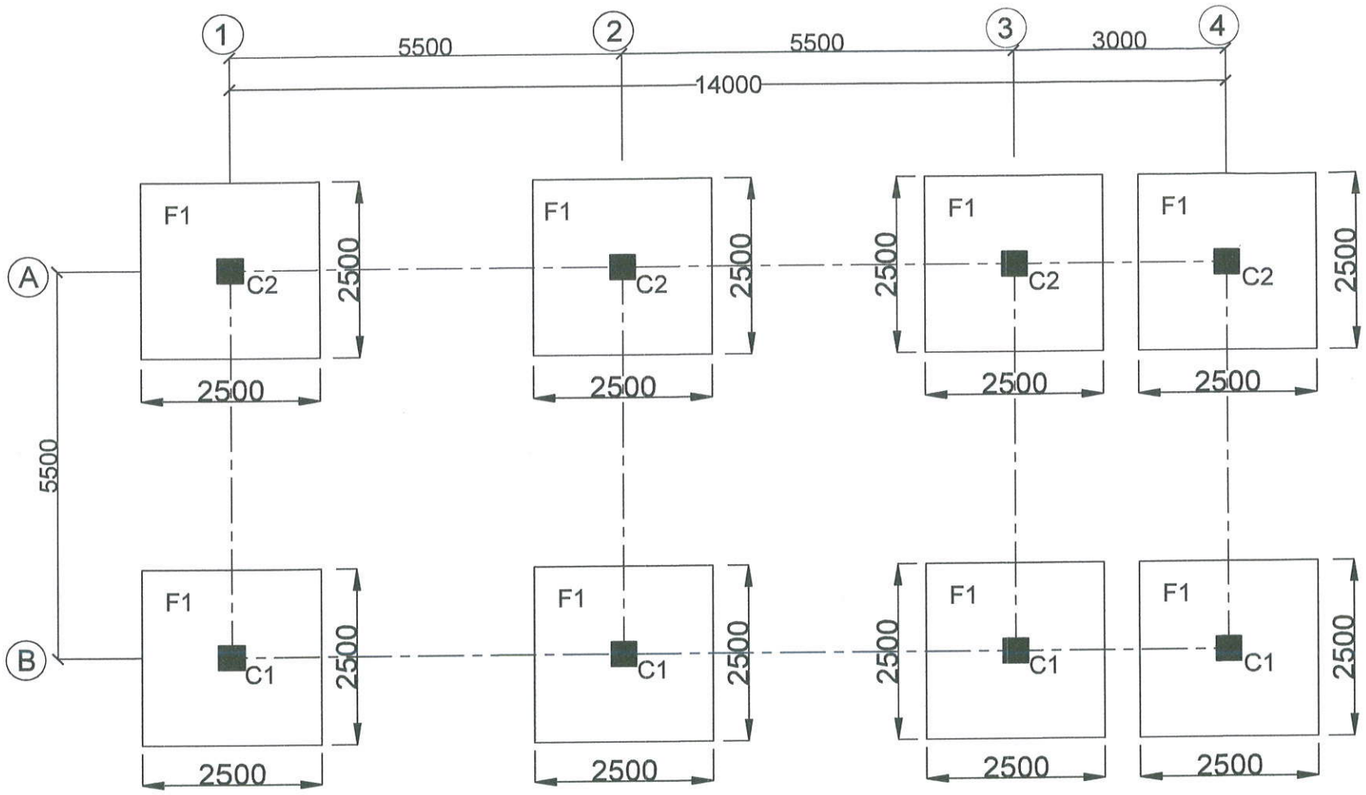
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

Categories
श्रेणियां
I. Approved/ Issued for Fabrication/ Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी। बशर्ते दी गई
टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
दी गयीं को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।

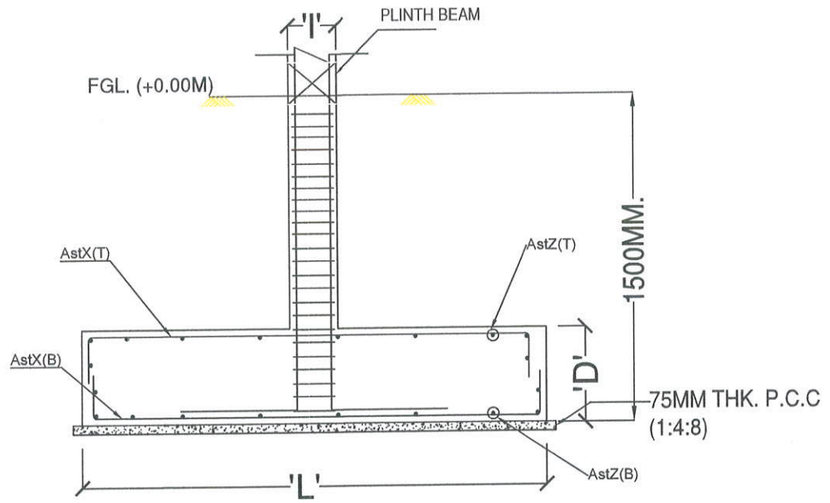
(Signature)
(हस्ताक्षर)
(Designation)

REC Power Development And Consultancy Ltd. Gurugram-122001

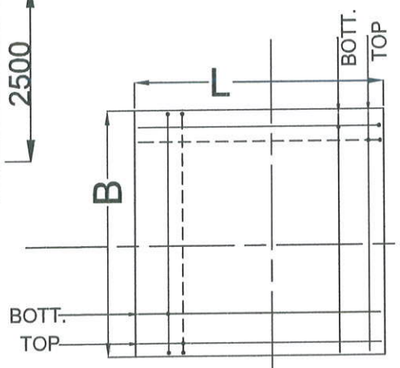
CW-16877
dt 2/6/2022



TYPICAL FOOTING LAYOUT PLAN



TYPICAL FOUNDATION DETAIL



FOOTING REINFORCEMENT KEY PLAN

MARK	SIZE (IN MTR)
F1	2.500 X 2.500 X 0.300

ISOLATED FOOTING SCHEDULE

Foundation Mark	Column/Pedestal		Foundation			Cover (m)	Reinforcement			
							TOP		BOTTOM	
	l (m)	b (m)	L (m)	B (m)	D (m)		AstX(T)	AstZ(T)	AstX(B)	AstZ(B)
F1	0.350	0.350	2.500	2.500	0.300	0.050	12mm @ 150 mm	12mm @ 150 mm	12mm @ 150 mm	12mm @ 150 mm

LEGEND:

B.O.L = BOTTOM OF LINTEL
T.O.S = TOP OF SLAB
T.O.C = TOP OF CONCRETE
B.O.C = BOUNDARY OF CONCRETE

GENERAL NOTES:

1. LOCATION OF COLUMN FOOTING SHALL BE AS PER GA/DWG. LATEST APPROVED AND SHALL BE REFERED FOR MARKING FOOTING BEFORE EXCAVATION.
2. LAYOUT SHALL BE MARKED ON SITE AND GOT APPROVED BY ENGINEER IN-CHARGE IN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
3. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
4. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
5. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
6. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
7. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM
8. P.C.C OF 1:4:8 GRADE SHALL BE WITH 40MM NOMINAL SIZE AGGREGATE.
9. The S.B.C OF SOIL AT 1.5M DEPTH IS 5 Tn/SQM.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
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EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FOOTING RCC DETAIL DRAWING OF CAR PARKING SHED OF 220/33 KV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/87 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 4 OF 5

	NAME	DATE	SIGN
PREPARED BY	B.K.	28.04.2022	
CHECKED BY	G.H	28.04.2022	
SUBMITTED BY	ANURAG	28.04.2022	

P.C.BANSAL

Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Categories
श्रेणियां

I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
डीजाईन/ड्रॉइंग/विनिर्माण हेतु अनुमोदित/जारी।

II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
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डीजाईन/ड्रॉइंग/विनिर्माण हेतु अनुमोदित/जारी/ बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।

III. Insert comments and submit again for approval.
टिप्पणियां को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।

IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।

V. Not approved.
अनुमोदित नहीं।

(Signature) (हस्ताक्षर)

(Designation) (पदनाम)

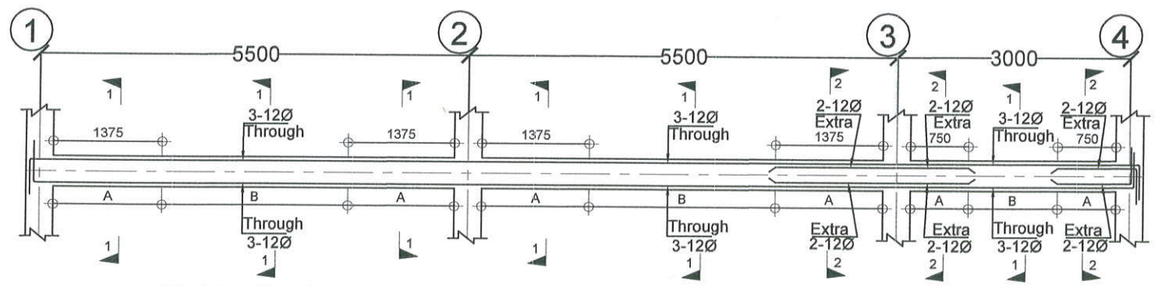
(Date) (तिथि)

REC Power Development & Consultancy Ltd. Gurugram-122001

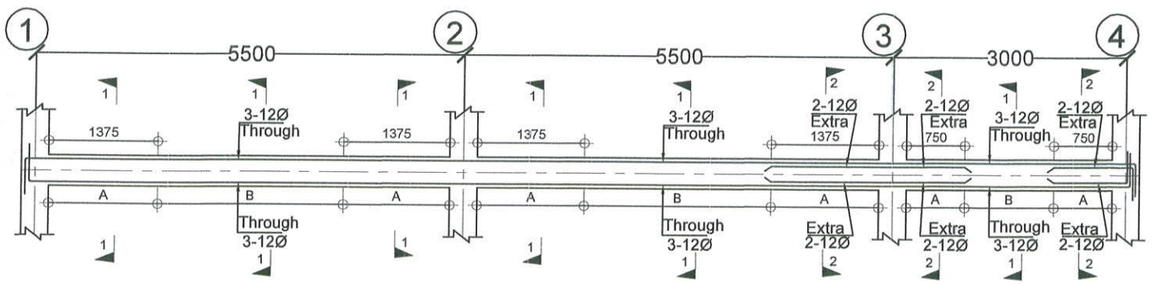
CW-116577
Dt 2/1/22



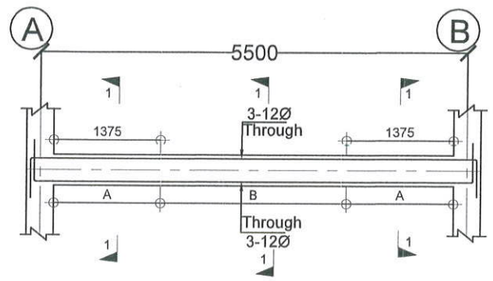
PLINTH BEAM PLAN



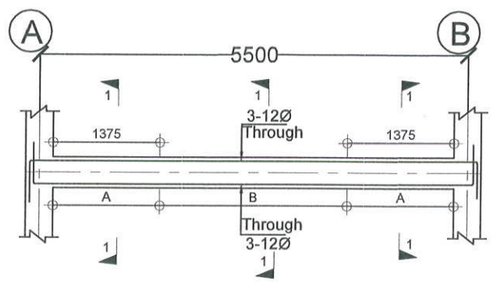
PB1(A–B–C)



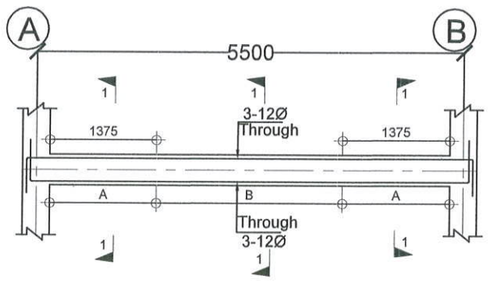
PB2(A–B–C)



PB3(A)



PB4(A)



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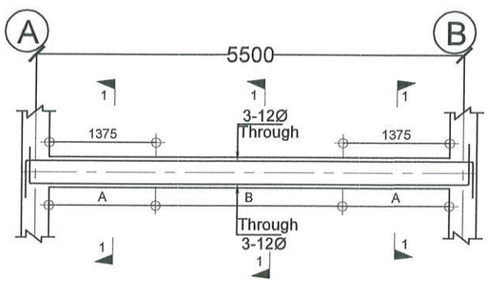
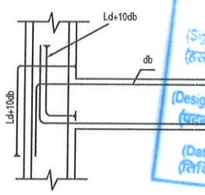
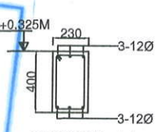


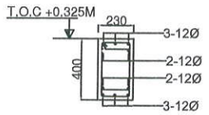
PB6(A)



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM & COLUMN JUNCTION



SECTION 1-1



SECTION 2-2

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

GENERAL NOTES:

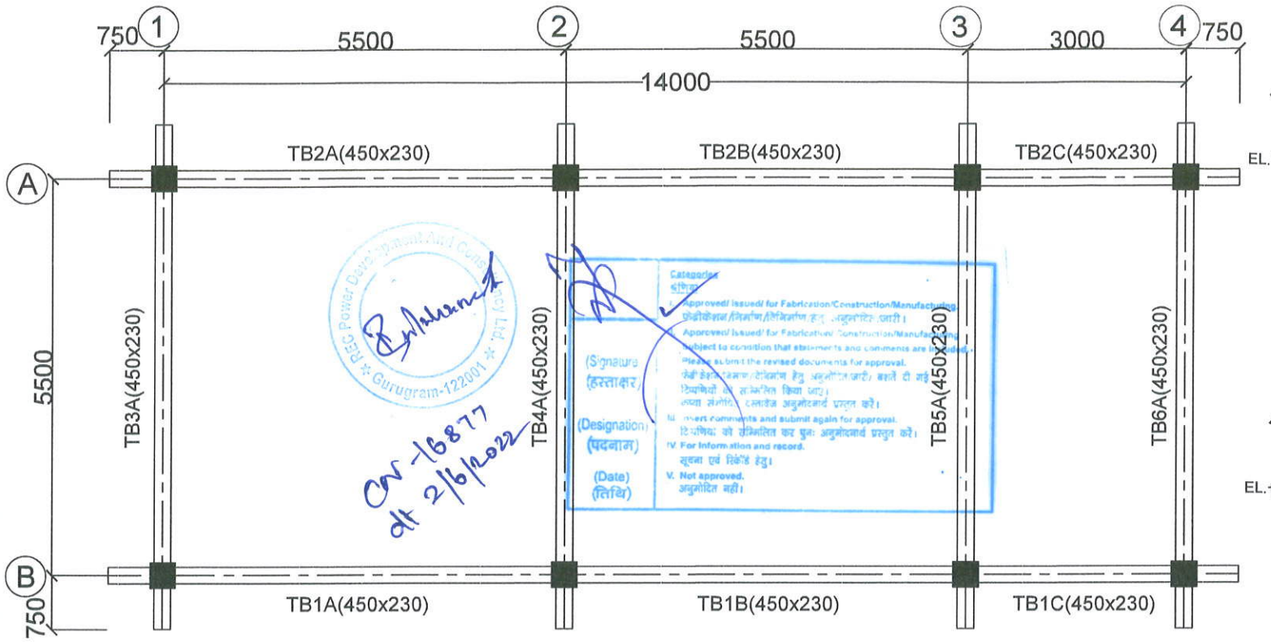
1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	PLINTH BEAM RCC DETAIL DRAWING CAR PARKING SHED OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/87	REV- 0	
SCALE	As shown in Drawing	SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 1 OF 5	
	NAME / DATE / SIGN		
PREPARED BY	B.K. 28.04.2022		
CHECKED BY	G.H 28.04.2022		
SUBMITTED BY	ANURAG 28.04.2022		

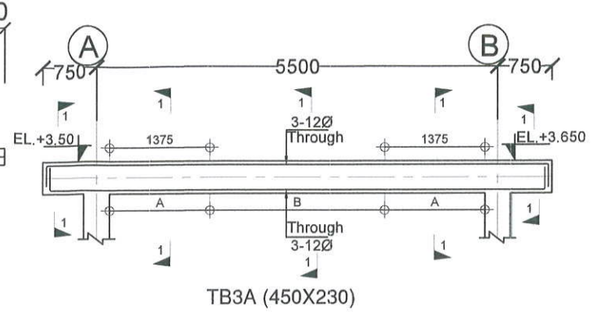
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Signature/Stamp...

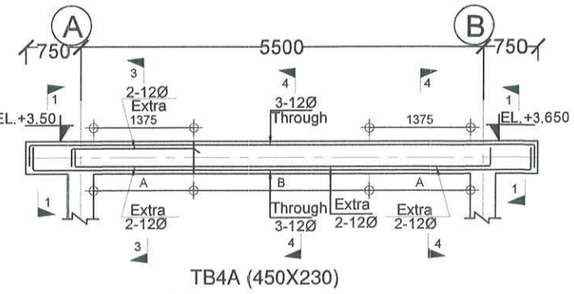


ROOF BEAM PLAN



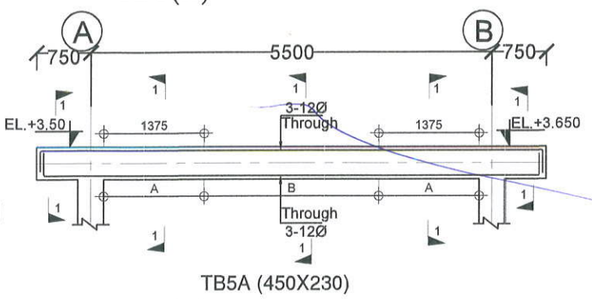
TB3A (450X230)

TB3(A)



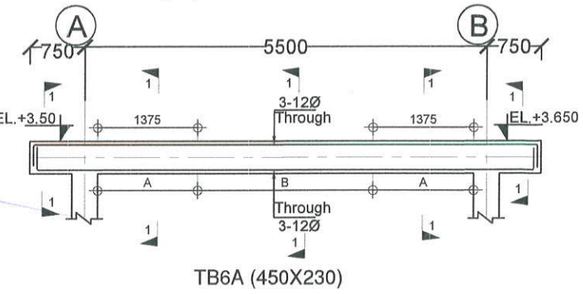
TB4A (450X230)

TB4(A)



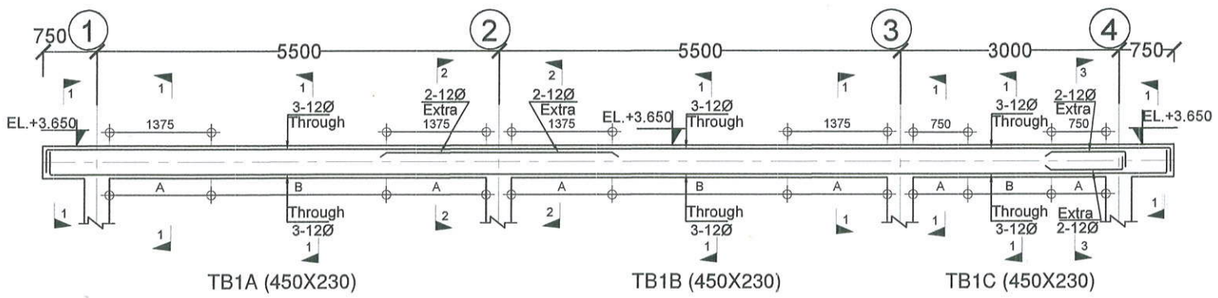
TB5A (450X230)

TB5(A)



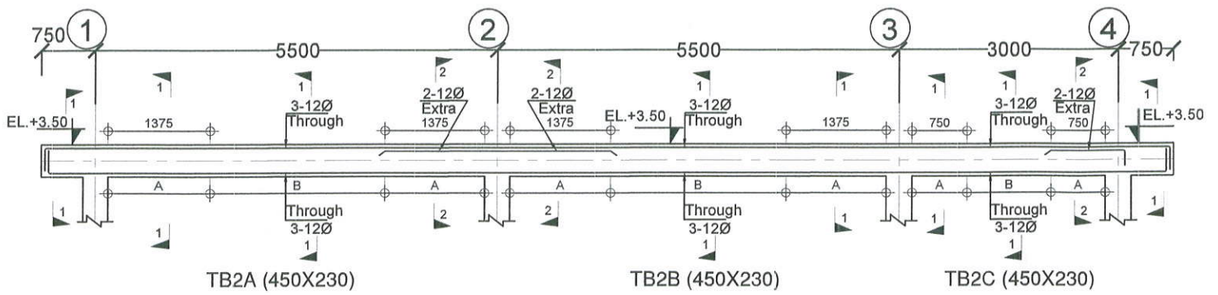
TB6A (450X230)

TB6(A)



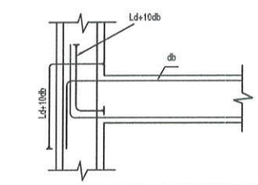
TB1A (450X230) TB1B (450X230) TB1C (450X230)

TB1(A–B–C)

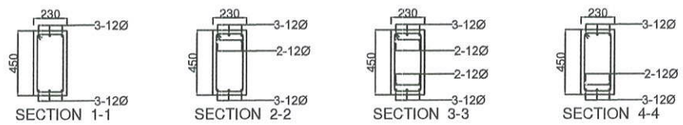


TB2A (450X230) TB2B (450X230) TB2C (450X230)

TB2(A–B–C)



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM
& COLUMN JUNCTION



STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

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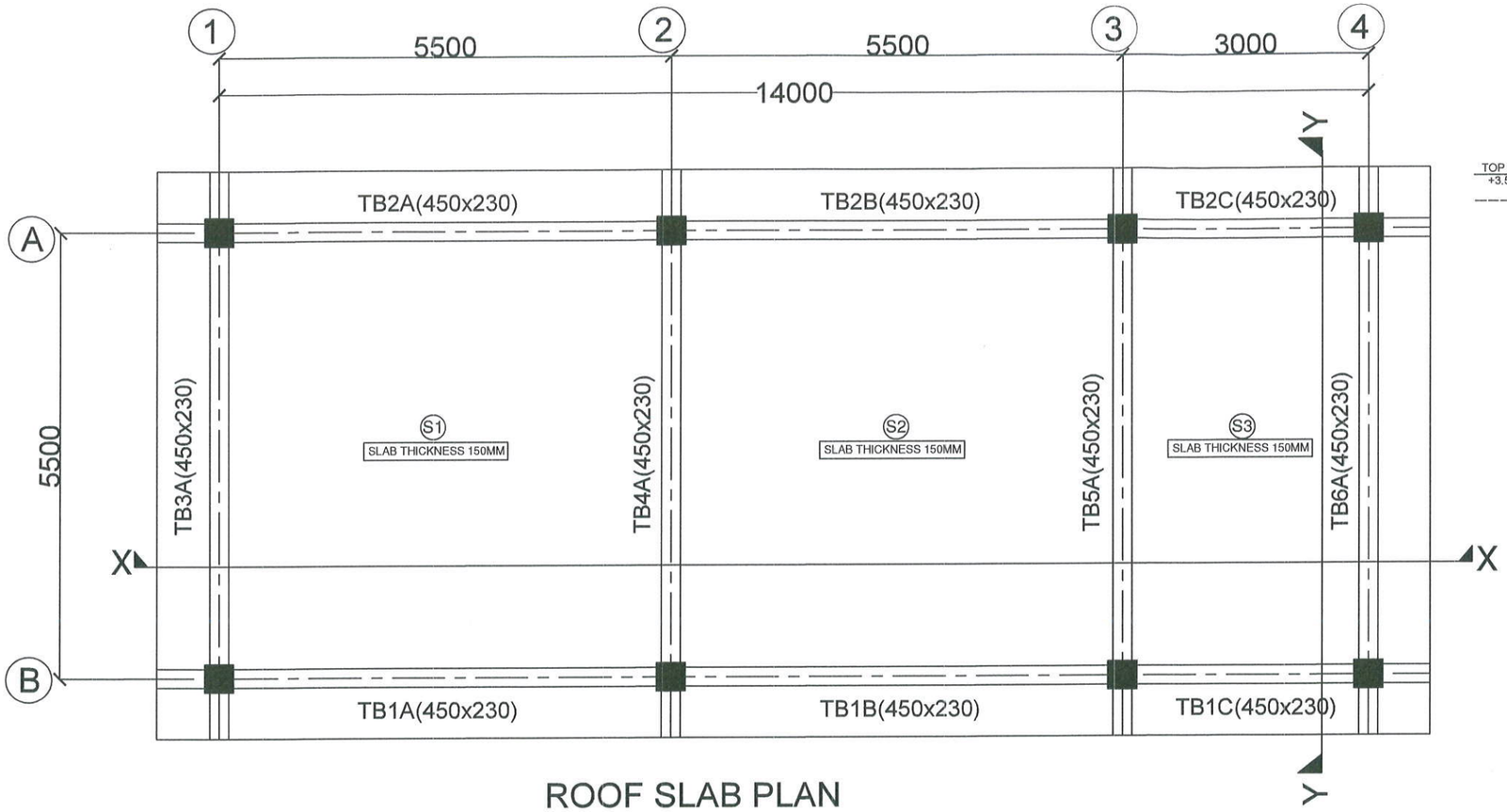
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	ROOF BEAM RCC DETAIL DRAWING CAR PARKING SHED OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/87		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 2 OF 5
	NAME	DATE	SIGN
PREPARED BY	B.K.	28.04.2022	
CHECKED BY	G.H	28.04.2022	
SUBMITTED BY	ANURAG	28.04.2022	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

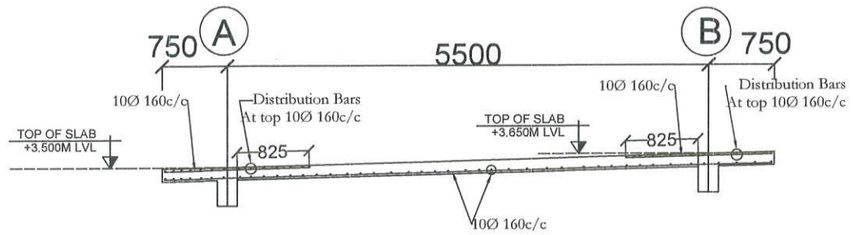
☐ More Information Date.....

Categories
i. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
ii. Approved/ Issued/ for Fabrication/ Construction/Manufacturing subject to condition that statements and comments are complied, please submit the revised documents for approval.
iii. Revert comments and submit again for approval.
iv. For information and record.
v. Not approved.

CW-16877 dt 2/6/2022



ROOF SLAB PLAN



SECTION Y–Y

SLAB THICKNESS 150MM

SLAB REINFORCEMENT DETAILS					
S.NO	SLAB TYPE	SHORT SPAN STEEL (BOT.)	LONG SPAN STEEL (BOT.)	SHORT SPAN STEEL (TOP)	LONG SPAN STEEL (TOP)
1	S1	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
2	S2	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c
3	S3	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c	10Ø@160c/c

GENERAL NOTES:

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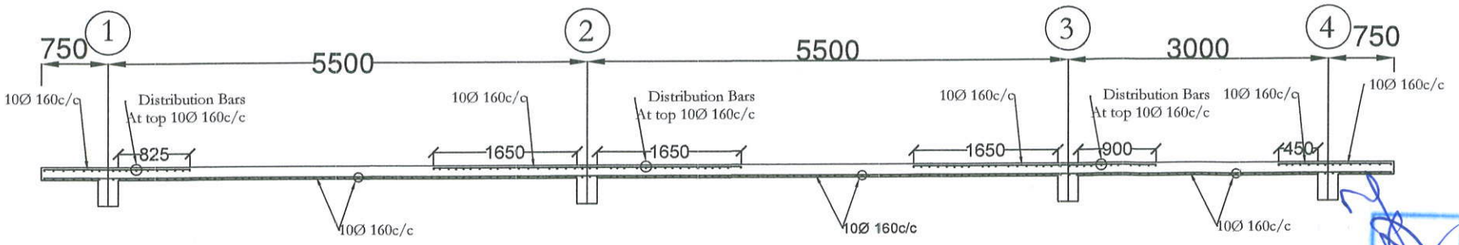


SECTION X–X

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	ROOF SLAB RCC DETAIL DRAWING OF CAR PARKING SHED OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/87 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 5 OF 5

	NAME	DATE	SIGN
PREPARED BY	B.K.	28.04.2022	
CHECKED BY	G.H	28.04.2022	
SUBMITTED BY	ANURAG	28.04.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

For KDPANVIL

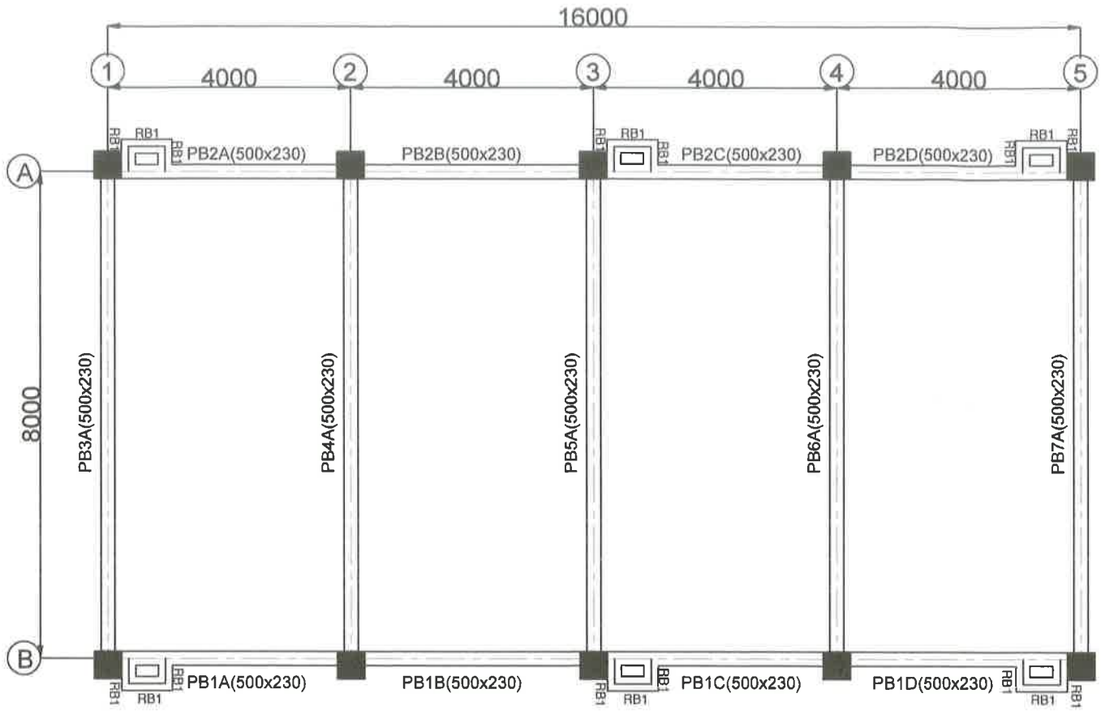
Signature/stamp...

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

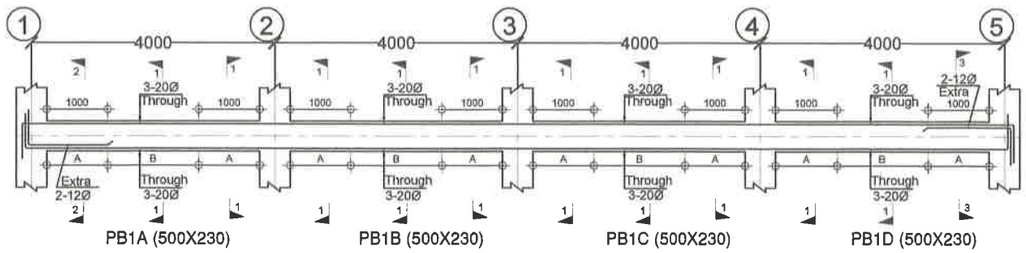
(Signature) (हस्ताक्षर)	Categories श्रेणियां I. Approved/ Issued/ for Fabrication/Construction/Manufacturing. फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी। II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included. Please submit the revised documents for approval. फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते दी गई टिप्पणियों को शामिल किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
(Designation) (पदनाम)	III. Insert comments and submit again for approval टिप्पणियां को शामिल कर पुनः अनुमोदनार्थ प्रस्तुत करें।
(Date) (तिथि)	IV. For Information and record. सूचना एवं रिकॉर्ड हेतु। V. Not approved. अनुमोदित नहीं।

REC Power Development And Consultancy Ltd. Gurugram-122001

CN-4877 dt 2/6/2022

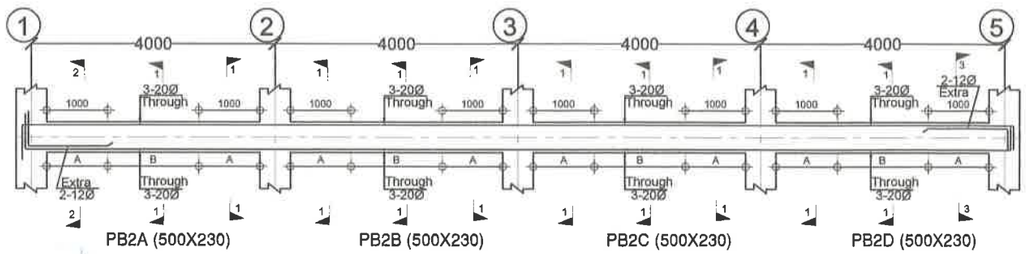


PLINTH BEAM PLAN



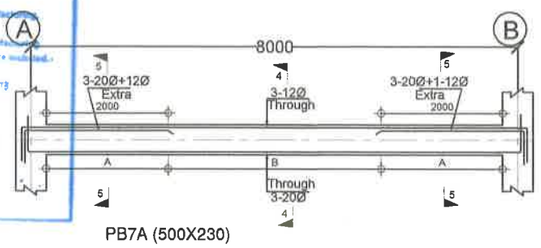
PB1A (500X230) PB1B (500X230) PB1C (500X230) PB1D (500X230)

PB1(A–B–C–D)



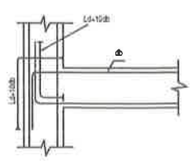
PB2A (500X230) PB2B (500X230) PB2C (500X230) PB2D (500X230)

PB2(A–B–C–D)

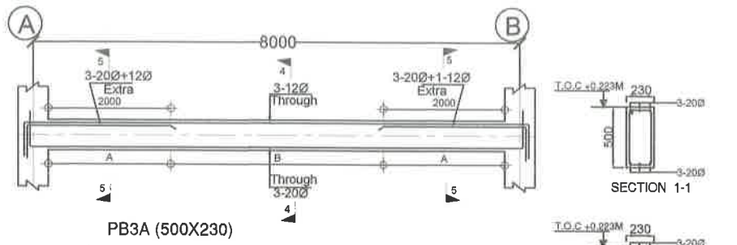


PB7A (500X230)

PB7(A)

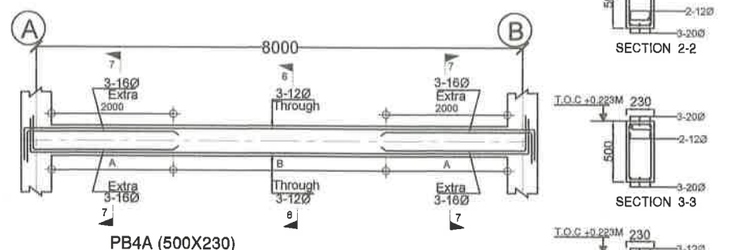


Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM
& COLUMN JUNCTION



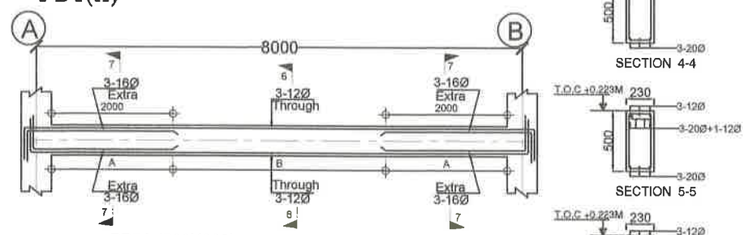
PB3A (500X230)

PB3(A)



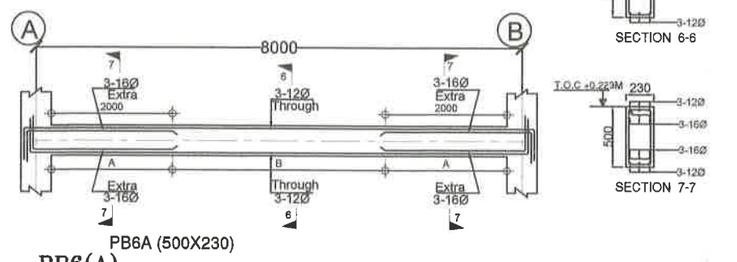
PB4A (500X230)

PB4(A)



PB5A (500X230)

PB5(A)

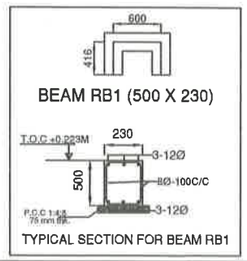


PB6A (500X230)

PB6(A)

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C



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NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/706 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	PLINTH BEAM RCC DETAIL DRAWING STORE ROOM OF 220/33 kV Nagrota (New) SS, Jasgro
DRG. NO.	KDBIL/250 PJ/20-21/D1/89 — REV- 0
SCALE	As shown In Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH.NO. 1 OF 6

	NAME	DATE	SIGN
PREPARED BY	B.K.	04.05.2022	
CHECKED BY	G.H	04.05.2022	
SUBMITTED BY	RACHIT	04.05.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

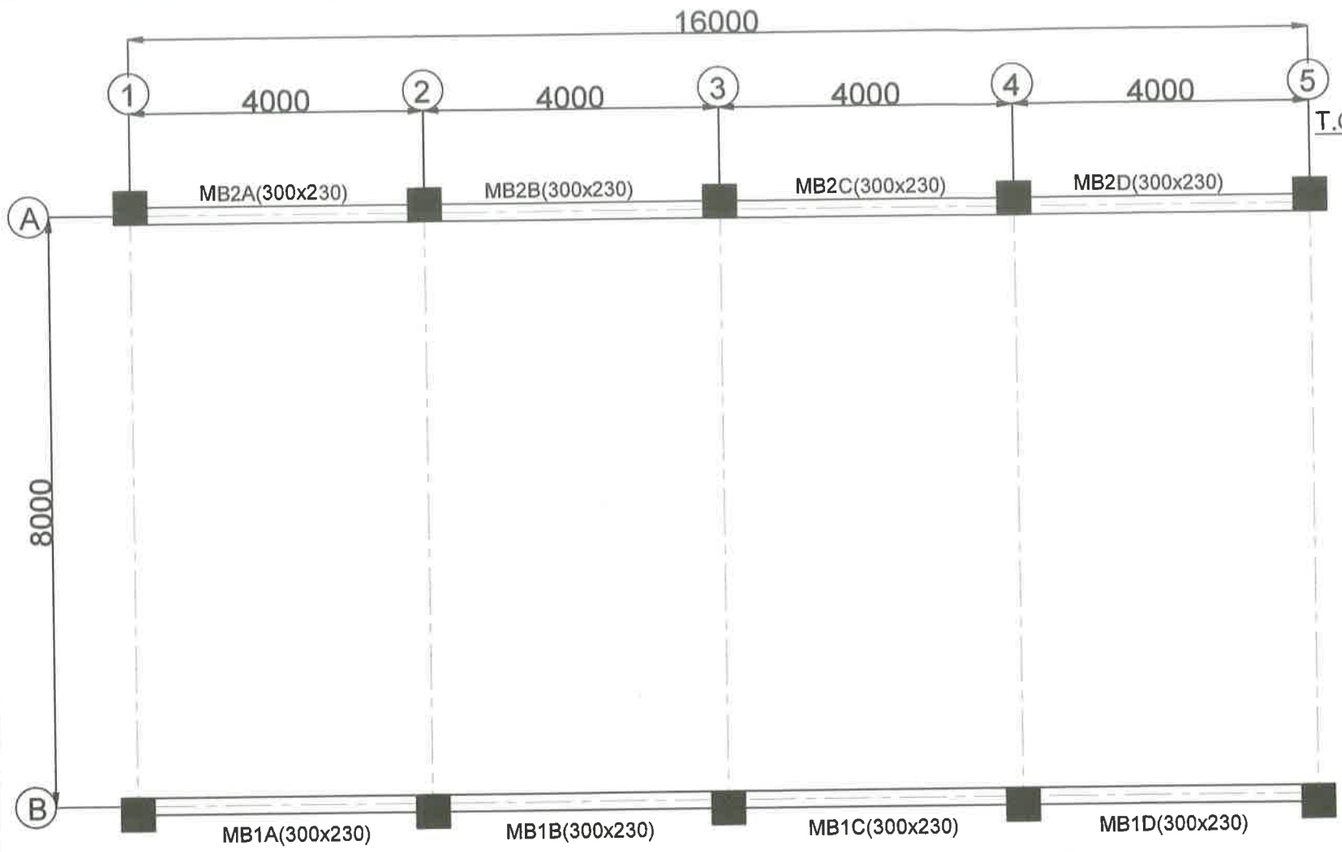
Signature/Stamp...

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

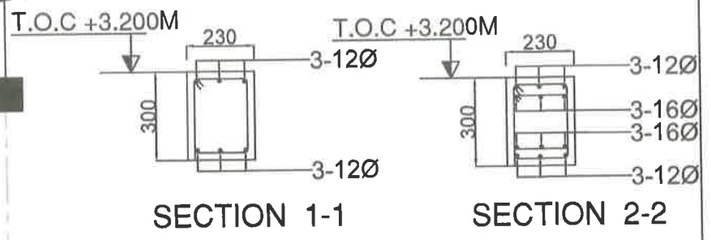
I. Approved/ स्वीकृत
II. Approved/issued for Fabrication/Construction/Manufacture. स्वीकृत/जारी किया गया/निर्माण हेतु अनुमोदित/जारी।
III. Approved/ issued for Fabrication/Construction/Manufacture. Subject to condition that statements and comments are incorporated. Please submit the revised documents for approval. स्वीकृत/जारी किया गया/निर्माण हेतु अनुमोदित/जारी, बशर्ते टीप टिप्पणियों को सम्मिलित किया जाए। कृपया संशोधित दस्तावेज अनुमोदन हेतु प्रस्तुत करें।
IV. Incorporate comments and submit again for approval. टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
V. For information and record. सूचना एवं रिकॉर्ड हेतु।
VI. Not approved. अनुमोदित नहीं।

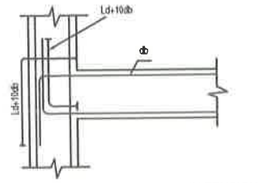
REC Power Development And Consultancy Ltd. Gurgaon-122001

CR-16880 dt 2/6/22



LINTEL BEAM PLAN

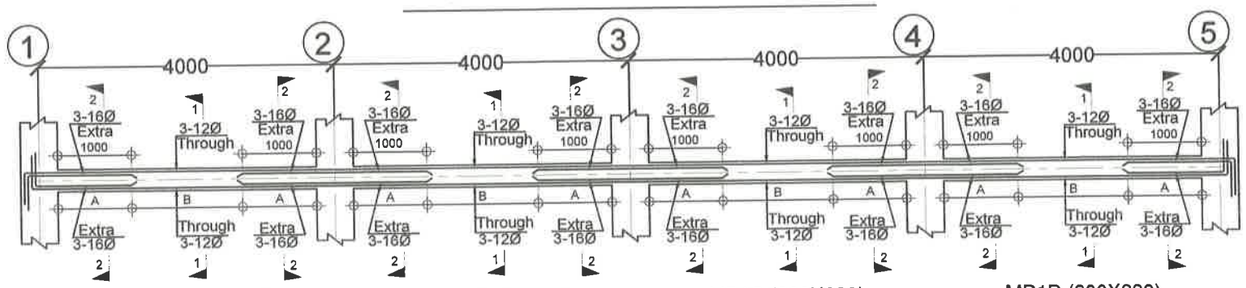




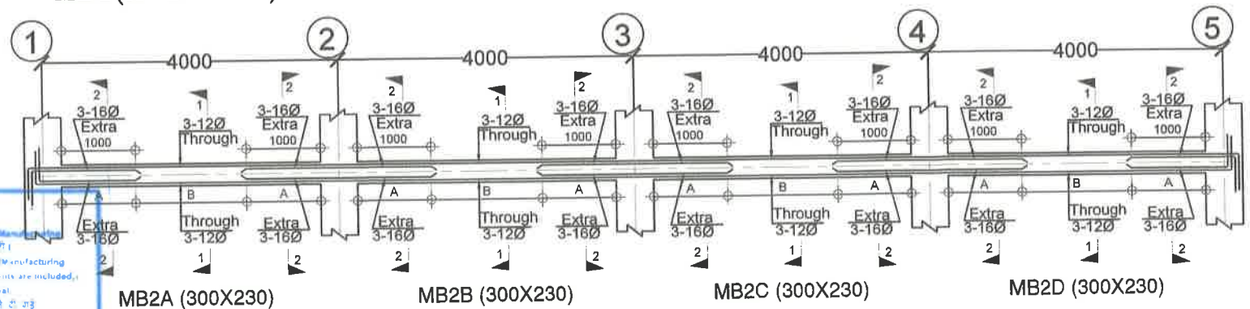
Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM
& COLUMN JUNCTION

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-110C/C



MB1(A–B–C–D)



MB2(A–B–C–D)

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	LINTEL BEAM RCC DETAIL DRAWING STORE ROOM OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/89 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 2 OF 6

	NAME	DATE	SIGN
PREPARED BY	B.K.	04.05.2022	
CHECKED BY	G.H	04.05.2022	
SUBMITTED BY	RACHIT	04.05.2022	

Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

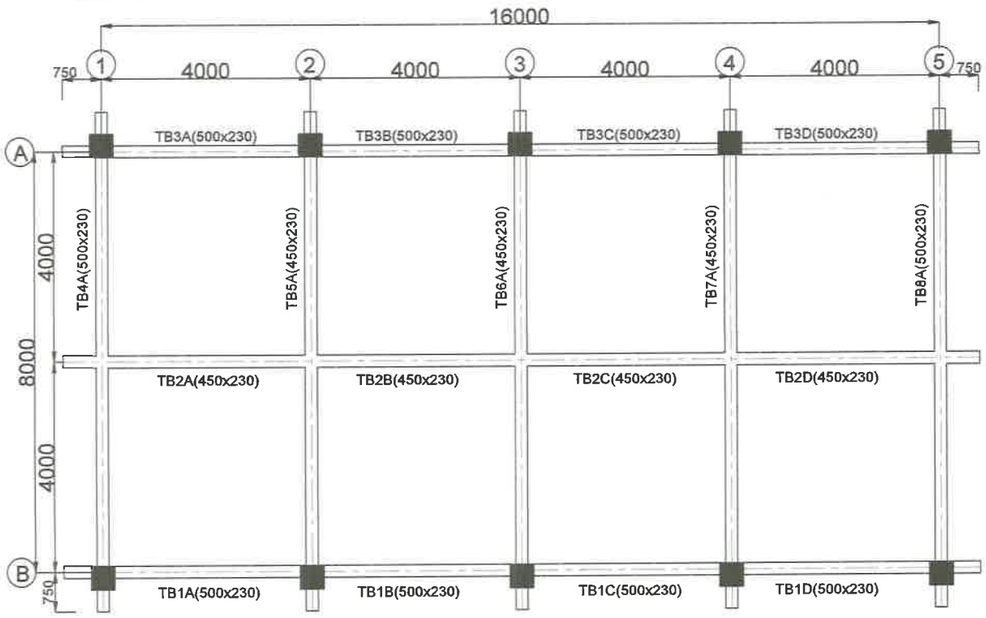
REC Power Development And Consultancy Ltd. Gurugram-122001

CN-16880
dt 02/06/22

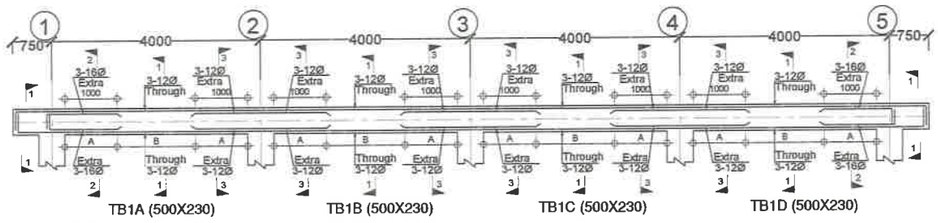
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

Categories
i. Approved/ issued/ for Fabrication/Construction/Manufacturing
ii. Approved/ issued/ for Fabrication/Construction/Manufacturing
Subject to condition that statements and comments are included,
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित जारी, बशर्ते दी गई टिप्पणियों को सम्मिलित किया गया।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
iii. Insert comments and submit again for approval
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
iv. For information and record.
सूचना एवं रिकॉर्ड हेतु।
v. Not approved.
अनुमोदित नहीं।



TERRACE BEAM PLAN



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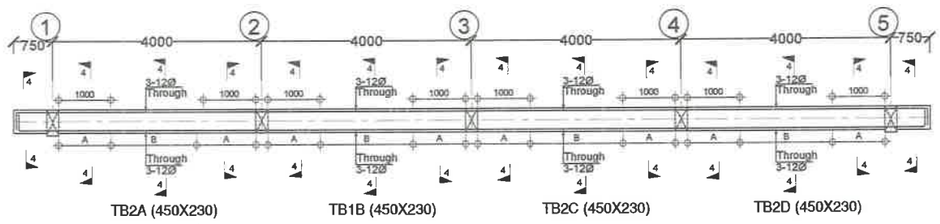
TB1(A–B–C–D)



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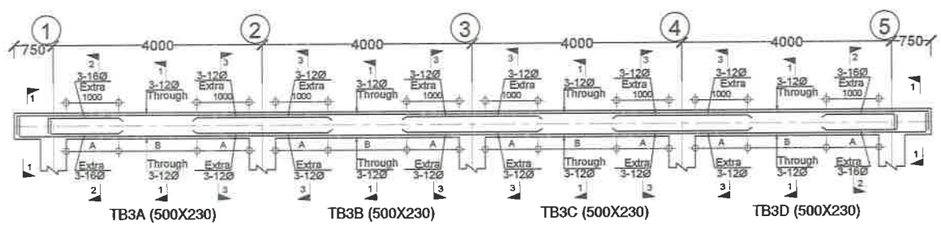
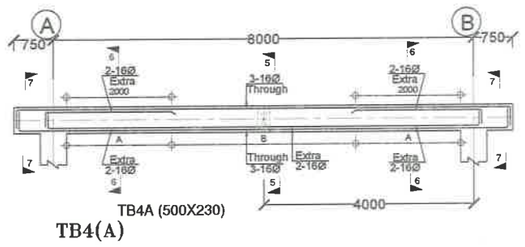
TB2(A–B–C–D)



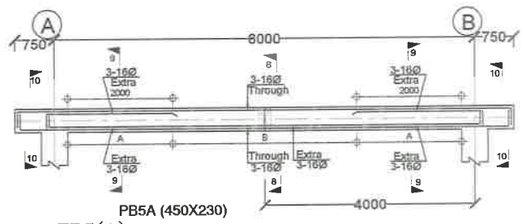
TB3A (500X230) TB3B (500X230) TB3C (500X230) TB3D (500X230)

TB3(A–B–C–D)



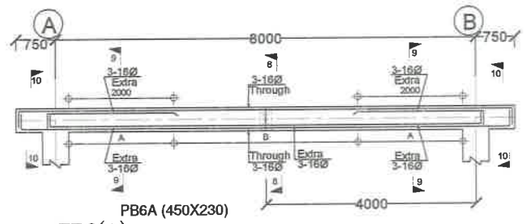
TB4A (500X230)

TB4(A)



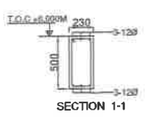
PB5A (450X230)

TB5(A)

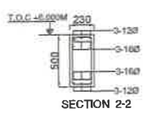


PB6A (450X230)

TB6(A)



SECTION 1-1



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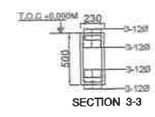

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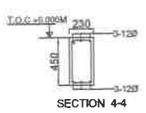

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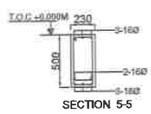

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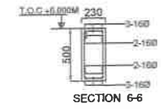

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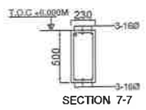

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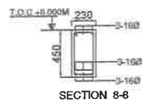

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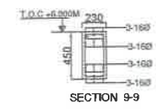
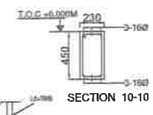
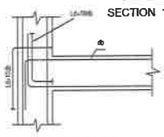


SECTION 9-9



SECTION 10-10



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM & COLUMN JUNCTION

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33kV Nagrota (New) SubStation including LILO of 220kV Kishenpur-Barn or Udhampur-jiadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Qusters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	i) CSP/AU/JKPTCL/Nagrota/SS & LILO-NOA/4705 Dt. 06.11.2020 ii) CSP/AU/JKPTCL/Nagrota/SS & LILO-NOA-II/4706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathilal, Jaisalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	ROOF BEAM RCC DETAIL DRAWING STORE ROOM OF 220/33 kV Nagrota (New) S/S Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/89 REV- 0
SCALE	As shown in Drawing SHEET SIZE- A0
AREA	91.6 KANAL 46336.5 SQM SHEET NO. 5 OF 6

	NAME	DATE	SIGN
PREPARED BY	B.K.	04.05.2022	
CHECKED BY	G.H	04.05.2022	
SUBMITTED BY	RACHIT	04.05.2022	

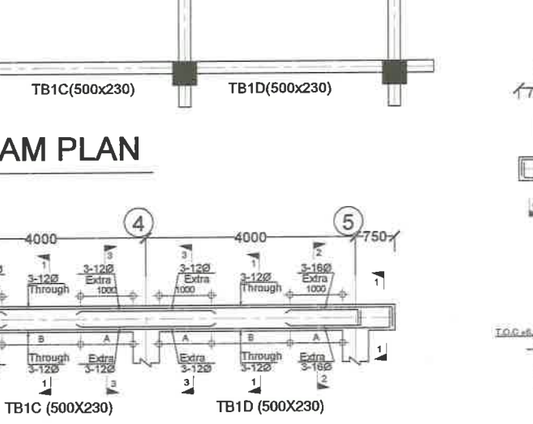
☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

PB7A (450X230)

TB7(A)



TB8A (500X230)

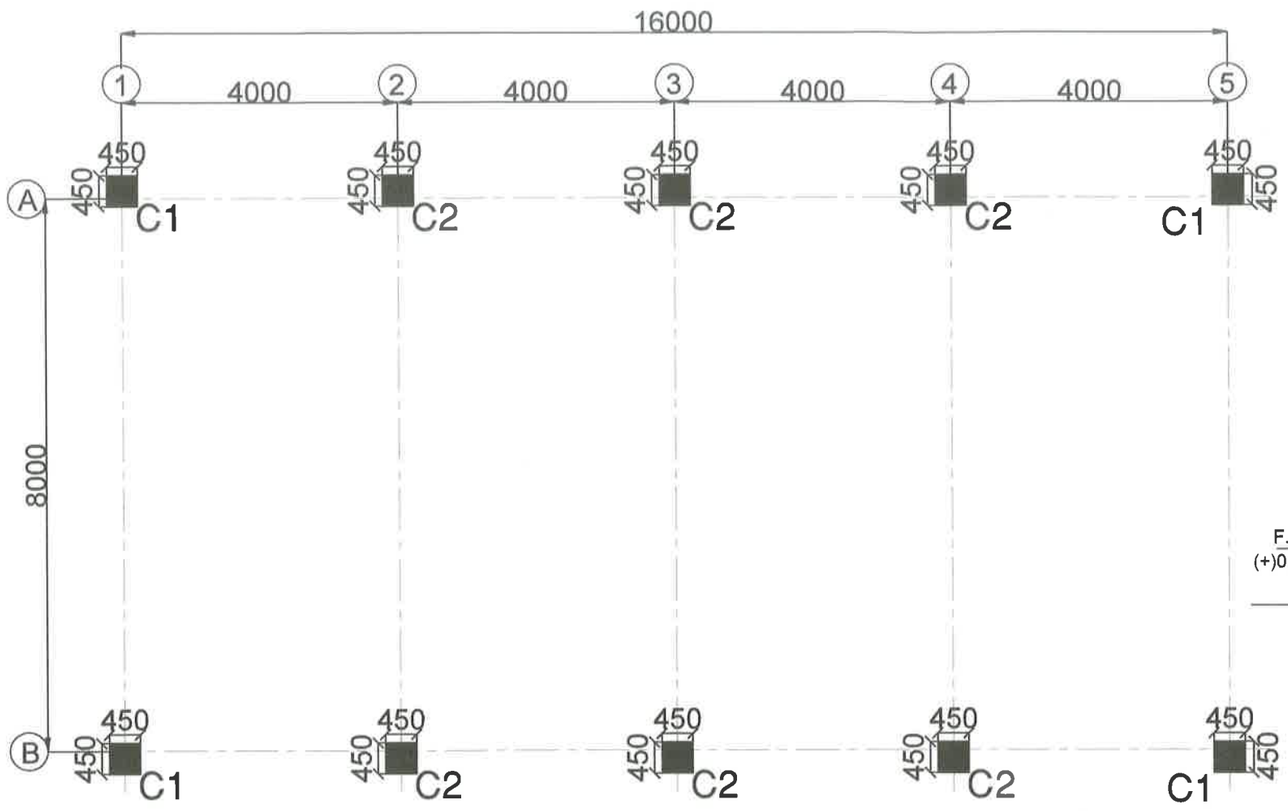
TB8(A)

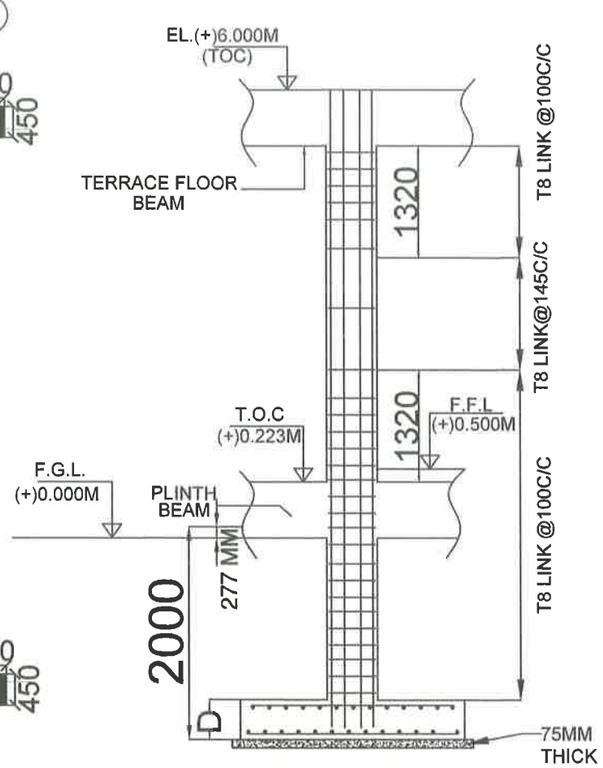
Certified that
Approved Issued for Fabrication/Construction/Manufacturing.
Approved Issued for Fabrication/ Construction/Manufacturing subject to condition that statements and comments are included.
Please submit the revised documents for approval.
Incorporate / make / rectify and resubmit again for approval.
Incorporate comments and submit again for approval.
For Information and record.
Not approved.

(Signature)
(Designation)
(Date)

REC Power Development And Consultancy Ltd. Gurugram-122001

CV-16880 dt 02/06/22





TYPICAL COLUMN DETAIL

COLUMN LAYOUT PLAN

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

LEGEND:

B.O.L = BOTTOM OF LINTEL
T.O.S = TOP OF SLAB
T.O.C = TOP OF CONCRETE
B.O.C = BOUNDARY OF CONCRETE

S.NO.	COL. MKD.	QTY. COL. (NOS.)	COLUMN SIZE (mm)	MAIN REINFORCEMENT FOUNDATION TO TERRACE FLOOR LEVEL
1.	C1	4	450X450	● 20Ø-6NOS. ○ 16Ø-8NOS.
2.	C2	6	450X450	● 20Ø-8NOS. ○ 16Ø-8NOS.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	COLUMN RCC DETAIL DRAWING STORE ROOM OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/89		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 4 OF 6
	NAME	DATE	SIGN
PREPARED BY	B.K.	04.05.2022	
CHECKED BY	G.H	04.05.2022	
SUBMITTED BY	RACHIT	04.05.2022	

Signature/Stamp...

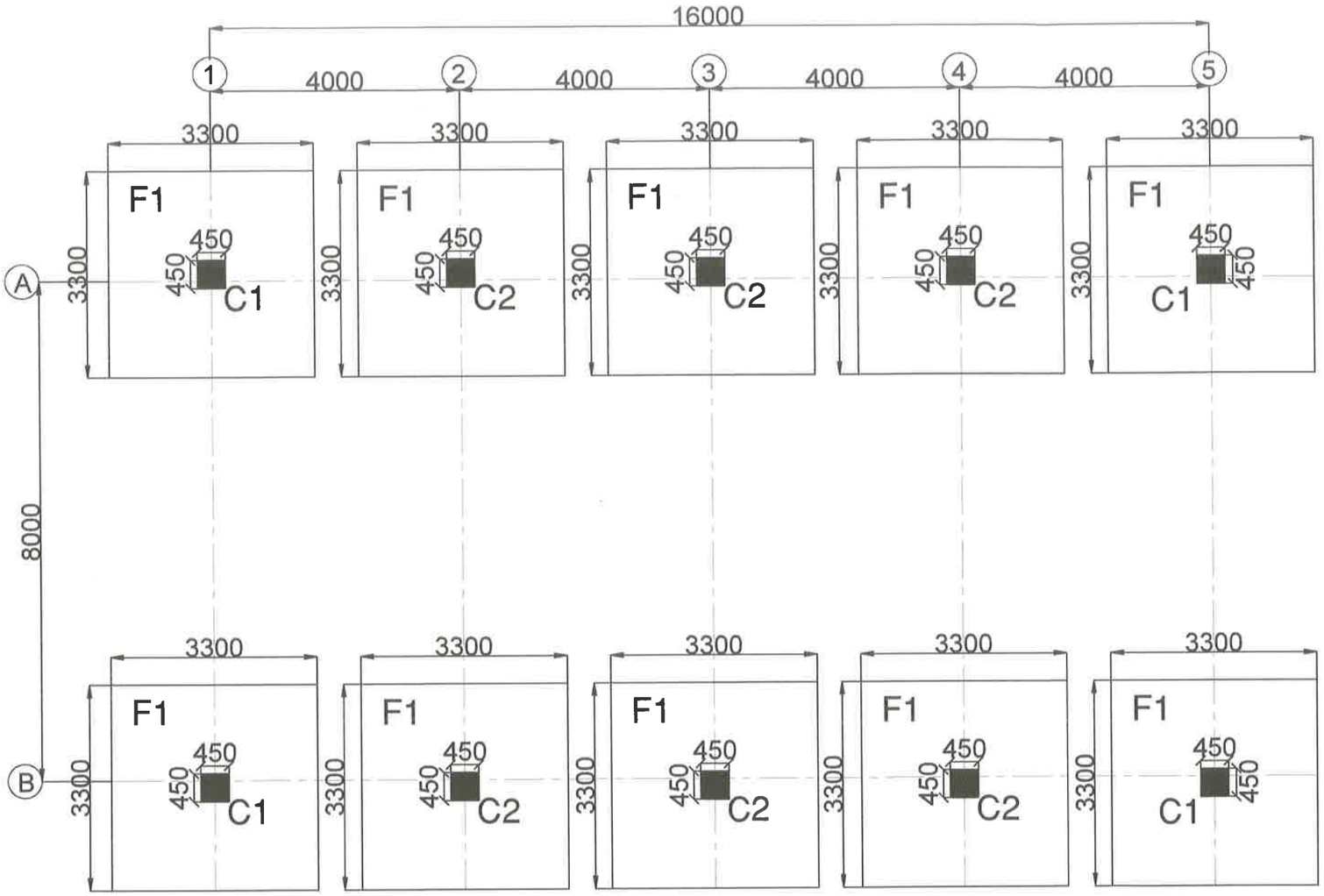
☐ Approved ☐ Approved with comments ☐ Not Approved

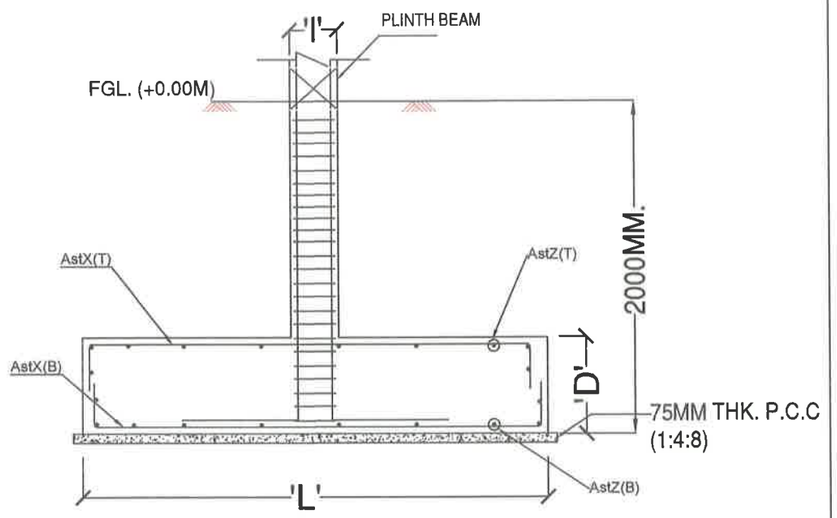
☐ More Information Date.....

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

REC Power Development And Consultancy Ltd. Gurugram-122001

CN-16660
dt 02/06/22

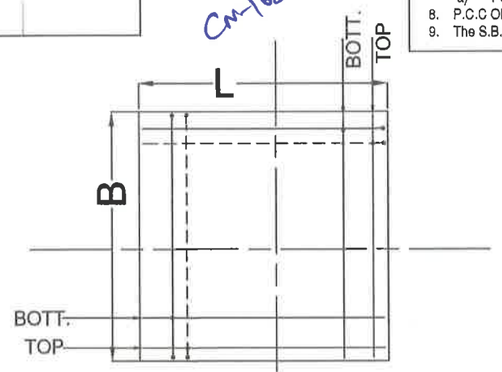




TYPICAL FOUNDATION DETAIL

TYPICAL FOOTING LAYOUT PLAN

MARK	SIZE (IN MTR)
F1	3.300 X 3.300 X 0.350



FOOTING REINFORCEMENT KEY PLAN

GENERAL NOTES:
1. LOCATION OF COLUMN FOOTING SHALL BE AS PER GA/DWG. LATEST APPROVED AND SHALL BE REFERED FOR MARKING FOOTING BEFORE EXCAVATION.
2. LAYOUT SHALL BE MARKED ON SITE AND GOT APPROVED BY ENGINEER IN-CHARGE IN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
3. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
4. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
5. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
6. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
7. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM
8. P.C.C OF 1:4:8 GRADE SHALL BE WITH 40MM NOMINAL SIZE AGGREGATE.
9. The S.B.C OF SOIL AT 2M DEPTH IS 5 Tn/SQM.

REC Power Development And Consultancy Ltd. * Gurugram-122001 * dt 2/4/22
CM-16880

Approval issued for Fabrication/Construction/Manufacturing.
Approval issued for Fabrication/Construction/Manufacturing subject to condition that statement is and documents are included.
Please submit the revised documents for approval.
Insert comments and submit again for approval.
For information and record.
Not approved.
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

ISOLATED FOOTING SCHEDULE

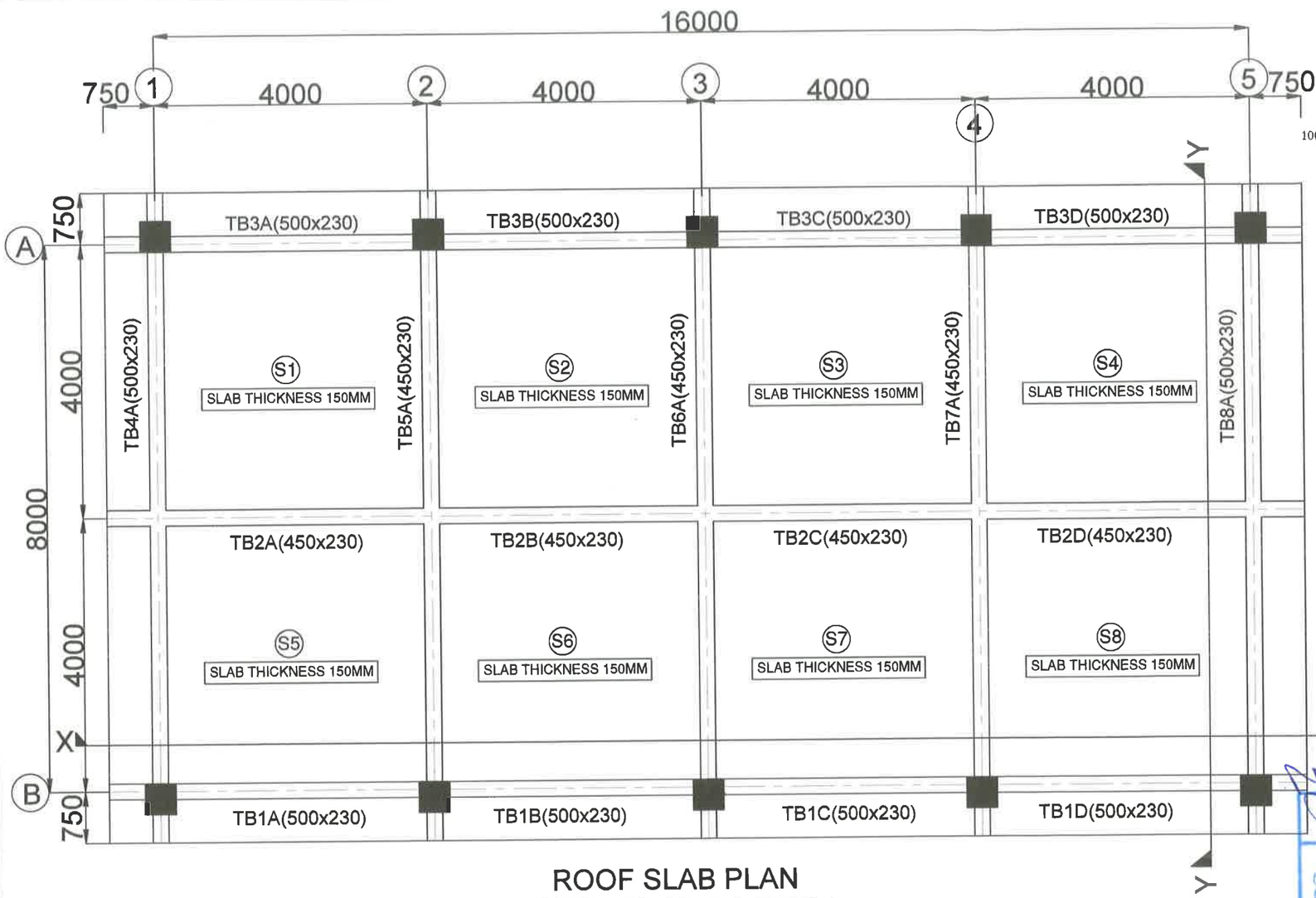
Foundation Mark	Column/Pedestal		Foundation			Cover (m)	Reinforcement			
							TOP		BOTTOM	
	l (m)	b (m)	L (m)	B (m)	D (m)		AstX(T)	AstZ(T)	AstX(B)	AstZ(B)
F1	0.450	0.450	3.300	3.300	0.350	0.050	12mm @ 150 mm	12mm @ 150 mm	12mm @ 150 mm	12mm @ 150 mm

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FOOTING RCC DETAIL DRAWING STORE ROOM OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/89 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 5 OF 6

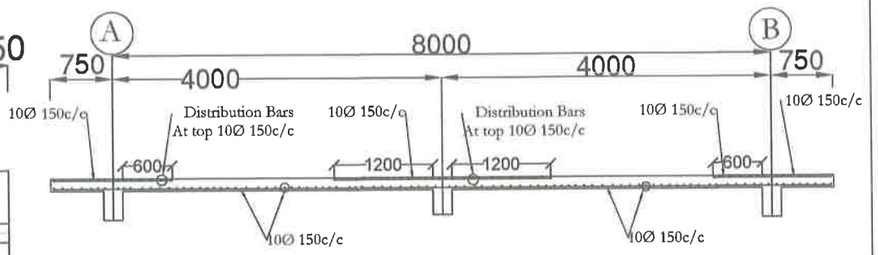
	NAME	DATE	SIGN
PREPARED BY	B.K.	04.05.2022	
CHECKED BY	G.H	04.05.2022	
SUBMITTED BY	RACHIT	04.05.2022	

Approved ☐ Approved with comments ☐ Not Approved ☐
More Information ☐ Date.....

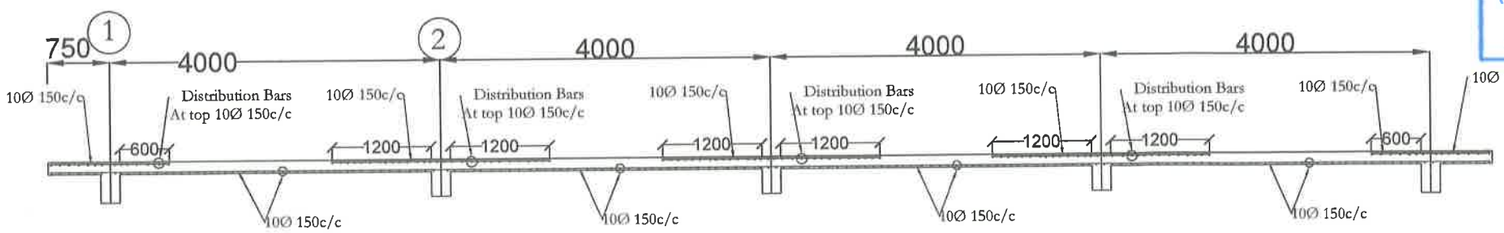
Kailash Devbuild (India) Pvt. Ltd. Jabalpur
RCC DRAWING
Signature/Stamp



ROOF SLAB PLAN



SECTION Y–Y



SECTION X–X

SLAB THICKNESS 150MM

SLAB REINFORCEMENT DETAILS

S.NO	SLAB TYPE	SHORT SPAN STEEL (BOT.)	LONG SPAN STEEL (BOT.)	SHORT SPAN STEEL (TOP)	LONG SPAN STEEL (TOP)
1	S1	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
2	S2	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
3	S3	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
4	S4	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
5	S5	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
6	S6	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
7	S7	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
8	S8	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation Including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation Including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	SLAB RCC DETAIL DRAWING STORE ROOM OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/89 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 6 OF 8

	NAME	DATE	SIGN
PREPARED BY	B.K.	04.05.2022	
CHECKED BY	G.H	04.05.2022	
SUBMITTED BY	RACHIT	04.05.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Signature/Stamp

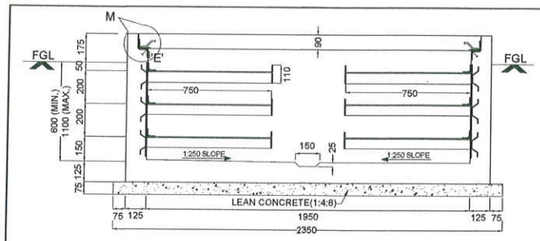
(Signature) (हस्ताक्षर)

(Designation) (पदनाम)

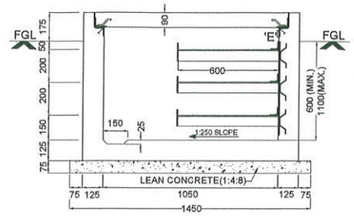
(Date) (तिथि)

i. Approved/Issued for Fabrication/Construction/Manufacturing.
ii. Approved/Issued for Fabrication/Construction/Manufacturing subject to condition that statements and comments are included.
iii. Insert statements and submit again for approval.
iv. For information and record.
v. Not approved.

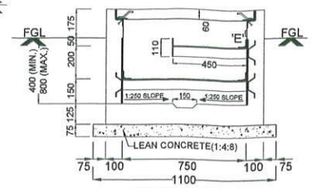
CN-16880 dt 2/6/22



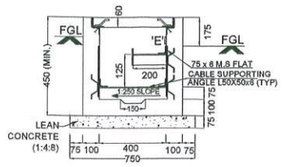
SECTION 1-1



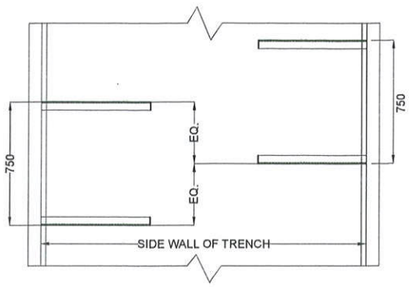
SECTION 2-2



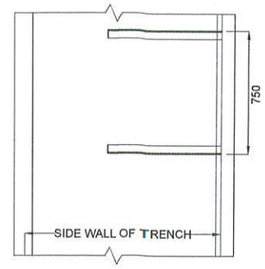
SECTION 3-3



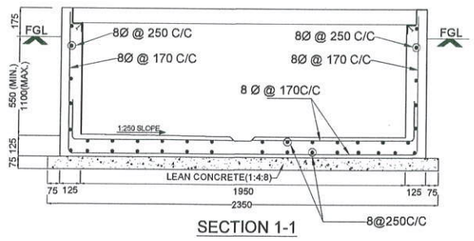
SECTION 4-4



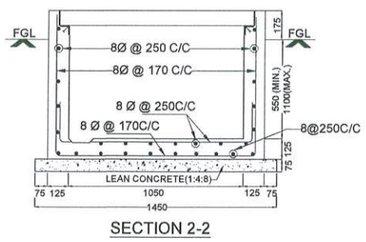
PLAN
CABLE TRAY SUPPORT
FOR SECTION 1-1



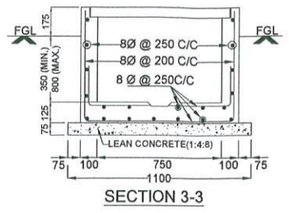
PLAN
CABLE TRAY SUPPORT
FOR SECTION 2-2 & 3-3



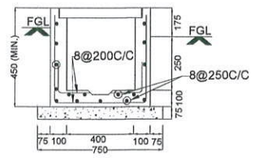
SECTION 1-1



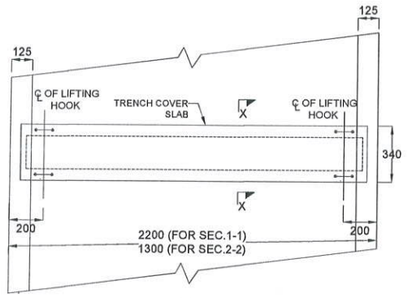
SECTION 2-2



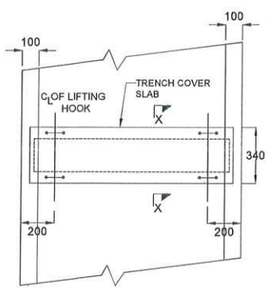
SECTION 3-3



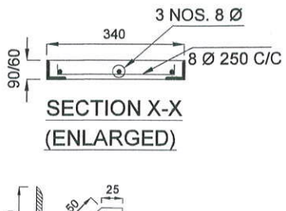
SECTION 4-4



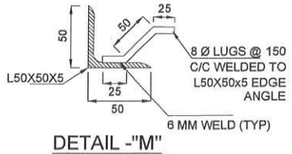
PLAN
(DETAIL OF TRENCH COVER
FOR SECTION 1-1 & 2-2)



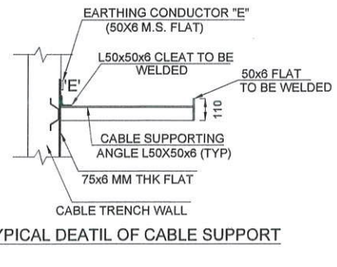
PLAN
(DETAIL OF TRENCH COVER
FOR SECTION 3-3 & 4-4)



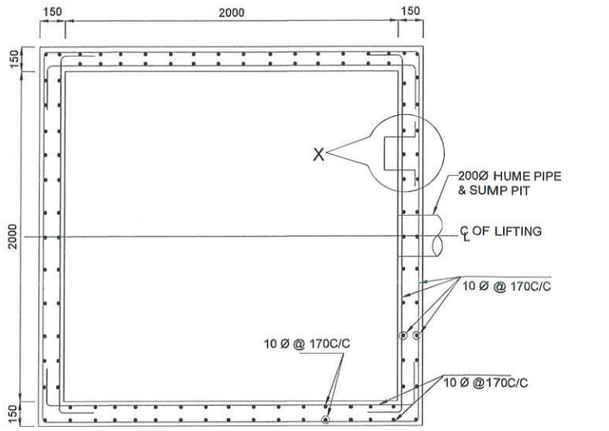
SECTION X-X
(ENLARGED)



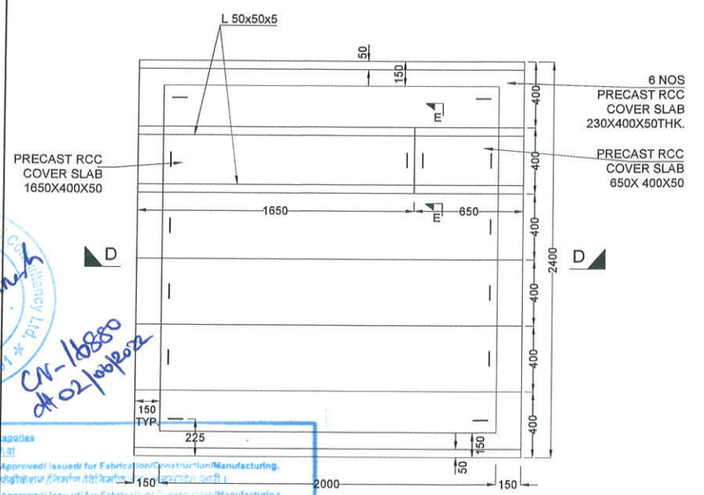
DETAIL -"M"
(ENLARGED)



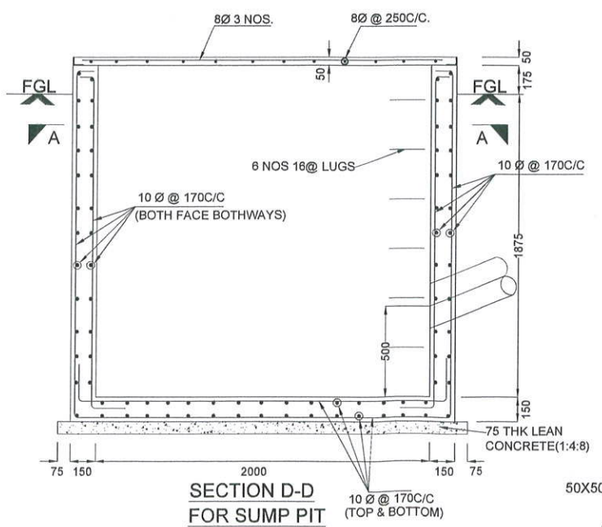
TYPICAL DEATIL OF CABLE SUPPORT



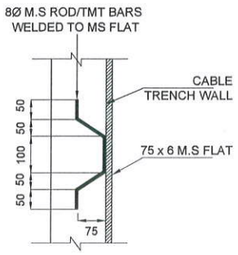
SECTION A-A
FOR SUMP PIT



TOP PLAN OF SUM PIT



SECTION D-D
FOR SUMP PIT



TYPICAL DETAIL OF
ANCHORING M.S FLAT 75x6

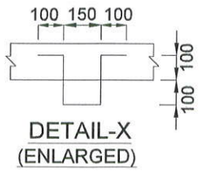
NOTES:-
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. LONGITUDINAL SLOPE OF CABLE TRENCH IS 1:1000 FOR ALL SECTION.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.	
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020	
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)	
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)	
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)	
CONSULTANT	Advanced Ultra Power Transmission Consultancy	
TITLE	DETAIL OF CABLE TRNCH SECTION DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu	
DRG. NO.	KDBIL/250 PJ/20-21/D1/90	REV- 1
SCALE	As shown in Drawing	SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 1 OF 1

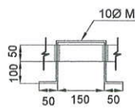
	NAME	DATE	SIGN
PREPARED BY	RAVI	12.05.2022	
CHECKED BY	G.H	12.05.2022	
SUBMITTED BY	ANURAG	12.05.2022	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

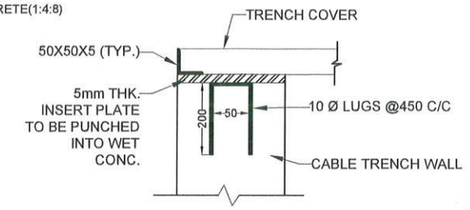
☐ More Information Date.....



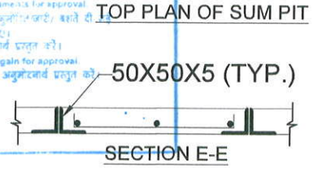
DETAIL-X
(ENLARGED)



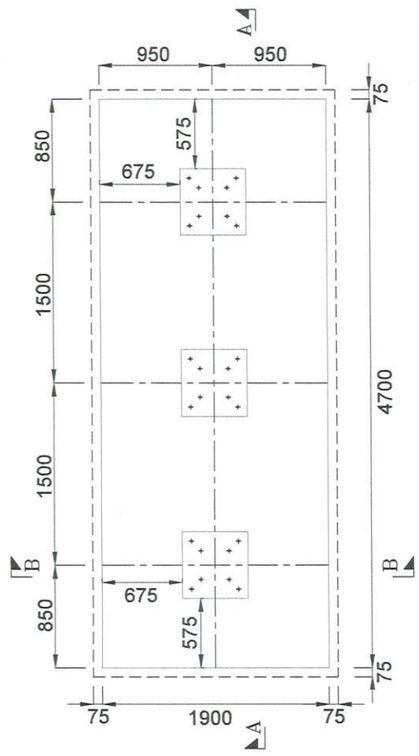
DETAIL OF LIFTING HOOK



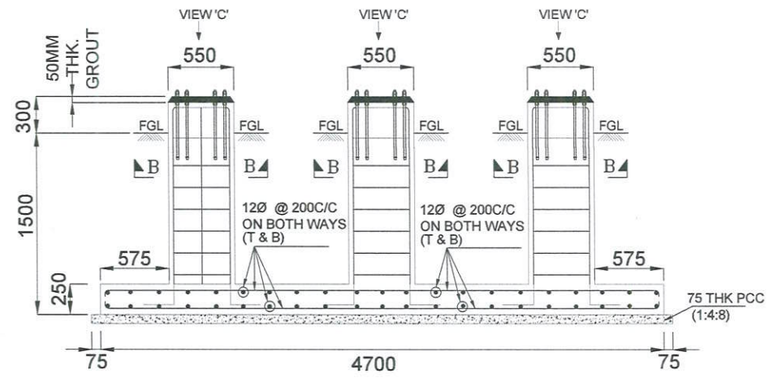
TYPICAL DETAIL OF SLAB SUPPORT



SECTION E-E

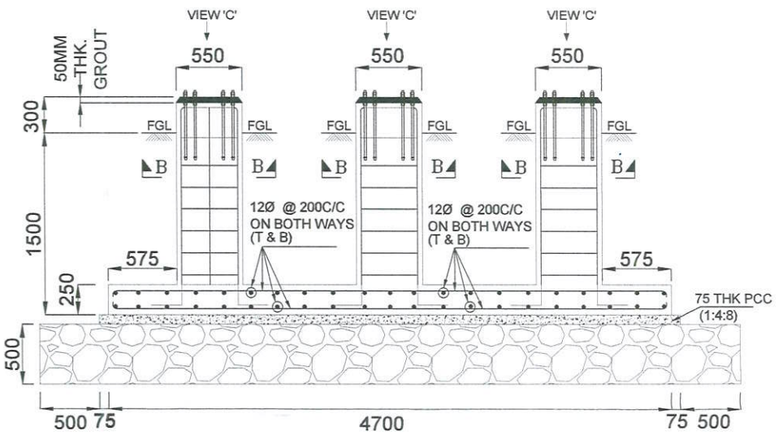


FOUNDATION PLAN



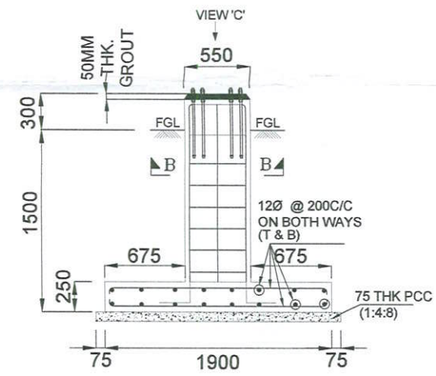
SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



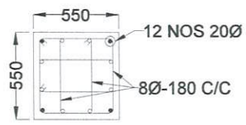
SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)

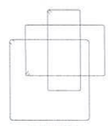


SECTION B-B

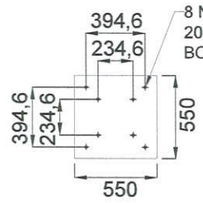
(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



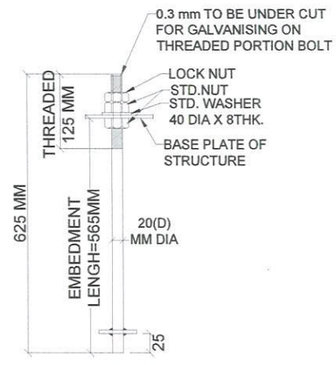
SECTION B-B



RING ARRANGEMENT



VIEW 'C'



FOUNDATION BOLT

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5 T/SQM AT 1.5MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-jiadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(i) CSP/AAI/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CSP/AAI/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	33KV PT COMBINED PDN DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/93		REV- 1
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM		SH.NO.1 OF 1
	NAME	DATE	SIGN
PREPARED BY	RAVI	24.05.2022	
CHECKED BY	G.H	24.05.2022	
SUBMITTED BY	ANURAG	24.05.2022	Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

REC Power Development And Consultancy Ltd. Gurugram-122001

Comments टिप्पणी

I. Approved/ Issued/ for Fabrication/Construction/Manufacturing. डीजाईनिंग/निर्माण/विनिर्माण हेतु अनुमोदित/ जारी।

II. Approved/ Issued/ for Fabrication/Construction/Manufacturing Subject to condition that stated vide and comments are included.. Please submit the revised documents for approval. डीजाईनिंग/निर्माण/विनिर्माण हेतु अनुमोदित/जारी। बशर्ते टी गई टिप्पणियों को संशोधित किया जाए। कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।

III. Incorporate comments and submit again for approval. टिप्पणियों को संशोधित कर पुनः अनुमोदनार्थ प्रस्तुत करें।

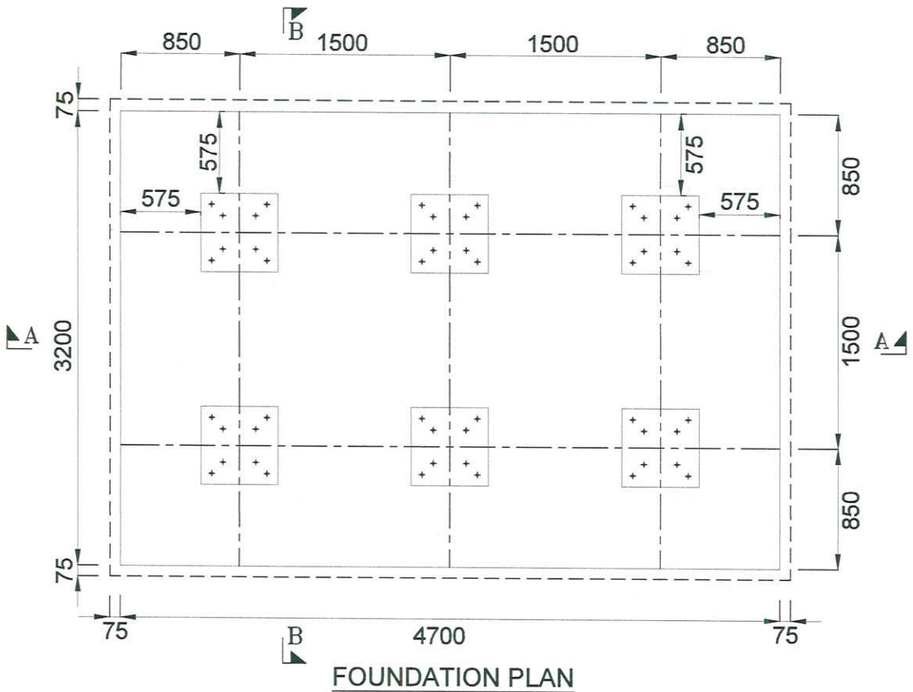
IV. For information and record. सूचना एवं रिकॉर्ड हेतु।

V. Not approved. अनुमोदित नहीं।

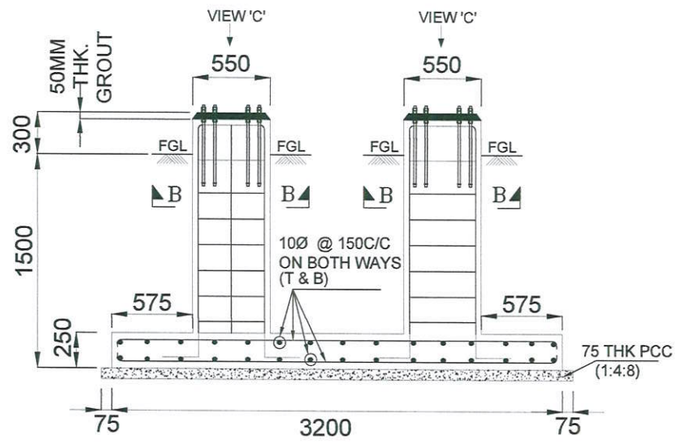
(Signature) (हस्ताक्षर)

(Designation) (पदनाम)

(Date) (तिथि)

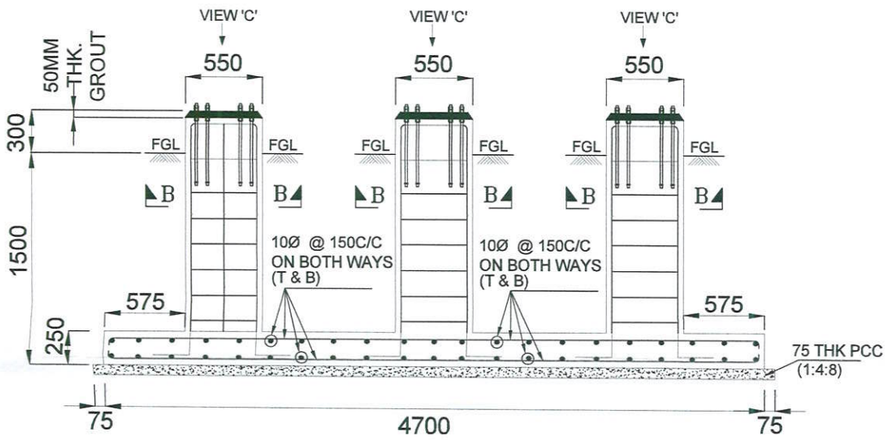


FOUNDATION PLAN



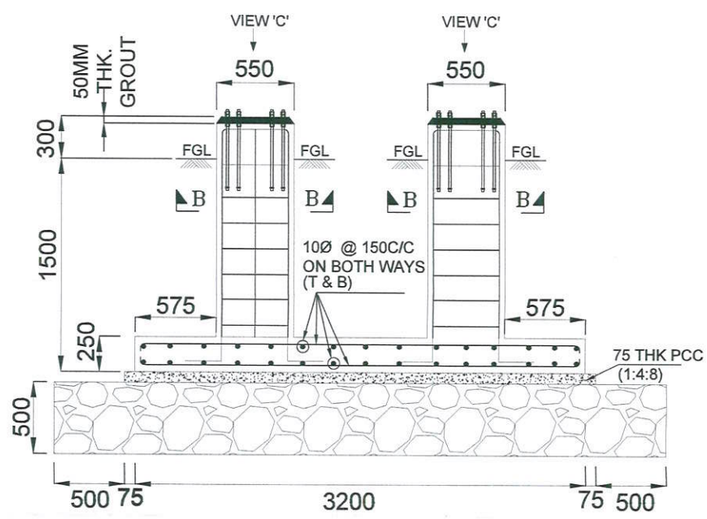
SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



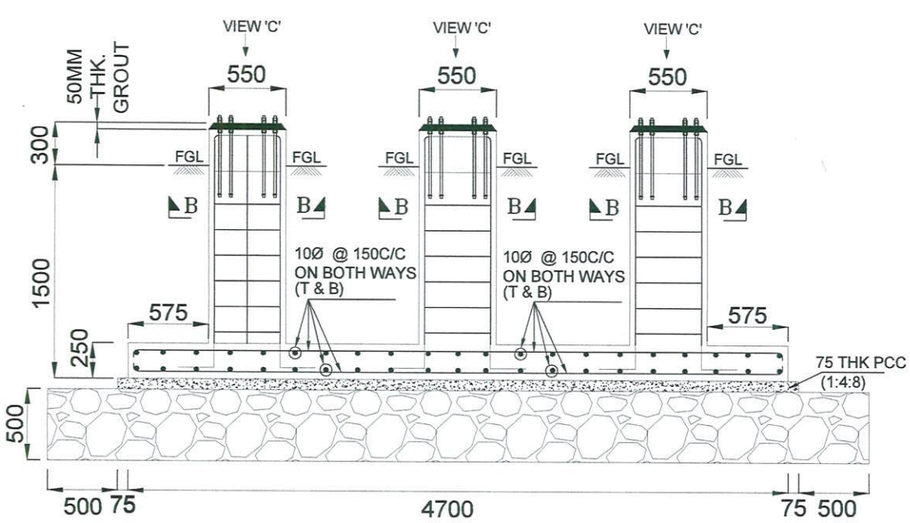
SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



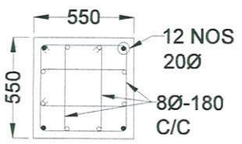
SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)

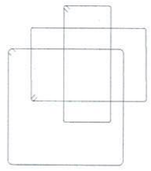


SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



SECTION B-B



RING ARRANGEMENT

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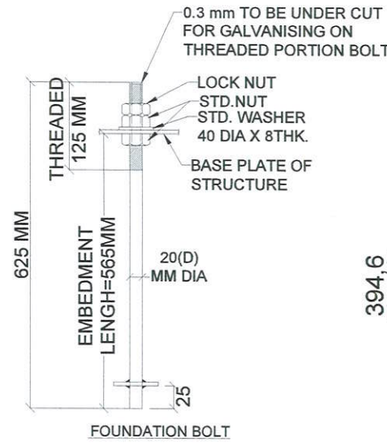
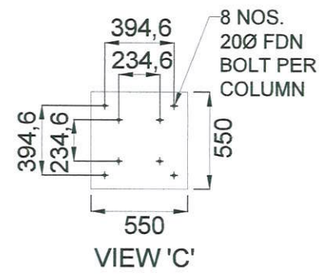


FOUNDATION BOLT



VIEW 'C'

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	33KV CT & 33KV LA COMBINED FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/95		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1
	NAME	DATE	SIGN
PREPARED BY	RAVI	21.05.2022	
CHECKED BY	G.H	21.05.2022	
SUBMITTED BY	ANURAG	21.05.2022	

Approved Approved with comments Not Approved

More Information Date.....

(Signature) (हस्ताक्षर)

(Designation) (पदनाम)

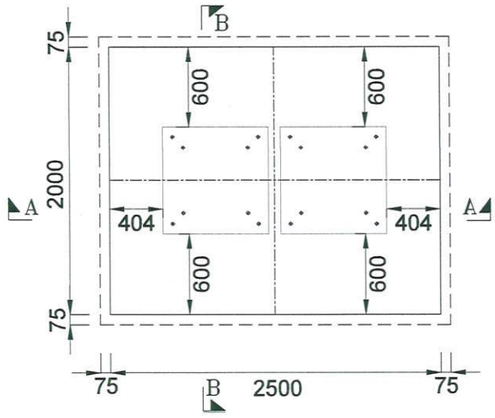
(Date) (तिथि)

Approved/Issued for Fabrication/Construction/Manufacturing.
Subject to condition that all comments are included.
Please submit revised document(s) for approval.
Insert comments and submit again for approval.
For Information and record.
Not approved.

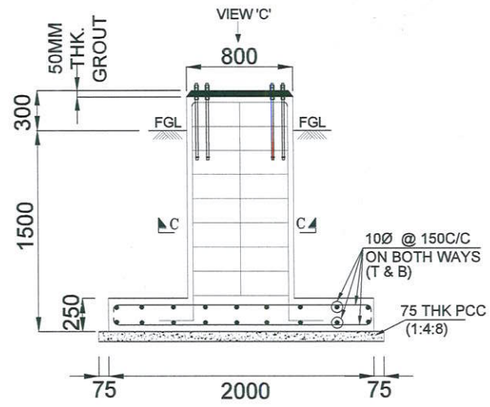
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

REC Power Development & Consultancy Ltd. Gurugram-122001

CV-17228 dt 25/06/22

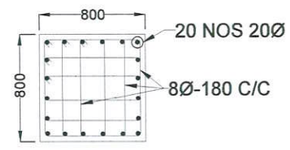


FOUNDATION PLAN

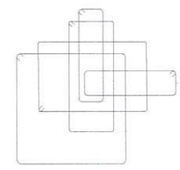


SECTION B-B

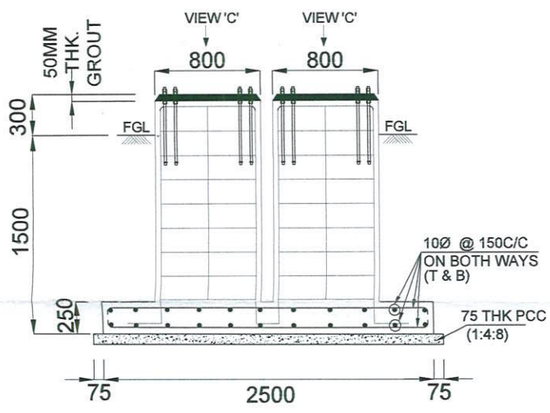
(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



SECTION C-C

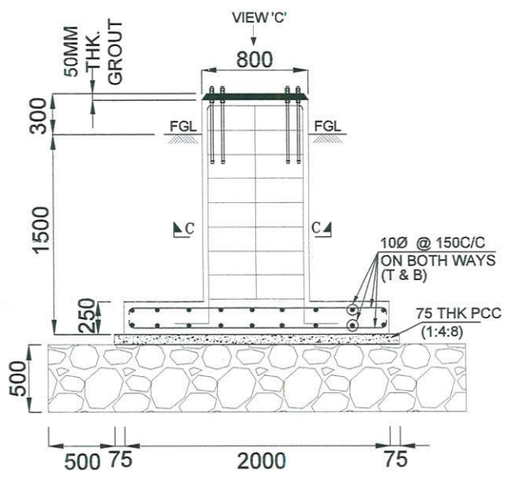


RING ARRANGEMENT



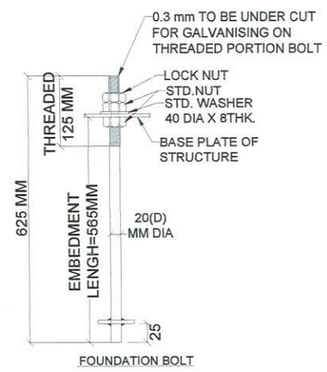
SECTION A-A

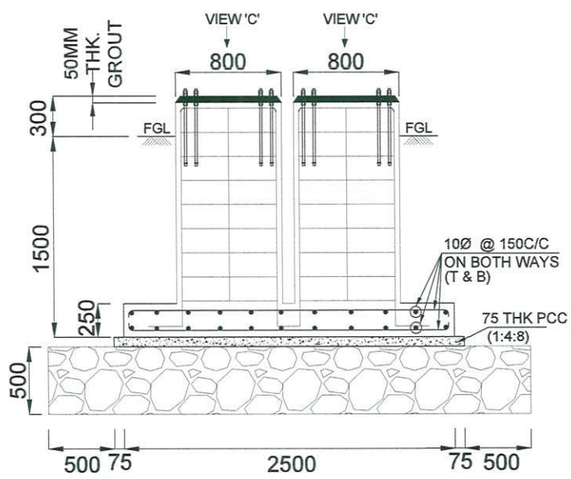
(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



SECTION B-B

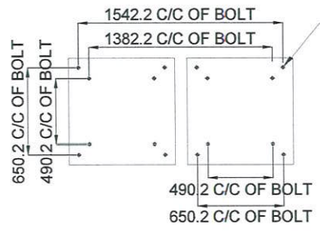
(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)





SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



VIEW 'C'

NOTES:-

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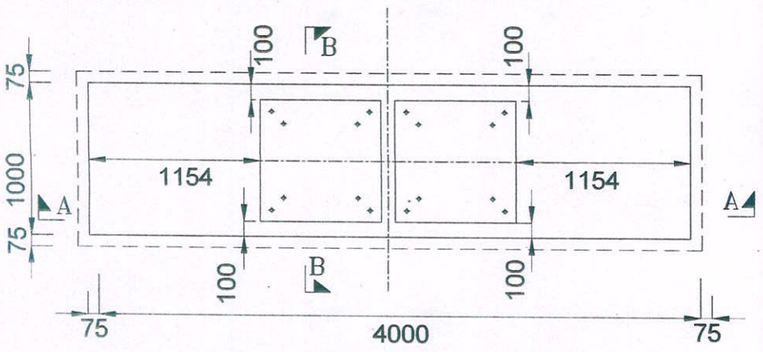
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-jiadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	33KV ISO FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/97			REV- 0
SCALE	As shown in Drawing			SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM			SH.NO: 1 OF 1
	NAME	DATE	SIGN	
PREPARED BY	RAVI	26.05.2022		
CHECKED BY	G.H	26.05.2022		
SUBMITTED BY	ANURAG	26.05.2022		Signature & Stamp
☐ Approved ☐ Approved with comments ☐ Not Approved				
☐ More Information	Date.....			

Kailash Devbuild (India) Pvt. Ltd.

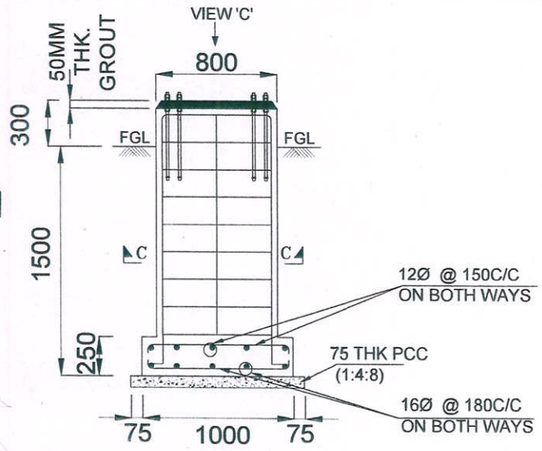
Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
स्वीकृत/जारी/निर्माण/विनिर्माण/हेतु अनुमोदित।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.- Please submit the revised documents for approval.
स्वीकृत/जारी/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
Signature (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

REC Power Development And Consultancy Ltd. Gurugram-122001

CW-17906 dt 12/7/2022



FOUNDATION PLAN



SECTION B-B

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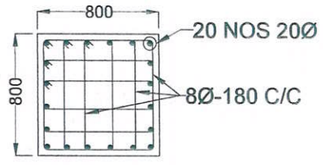
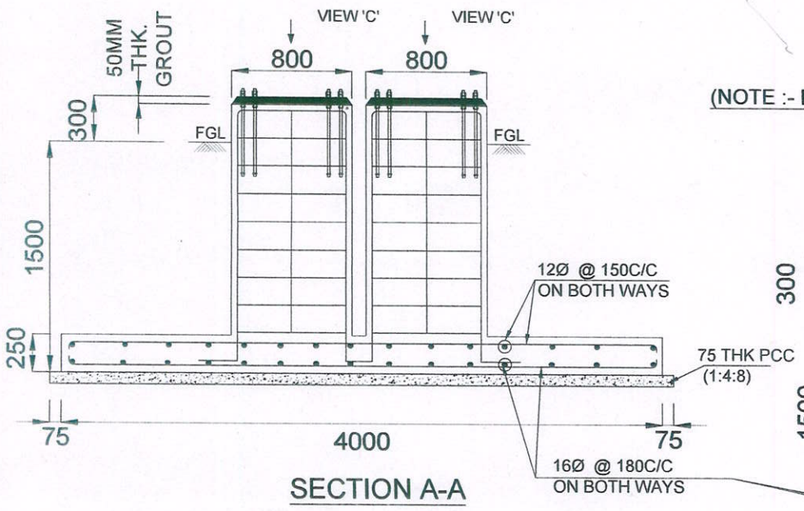


SECTION C-C



SECTION A-A

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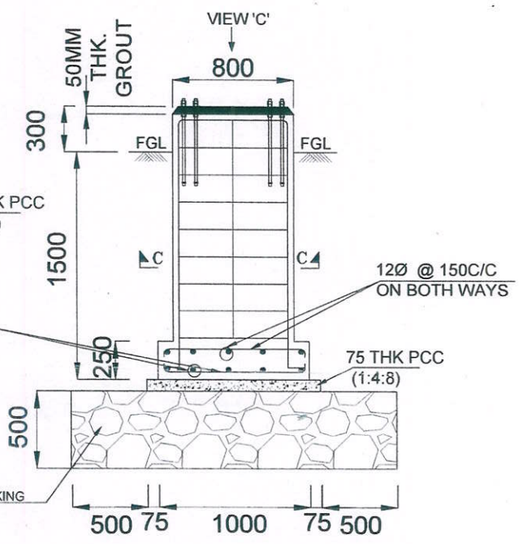

SECTION B-B

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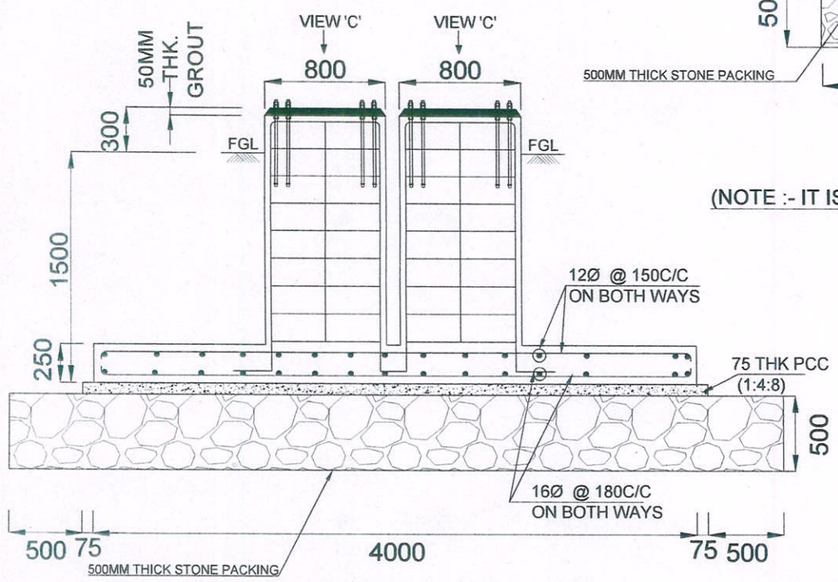

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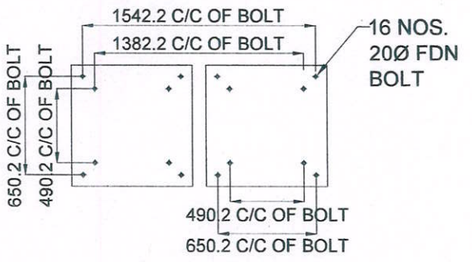

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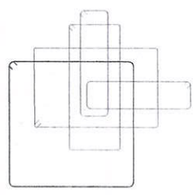
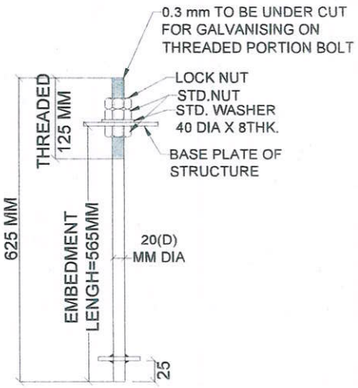


RING ARRANGEMENT



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7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5 T/SQM AT 1.5MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	33KV ISO FDN DRAWING OF 220/33 KV Nagrota (New) S/S, Jammu (TYPE 'B' VARIATION IN SIZE)
DRG. NO.	KDBIL/250 PJ/20-21/D1/97(B) — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 1

	NAME	DATE	SIGN
PREPARED BY	SHIVAM	27.09.2022	
CHECKED BY	G.H	27.09.2022	
SUBMITTED BY	ANURAG	27.09.2022	Signature/Stamp...

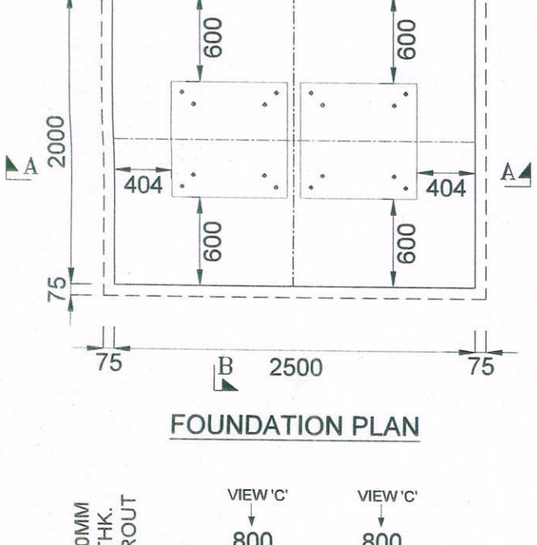
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

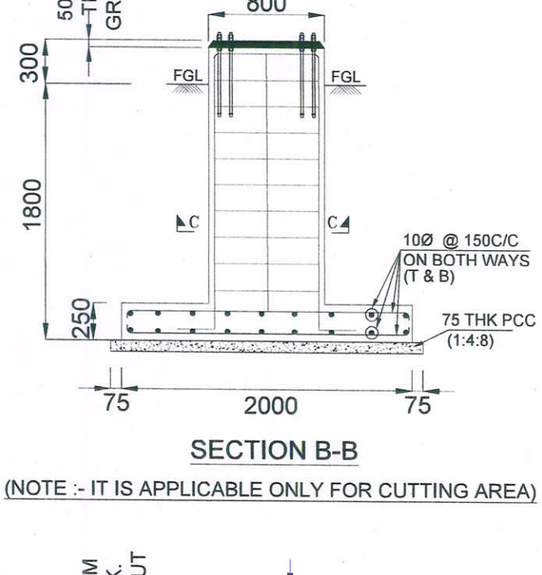
CN-20855

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.- Please submit the revised document for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी/ बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

(Signature) (हस्ताक्षर)
Manager
(Designation) (पदनाम)
3/10/22
(Date) (तिथि)

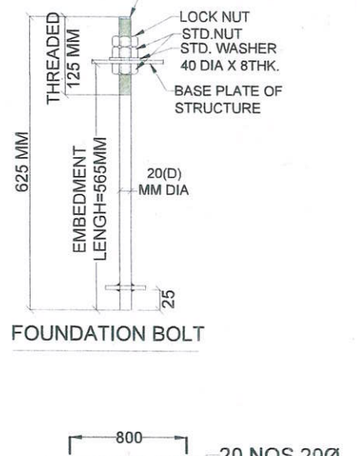


FOUNDATION PLAN

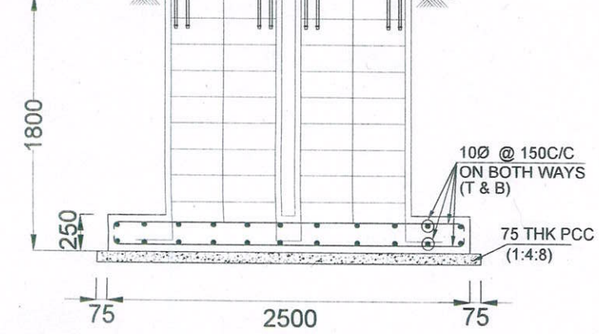


SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)

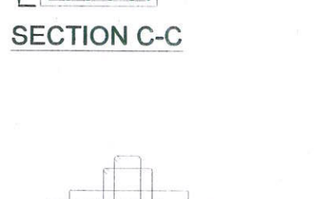


FOUNDATION BOLT

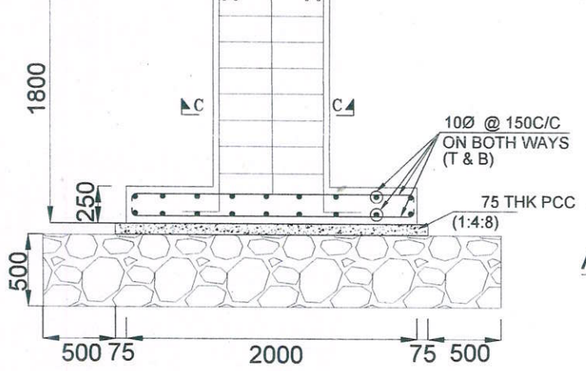


SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



SECTION C-C

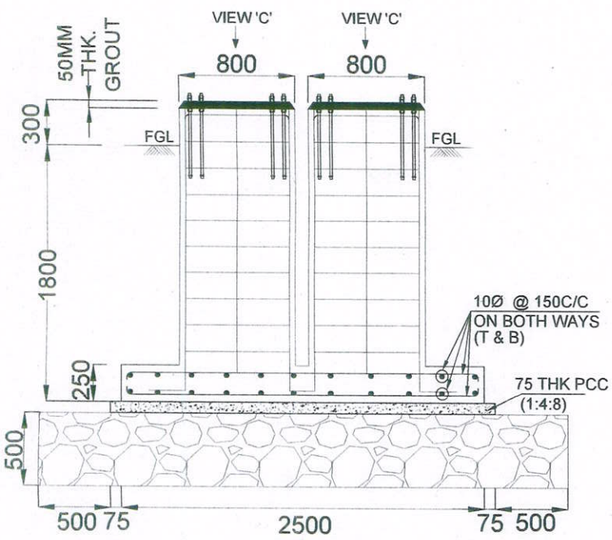


SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)

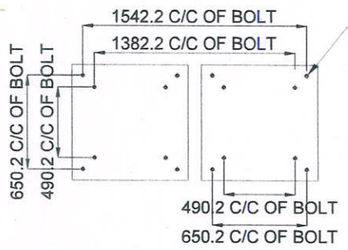


RING ARRANGEMENT



SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



VIEW 'C'

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5 T/SQM AT 1.8 MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 617, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	33KV ISO FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu (TYPE 'A' VARIATION IN DEPTH)			
DRG. NO.	KDBIL/250 PJ/20-21/D1/97A			REV- 0
SCALE	As shown in Drawing			SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM			SH.NO.:- 1 OF 1
	NAME	DATE	SIGN	
PREPARED BY	P.P.	27.09.2022		
CHECKED BY	G.H	27.09.2022		
SUBMITTED BY	ANURAG	27.09.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

CN-20855

Categories
श्रेणियां

I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण/हेतु अनुमोदित/जारी।

II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that attements and comments are included.
Please submit the revised document for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी/ शर्तों दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।

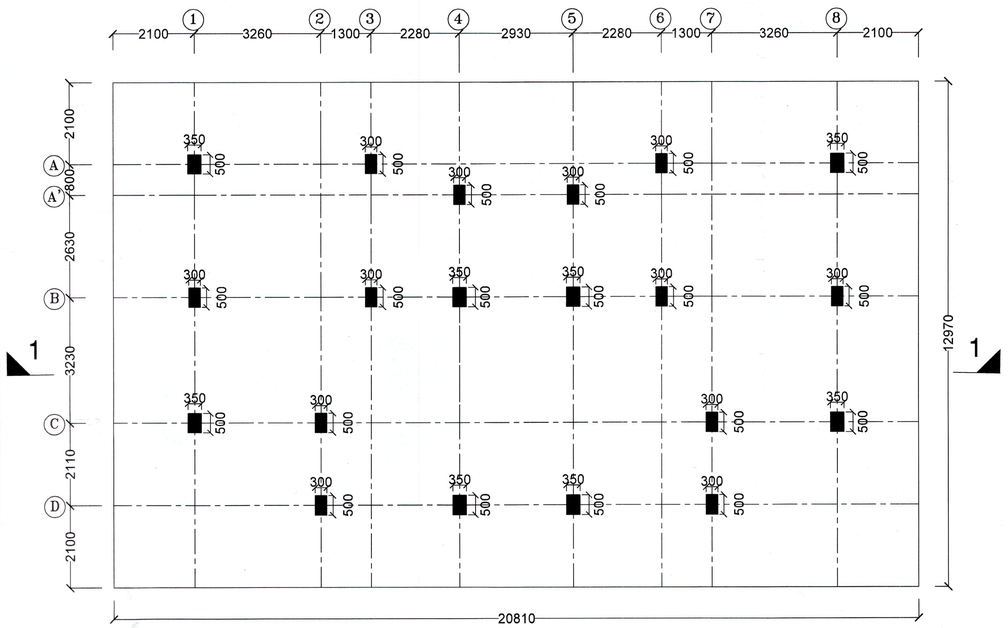
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।

IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।

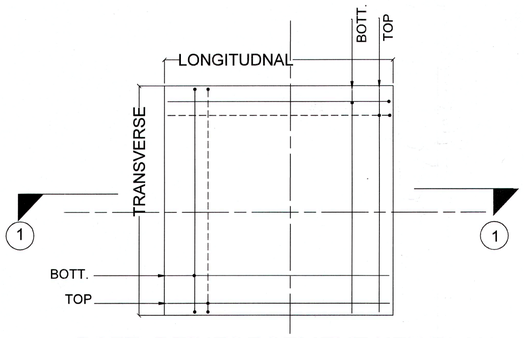
V. Not approved.
अनुमोदित नहीं।

(Signature) (हस्ताक्षर)
Naraga
(Designation) (पदनाम)
3/10/22
(Date) (तिथि)

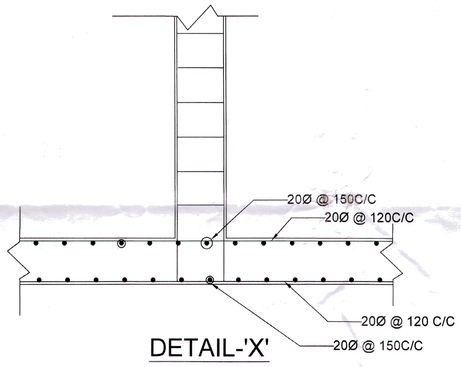
REC Power Development & Consultancy Ltd. Gurugram-122001



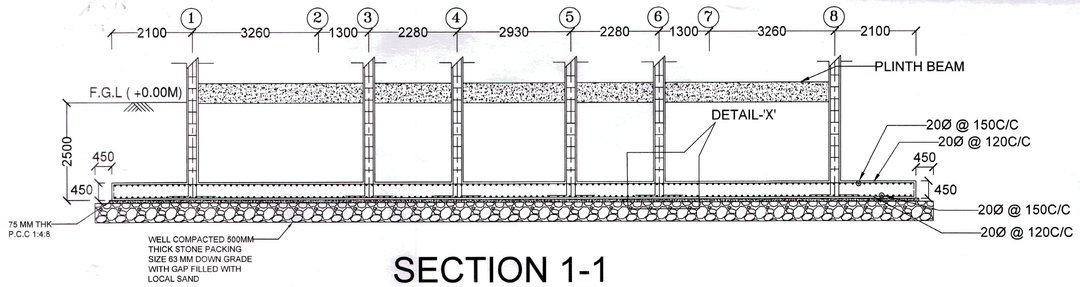
RAFT PLAN



RAFT REINFORCEMENT KEY PLAN



DETAIL-'X'



SECTION 1-1

S.NO.	FOOTING TYPE	FOOTING (IN MTR)		FOOTING THK.(IN MTR) 'D'	BOTTOM REINF.		TOP REINF.	
		BREADTH	LENGTH		LONGITUDINAL	TRANSVERSE	LONGITUDINAL	TRANSVERSE
1	RAFT	12.970	20.810	0.450	20Ø @120c/c	20Ø @150c/c	20Ø @120c/c	20Ø @150c/c

GENERAL NOTES

1. ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CLEAR COVER TO REINFORCEMENT SHALL BE AS GIVEN BELOW :-
   a) 40MM FOR COLUMN
   b) 50MM FOR FOOTING
   c) 25MM FOR BEAM
   d) 20MM FOR SLAB
3. GRADE OF CONCRETE M25.
4. GRADE OF REINFORCEMENT SHALL BE Fe500 AS PER IS 1786.
5. LAP LENGTH SHALL BE 47-TIMES DIA OF BAR.
6. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF BARS SHALL BE AS PER IS:456-2000.
7. THE ALLOWABLE BEARING CAPACITY OF SOIL FOR RAFT FOUNDATION FOR 2.5M DEPTH IS CONSIDERED AS 5 KN/M2.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	JE QUARTER FOUNDATION DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/98		REV-0	
SCALE	As shown in Drawing		SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1	
	NAME	DATE	SIGN	
PREPARED BY	B.K	26.05.2022		R.C BANSAL
CHECKED BY	G.H	26.05.2022		
SUBMITTED BY	ANURAG	26.05.2022		Signature/Stamp

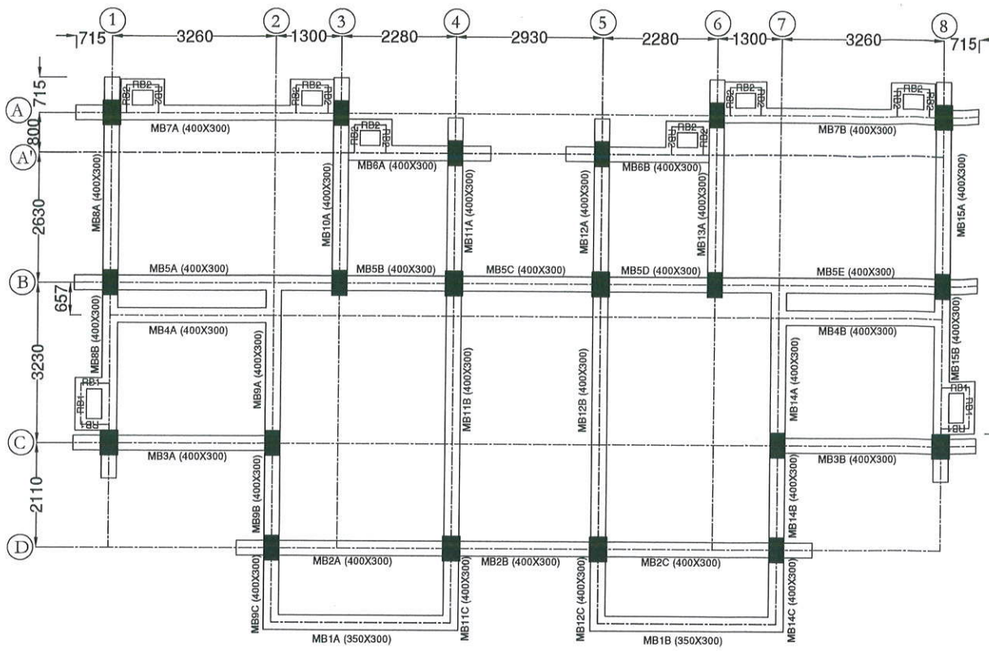
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

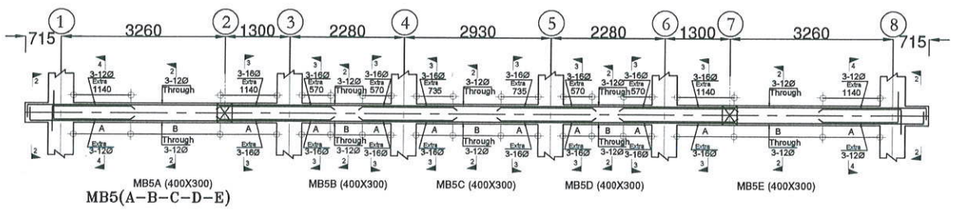
Consentes
Approved Issued for Fabrication/Construction/Manufacturing.
Approved Issued for Fabrication/Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
Please submit the revised documents for approval.
Insert comments and submit again for approval.
For information and record.
Not approved.

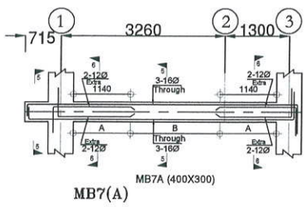
(Signature) (Designation) (Date)

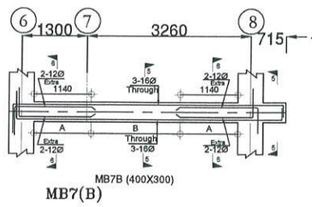
Cnr-17906 dt 12/7/2022

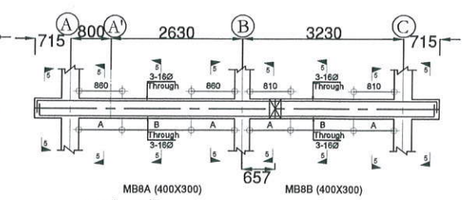


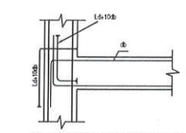
FIRST FLOOR BEAM PLAN

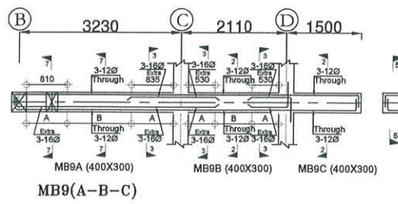


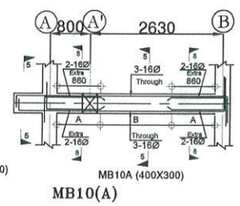


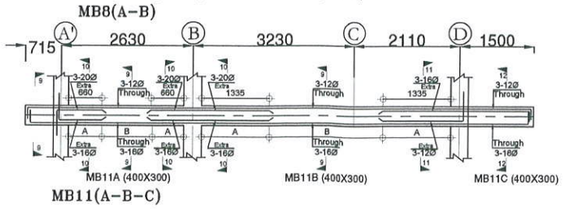


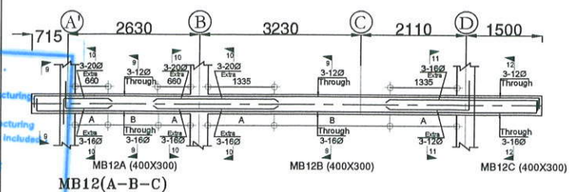


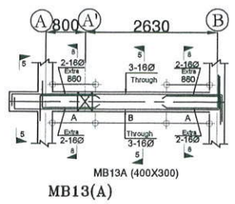


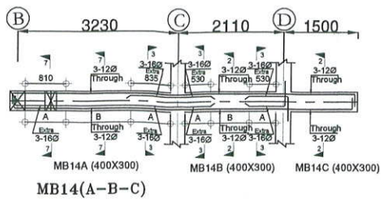


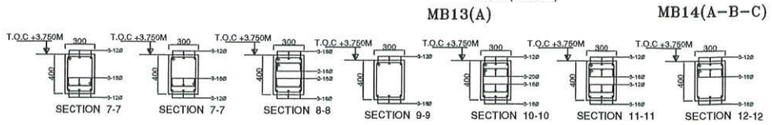


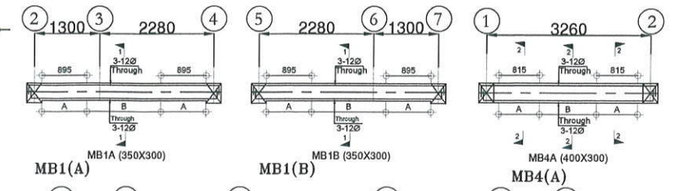


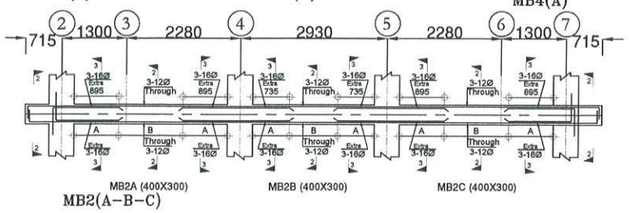


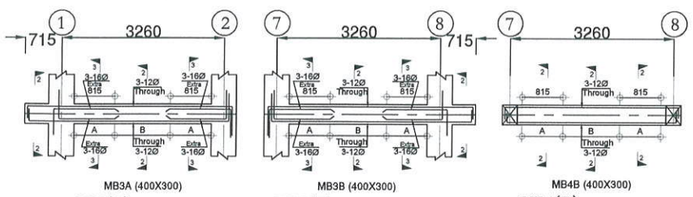


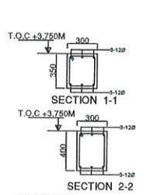


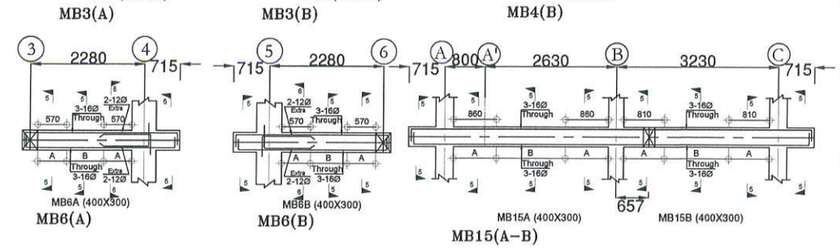


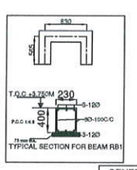


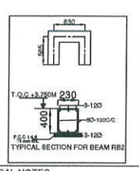












STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FIRST FLOOR BEAM DETAIL DRAWING JE QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.
DRG. NO.	KDBIL/250 PJ/20-21/D1/99 — REV- 1
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 2 OF 5

	NAME	DATE	SIGN
PREPARED BY	BK	11.06.2022	
CHECKED BY	G.H	11.06.2022	
SUBMITTED BY	ANURAG	11.06.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

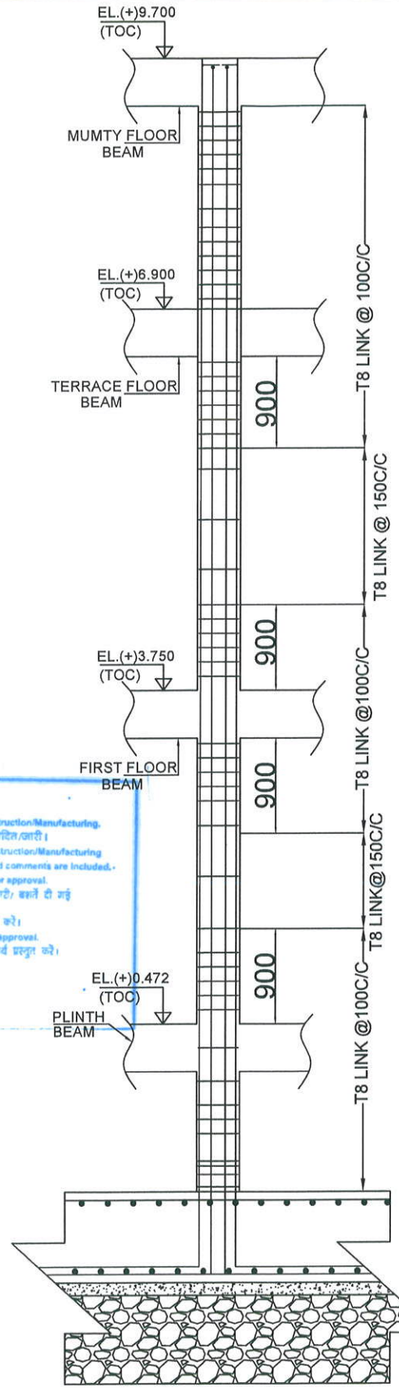
KDBIL

Signature/Stamp...

Categories
श्रेणियाँ
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing
स्वीकृत/जिसे/निर्माण/विनिर्माण/हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing
स्वीकृत/जिसे/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते टी
टिप्पणियों को सम्मिलित किया जाए।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

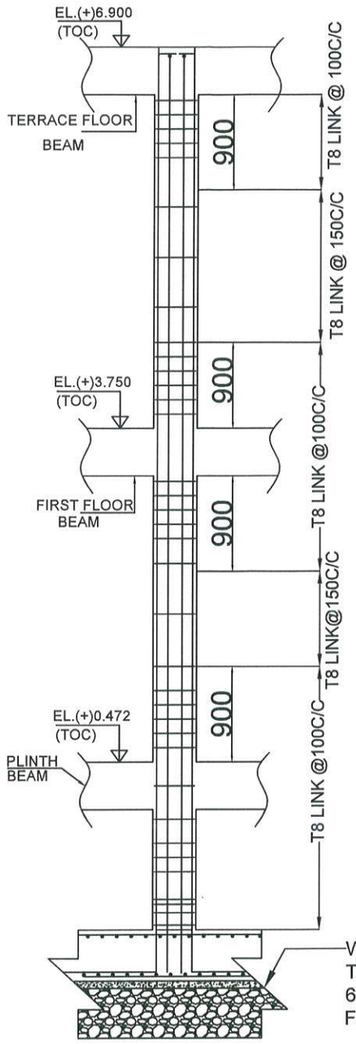
(Signature)
(हस्ताक्षर)
12/7/22
(Designation)
(पदनाम)
(Date)
(तिथि)

CN-1796



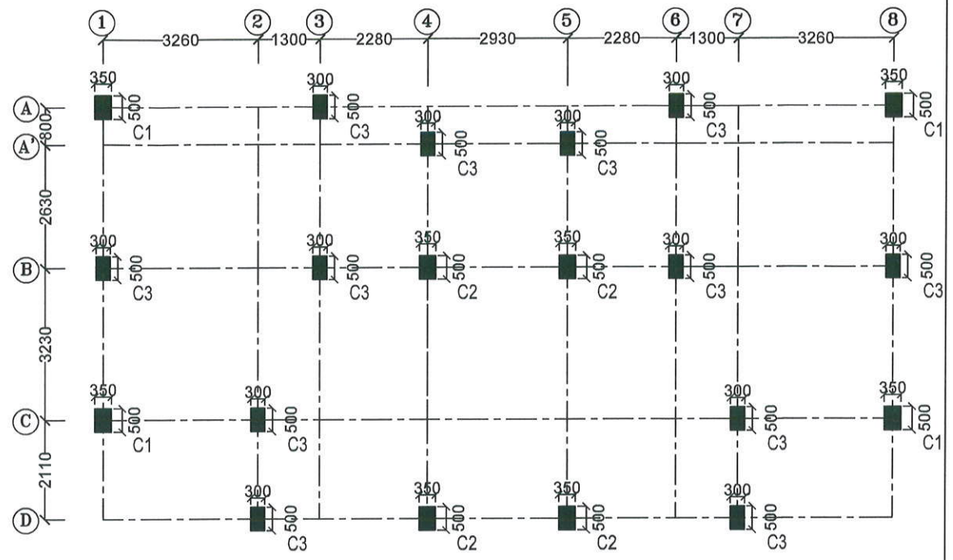
WELL COMPACTED 500MM
THICK STONE PACKING SIZE
63MM DOWN GRADE WITH GAP
FILLED WITH LOCAL SAND.

TYPICAL COLUMN SECTION UPTO MUMTY LEVEL



WELL COMPACTED 500MM
THICK STONE PACKING SIZE
63MM DOWN GRADE WITH GAP
FILLED WITH LOCAL SAND.

TYPICAL COLUMN SECTION UPTO TERRACE LEVEL



COLUMN LAYOUT PLAN

S.NO.	COL. MKD.	QTY. COL. (NOS.)	COLUMN SIZE (mm)	MAIN REINFORCEMENT
				FOUNDATION TO TERRACE FLOOR LEVEL
1.	C1	4	350X500	●25Ø-4NOS. ○16Ø-6NOS.
2.	C3	12	300X500	●25Ø-4NOS. ○16Ø-6NOS.

S.NO.	COL. MKD.	QTY. COL. (NOS.)	COLUMN SIZE (mm)	MAIN REINFORCEMENT
				FOUNDATION TO MUMTY FLOOR LEVEL
1.	C2	4	350X500	●25Ø-6NOS. ○20Ø-4NOS.

GENERAL NOTES

1. ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CLEAR COVER TO REINFORCEMENT SHALL BE AS GIVEN BELOW :-
   a) 40MM FOR COLUMN
   b) 50MM FOR FOOTING
   c) 25MM FOR BEAM
   d) 20MM FOR SLAB
3. GRADE OF CONCRETE M25.
4. GRADE OF REINFORCEMENT SHALL BE Fe500 AS PER IS 1786.
5. LAP LENGTH SHALL BE 47-TIMES DIA OF BAR.
6. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF BARS SHALL BE AS PER IS:456-2000.
7. THE ALLOWABLE BEARING CAPACITY OF SOIL FOR RAFT FOUNDATION FOR 2.5M DEPTH IS CONSIDERED AS 5 KN/M2.

LEGEND:

B.O.L = BOTTOM OF LINTEL
T.O.S = TOP OF SLAB
T.O.C = TOP OF CONCRETE
B.O.C = BOUNDARY OF CONCRETE

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 09.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	COLUMN RCC DETAIL DRAWING JE QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.
DRG. NO.	KDBIL/250 PJ/20-21/D1/99 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO.- 5 OF 5

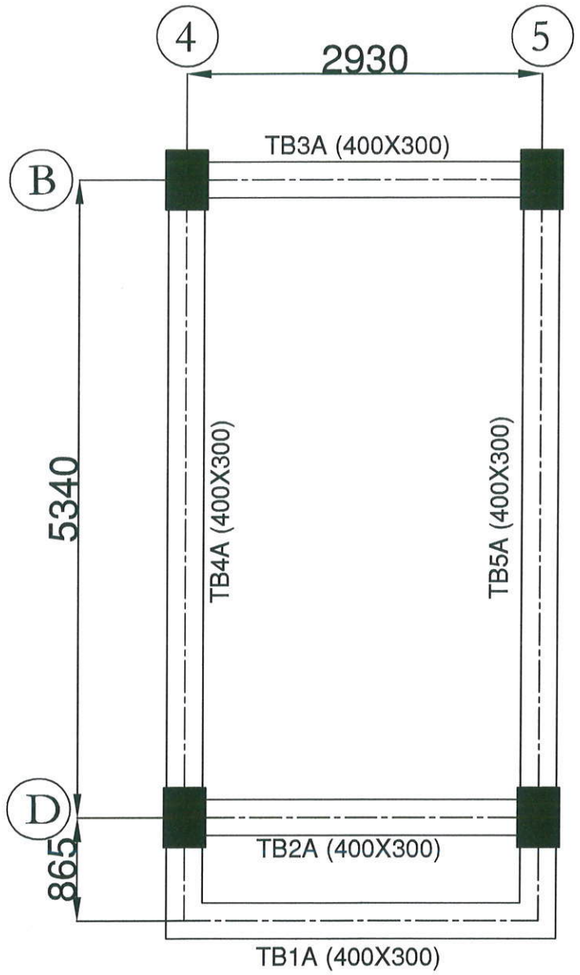
	NAME	DATE	SIGN
PREPARED BY	BK	27.05.2022	
CHECKED BY	G.H	27.05.2022	
SUBMITTED BY	ANURAG	27.05.2022	

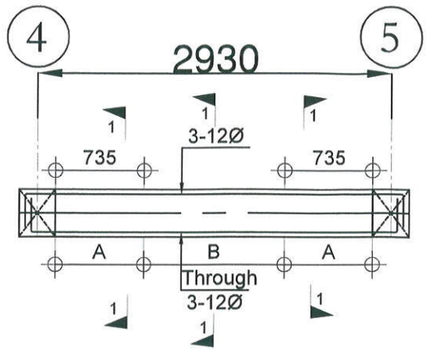
KDBIL Jabalpur
Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
पेंडीकेशन /निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing subject to condition that statements and comments are included.-
Please submit the revised documents for approval.
पेंडीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी/ बशर्ते दी गई टिप्पणियों को शामिल किया जाए।
अपने संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर) 24/5/22
(Designation) (पदनाम)
(Date) (तिथि)

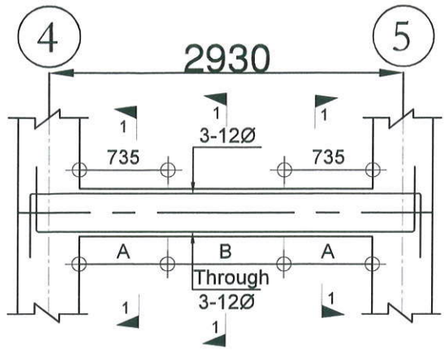
REC Power Development And Consultancy Ltd. * Gurugram-122001 *
CN-17906





TB1A (400X300)

TB1(A)



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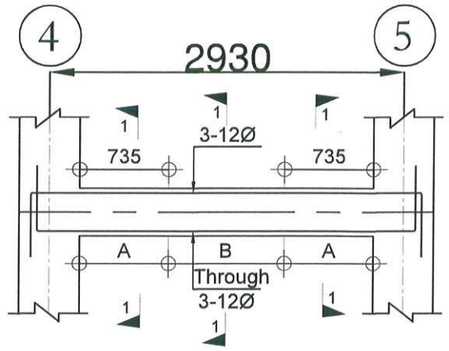
TB2(A)



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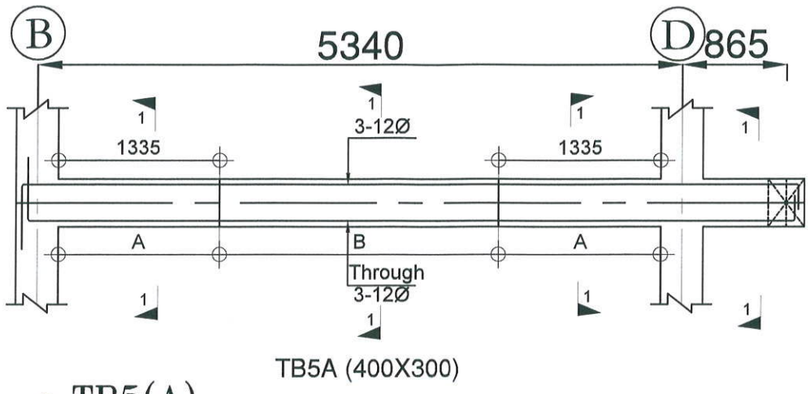
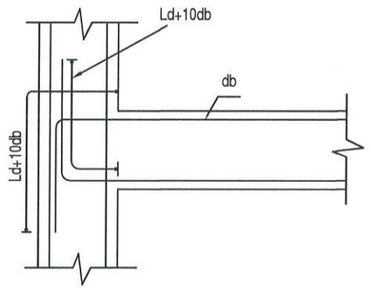
TB3(A)



TB5A (400X300)

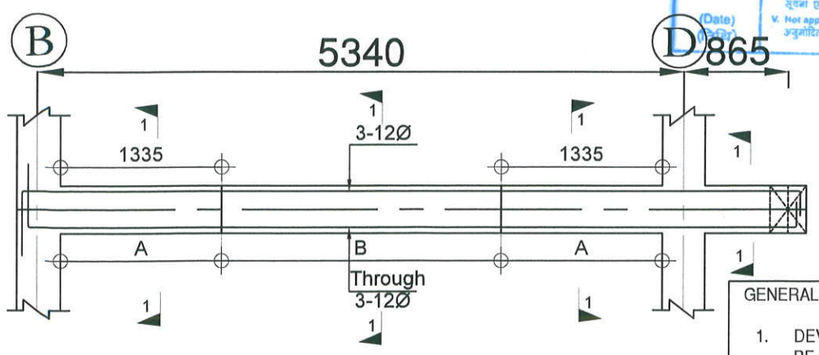
TB5(A)



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER

TYPICAL BEAM
& COLUMN JUNCTION

MUMTY BEAM PLAN



TB4A (400X300)

TB4(A)



SECTION 1-1

Disapproved
अस्वीकृत
I. Approved/ issued for Fabrication/Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ issued for Fabrication/ Construction/Manufacturing subject to condition that statements and comments are included..
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी नहीं की गई टिप्पणियों को शामिल किया जाए।
पुनः संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Resubmit comments and submit again for approval.
टिप्पणियों को शामिल कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकार्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
12/7/22
(Designation) (पदनाम)
(Date) (दिनांक)

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 08.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 08.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	MUMTY BEAM DETAIL DRAWING JE QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.		
DRG. NO.	KDBIL/250 PJ/20-21/D1/99		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM		SH.NO. 4 OF 5
	NAME	DATE	SIGN
PREPARED BY	BK	27.05.2022	
CHECKED BY	G.H	27.05.2022	
SUBMITTED BY	ANURAG	27.05.2022	

KDBIL

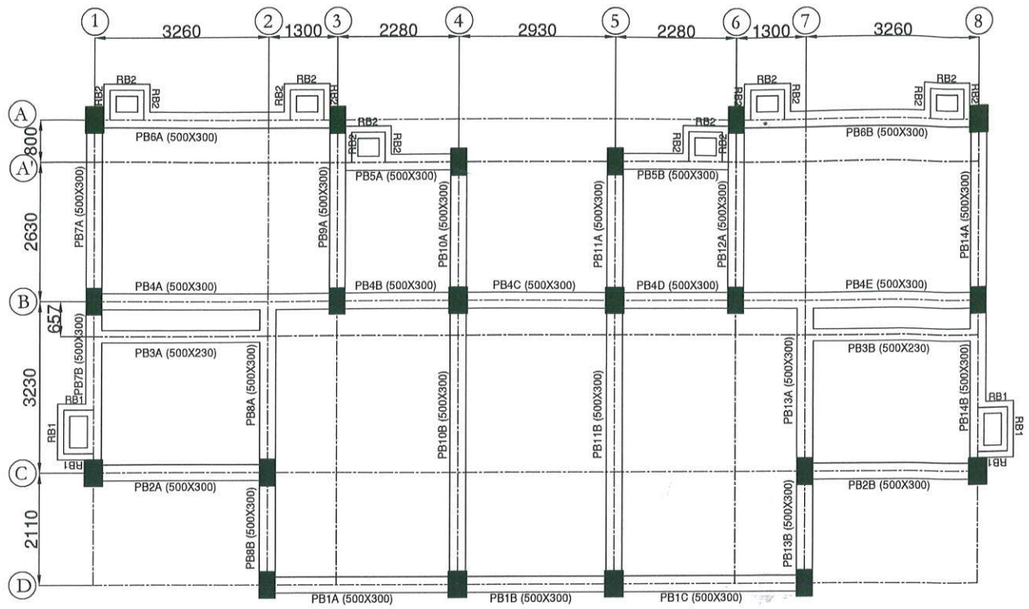
Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

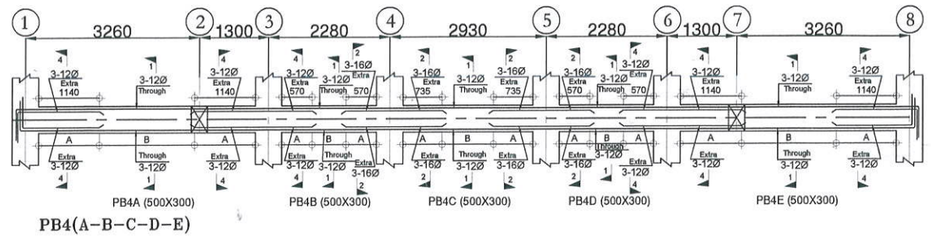
☐ More Information Date.....

REC Power Development And Consultancy Ltd. Gurgaon-122001

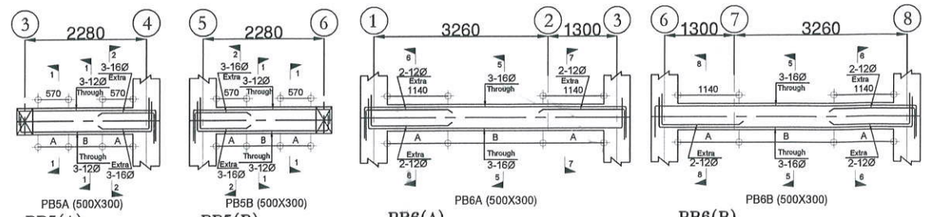
CRI-17906



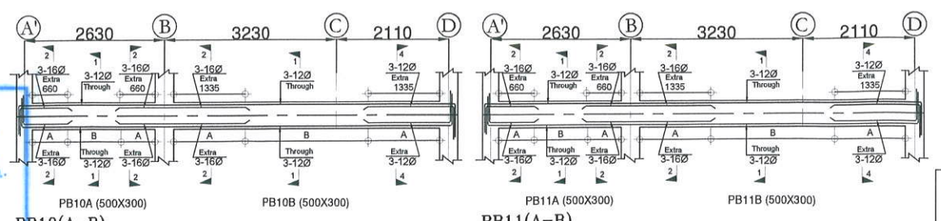
PLINTH BEAM PLAN



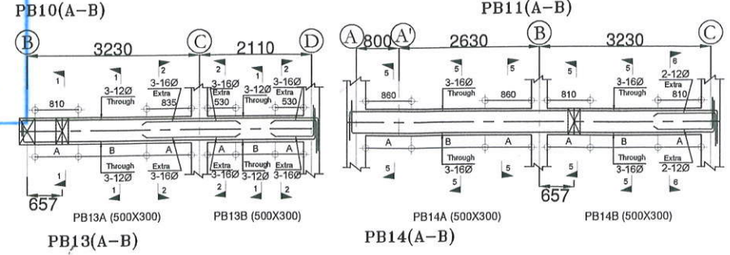
PB4(A–B–C–D–E)



PB5(A) PB5(B) PB6(A) PB6(B)



PB10(A–B) PB11(A–B)



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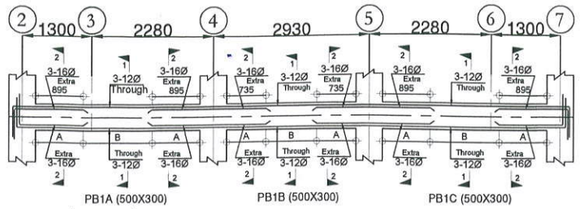
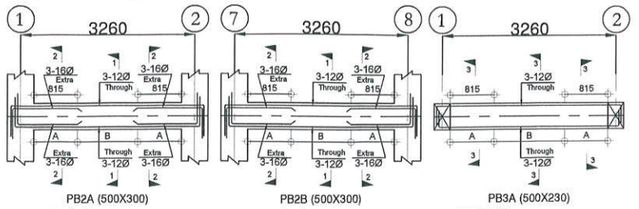
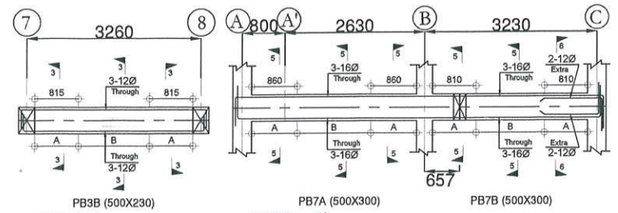


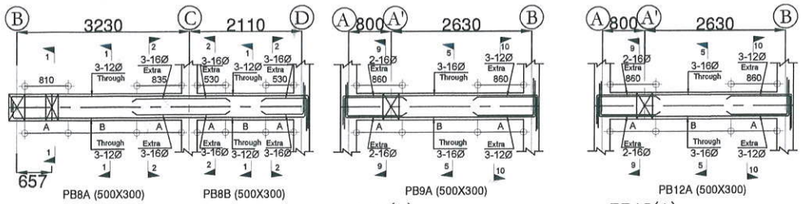
PB1(A–B–C)



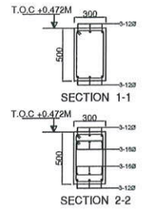
PB2(A) PB2(B) PB3(A)

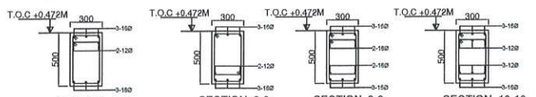


PB3(B) PB7(A–B)



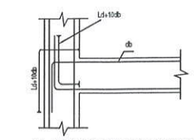
PB8(A–B) PB9(A) PB12(A)



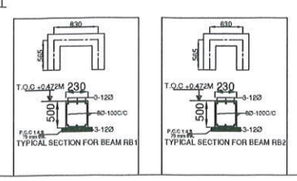


STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM
& COLUMN JUNCTION



GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	PLINTH BEAM DETAIL DRAWING JE QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.
DRG. NO.	KDBIL/250 PJ/20-21/D1/99 — REV- 1
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM — SH.NO.- 1 OF 5

	NAME	DATE	SIGN
PREPARED BY	BK	11.06.2022	
CHECKED BY	G.H	11.06.2022	
SUBMITTED BY	ANURAG	11.06.2022	

KDBIL Jabalpur
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

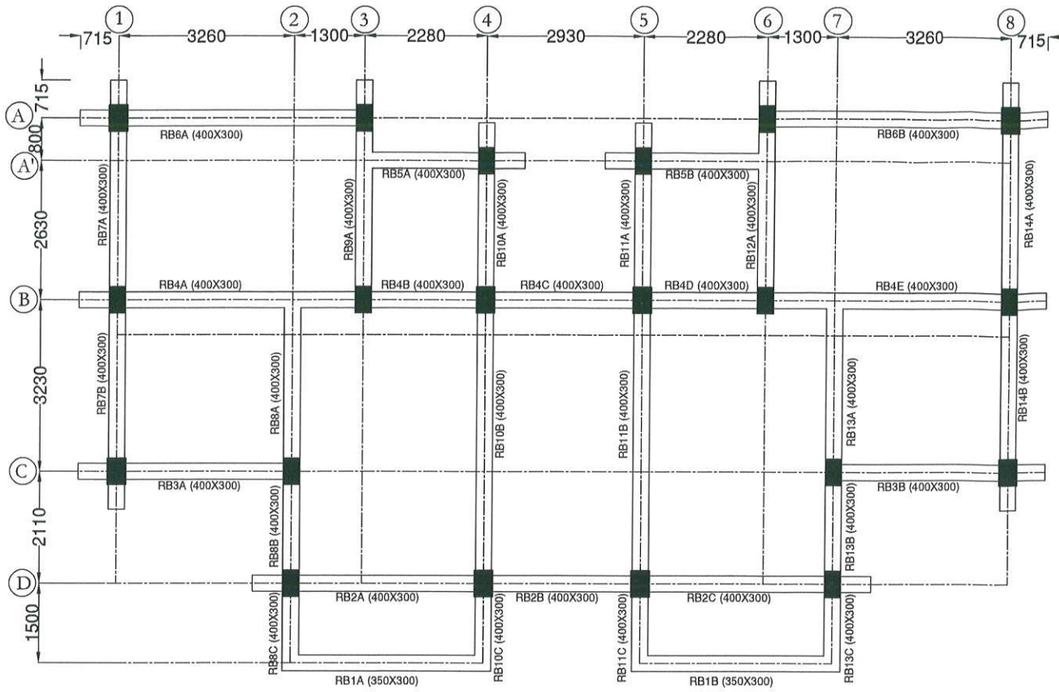
☐ More Information Date.....

Categories श्रेणियां
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
II. Approved/ Issued for Fabrication/ Construction/Manufacturing subject to condition that statements and comments are included.
III. Please submit the revised documents for approval.
IV. For Information and record.
V. Not approved.

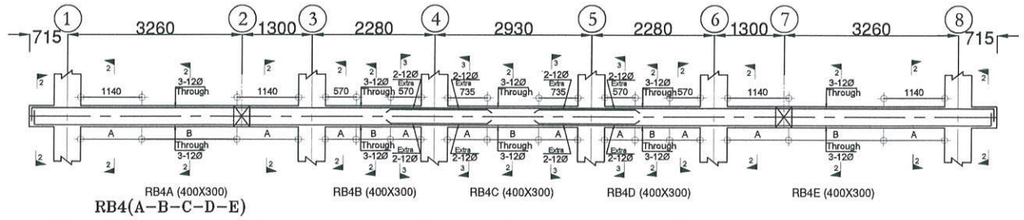
(Signature) (हस्ताक्षर) 12/7/22
(Designation) (पदनाम)
(Date) (तिथि)

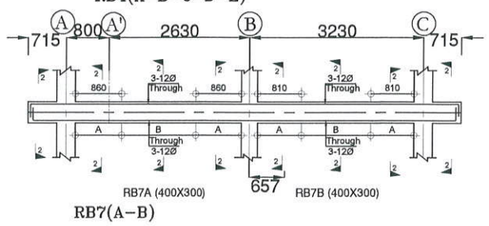
RES Power Development & Consultancy Ltd. Gurugram-122001

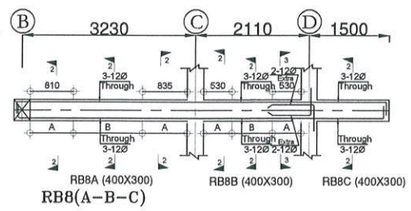
CN-17906

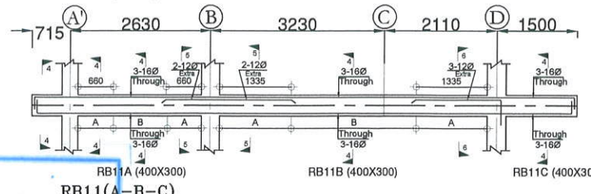


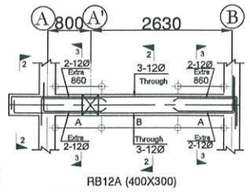
TERRACE ROOF BEAM PLAN

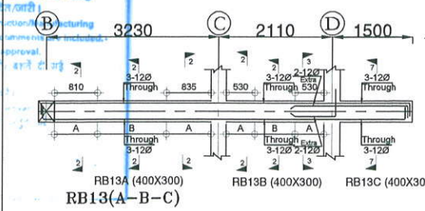


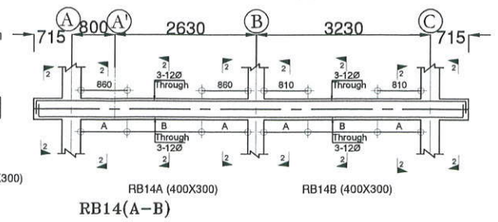


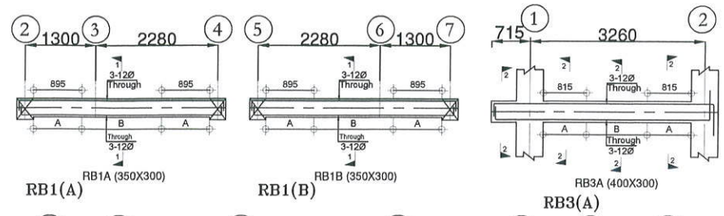


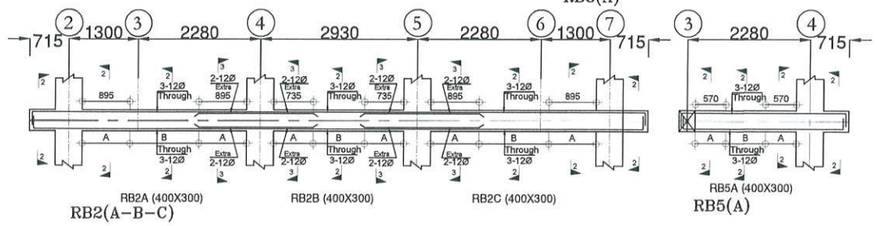


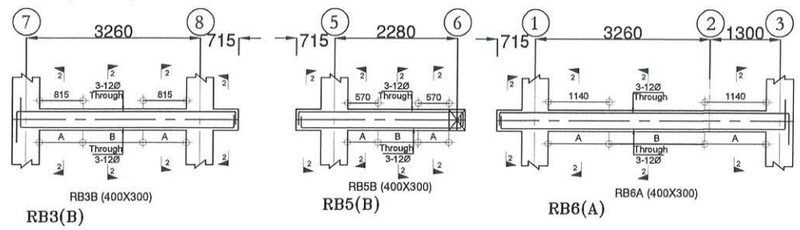


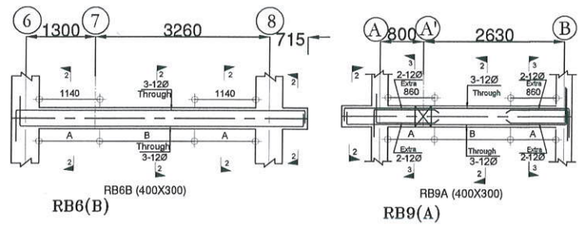


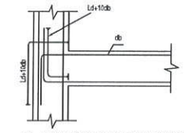




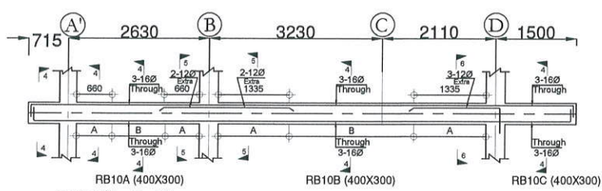






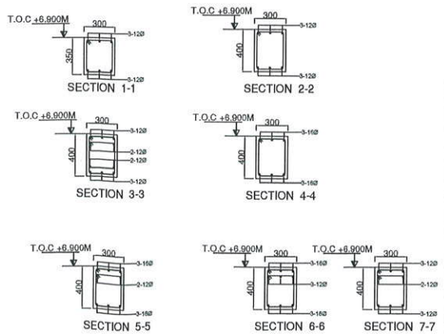


Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM
& COLUMN JUNCTION



STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C



GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

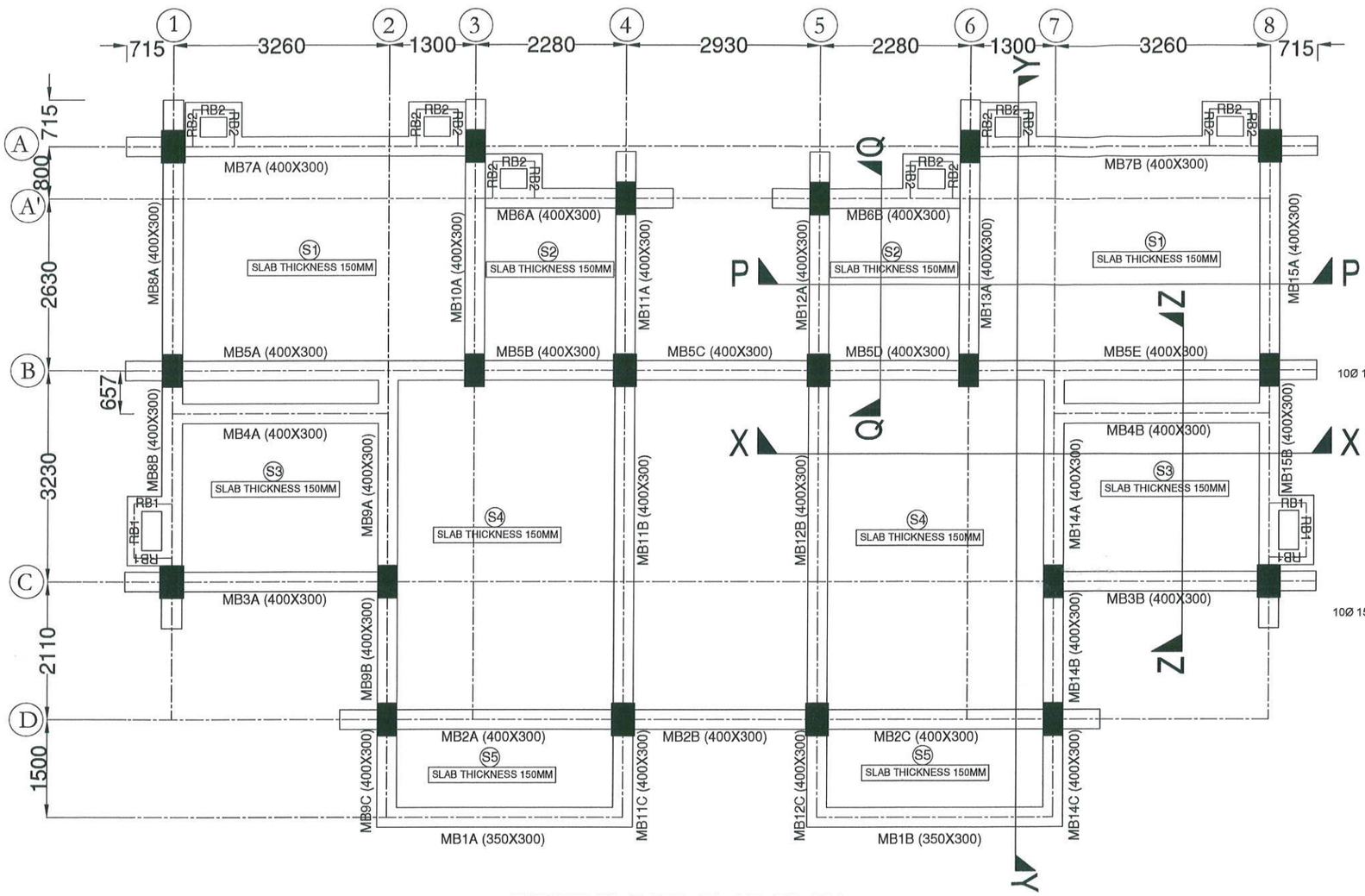
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	TERRACE ROOF BEAM DETAIL DRAWING JE QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.			
DRG. NO.	KDBIL/250 PJ/20-21/D1/99		REV- 1	
SCALE	As shown in Drawing		SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM		SH.NO. 3 OF 5	
	NAME	DATE	SIGN	
PREPARED BY	BK	11.06.2022		
CHECKED BY	G.H	11.06.2022		
SUBMITTED BY	ANURAG	11.06.2022		Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

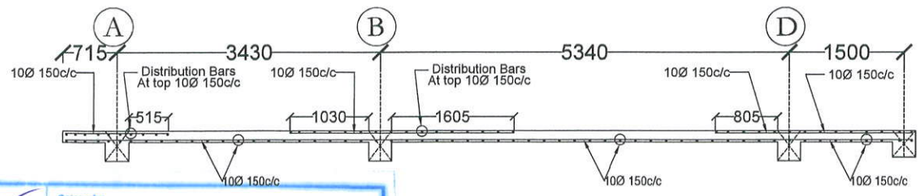
☐ More Information Date.....

Comments
Approved/ Issued/ for Fabrication/Construction/Manufacturing.
स्वीकृतिकरण /निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/ Manufacturing subject to condition that statements and comments are included.
Please submit the revised documents for approval.
स्वीकृतिकरण/निर्माण/विनिर्माण हेतु अनुमोदित/जारी किन्तु टिप्पणी को सम्मिलित किया जाए।
कथन एवं टिप्पणी सम्मिलित अनुमोदनार्थ प्रस्तुत करें।
(Signature) (हस्ताक्षर) 12/7/22
(Designation) (पदनाम)
(Date) (तिथि)

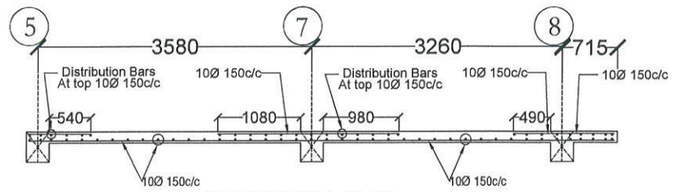
Kailash Devbuild (India) Pvt. Ltd. Gurugram-122001
KDBIL Jabalpur
CN-17906



FIRST FLOOR SLAB PLAN
T.O.C +3.750M



SECTION Y-Y



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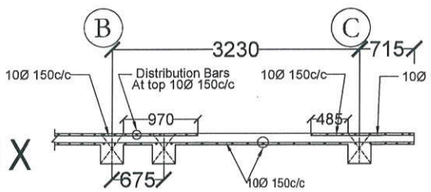
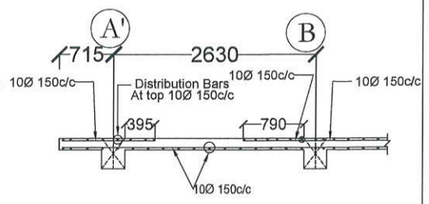
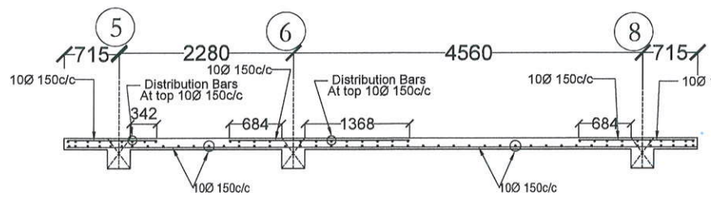


SECTION Z-Z



SECTION Q-Q



SECTION P-P

CAL-No - 17906
12/7/22

REC PDCL GURUGRAM

SLAB THICKNESS 150MM

SLAB REINFORCEMENT DETAILS					
S.NO	SLAB TYPE	SHORT SPAN STEEL (BOT.)	LONG SPAN STEEL (BOT.)	SHORT SPAN STEEL (TOP)	LONG SPAN STEEL (TOP)
1	S1	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
2	S2	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
3	S3	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
4	S4	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
5	S5	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
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   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	FIRST FLOOR SLAB DETAIL DRAWING JE QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.		
DRG. NO.	KDBIL/250 PJ/20-21/D1/100		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 3
	NAME	DATE	SIGN
PREPARED BY	BK	28.05.2022	
CHECKED BY	G.H	28.05.2022	
SUBMITTED BY	ANURAG	28.05.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

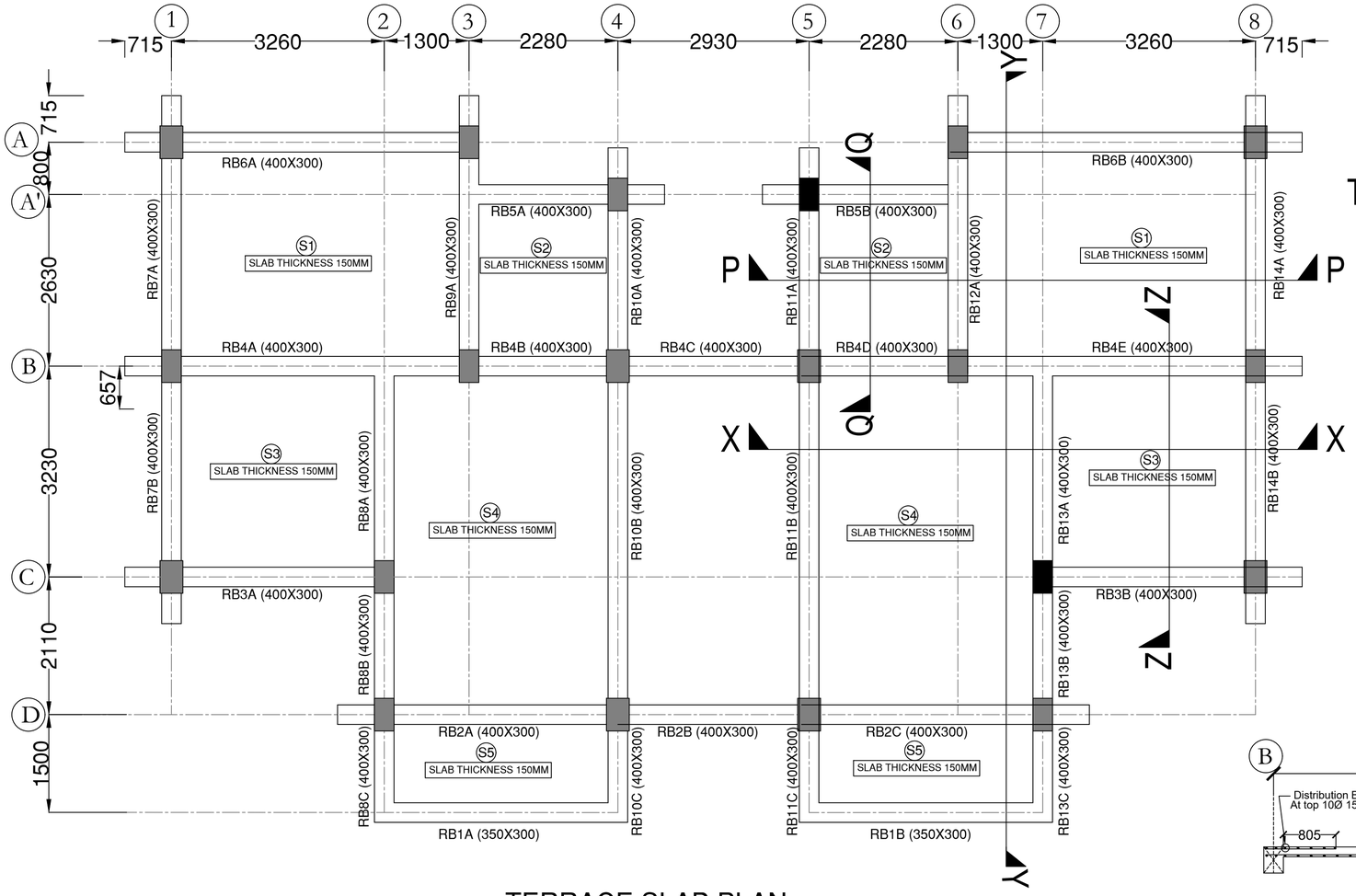
KDBIL

Signature/Stamp

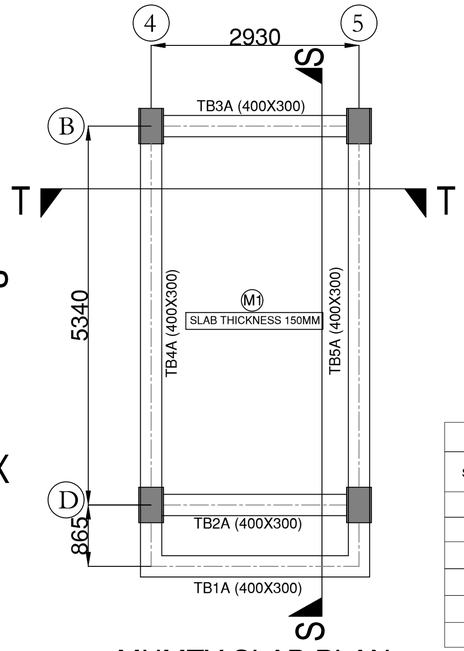
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
पी/निर्माण/निर्माण/विनिर्माण/हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing subject to condition that statements and comments are included.
Please submit the revised documents for approval.
पी/निर्माण/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते की गई टिप्पणियों को शामिल किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Revert comments and submit again for approval.
टिप्पणियों को शामिल कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर) 12/7/22
(Designation) (पदनाम)
(Date) (तिथि)

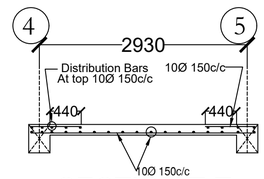
REC PDCL GURUGRAM



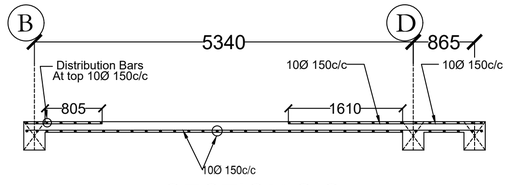
TERRACE SLAB PLAN
T.O.C +6.900M



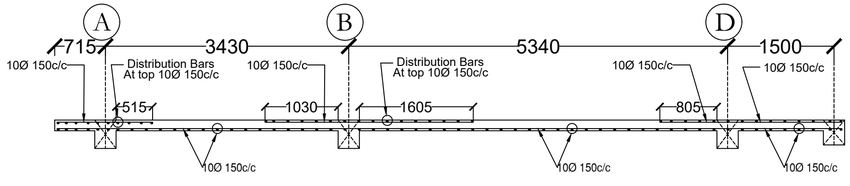
MUMTY SLAB PLAN
T.O.C +9.700M



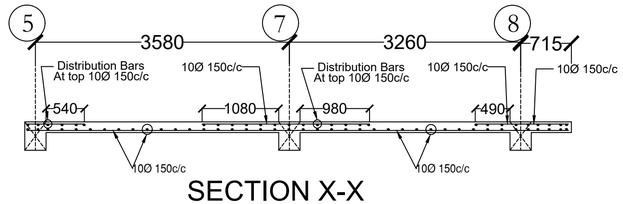
SECTION T-T



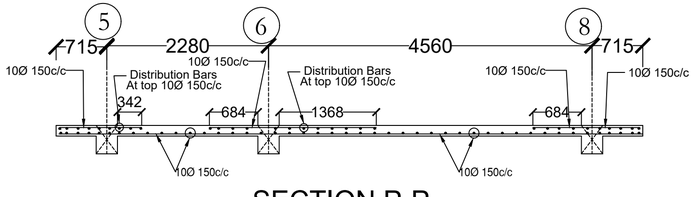
SECTION S-S



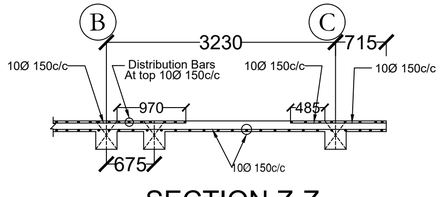
SECTION Y-Y



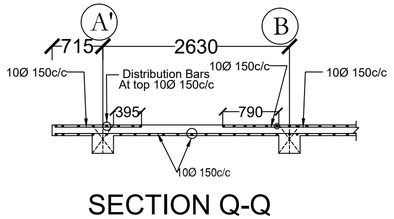
SECTION X-X



SECTION P-P



SECTION Z-Z



SECTION Q-Q

SLAB THICKNESS 150MM

SLAB REINFORCEMENT DETAILS					
S.NO	SLAB TYPE	SHORT SPAN STEEL (BOT.)	LONG SPAN STEEL (BOT.)	SHORT SPAN STEEL (TOP)	LONG SPAN STEEL (TOP)
1	R1	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
2	R2	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
3	R3	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
4	R4	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
5	R5	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
6	M1	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
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6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
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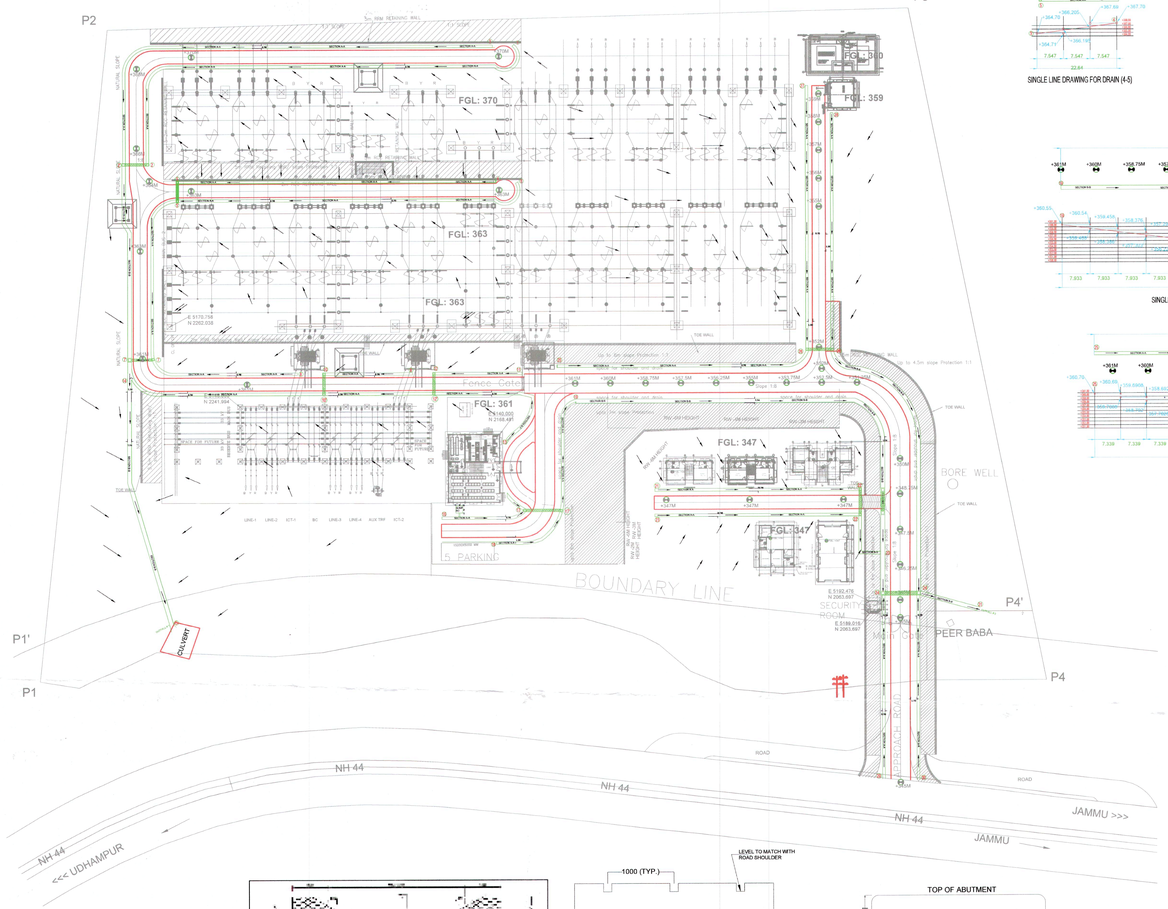
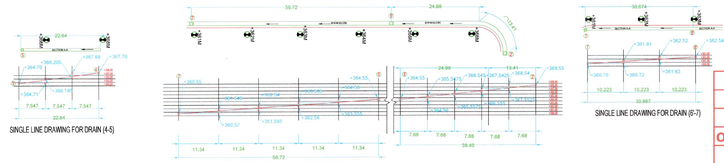
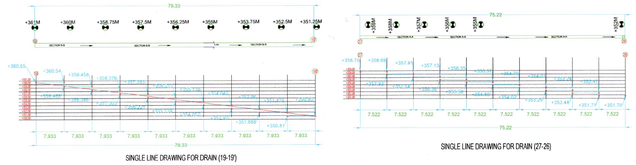
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Distribution Company Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	TERRACE AND MUMTY SLAB DETAIL DRAWING JE QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.			
DRG. NO.	KDBIL/250 PJ/20-21/D1/100		REV- 0	
SCALE	As shown in Drawing		SHEET SIZE- A1	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 2 OF 3	
	NAME	DATE	SIGN	
PREPARED BY	BK	28.05.2022		R.C BANSAL
CHECKED BY	G.H	28.05.2022		
SUBMITTED BY	RACHIT	28.05.2022		Signature/Stamp...

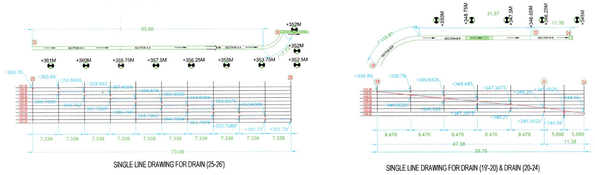
☐ Approved ☐ Approved with comments ☐ Not Approved

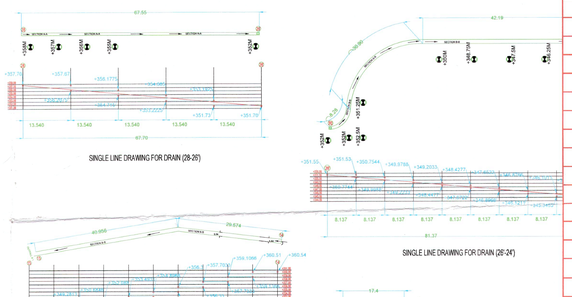
☐ More Information Date.....

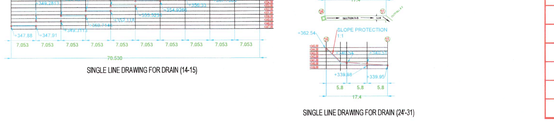










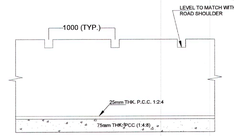


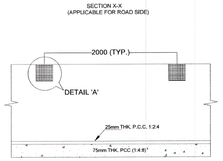
INVERT LEVELS

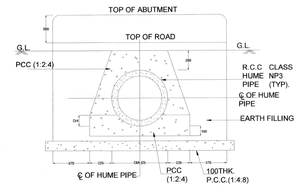
Drain no	BEG. NODE	END NODE	DRAIN (FGL POINTS) BEG (m)	END (m)	DRAIN LENGTH (m)
OUTFALL # 1					
A	1	2	369.70	363.60	105.4
B	3	2'	369.70	363.58	92.06
C	4	5	362.65	362.45	93.06
			368.55	368.54	7.68
E	2'	7'	363.65	360.55	56.72
			364.55	364.535	11.344
F	6	5'	362.70	362.54	105.74
G	5'	7	362.54	360.70	44.67
			362.54	362.52	10.223
H	8	7	360.70	360.65	40.88
I	7'	14	360.55	360.54	5.6
J	9	10	360.70	360.67	25.4
K	13	12'	360.70	360.65	41.97
L	11	12	360.70	360.67	25.4
M	12'	10'	360.65	360.61	31.1
N	10'	14	360.61	360.54	54.08
O	14	15	360.54	347.88	70.53
			360.54	360.51	7.053
OUTFALL # 2					
P	16	17	360.70	360.67	24.89
Q	18	17'	360.70	360.67	23.56
R	17'	19	360.67	360.63	32.53
S	19	19'	360.55	350.80	79.33
			360.55	360.54	7.933
T	19'	20	350.80	346.20	47.38
			350.80	350.79	9.476
U	21	22	346.70	346.635	58.67
V	23	22'	346.70	346.635	58.67
W	22'	20	346.635	346.61	16.99
X	20	24	346.20	344.55	11.38
			345.0625	345.0525	5.69
Y	25	26	360.70	351.70	73.39
			360.70	360.69	7.339
Z	27	26	358.70	351.70	75.22
			358.70	358.69	7.522
AA	28	26'	357.70	351.70	67.55
			357.70	357.67	13.54
AB	26'	24'	351.55	344.54	81.37
			351.55	351.53	8.137
AC	29	24	344.70	344.64	52.62
AD	30	24'	344.70	344.64	52.62
AE	24'	31	344.54	339.95	17.4
			340.54	340.51	5.8







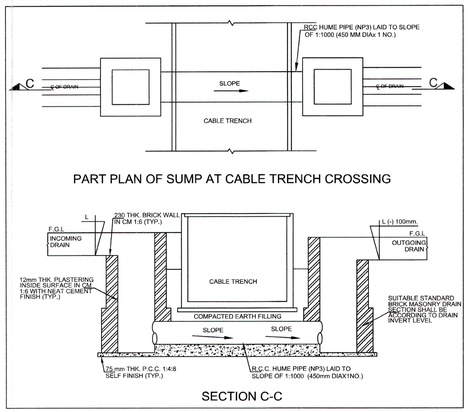




NOTE :-

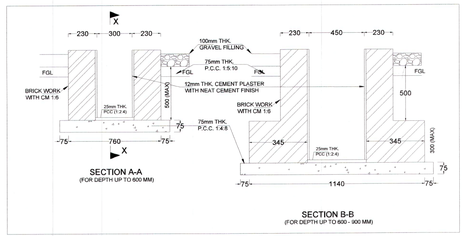
= CABLE TRENCH CROSSING

= FLOW OF WATER



NOTES:-

1. ALL DIMENSIONS ARE IN METERS OTHERWISE SPECIFIED
2. SLOPE FOR ALL DRAINS SHALL NOT BE MORE THAN 1:1000 .
3. MINIMUM DEPTH OF DRAIN SHALL BE 300MM BELOW FGL.
4. WHERE EVER TWO SECTIONS ARE MEETING A TRANSITION ZONE SHALL BE CONSTRUCTED HAVING LENGTH 1000MM.
5. DEPTH OF DRAIN IS TAKEN AS HEIGHT FROM TOP OF DRAIN INVERT OF DRAIN.
6. ALL REINFORCEMENT SHALL BE AS PER BPS.
7. SECTION A-A & SECTION B-B SHALL BE USED FOR THE CONSTRUCTION.
8. 75X75 WEEP HOLE SHALL BE PROVIDED AT SPACING OF 1500mm HORIZONTALLY AND 300mm VERTICALLY IN STAGGERED MANNER. HOWEVER 75 MM DIA PVC PIPE WEEP HOLE SHALL BE PROVIDED IN CASE OF R.C.C. DRAIN.
9. WHENEVER DRAINS ARE COMING IN THE SIDE OF SWITCHYARD/ TOWNSHIP ROAD, PROPER COMPACTION BETWEEN EDGE OF ROAD AND DRAIN SHOULD BE ENSURED.
10. THERE WOULD BE NO CHANGE IN DRAIN DUE TO CABLE TRENCH, PROPER ARRANGEMENT SHALL BE CONSIDERED WHILE CABLE TRENCH DESIGN. IF IT HAPPENS CABLE TRENCH CROSSING SHALL BE PROVIDED.
11. REFER DWG NO. KDBIL/250 PJ/20-21/D1/73 (REV-1) FOR DETAILED DWG OF 5.5m & 3.75 m ROAD.



PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	DETAILED DRAIN & ROAD LAYOUT FOR 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/101 — REV- 02
SCALE	As shown in Drawing
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	AZEEM	03.09.2022	
CHECKED BY	G.H	03.09.2022	
SUBMITTED BY	Mr.ANURAG	03.09.2022	

KDBIL — Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

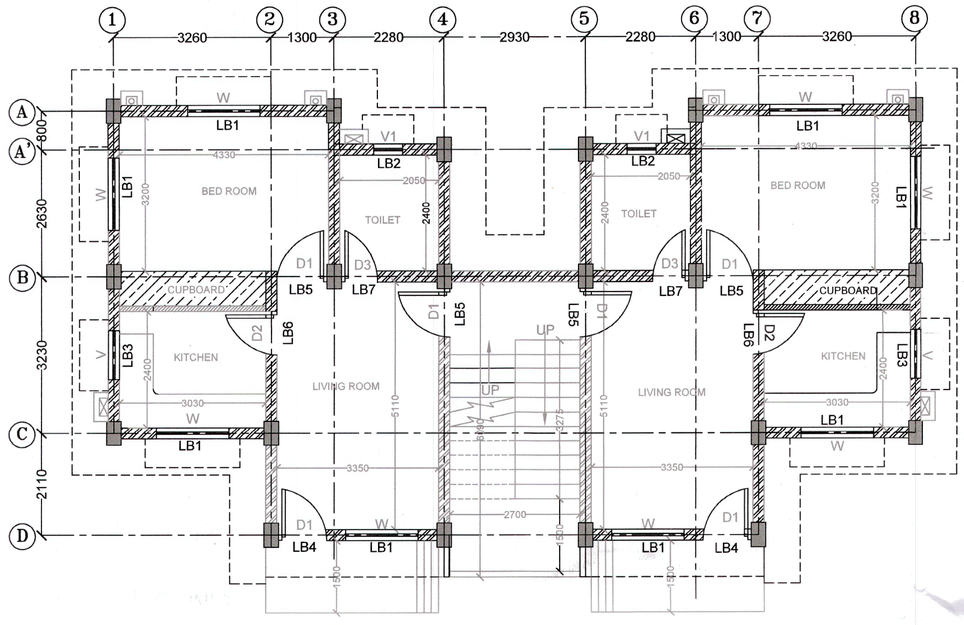
☐ More Information Date.....

CW-20676

27/9/22

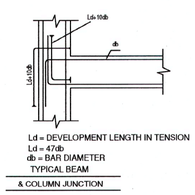
Computer generated Issued for Fabrication/Construction/Manufacturing
Approved/ Issued for Fabrication/ Construction/ Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
Returned for revision as per approved copy of.
No further submission required.
Not approved. Please resubmit after approval copy of.
In reply to your letter/ email dated
Marked up prints are returned for your records.
For information and record.
Received with thanks.
Not approved. Please resubmit after approval copy of.

Signature (Engineer) Designation (Engineer) 27/9/22 Date (India)

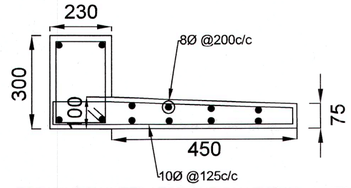


CARPET AREA : 117.31 SQ.M

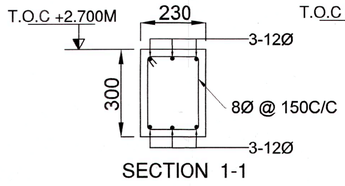
GROUND FLOOR LINTEL BEAM PLAN



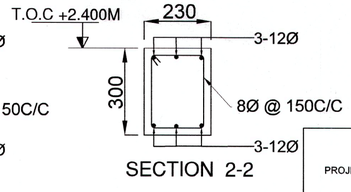
Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM
& COLUMN JUNCTION



FOR WINDOW/VETILATOR AND FAN TYPICAL LINTAL
SECTION WITH SUNSHADE
PROJECTION OF 450 MM



SECTION 1-1



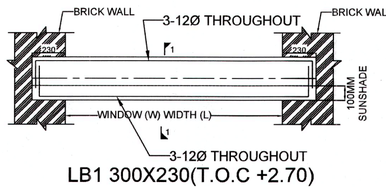
SECTION 2-2

SCHEDULE OF OPENING

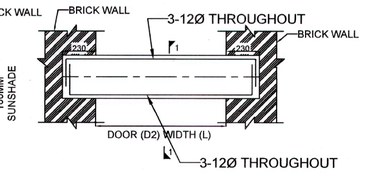
SL. NO.	TYPE	SIZE (WIDTHxHEIGHT)	SWING	SILL LEVEL WR. TO FFL.	LINTEL LEVEL WR. TO FFL.
1.	D1 (DOOR)	1000 x 2400	SEE PLAN	--	+2.40 M
2.	D2 (DOOR)	900 x 2400	SEE PLAN	--	+2.40 M
3.	D3 (DOOR)	750 x 2100	SEE PLAN	--	+2.10 M
4.	W (WINDOW)	1500 x 1500	--	+0.90 M (G.F.)	+2.40 M (G.F.)
5.	V (VENTILATOR)	1000 x 600	--	+1.80 M (G.F.)	+2.40 M (G.F.)
6.	V1 (VENTILATOR)	600 x 600	--	+1.80 M (G.F.)	+2.40 M (G.F.)

GENERAL NOTES:

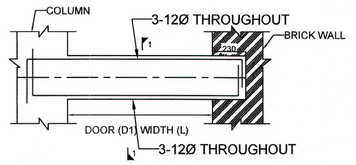
1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM



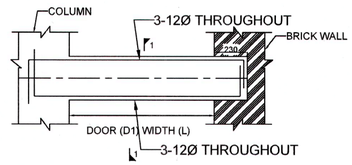
LB1 300X230(T.O.C +2.70)



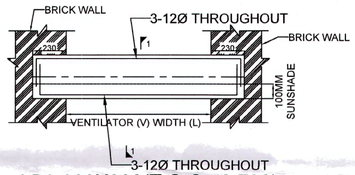
LB6 300X230(T.O.C +2.700)



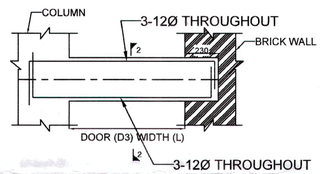
LB4 300X230(T.O.C +2.700)



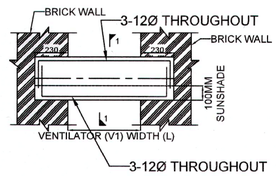
LB5 300X230(T.O.C +2.700)



LB3 300X230(T.O.C +2.700)



LB7 300X230(T.O.C +2.400)



LB2 300X230(T.O.C +2.700)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	GROUND FLOOR LINTEL BEAM DETAIL JE QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/103 — REV- 1
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 2

	NAME	DATE	SIGN
PREPARED BY	B.K.	11.06.2022	
CHECKED BY	G.H	11.06.2022	
SUBMITTED BY	ANURAG	11.06.2022	

KDBIL
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

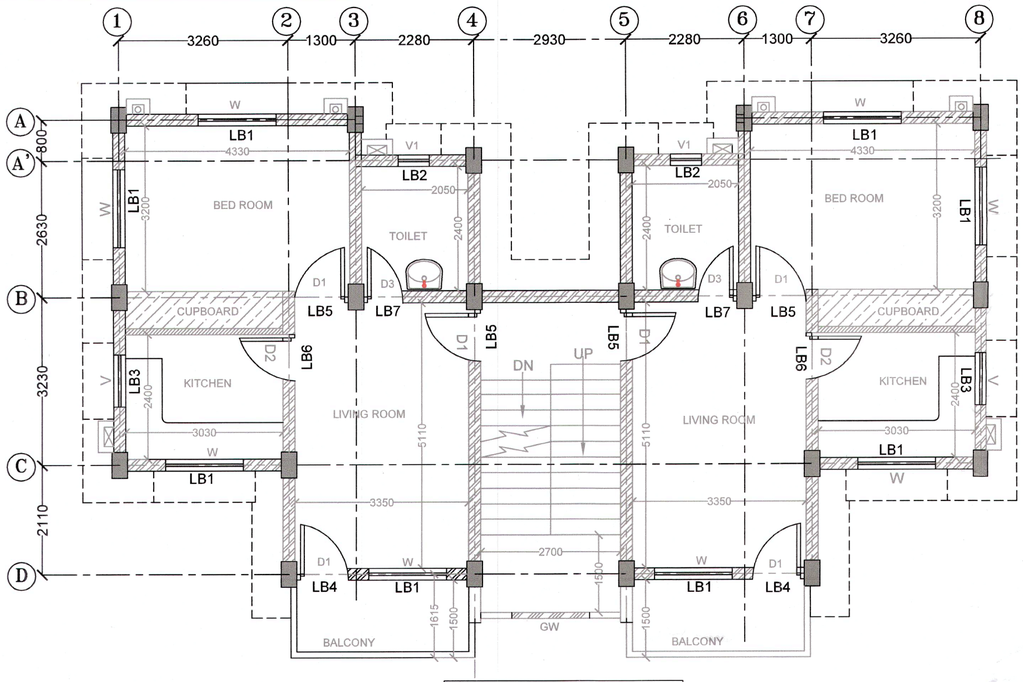
☐ More Information Date.....

Categories
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
II. Approved/ Issued for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.-
III. Please submit the revised documents for approval.
IV. Insert comments and submit again for approval.
V. Not approved.
VI. For Information and record.

(Signature) (Designation) (Date)
12/12/22

REC Power Development And Consultancy Ltd. * Gurugram-122001 *

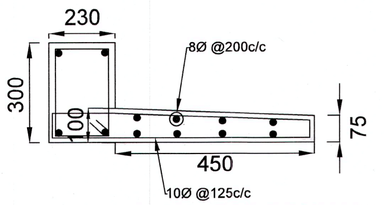
CAS-17745



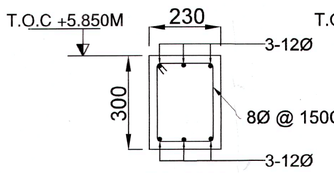
CARPET AREA : 117.31 SQ.M

FIRST FLOOR LINTEL BEAM PLAN

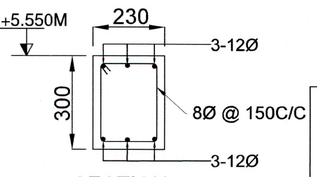
Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM
& COLUMN JUNCTION



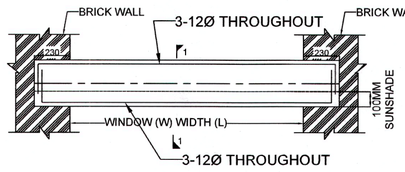
FOR WINDOW/VETILATOR AND FAN TYPICAL LINTAL
SECTION WITH SUNSHADE
PROJECTION OF 450 MM



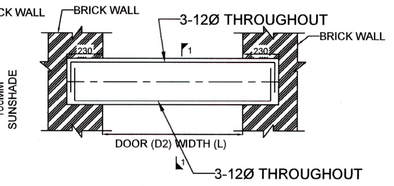
SECTION 1-1



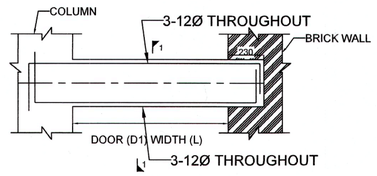
SECTION 2-2



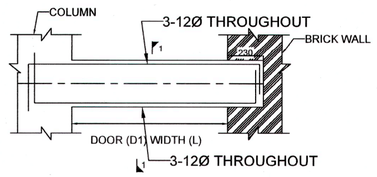
LB1 300X230(T.O.C +5.850)



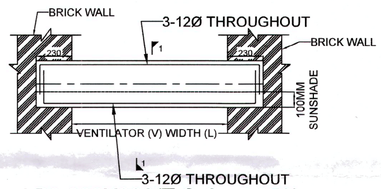
LB6 300X230(T.O.C +5.850)



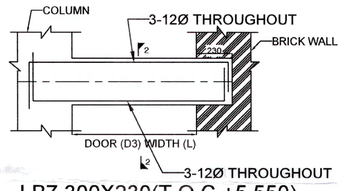
LB4 300X230(T.O.C +5.850)



LB5 300X230(T.O.C +5.850)



LB3 300X230(T.O.C +5.850)



LB7 300X230(T.O.C +5.550)

LB2 300X230(T.O.C +5.850)

SCHEDULE OF OPENING

SL. NO.	TYPE	SIZE (WIDTHxHEIGHT)	SWING	SILL LEVEL WR. TO FFL.	LINTEL LEVEL WR. TO FFL.
1.	D1 (DOOR)	1000 x 2400	SEE PLAN	--	+2.40 M
2.	D2 (DOOR)	900 x 2400	SEE PLAN	--	+2.40 M
3.	D3 (DOOR)	750 x 2100	SEE PLAN	--	+2.10 M
4.	W (WINDOW)	1500 x 1500	--	+4.05 M (F.F.)	+5.55 M (F.F.)
5.	V (VENTILATOR)	1000 x 600	--	+4.95 M (F.F.)	+5.55 M (F.F.)
6.	V1 (VENTILATOR)	600 x 600	--	+4.95 M (F.F.)	+5.55 M (F.F.)

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	FIRST FLOOR LINTEL BEAM DETAIL JE QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/103		REV- 1
SCALE	As shown in Drawing		SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 2 OF 2
	NAME	DATE	SIGN
PREPARED BY	B.K.	11.06.2022	
CHECKED BY	G.H	11.06.2022	
SUBMITTED BY	ANURAG	11.06.2022	

KDBIL

Signature/Stamp...

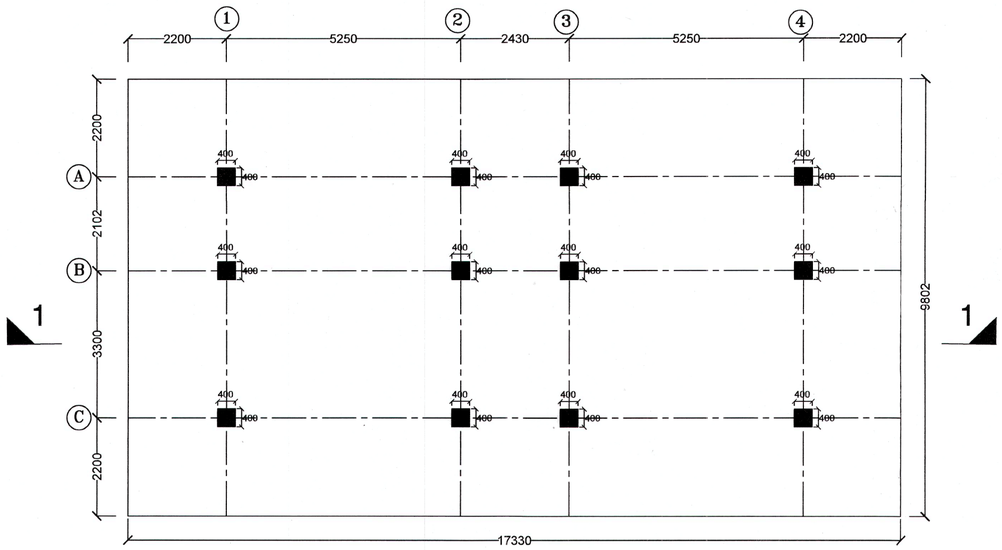
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

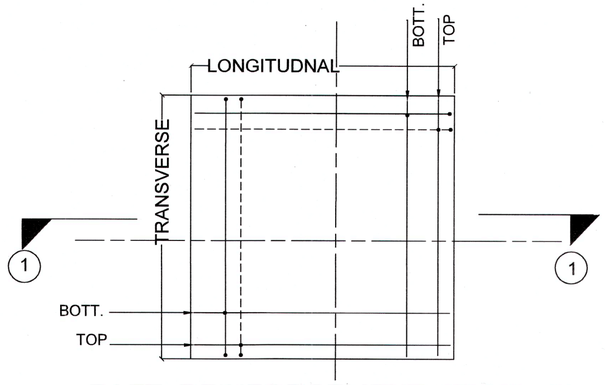
Categories
I. Approved Issued for Fabrication/Construction/Manufacturing.
II. Approved Issued for Fabrication/Construction/Manufacturing.
Subject to condition that statement & drg. comments are included.
Please submit the revised documents for approval.
V. For Information and record.
VI. Not approved.

(Signature) 12/5/22
(Designation)
(Date)

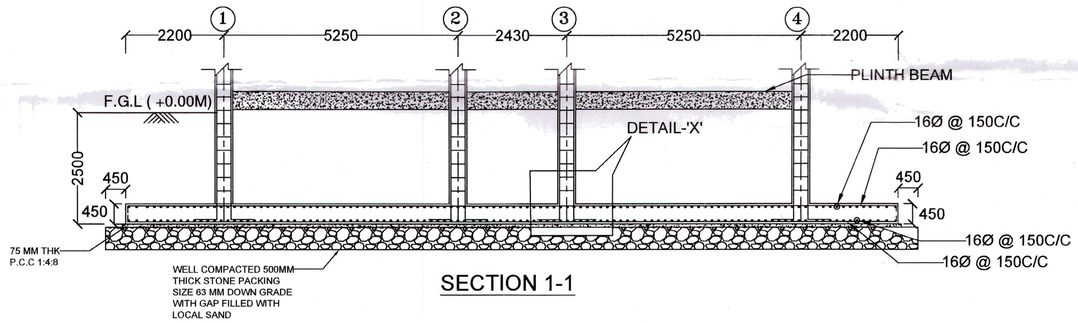
REC Power Development And Consultancy Ltd. Gurugram-122001



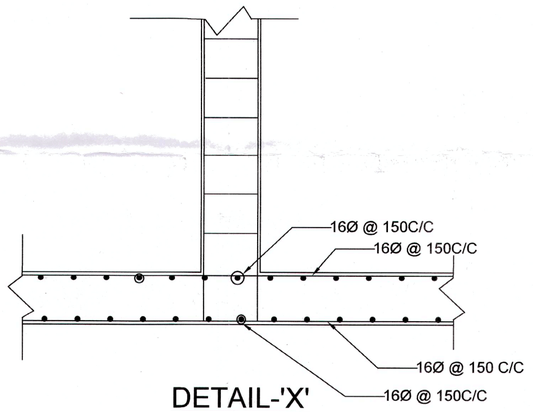
RAFT PLAN



RAFT REINFORCEMENT KEY PLAN



SECTION 1-1



DETAIL-'X'

S.NO.	FOOTING TYPE	FOOTING (IN MTR)		FOOTING THK.(IN MTR) 'D'	BOTTOM REINF.		TOP REINF.	
		BREADTH	LENGTH		LONGITUDINAL	TRANSVERSE	LONGITUDINAL	TRANSVERSE
1	RAFT	9.802	17.330	0.450	16Ø @150c/c	16Ø @150c/c	16Ø @150c/c	16Ø @150c/c

GENERAL NOTES

1. ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CLEAR COVER TO REINFORCEMENT SHALL BE AS GIVEN BELOW :-
   a) 40MM FOR COLUMN
   b) 50MM FOR FOOTING
   c) 25MM FOR BEAM
   d) 20MM FOR SLAB
3. GRADE OF CONCRETE M25.
4. GRADE OF REINFORCEMENT SHALL BE Fe500 AS PER IS 1786.
5. LAP LENGTH SHALL BE 47-TIMES DIA OF BAR.
6. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF BARS SHALL BE AS PER IS:456-2000.
7. THE ALLOWABLE BEARING CAPACITY OF SOIL FOR RAFT FOUNDATION FOR 2.5M DEPTH IS CONSIDERED AS 5 KN/M2.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	SBA QUARTER FOUNDATION DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/107		REV-0	
SCALE	As shown in Drawing		SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1	
	NAME	DATE	SIGN	
PREPARED BY	AA	07.06.2022	Amit	R.C.BANSAL
CHECKED BY	G.H	07.06.2022		
SUBMITTED BY	ANURAG	07.06.2022		Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

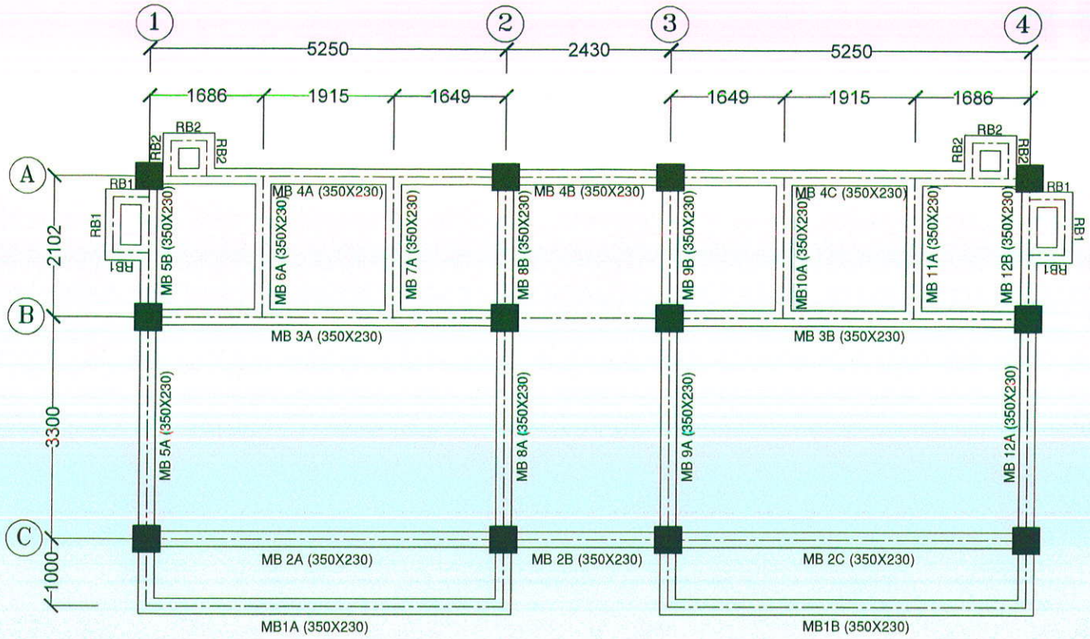
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

Categories
Approved/ Issued/ for Fabrication/Construction/Manufacturing.
Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
Insert comments and submit again for approval.
For information and record.
Not approved.

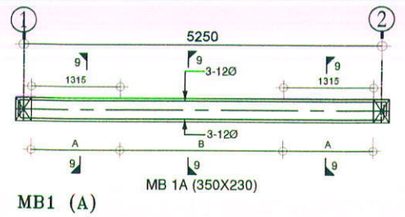
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

REC Power Development And Consultancy Ltd. Gurugram-122001

CN - 17906 dt 12/9/2022



FIRST FLOOR BEAM PLAN



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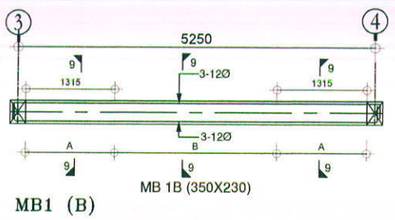

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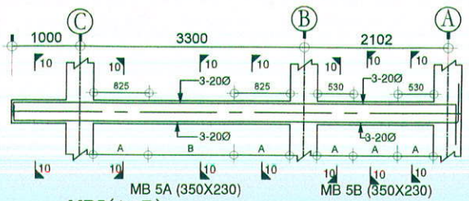
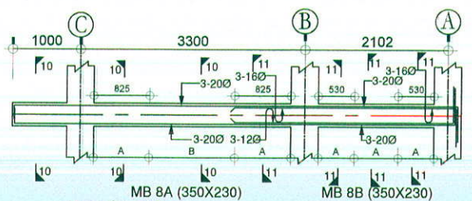
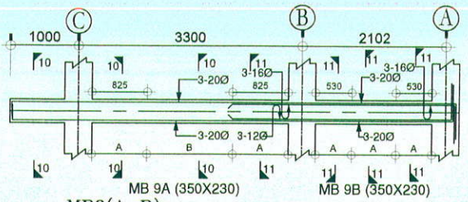


MB5(A–B)



MB8(A–B)



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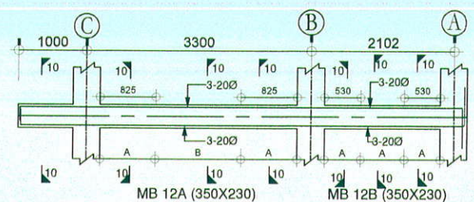

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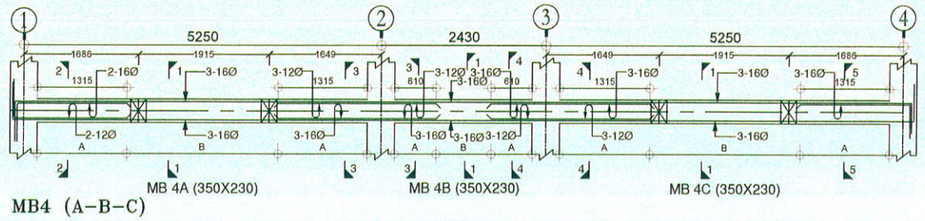
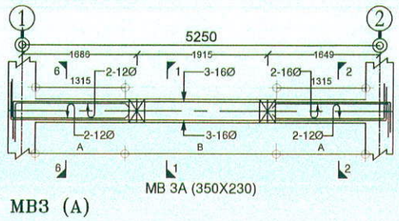


MB4 (A–B–C)



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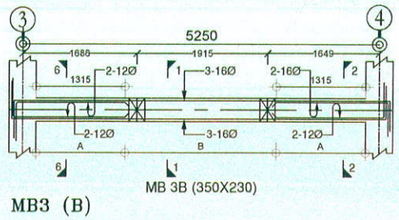

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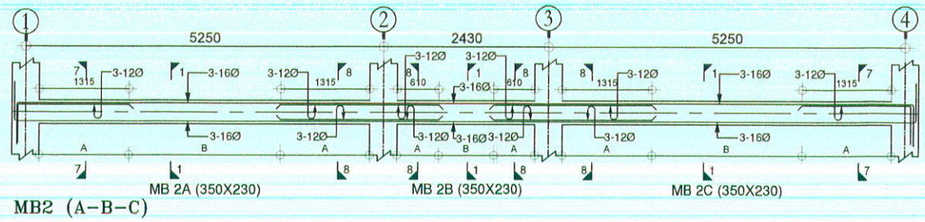
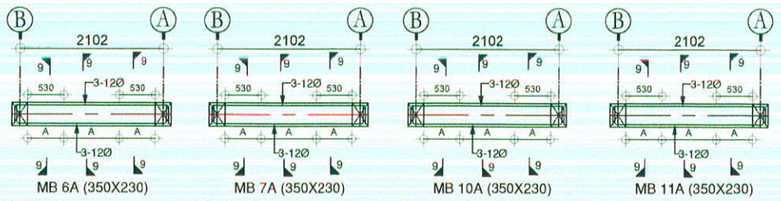
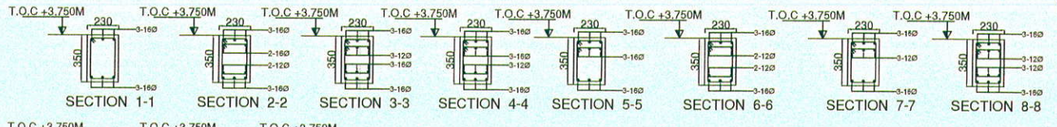
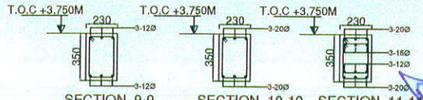


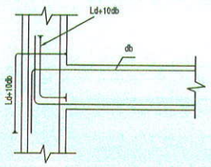
MB2 (A–B–C)



MB6(A) MB7(A) MB10(A) MB11(A)

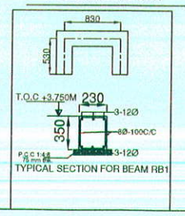


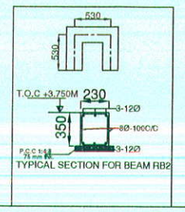




Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER

TYPICAL BEAM & COLUMN JUNCTION





STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

i. Approved issued for Fabrication/Construction.
ii. Approved issued for Fabrication/Construction subject to correction that comments are included.
iii. Please submit the revised documents for approval incorporating our comments.
iv. For Information and record.
v. Not approved.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Developmet and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FIRST FLOOR BEAM DETAIL DRAWING SBA QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.
DRG. NO.	KDBIL/250 PJ/20-21/D1/109 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 2 OF 4

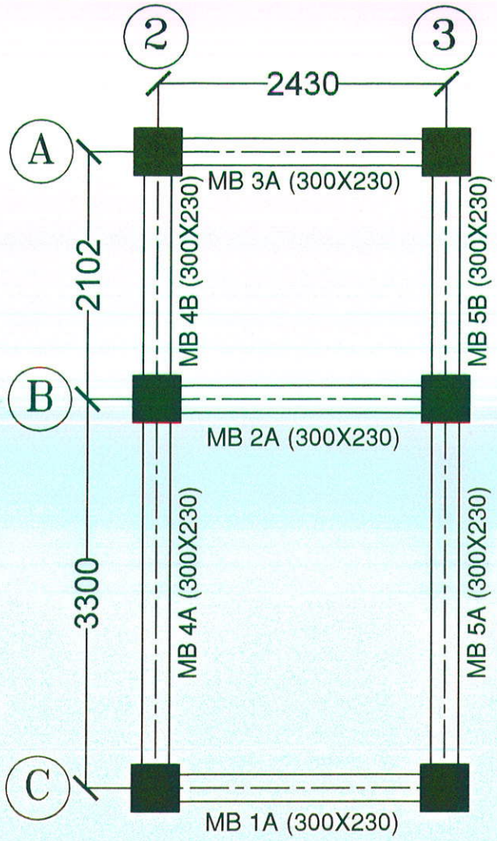
	NAME	DATE	SIGN
PREPARED BY	BK	16.06.2022	
CHECKED BY	G.H	16.06.2022	
SUBMITTED BY	ANURAG	16.06.2022	

KDBIL Signature/Stamp

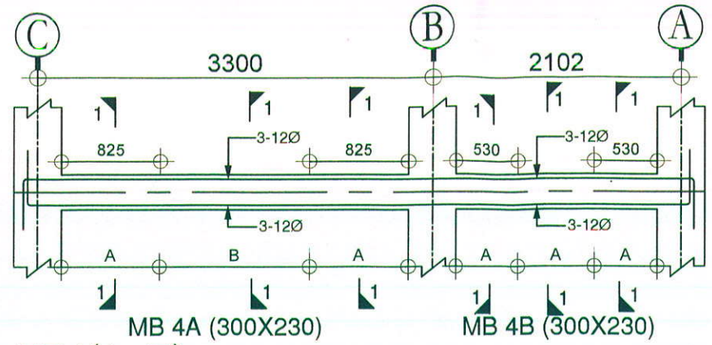
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

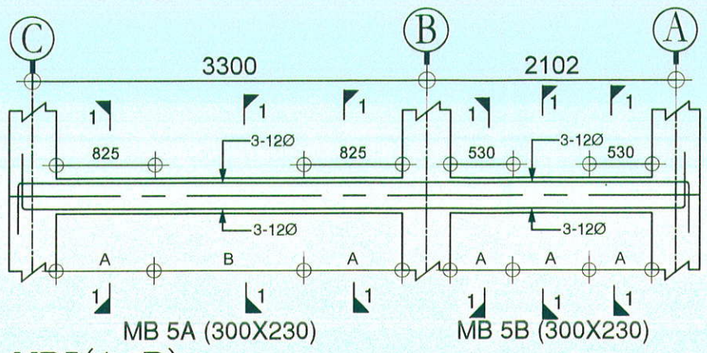
CN-18197 dt 21/7/22



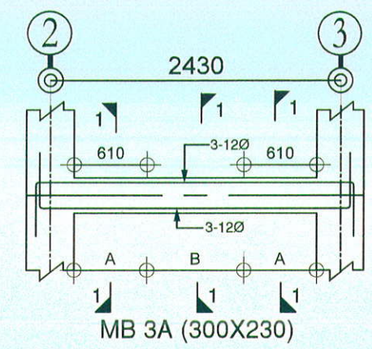
MUMTY BEAM PLAN



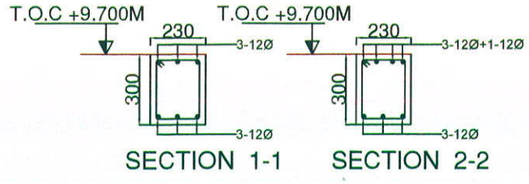
MB4(A–B)

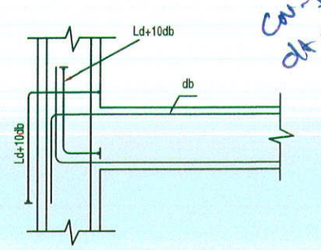


MB5(A–B)

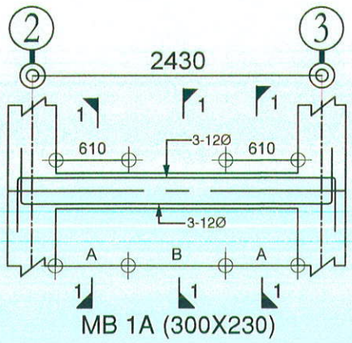


MB3(A)

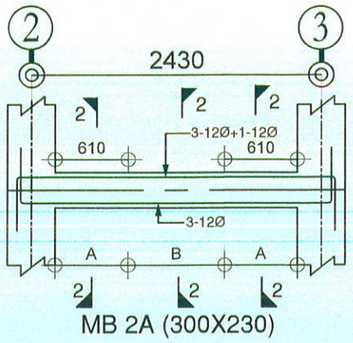




Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM
& COLUMN JUNCTION



MB1(A)



MB2(A)

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
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   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

Classification
(Signature)
(Designation)
(Date)
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
II. Approved/ Issued for Fabrication/ Construction/Manufacturing. Subject to correction that statement to and comments are included.
III. Please submit the revised documents for approval.
IV. For information and record.
V. Not approved.

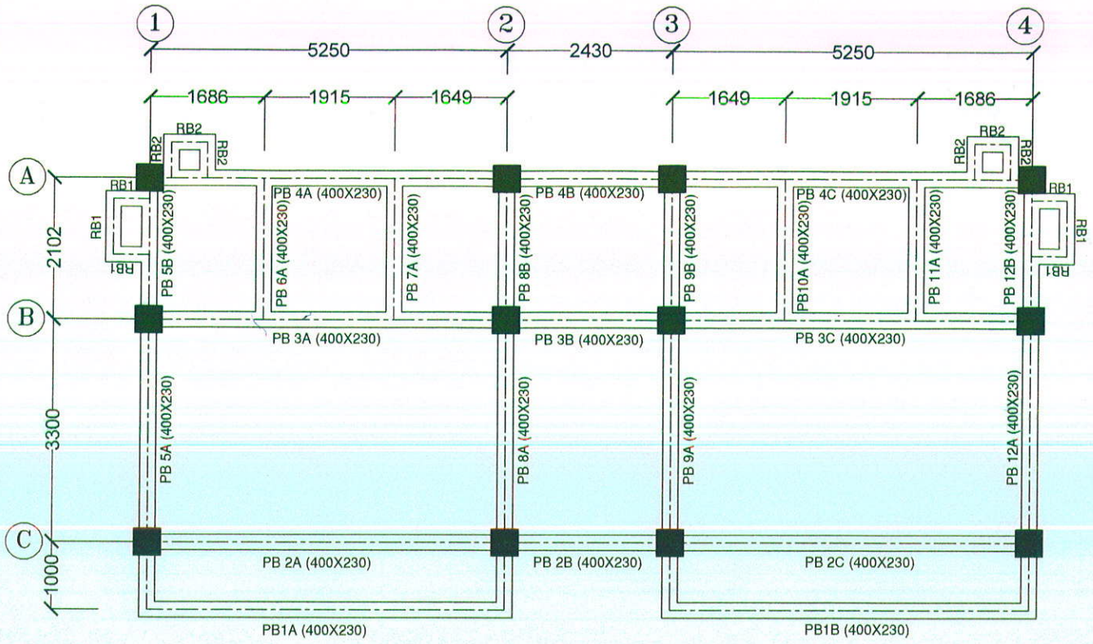
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Developmet and Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	MUMTY BEAM DETAIL DRAWING SBA QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.		
DRG. NO.	KDBIL/250 PJ/20-21/D1/109		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 4 OF 4

	NAME	DATE	SIGN
PREPARED BY	BK	16.06.2022	
CHECKED BY	G.H	16.06.2022	
SUBMITTED BY	ANURAG	16.06.2022	

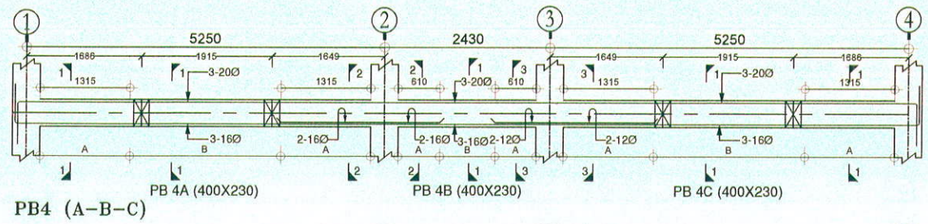
KDBIL
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



PLINTH BEAM PLAN



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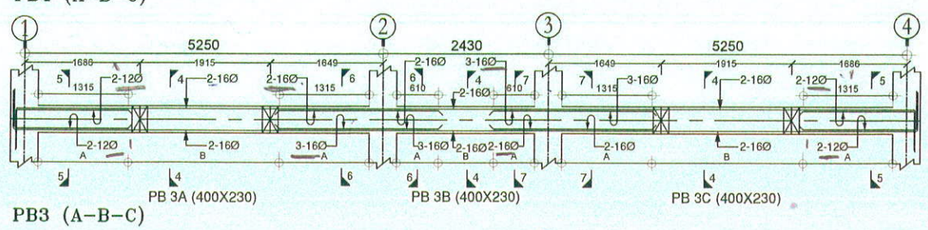
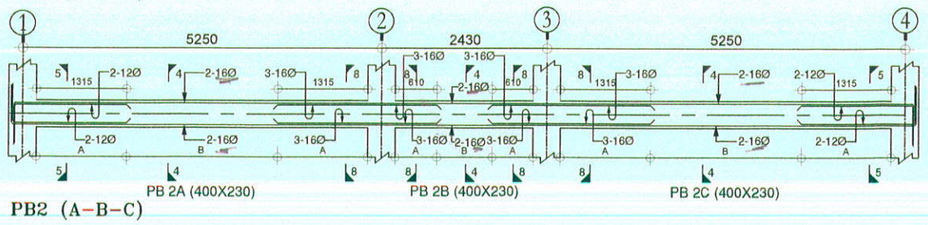


PB3 (A–B–C)



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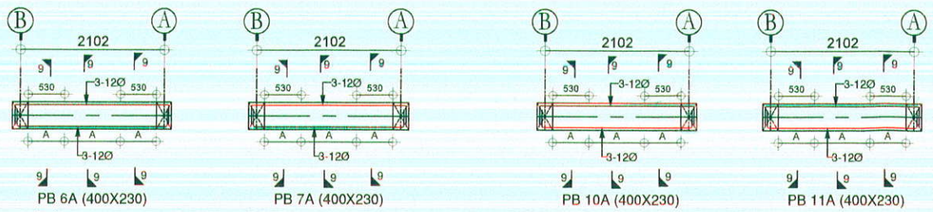
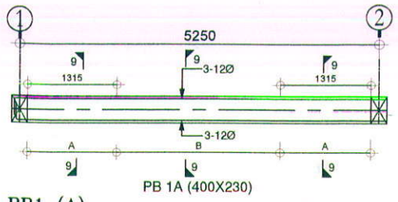


PB6(A) PB7(A) PB10(A) PB11(A)



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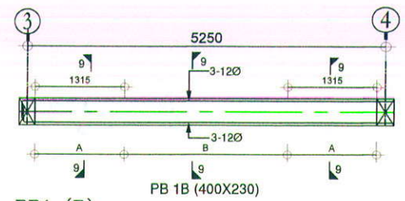

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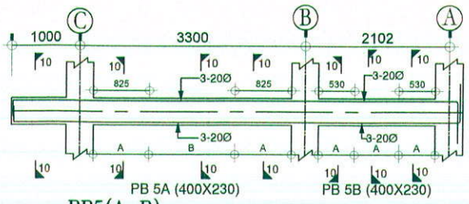

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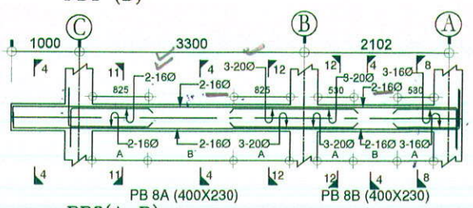
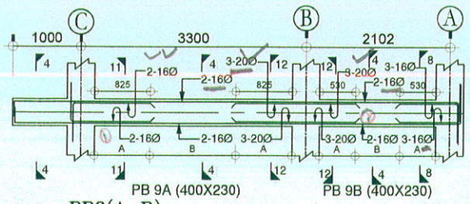
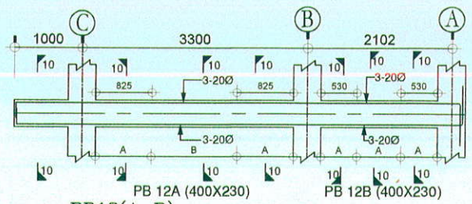


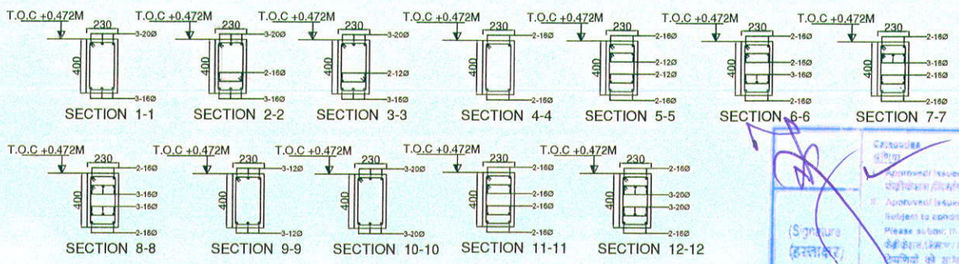
PB8(A–B)

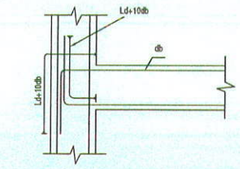


PB9(A–B)

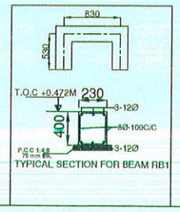


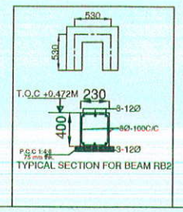
PB12(A–B)





Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM & COLUMN JUNCTION





GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	PLINTH BEAM DETAIL DRAWING SBA QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.
DRG. NO.	KDBIL/250 PJ/20-21/D1/109 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 4

	NAME	DATE	SIGN
PREPARED BY	BK	16.06.2022	
CHECKED BY	G.H	16.06.2022	
SUBMITTED BY	ANURAG	16.06.2022	

KDBIL — Signature/Stamp.

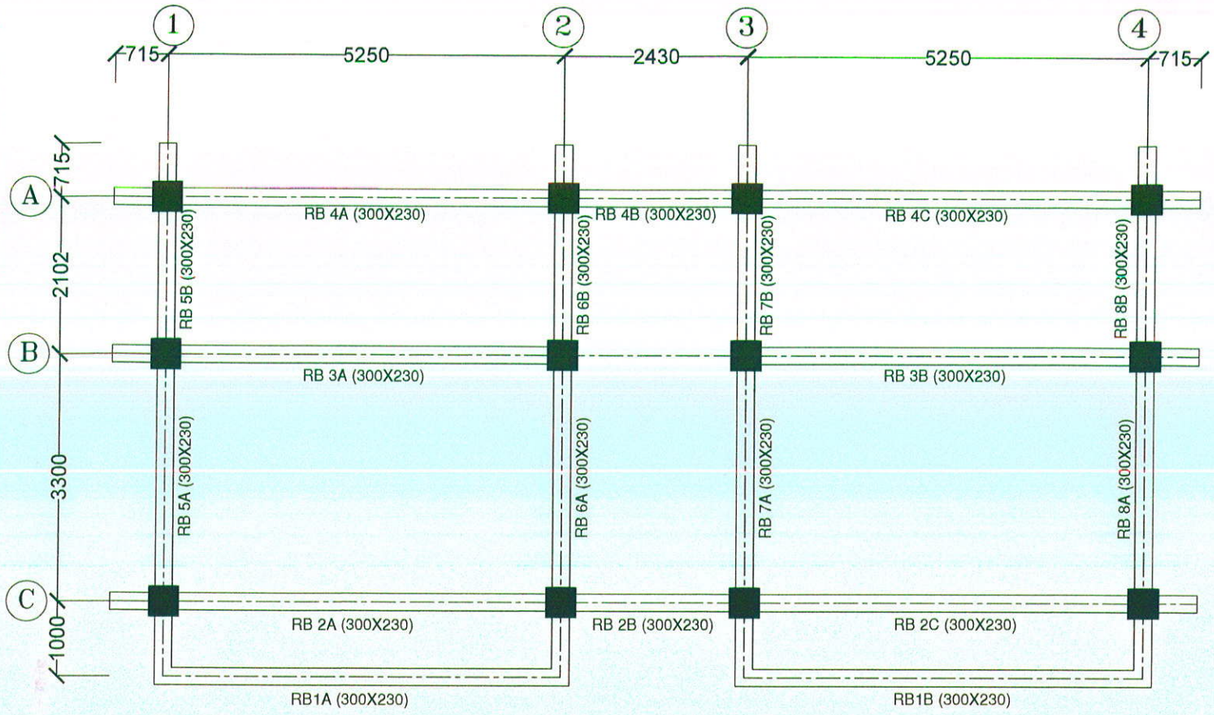
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

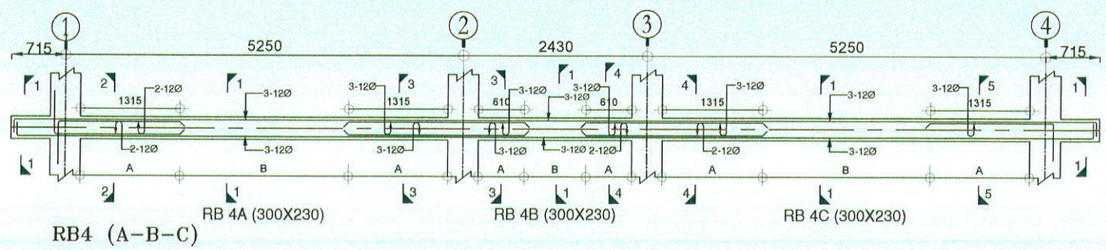
REC Power Development & Consultancy Limited * Gurugram-122001 *

CV-18191 dt 21/7/2022

Kailash Devbuild (India) Pvt. Ltd. * Jabalpur *



TERRACE ROOF BEAM PLAN



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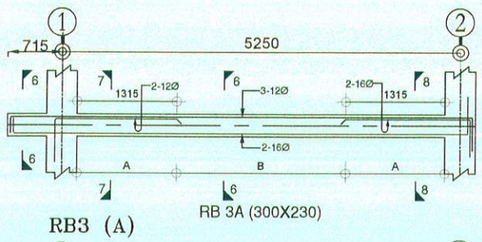

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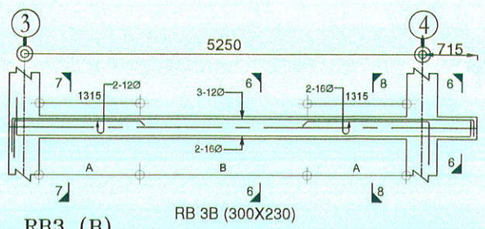

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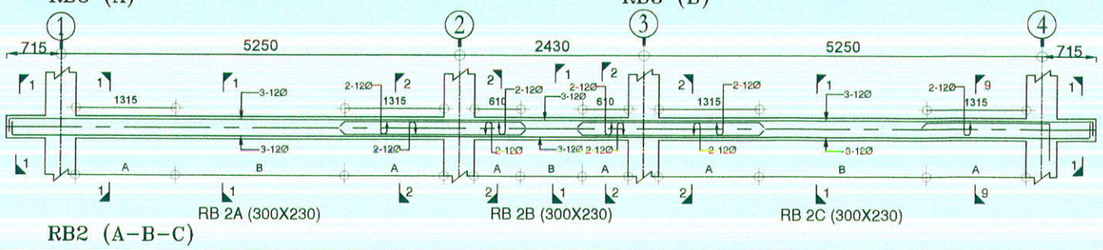

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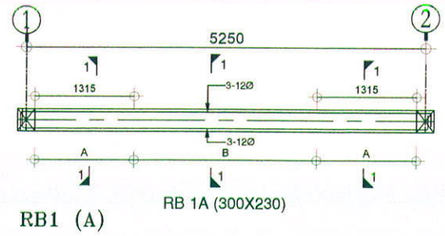

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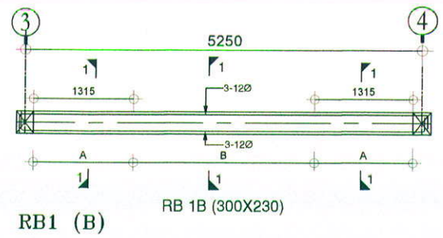

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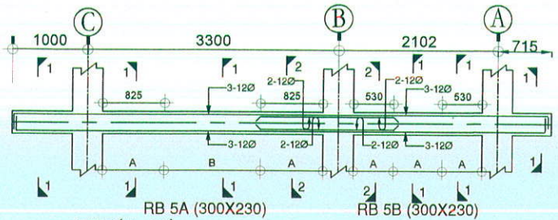

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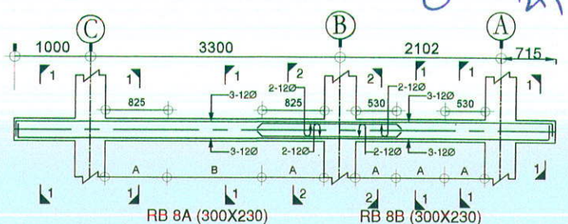
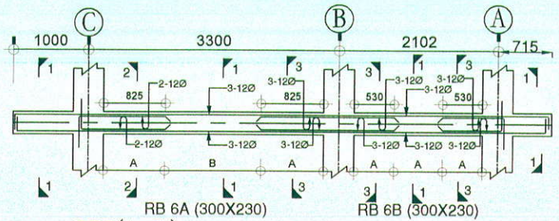
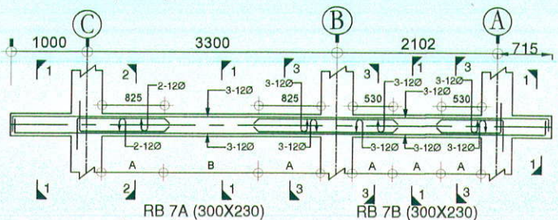


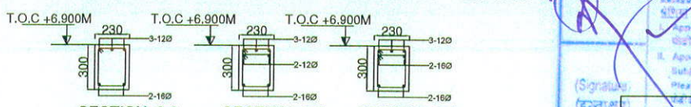
RB8(A–B)

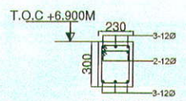


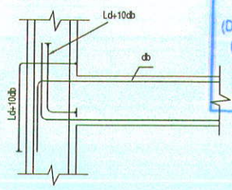
RB6(A–B)



RB7(A–B)







Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM & COLUMN JUNCTION

STIRRUPS SCHEDULE

S.NO	ZONE	DETAILS
1.	A	8Ø-100C/C
2.	B	8Ø-125C/C

GENERAL NOTES:

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(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) तिथि)

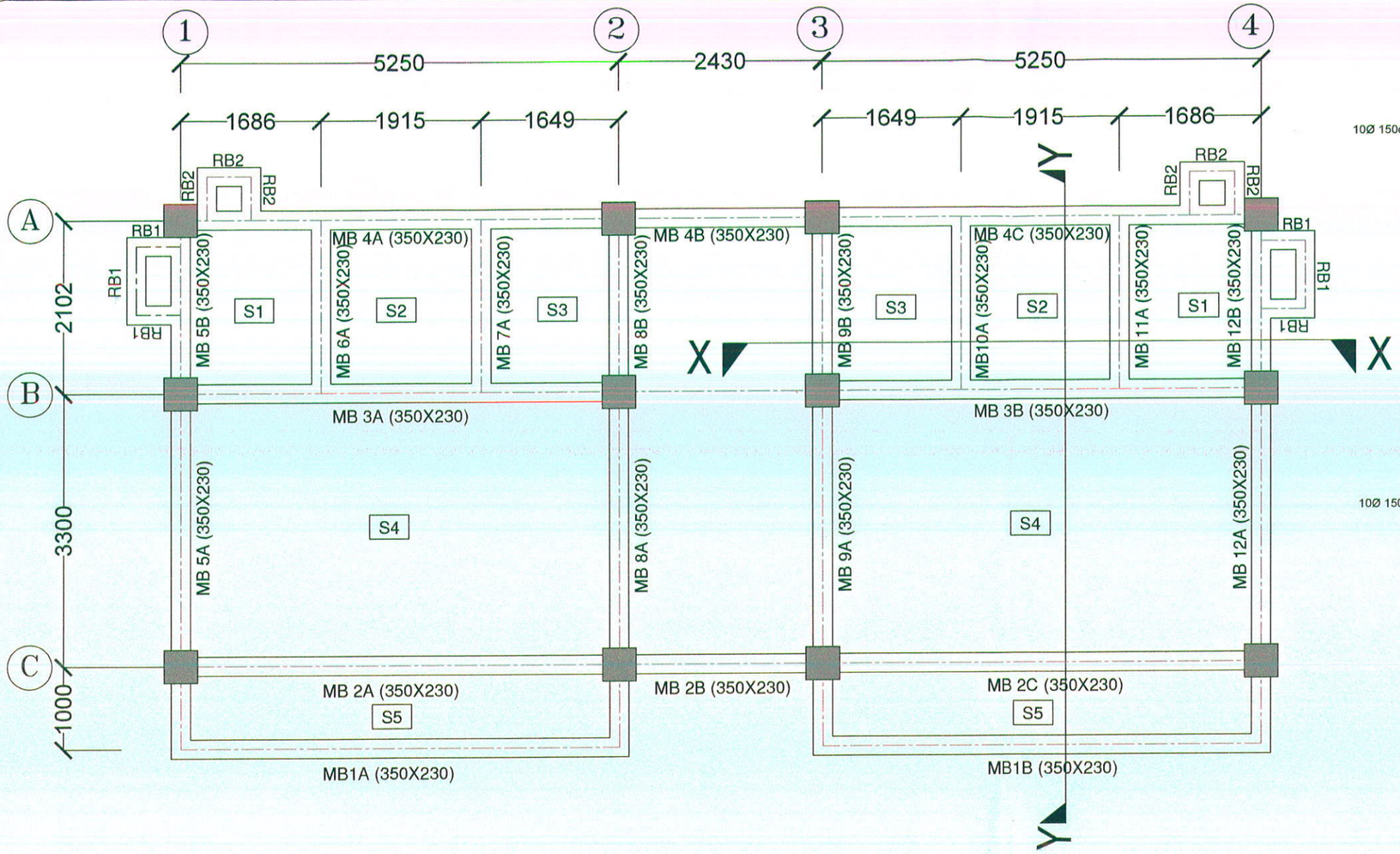
PROJECT: Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.

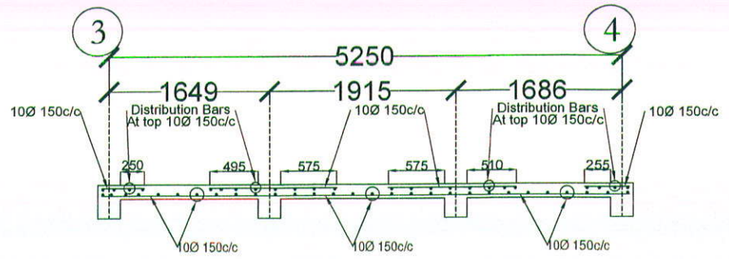
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Developmet and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	TERRACE ROOF BEAM DETAIL DRAWING SBA QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.
DRG. NO.	KDBIL/250 PJ/20-21/D1/109 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 3 OF 4

	NAME	DATE	SIGN
PREPARED BY	BK	16.06.2022	
CHECKED BY	G.H	16.06.2022	
SUBMITTED BY	ANURAG	16.06.2022	

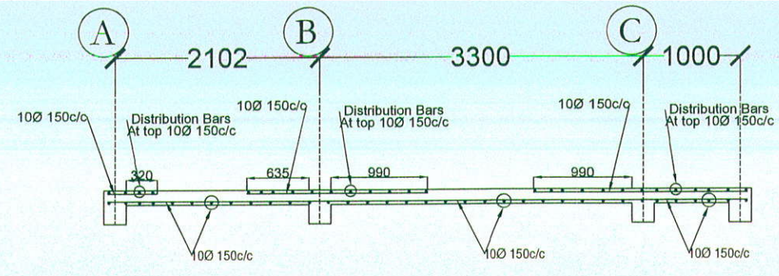
KDBIL
Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....





SECTION X-X



SECTION Y-Y

FIRST FLOOR SLAB PLAN

T.O.C +3.750M

Categories
श्रेणियां
I. Approved issued for Fabrication/Construction/Manufacturing.
निर्माण/संचालन/विनिर्माण हेतु अनुमोदित जारी।
II. Approved issued for Fabrication/Construction/Manufacturing subject to correction that statement is also comments are included.
Please submit the revised documents for approval.
निर्माण/संचालन/विनिर्माण हेतु अनुमोदित जारी, बशर्ते की उक्त टिप्पणियों को संमिलित किया जाए।
पुनरा संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Incert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

SLAB THICKNESS 150MM

SLAB REINFORCEMENT DETAILS

S.NO	SLAB TYPE	SHORT SPAN STEEL (BOT.)	LONG SPAN STEEL (BOT.)	SHORT SPAN STEEL (TOP)	LONG SPAN STEEL (TOP)
1	S1	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
2	S2	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
3	S3	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
4	S4	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
5	S5	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c

GENERAL NOTES:

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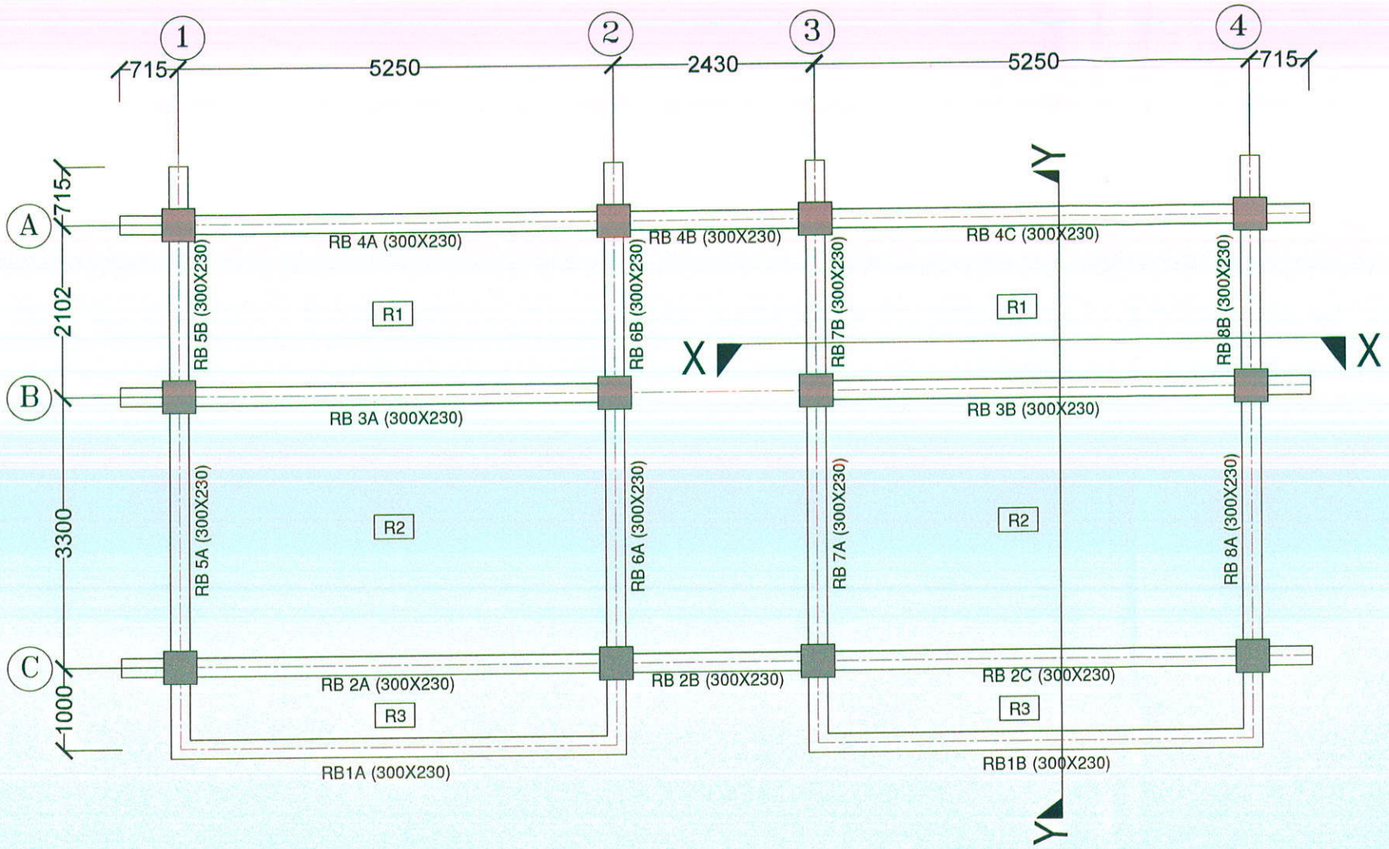
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	FIRST FLOOR SLAB DETAIL DRAWING SBA QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.		
DRG. NO.	KDBIL/250 PJ/20-21/D1/110		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 2
	NAME	DATE	SIGN
PREPARED BY	BK	16.06.2022	
CHECKED BY	G.H	16.06.2022	
SUBMITTED BY	ANURAG	16.06.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

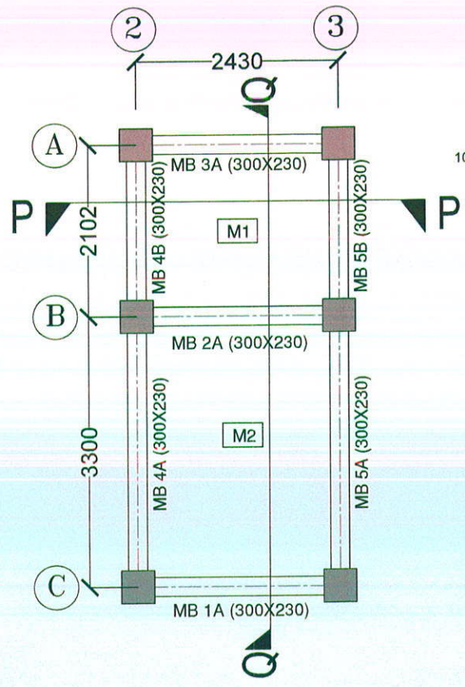
☐ More Information Date.....

KDBIL Signature/Stamp...



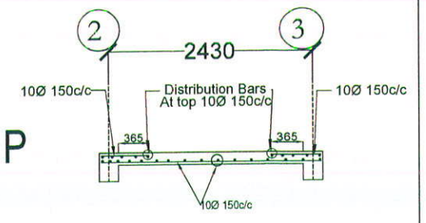
TERRACE ROOF SLAB PLAN

T.O.C +6.900M

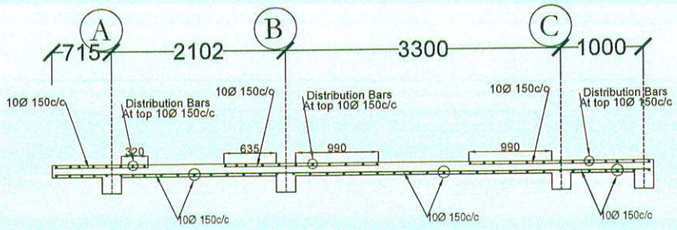


MUMTY SLAB PLAN

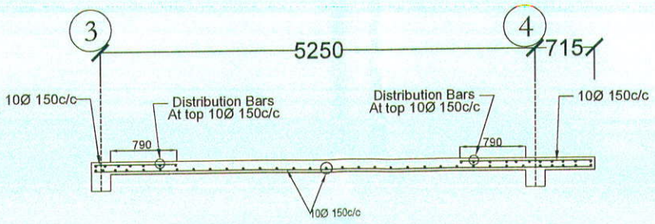
T.O.C +9.700M



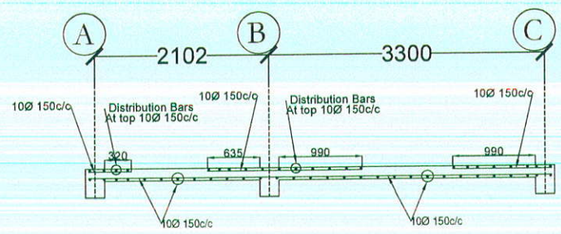
SECTION P-P



SECTION Y-Y



SECTION X-X



SECTION Q-Q

SLAB THICKNESS 150MM

SLAB REINFORCEMENT DETAILS

S.NO	SLAB TYPE	SHORT SPAN STEEL (BOT.)	LONG SPAN STEEL (BOT.)	SHORT SPAN STEEL (TOP)	LONG SPAN STEEL (TOP)
1	R1	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
2	R2	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
3	R3	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
4	M1	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c
5	M2	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c	10Ø@150c/c

Categories
i. Approved/ Issued for Fabrication/ Construction/Manufacturing.
ii. Approved/ Issued for Fabrication/ Construction/Manufacturing subject to condition that all comments are incorporated/ revised are included. Please submit the revised documents for approval.
iii. Others comments and submit again for approval.
iv. For information and record.
v. Not approved.
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	TERRACE ROOF AND MUMTY SLAB DETAIL DRAWING SBA QUARTER OF 220/33 kV Nagrota (New) S/S Jammu.
DRG. NO.	KDBIL/250 PJ/20-21/D1/110 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 2 OF 2

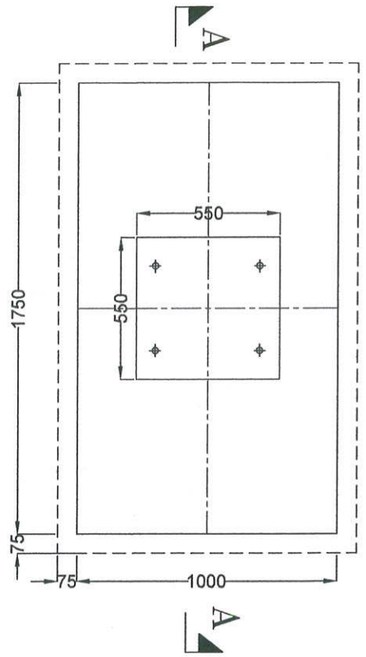
	NAME	DATE	SIGN
PREPARED BY	BK	16.06.2022	
CHECKED BY	G.H	16.06.2022	
SUBMITTED BY	ANURAG	16.06.2022	

KDBIL Jabalpur
Signature/Stamp...

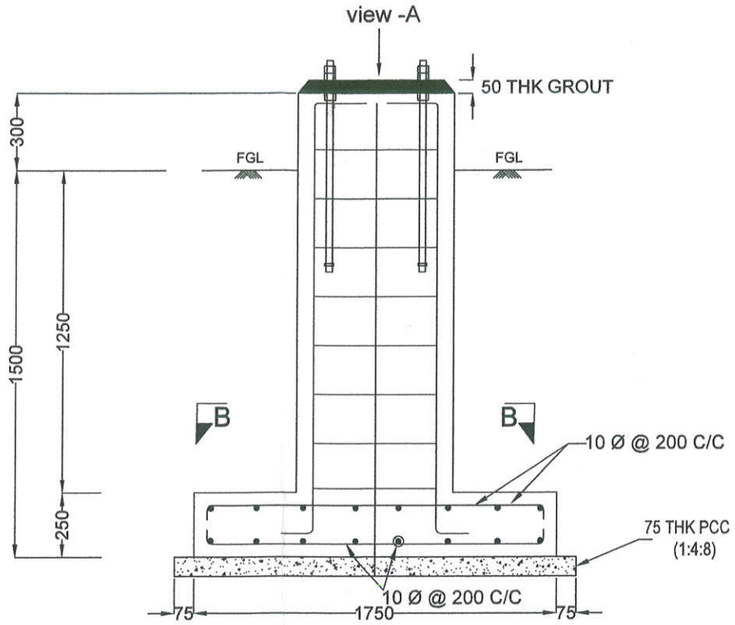
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

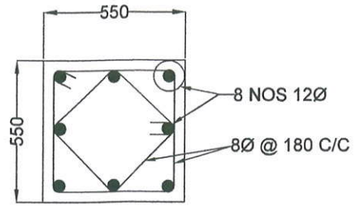
CV-18191 21/7/2022

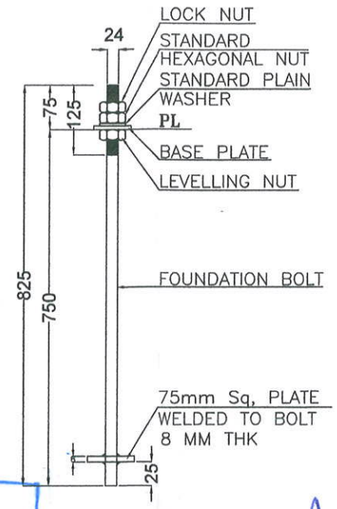


FOUNDATION PLAN

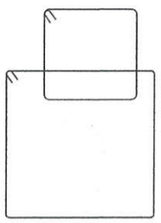


SECTION A-A



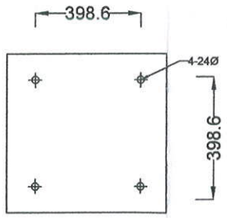


FOUNDATION BOLT



8 Ø @ 180mm

RING ARRANGEMENT



VIEW-A

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
फेब्रीकेशन/निर्माण/विनिर्माण/हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी, बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature)
(हस्ताक्षर)
Manager
(Designation)
(पदनाम)
(Date)
(तिथि)

CN - 22118
14/11/22

KAILASH DEVBUILD (INDIA) PVT. LTD.
JABALPUR

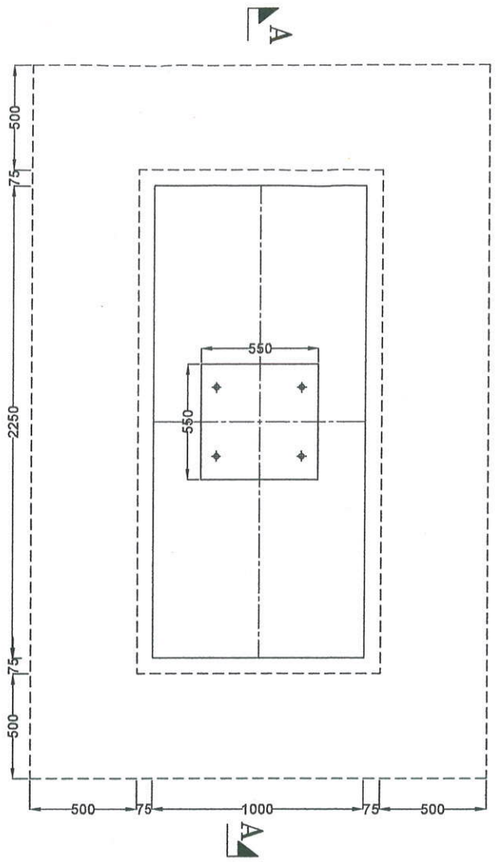
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 8.44 T/SQM AT 1.5MT DEPTH.

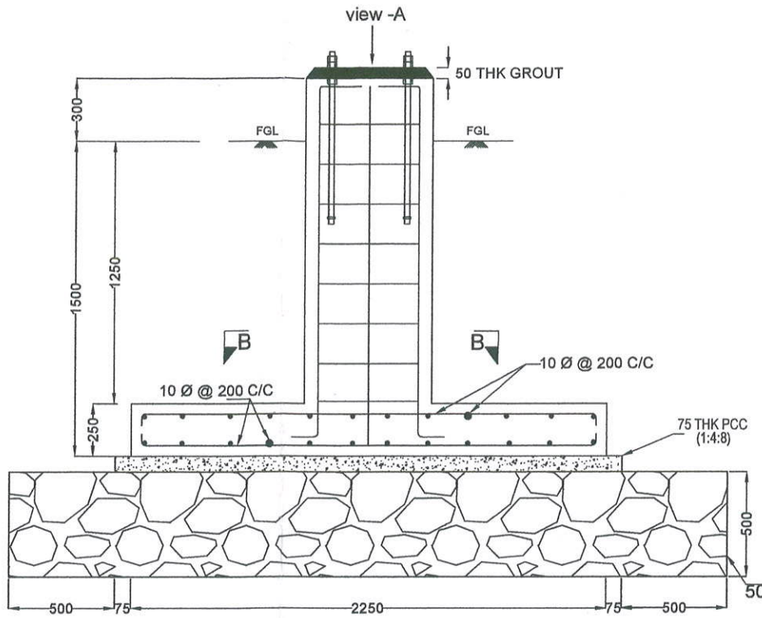
PROJECT	Construction of 2x50MVA, 220/33kV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	FOUNDATION DRAWING OF33KV BPI (TYPE 'A' FOR CUTTING AREA) FOR 2x50 MVA, 220/33 kV Nagrota (New) S/S,Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/118A		REV- 0	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1	
	NAME	DATE	SIGN	
PREPARED BY	PURNIMA	08.11.2022		KDBIL
CHECKED BY	G.H	08.11.2022		
SUBMITTED BY	Mr.ANURAG	08.11.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

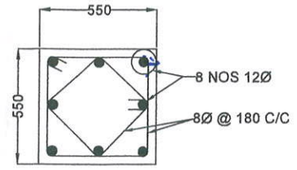
☐ More Information Date.....

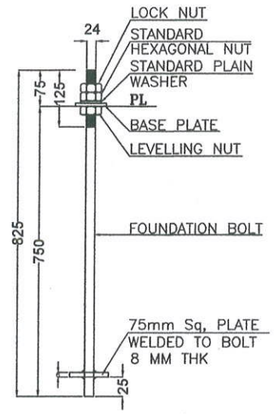


FOUNDATION PLAN

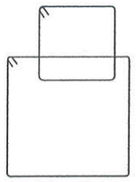


SECTION A-A



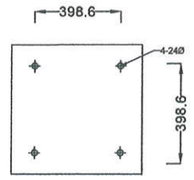


FOUNDATION BOLT



8 Ø @ 180mm

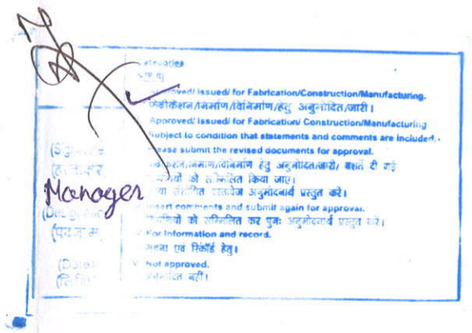
RING ARRANGEMENT



VIEW-A

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5.0 T/SQM AT 1.5MT DEPTH.





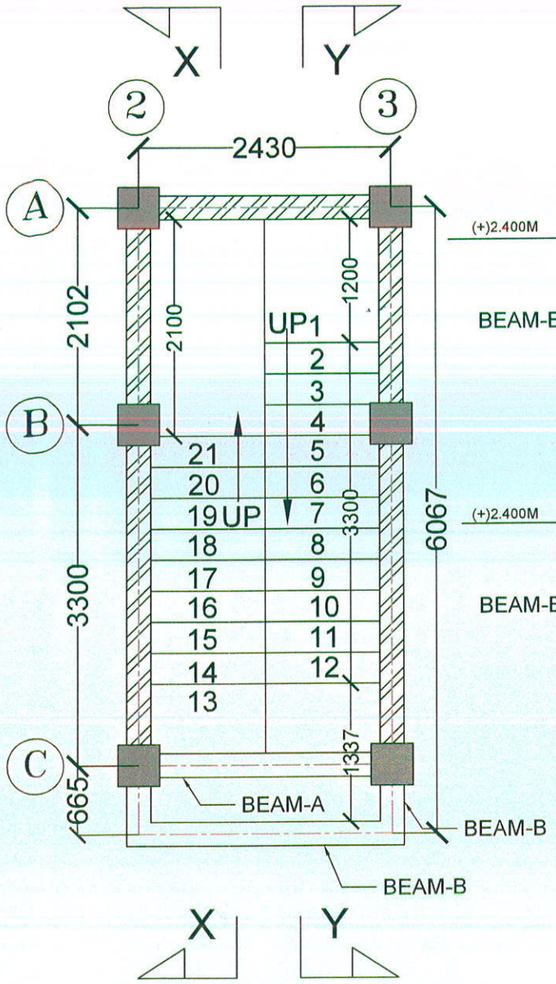
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation Including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 08.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 08.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	FOUNDATION DRAWING OF 33KV BPI (TYPE 'B' FOR FILLING AREA) FOR 2x50 MVA, 220/33 kV Nagrota (New) S/S,Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/118B	REV- 0	
SCALE	As shown in Drawing	SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 1 OF 1	
	NAME / DATE / SIGN		
PREPARED BY	PURNIMA 08.11.2022	KDBIL	
CHECKED BY	G.H 08.11.2022		
SUBMITTED BY	Mr.ANURAG 08.11.2022	Signature/Stamp...	

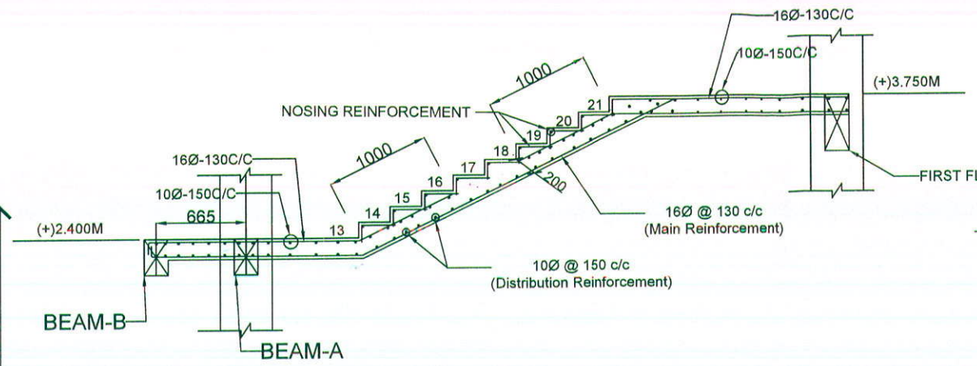
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

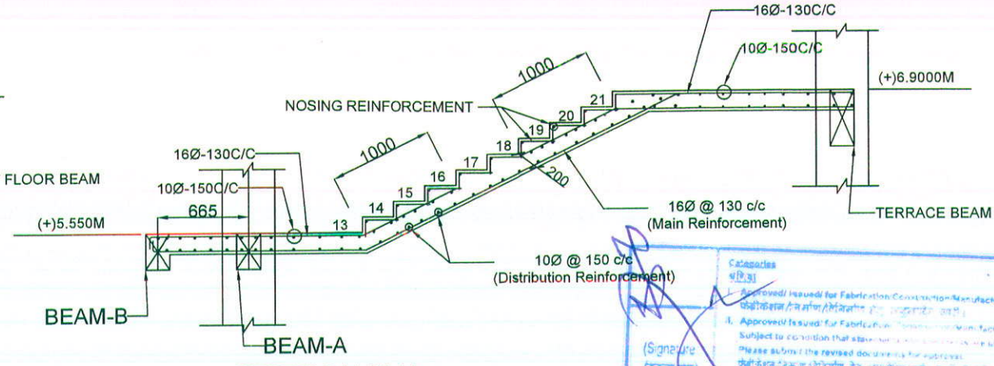
REC Power Development And Consultancy Ltd.

CN - 22118
14/11/22

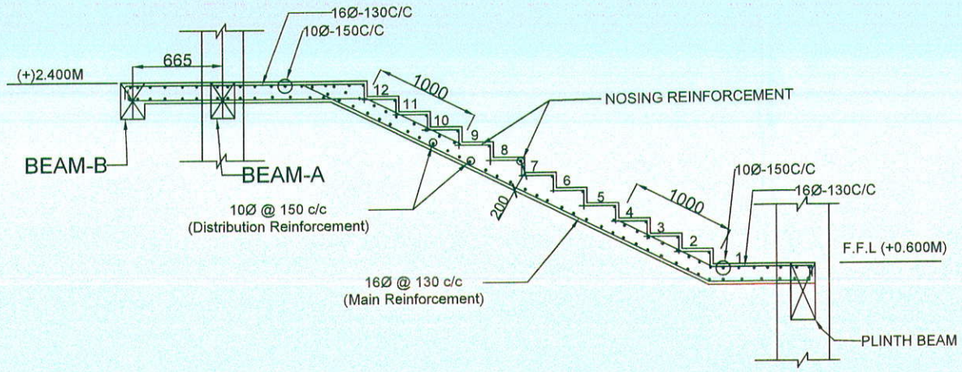




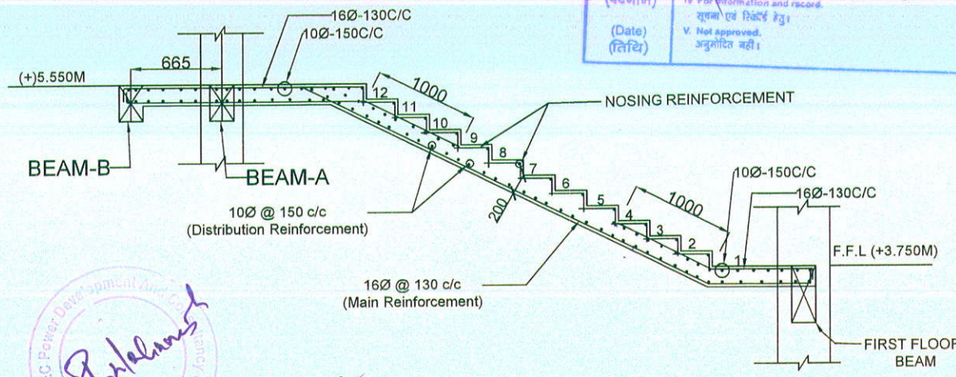
SECTION X-X



SECTION X-X



SECTION Y-Y

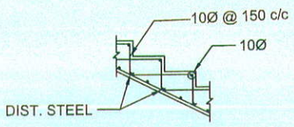


SECTION Y-Y

GROUND FLOOR TO FISRT FLOOR

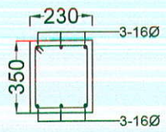
FIRST FLOOR TO TERRACE FLOOR

STAIRCASE

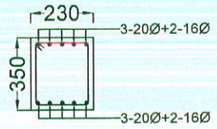


TYPICAL DETAIL OF NOSING REINFORCEMENT

WIDTH 1100
TREAD = 300
RISE = 150
SLAB THICKNES = 200



CROSS SECTION-B



CROSS SECTION-A

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. DETAIL DRAWING SCALE IS 1:200.
7. DETAIL OF FIXING OF RAILING AND EDGE DETAILS OF TREAD FOR HANDRAIL PROVIDE AS PER RAILING SUPPORT SECTION FINISHING.
8. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-25MM c) COLUMN-40MM d) BEAMS-25MM

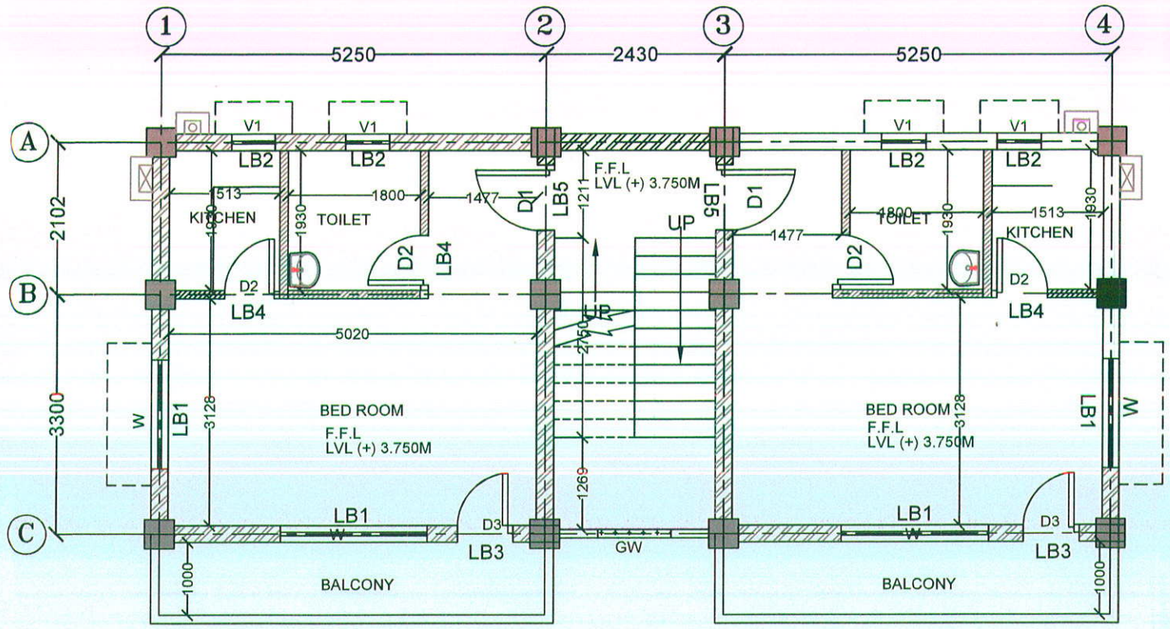
Categories
(i) Approved/ Issued for Fabrication/Construction/Manufacturing.
(ii) Approved/ Issued for Fabrication/Construction/Manufacturing. Subject to condition that
Please submit the revised documents for approval.
(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)
III. Insert comments and submit again for approval.
IV. For information and record.
V. Not approved.

REC Power Development & Consultancy Ltd. Gurugram-122001
Co-18191 dt 4/9/22

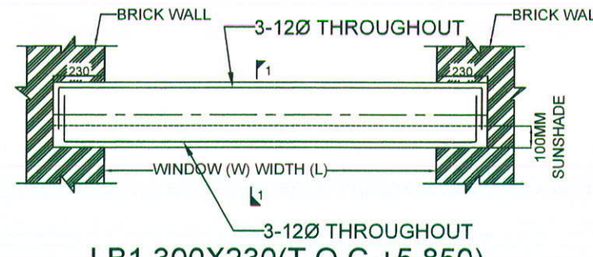
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	STAIRCASE RCC DETAIL DRAWING OF SBA QUARTER, 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/122		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM		SH. NO.:- 1 OF 1
	NAME	DATE	SIGN
PREPARED BY	BK	17.06.2022	
CHECKED BY	G.H	17.06.2022	
SUBMITTED BY	ANURAG	17.06.2022	

Kailash Devbuild (India) Pvt. Ltd. Jabalpur
KDBIL
Signature/Stamp...

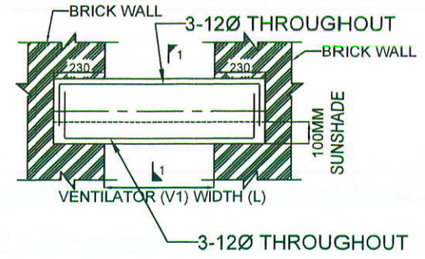
☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date.....



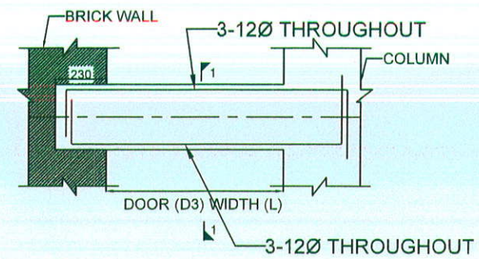
FIRST FLOOR LINTEL BEAM PLAN



LB1 300X230(T.O.C +5.850)



LB2 300X230(T.O.C +5.850)



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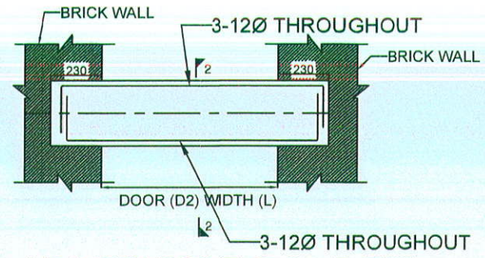
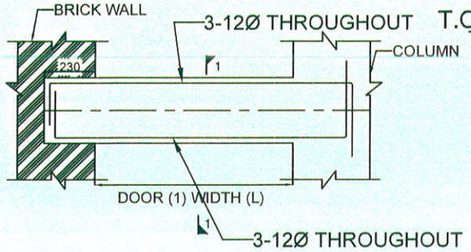
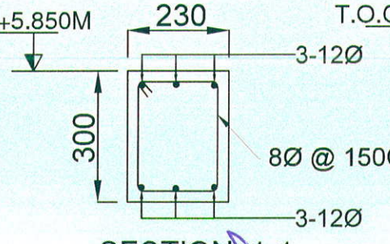


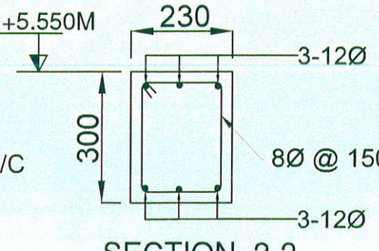
LB4 300X230(T.O.C +5.550)



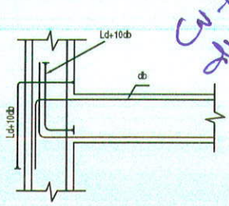
LB5 300X230(T.O.C +5.850)



SECTION 1-1



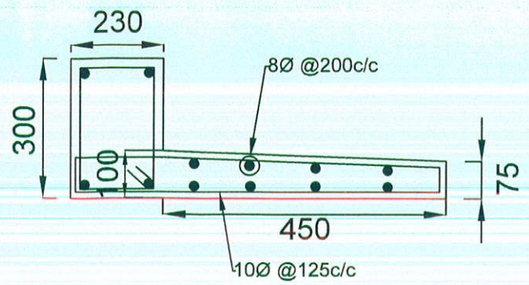
SECTION 2-2



Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM & COLUMN JUNCTION

SCHEDULE OF OPENING

SL. NO.	TYPE	SIZE (WIDTHxHEIGHT)	SWING	SILL LEVEL WR. TO FFL.	LINTEL LEVEL WR. TO FFL.
1.	D1 (DOOR)	900 x 2400	SEE PLAN	--	+2.40 M
2.	D2 (DOOR)	750 x 2100	SEE PLAN	--	+2.10 M
3.	W (WINDOW)	1500 x 1500	--	+4.05 M (F.F.)	+5.55 M (F.F.)
4.	V1 (VENTILATOR)	600 x 600	--	+4.95 M (F.F.)	+5.55 M (F.F.)
5.	GW (GLAZED WINDOW)	1500 x 1500	--	AT STAIRCASE WASTE SLAB LVL. (02No) REFER SECTION C-C	
6.	D3 (DOOR)	750 x 2400	--	--	+2.40 M



FOR WINDOW/VETILATOR AND FAN TYPICAL LINTAL SECTION WITH SUNSHADE PROJECTION OF 450 MM

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

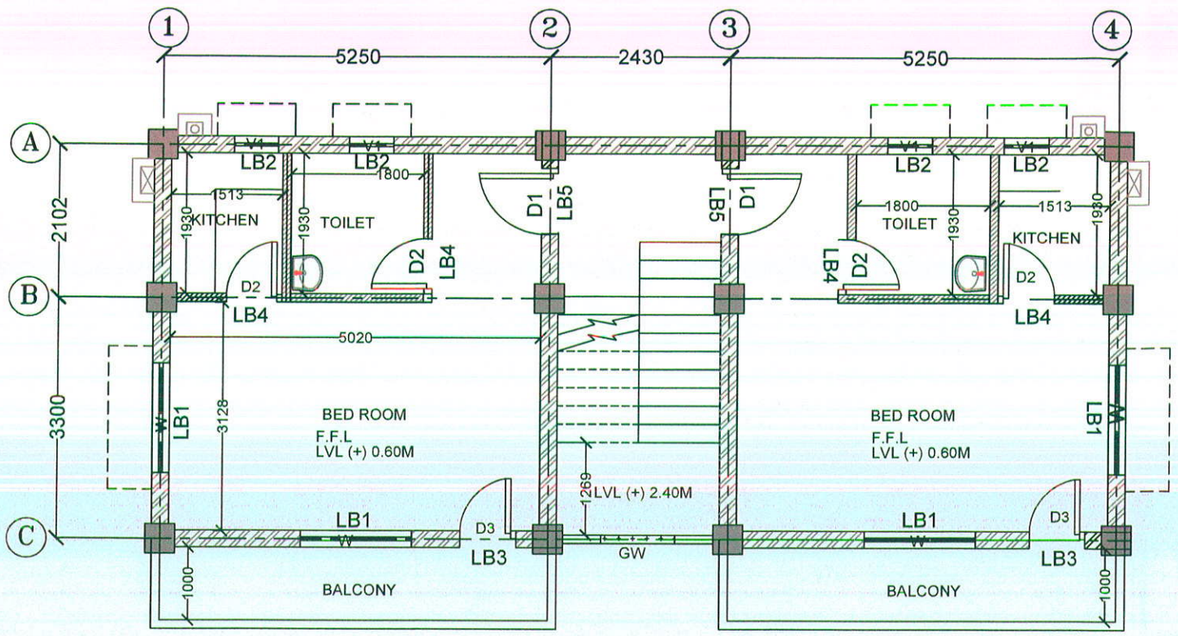
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FIRST FLOOR LINTEL BEAM DETAIL SBA QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/123 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 2 OF 2

	NAME	DATE	SIGN
PREPARED BY	B.K.	17.06.2022	
CHECKED BY	G.H	17.06.2022	
SUBMITTED BY	ANURAG	17.06.2022	

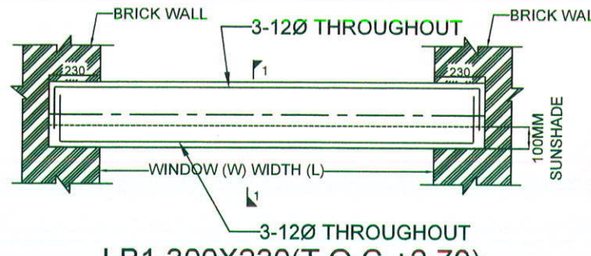
KDBIL Jabalpur Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

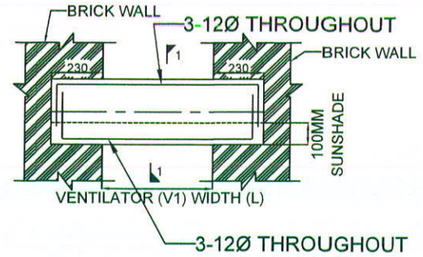
☐ More Information Date.....



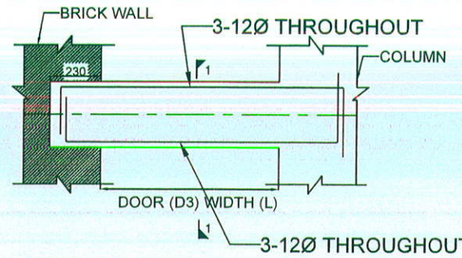
GROUND FLOOR LINTEL BEAM PLAN



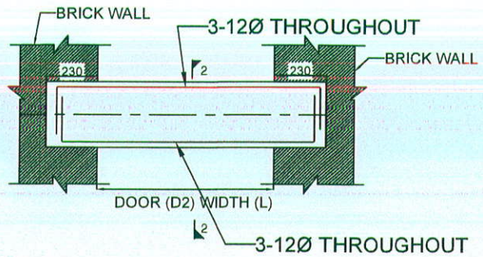
LB1 300X230(T.O.C +2.70)



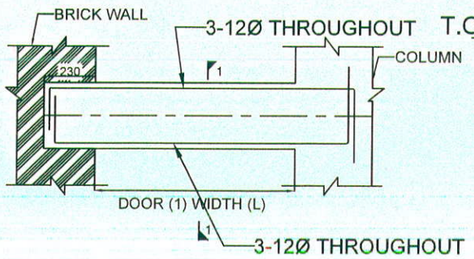
LB2 300X230(T.O.C +2.700)



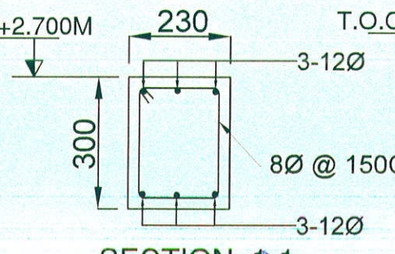
LB3 300X230(T.O.C +2.700)



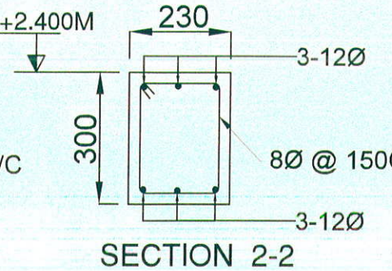
LB4 300X230(T.O.C +2.400)



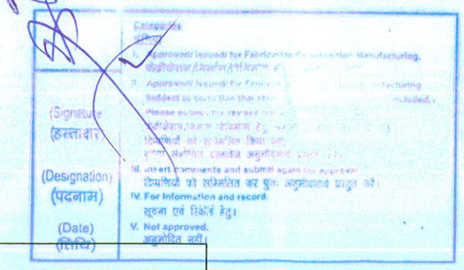
LB5 300X230(T.O.C +2.700)

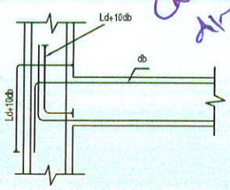


SECTION 1-1



SECTION 2-2

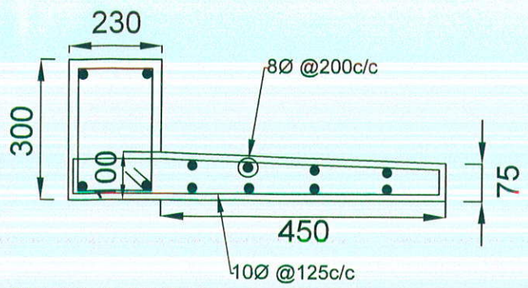




Ld = DEVELOPMENT LENGTH IN TENSION
Ld = 47db
db = BAR DIAMETER
TYPICAL BEAM & COLUMN JUNCTION

SCHEDULE OF OPENING

SL. NO.	TYPE	SIZE (WIDTHxHEIGHT)	SWING	SILL LEVEL WR. TO FFL.	LINTEL LEVEL WR. TO FFL.
1.	D1 (DOOR)	900 x 2400	SEE PLAN	--	+2.40 M
2.	D2 (DOOR)	750 x 2100	SEE PLAN	--	+2.10 M
3.	W (WINDOW)	1500 x 1500	--	+0.90 M (G.F.)	+2.40 M (G.F.)
4.	V1 (VENTILATOR)	600 x 600	--	+1.80 M (G.F.)	+2.40 M (G.F.)
5.	GW (GLAZED WINDOW)	1500 x 1500	--	AT STAIRCASE WASTE SLAB LVL. (02No) REFER SECTION C-C	
6.	D3 (DOOR)	750 x 2400	--	--	+2.40 M



FOR WINDOW/VETILATOR AND FAN TYPICAL LINTAL SECTION WITH SUNSHADE PROJECTION OF 450 MM

GENERAL NOTES:

1. DEVELOPMENT LENGHT, ANCHORAGE LENGTH, HOOKS & BENDS OF LAYOUT SHALL BE MARKED ON SITE AND GOT APPVD. BY ENGINEER IN-CHARGEIN WRITING BEFORE COMMENCING EXCAVATION WORK AT SITE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
3. CONC. FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS:1786 AS PER BPS.
5. LAP /ANCHORAGE SHALL BE 50X DIA OF BARS
6. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS:
   a) FOOTING-50MM b) SLAB-20MM c) COLUMN-40MM d) BEAMS-25MM

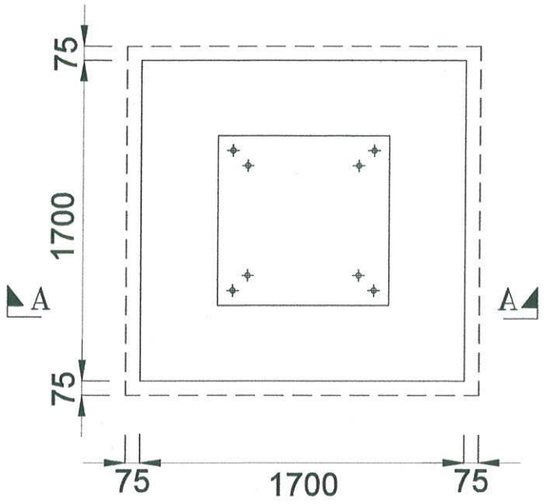
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	GROUND FLOOR LINTEL BEAM DETAIL SBA QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/123 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM — SH.NO.- 1 OF 2

	NAME	DATE	SIGN
PREPARED BY	B.K.	17.06.2022	
CHECKED BY	G.H	17.06.2022	
SUBMITTED BY	ANURAG	17.06.2022	

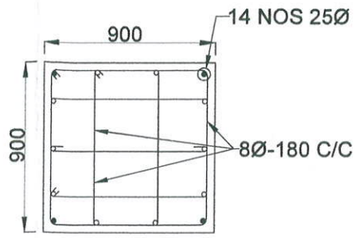
KDBIL Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

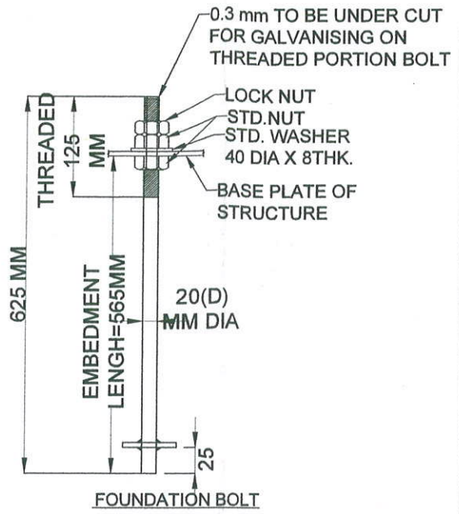
☐ More Information Date.....

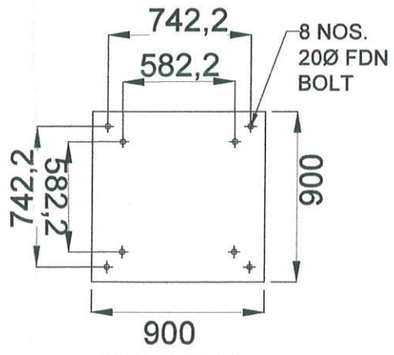


FOUNDATION PLAN



SECTION B-B





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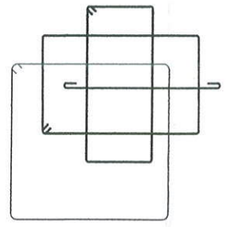
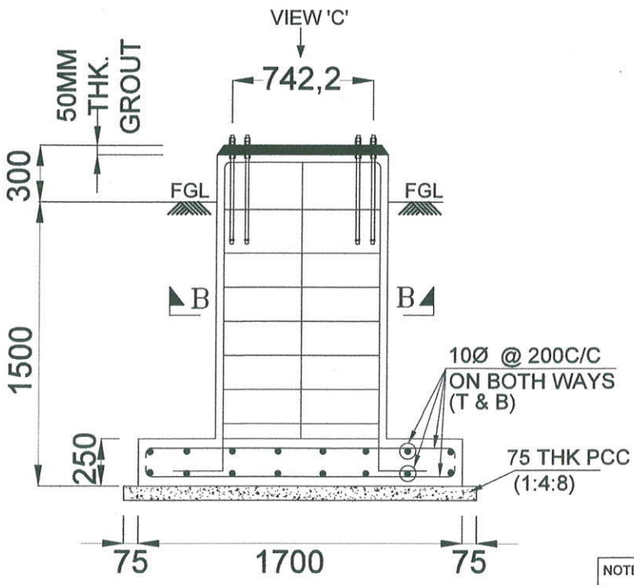


RING ARRANGEMENT



SECTION A-A

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 11.12 T/SQM AT 1.5MT DEPTH.

KAILASH DEVBUILD (INDIA) PVT. LTD. ★ JABALPUR

CN-22118
14/11/22

REC Power Development and Consultancy Ltd.

Categories
Approved/ Issued/ for Fabrication/Construction/Manufacturing.
Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
III Revised comments and submit again for approval.
IV For Information and record.
V. Not approved.

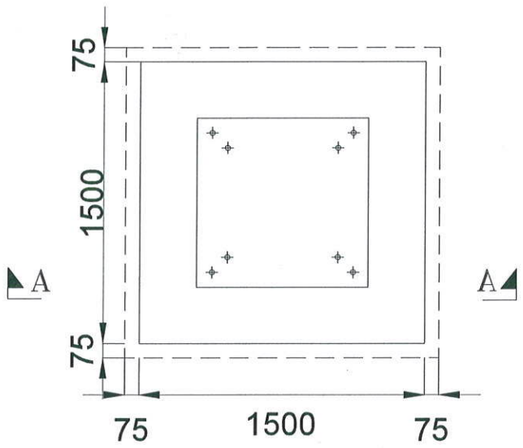
(Signature) (हस्ताक्षर) Manager (Designation) (पदनाम) (Date) (तिथि)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	220KV BPI FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/124 — REV- 0
SCALE	As shown in Drawing — SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM — SH.NO.: 1 OF 1

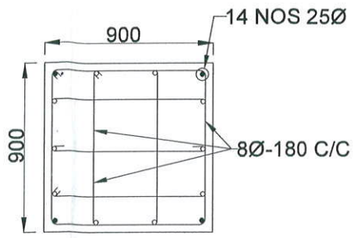
	NAME	DATE	SIGN	
PREPARED BY	PURNIMA	03.11.2022	Purnima	
CHECKED BY	G.H	03.11.2022		
SUBMITTED BY	Mr. ANURAG	03.11.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

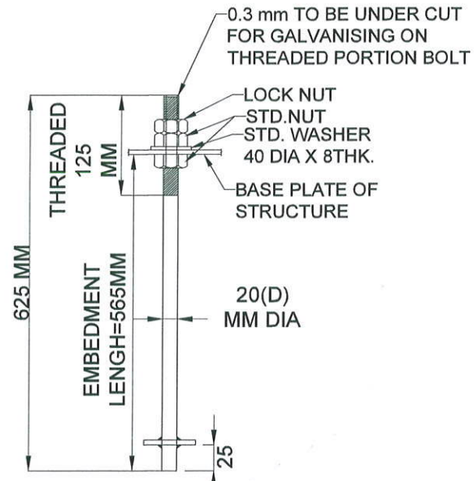
☐ More Information Date.....



FOUNDATION PLAN



SECTION B-B



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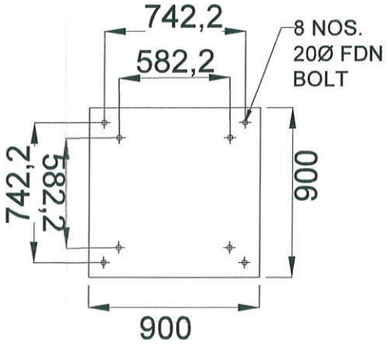

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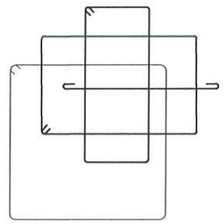
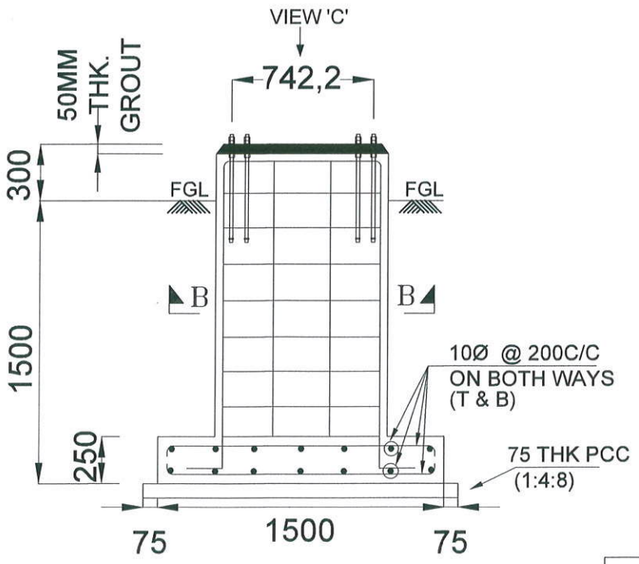


RING ARRANGEMENT



SECTION A-A

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 15.16 T/SQM AT 1.5MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-jiadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	220KV LA FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/125	REV- 0	
SCALE	As shown in Drawing	SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 1 OF 1	

	NAME	DATE	SIGN
PREPARED BY	PURNIMA	22.06.2022	
CHECKED BY	G.H	22.06.2022	
SUBMITTED BY	Mr. ANURAG	22.06.2022	

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Signature/Stamp.....

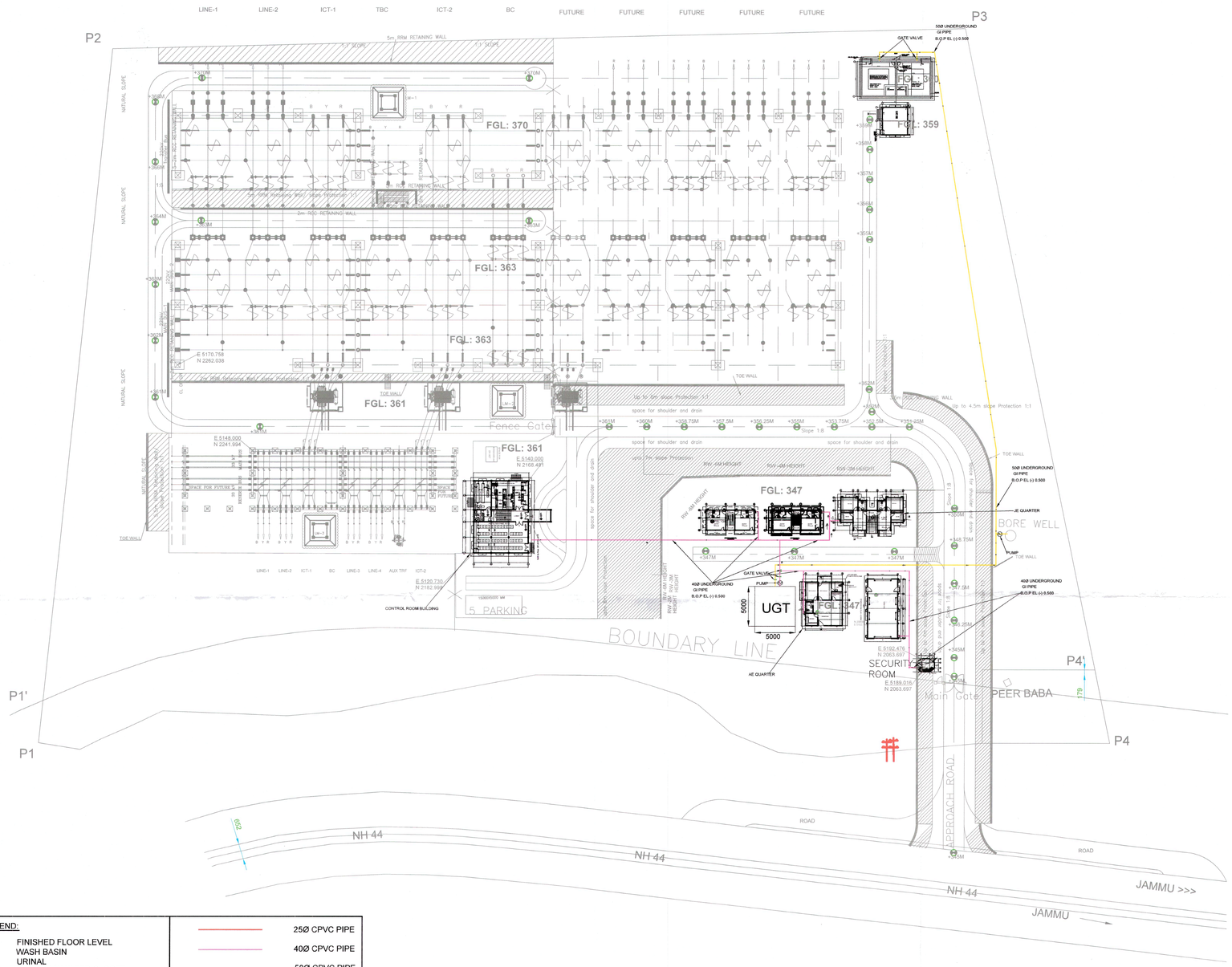
Kailash Devbuild (India) Pvt. Ltd. Jabalpur

Enclosures
Status
A. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
स्वीकृतिकरण/निर्माण/विनिर्माण हेतु अनुमोदित जारी।
B. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
स्वीकृतिकरण/निर्माण/विनिर्माण हेतु अनुमोदित जारी/ बातें दी गई टिप्पणियों को अंकेक्षित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
C. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
D. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
E. Not approved.
अनुमोदित नहीं।

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

REC Power Development And Consultancy Ltd. Gurugram-122001

CN-17906 dt 12/7/2022



ITEM SCHEDULE:	
ITEM	QUANTITY
WASHBASIN WITH TAP	16 NOS.
KITCHEN SINK WITH TAP	6 NOS.
URINAL	4 NOS.
EUROPEAN CLOSET	12 NOS.
INDIAN CLOSET	2 NOS.
WATER TANK FOR CRB & JE QUARTER	2 NOS. 1500 LTR.
WATER TANK FOR SECURITY ROOM	1 NOS. 1000 LTR.
WATER TANK FOR SBA	2 NOS. 1000 LTR.
WATER TANK FOR AE QUARTER	1 NOS. 1000 LTR.
PUMP	2 NOS, OF 5 HP CAPACITY
T-JOINT	AS PER CONNECTION REQ.
ELBOW JOINT	AS PER CONNECTION REQ.
WATER COOLER	1 NOS.

LEGEND:

FFL	FINISHED FLOOR LEVEL
WB	WASH BASIN
U	URINAL
EWC	EUROPIAN WATER CLOSET
IWC	INDIAN WATER CLOSET
KS	KITCHEN SINK
PW	POTABLE PIPE
B.O.P	BOTTOM OF PIPE
O.W.T	OVERHEAD WATER TANK
W.T	WATER TANK
U.G.T	UNDERGROUND WATER TANK
T.E.W	TAP FOR EXTERNAL WATER POINT

25Ø CPVC PIPE
40Ø CPVC PIPE
50Ø CPVC PIPE
200Ø CPVC PIPE
PUMP
GATE VALVE

NOTES:
1. ALL DIMENSIONS ARE INDICATED IN MILLIMETERS AND LEVELS IN METERS.
2. ALL DIMENSIONS MARKED ARE FINISHED FLOOR LEVELS UNLESS INDICATED OTHERWISE.
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4. ANY DOUBT OR DISCREPANCY IN THIS DRAWING SHALL BE BROUGHT TO THE NOTICE OF ENGINEER-IN-CHARGE BEFORE STARTING THE WORK.
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6. C.I PIPES TO BE USED FOR ALL SANITARY WORK ABOVE GROUND.
7. R.C.C PIPES TO BE USED FOR SANITARY WORK BELOW GROUND.
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9. QUANTITIES IN SCHEDULE ARE AS PER DRAWING, IT MAY VARY AS PER SITE CONDITION.
10. AS PER ACTUAL REQUIREMENTS DURING EXECUTION OF THE PROJECT AT SITE, WHEREVER REQUIRED , ADDITIONAL WATER PIPELINE WILL BE EXTENDED AND CONNECTIONS PROVIDED.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	PLUMBING & SANITARY LAYOUT FOR 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/131 — SHEET NO. 1 OF 6
SCALE	As shown in Drawing — REV- 01 — SIZE - A2
AREA	91.6 KANAL 46336.5 SQM

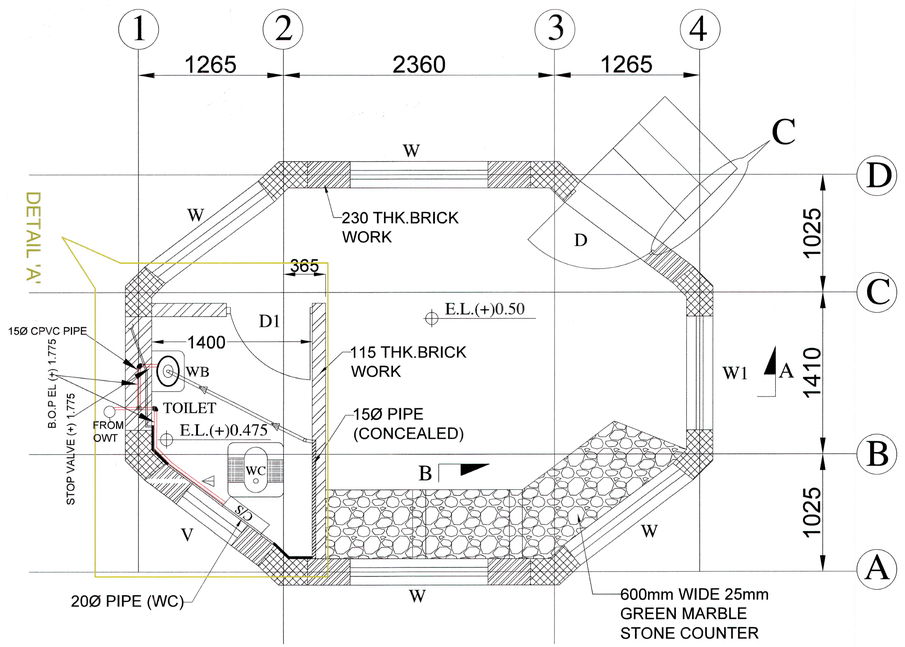
	NAME	DATE	SIGN
PREPARED BY	AZEEM	06.08.2022	Azeem Ahmad
CHECKED BY	G.H	06.08.2022	
SUBMITTED BY	Mr.ANURAG	06.08.2022	

KDBIL
Signature/Stamp...

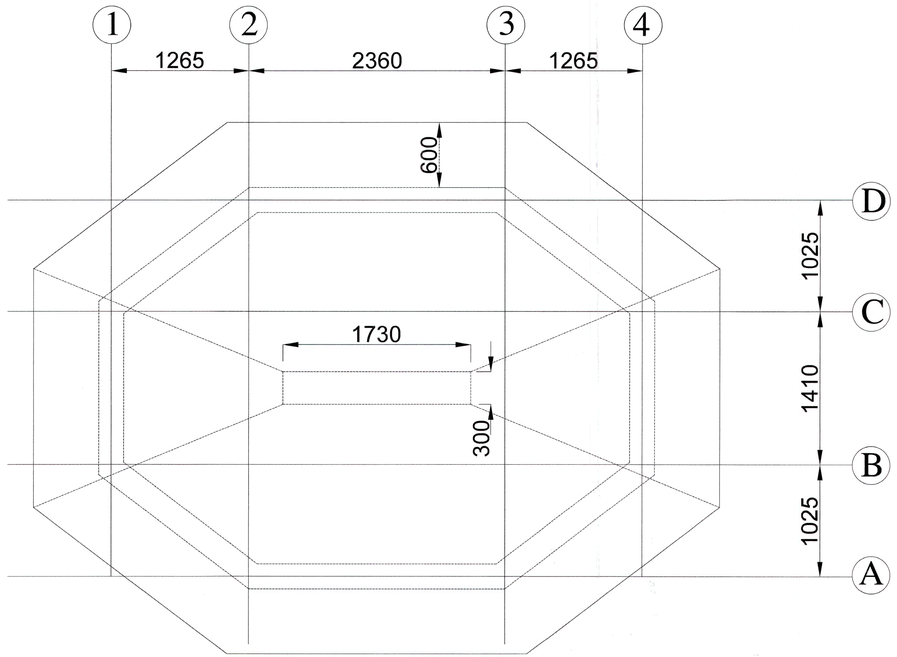
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

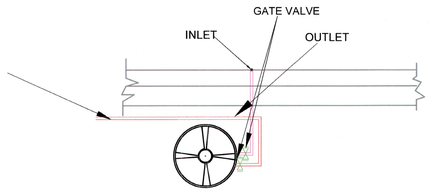
CN – 20704
Manager (Designs) RECPDCL (NOIDA) 31/10/22
31/10/22



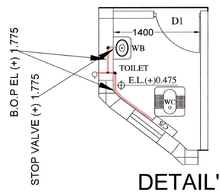
FLOOR PLAN(1:50)



ROOF PLAN



1 NO. 1000 LTR. WATER TANK SECURITY ROOM



DETAIL'A'

WB & WC FOR SECURITY ROOM

LEGEND:

FFL	FINISHED FLOOR LEVEL		25Ø CPVC PIPE
WB	WASH BASIN		40Ø CPVC PIPE
U	URINAL		50Ø CPVC PIPE
EWC	EUROPIAN WATER CLOSET		200Ø CPVC PIPE
IWC	INDIAN WATER CLOSET		PUMP
KS	KITCHEN SINK		GATE VALVE
PW	POTABLE PIPE		
B.O.P	BOTTOM OF PIPE		
O.W.T	OVERHEAD WATER TANK		
W.T	WATER TANK		
U.G.T	UNDERGROUND WATER TANK		
T.E.W	TAP FOR EXTERNAL WATER POINT		

NOTES:

1. ALL DIMENSIONS ARE INDICATED IN MILLIMETERS AND LEVELS IN METERS.
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9. QUANTITIES IN SCHEDULE ARE AS PER DRAWING, IT MAY VARY AS PER SITE CONDITION.
10. AS PER ACTUAL REQUIREMENTS DURING EXECUTION OF THE PROJECT AT SITE, WHEREVER REQUIRED , ADDITIONAL WATER PIPELINE WILL BE EXTENDED AND CONNECTIONS PROVIDED.

ITEM SCHEDULE:

ITEM	DIMENSIONS AS PER TS
WASHBASIN WITH TAP	550 X 400 MM
KITCHEN SINK WITH TAP	STAINLESS STEEL
URINAL	430 X 260 X 350 MM
TOWEL RAIL	600 MM
MIRROR	600 X 450 X 178 MM

ITEM SCHEDULE:

ITEM	QUANTITY
WASHBASIN WITH TAP	1 NOS.
KITCHEN SINK WITH TAP	0 NOS.
URINAL	0 NOS.
INDIAN CLOSET	1 NOS.
WATER TANK	1 NOS. 1000 LTR.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	PLUMBING & SANITARY OF SECURITY ROOM BUILDING OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/131	SHEET NO.	2 OF 6	
SCALE	As shown in Drawing	REV- 01	SIZE - A2	
AREA	91.6 KANAL 46336.5 SQM			

	NAME	DATE	SIGN	
PREPARED BY	AZEEM	06.08.2022	Azeem Ahmad.	KDBIL
CHECKED BY	G.H	06.08.2022		Signature/Stamp...
SUBMITTED BY	Mr.ANURAG	06.08.2022		

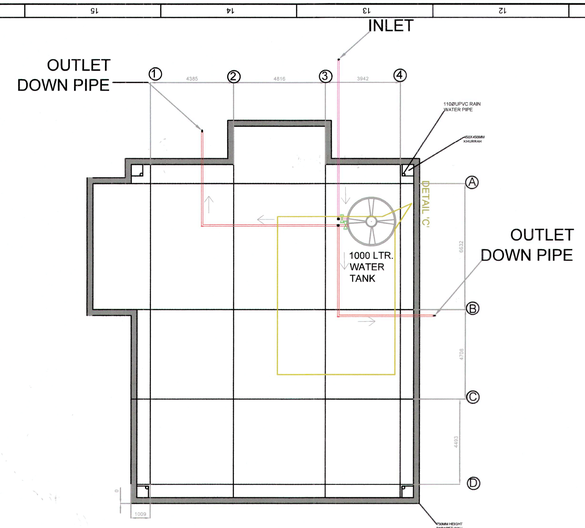
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

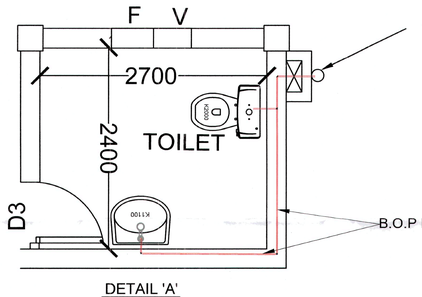
CN-20704

Manager (Designs) 03/10/22

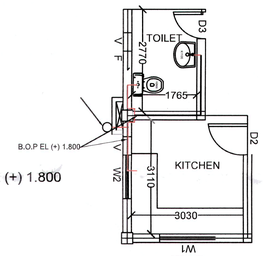
03/10/22



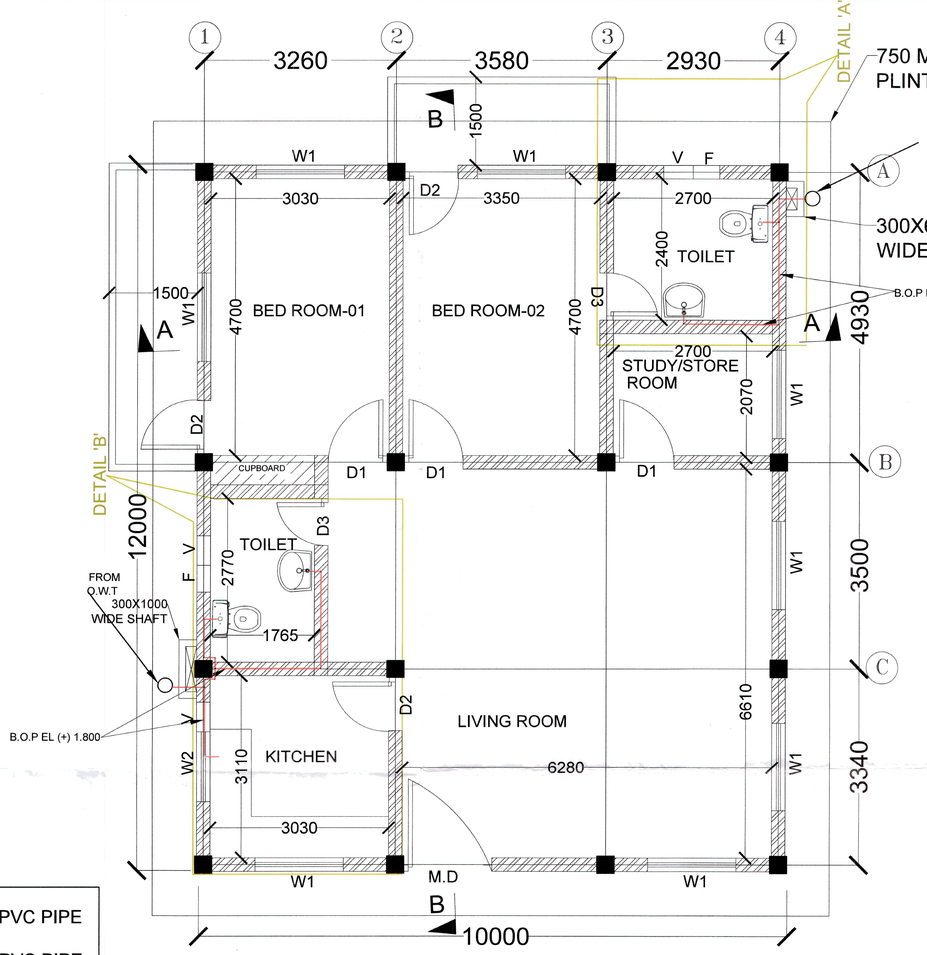
TERRACE FLOOR PLAN (+3.650M)



DETAIL 'A'
TOILET & WASHBASIN
AE QUARTER

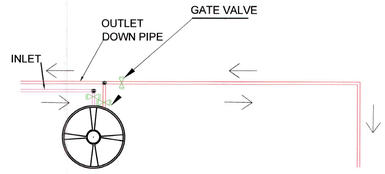


I/M
DETAIL 'B'
TOILET, WASHBASIN& KITCHEN
AE QUARTER



GROUND FLOOR PLAN (+ 0.500 M)

AE QUARTER



DETAIL 'C'
1 NO. 1000 LTR. WATER TANK

ITEM SCHEDULE:	
ITEM	QUANTITY
WASHBASIN WITH TAP	2 NOS.
KITCHEN SINK WITH TAP	1 NOS.
URINAL	0 NOS.
EUROPEAN CLOSET	2 NOS.
WATER TANK	1 NOS. 1000 LTR.

LEGEND:

FFL	FINISHED FLOOR LEVEL
WB	WASH BASIN
U	URINAL
EWC	EUROPIAN WATER CLOSET
IWC	INDIAN WATER CLOSET
KS	KITCHEN SINK
PW	POTABLE PIPE
B.O.P	BOTTOM OF PIPE
O.W.T	OVERHEAD WATER TANK
W.T	WATER TANK
U.G.T	UNDERGROUND WATER TANK
T.E.W	TAP FOR EXTERNAL WATER POINT

	25Ø CPVC PIPE
	40Ø CPVC PIPE
	50Ø CPVC PIPE
	200Ø CPVC PIPE
	PUMP
	GATE VALVE

NOTES:

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9. QUANTITIES IN SCHEDULE ARE AS PER DRAWING, IT MAY VARY AS PER SITE CONDITION.
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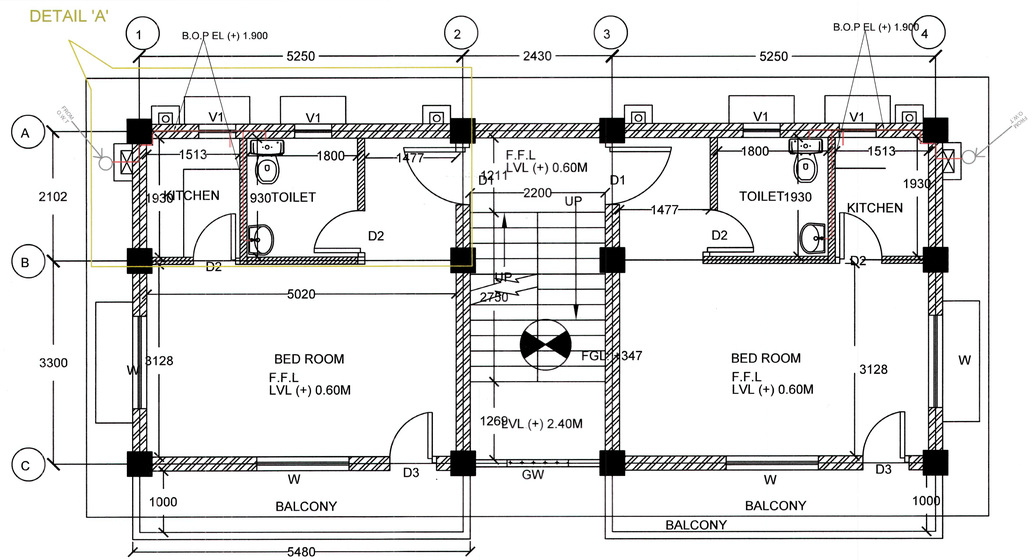
ITEM SCHEDULE:	
ITEM	DIMENSIONS AS PER TS
WASHBASIN WITH TAP	550 X 400 MM
KITCHEN SINK WITH TAP	STAINLESS STEEL
URINAL	430 X 260 X 350 MM
TOWEL RAIL	600 MM
MIRROR	600 X 450 X 178 MM

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	PLUMBING & SANITARY OF AE QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/131		SHEET NO.	3 OF 6
SCALE	As shown in Drawing		REV- 01	SIZE - A2
AREA	91.6 KANAL 46336.5 SQM			
	NAME	DATE	SIGN	
PREPARED BY	AZEEM	06.08.2022		KDBIL
CHECKED BY	G.H	06.08.2022		
SUBMITTED BY	Mr.ANURAG	06.08.2022		Signature/Stamp...

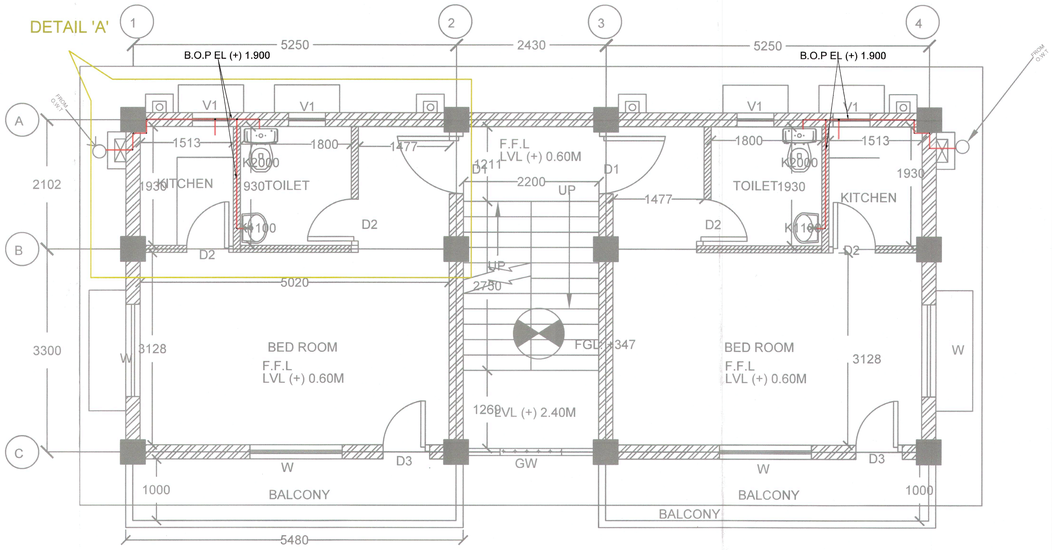
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

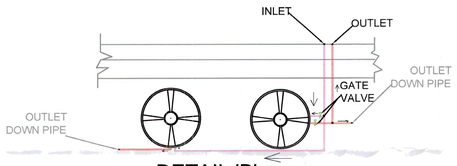
CN-20704



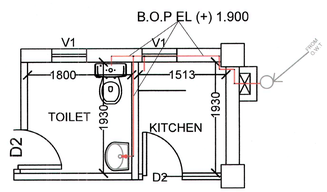
GROUND FLOOR PLAN
LVL (+0.600)



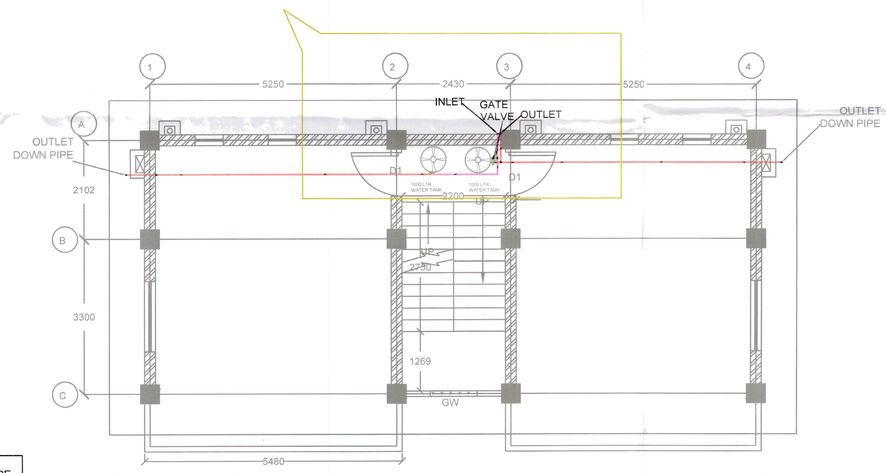
FIRST FLOOR PLAN
LVL (+3.750)



DETAIL 'B'
2 NOS. 1000 LTR. WATER TANK



DETAIL 'A'
KITCHEN & TOILET



LEGEND:

FFL	FINISHED FLOOR LEVEL
WB	WASH BASIN
U	URINAL
EWC	EUROPIAN WATER CLOSET
IWC	INDIAN WATER CLOSET
KS	KITCHEN SINK
PW	POTABLE PIPE
B.O.P	BOTTOM OF PIPE
O.W.T	OVERHEAD WATER TANK
W.T	WATER TANK
U.G.T	UNDERGROUND WATER TANK
T.E.W	TAP FOR EXTERNAL WATER POINT

	25Ø CPVC PIPE
	40Ø CPVC PIPE
	50Ø CPVC PIPE
	200Ø CPVC PIPE
	PUMP
	GATE VALVE

NOTES:
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ITEM SCHEDULE:

ITEM	DIMENSIONS AS PER TS
WASHBASIN WITH TAP	550 X 400 MM
KITCHEN SINK WITH TAP	STAINLESS STEEL
URINAL	430 X 260 X 350 MM
TOWEL RAIL	600 MM
MIRROR	600 X 450 X 178 MM

ITEM SCHEDULE:

ITEM	QUANTITY
WASHBASIN WITH TAP	4 NOS.
KITCHEN SINK WITH TAP	4 NOS.
URINAL	0 NOS.
EUROPEAN CLOSET	4 NOS.
WATER TANK	2 NOS. 1000 LTR.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	PLUMBING & SANITARY OF SBA QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/131 — SHEET NO. 4 OF 6
SCALE	As shown in Drawing — REV- 01 — SIZE - A2
AREA	91.6 KANAL 46336.5 SQM

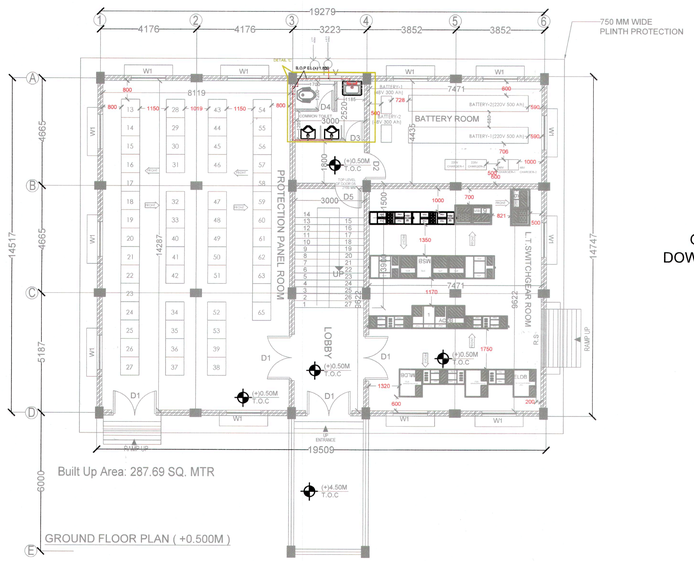
	NAME	DATE	SIGN
PREPARED BY	AZEEM	06.08.2022	
CHECKED BY	G.H	06.08.2022	
SUBMITTED BY	Mr.ANURAG	06.08.2022	

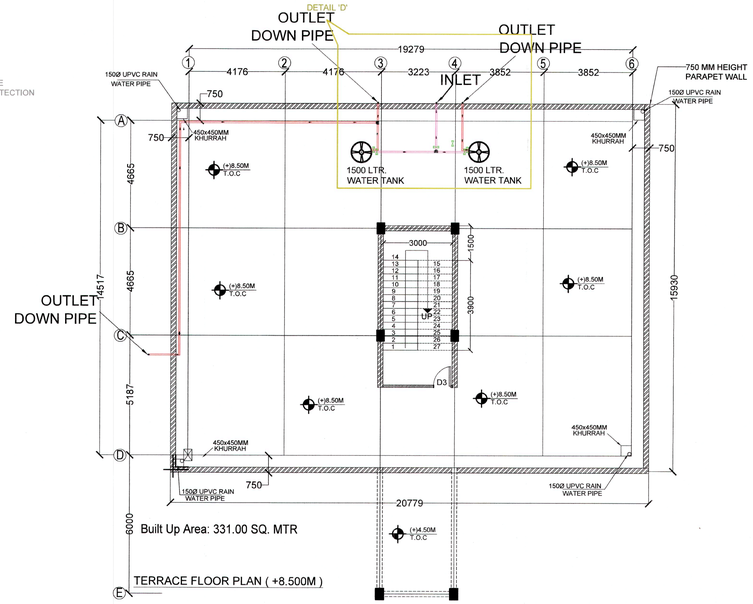
KDBIL
Signature/Stamp...

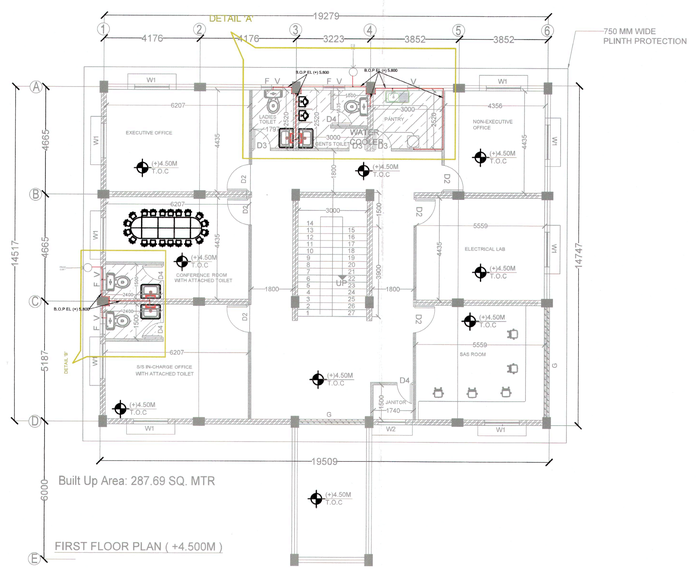
☐ Approved ☐ Approved with comments ☐ Not Approved

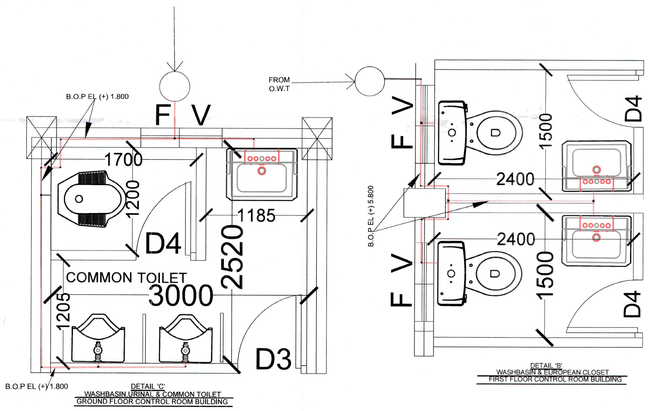
☐ More Information Date.....

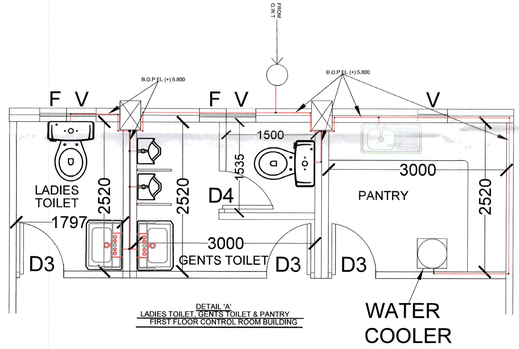
CN-20704

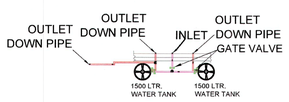












DETAIL 'D'
2 NOS. 1500 LTR. WATER TANK
CONTROL ROOM BUILDING

LEGEND:

FFL	FINISHED FLOOR LEVEL
WB	WASH BASIN
U	URINAL
EWC	EUROPIAN WATER CLOSET
IWC	INDIAN WATER CLOSET
KS	KITCHEN SINK
PW	POTABLE PIPE
B.O.P	BOTTOM OF PIPE
O.W.T	OVERHEAD WATER TANK
W.T	WATER TANK
U.G.T	UNDERGROUND WATER TANK
T.E.W	TAP FOR EXTERNAL WATER POINT

25Ø CPVC PIPE
40Ø CPVC PIPE
50Ø CPVC PIPE
200Ø CPVC PIPE
PUMP
GATE VALVE

NOTES:
1. ALL DIMENSIONS ARE INDICATED IN MILLIMETERS AND LEVELS IN METERS.
2. ALL DIMENSIONS MARKED ARE FINISHED FLOOR LEVELS UNLESS INDICATED OTHERWISE.
3. DRAWINGS SHALL NOT BE SCALED, ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
4. ANY DOUBT OR DISCREPANCY IN THIS DRAWING SHALL BE BROUGHT TO THE NOTICE OF ENGINEER-IN-CHARGE BEFORE STARTING THE WORK.
5. CPVC PIPES ARE USED FOR INTERNAL PLUMBING WORK.
6. C.I PIPES TO BE USED FOR ALL SANITARY WORK ABOVE GROUND.
7. R.C.C PIPES TO BE USED FOR SANITARY WORK BELOW GROUND.
8. FOR DETAILED SPECIFICATION REFER T.S.
9. QUANTITIES IN SCHEDULE ARE AS PER DRAWING, IT MAY VARY AS PER SITE CONDITION.
10. AS PER ACTUAL REQUIREMENTS DURING EXECUTION OF THE PROJECT AT SITE, WHEREVER REQUIRED , ADDITIONAL WATER PIPELINE WILL BE EXTENDED AND CONNECTIONS PROVIDED.

ITEM SCHEDULE:

ITEM	DIMENSIONS AS PER TS
WASHBASIN WITH TAP	550 X 400 MM
KITCHEN SINK WITH TAP	STAINLESS STEEL
URINAL	430 X 260 X 350 MM
TOWEL RAIL	600 MM
MIRROR	600 X 450 X 178 MM

ITEM SCHEDULE:

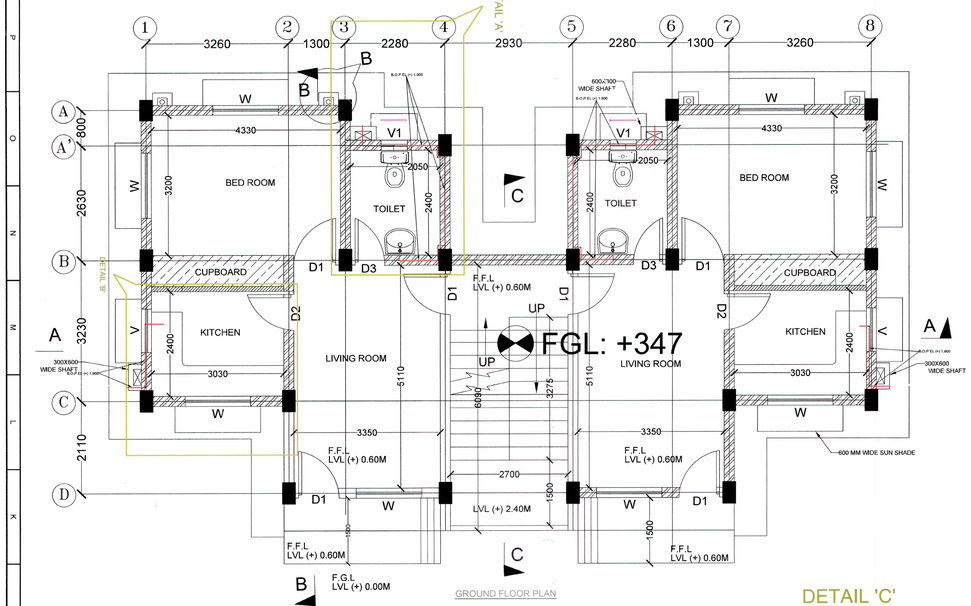
ITEM	QUANTITY
WASHBASIN WITH TAP	5 NOS.
KITCHEN SINK WITH TAP	1 NOS.
URINAL	4 NOS.
EUROPEAN CLOSET	4 NOS.
WATER TANK	2 NOS. 1500 LTR.
INDIAN CLOSET	1 NOS.
WATER COOLER	1 NOS.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	PLUMBING & SANITARY OF CONTROL ROOM BUILDING GROUND FLOOR & FIRST FLOOR 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/131		SHEET NO.	5 OF 6
SCALE	As shown in Drawing		REV- 01	SIZE - A2
AREA	91.6 KANAL 46336.5 SQM			
	NAME	DATE	SIGN	
PREPARED BY	AZEEM	06.08.2022	Azeem Ahmad	KDBIL
CHECKED BY	G.H	06.08.2022		
SUBMITTED BY	Mr.ANURAG	06.08.2022		Signature/Stamp...

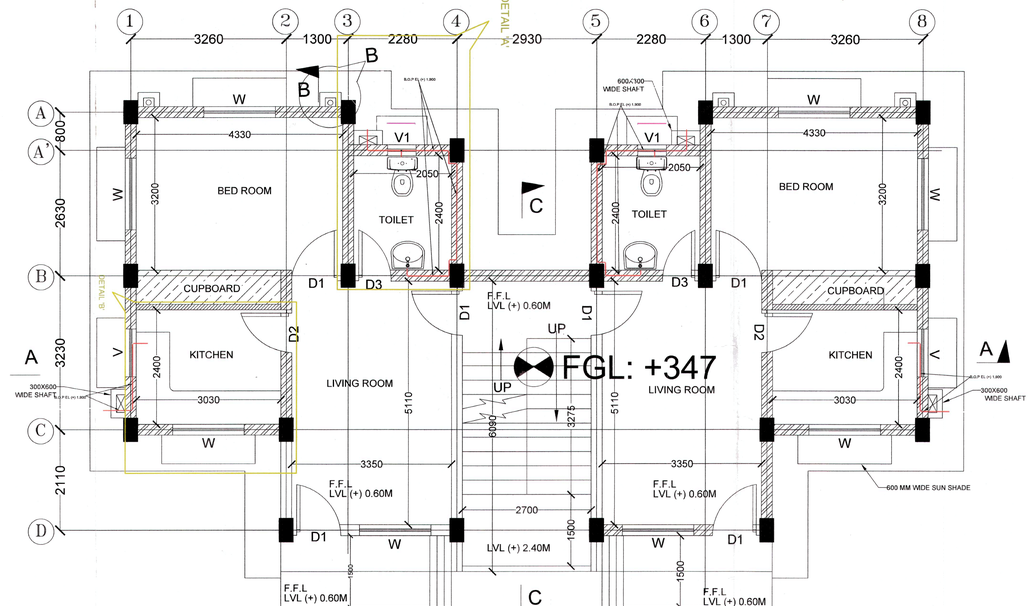
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

CN-20704
03/10/22

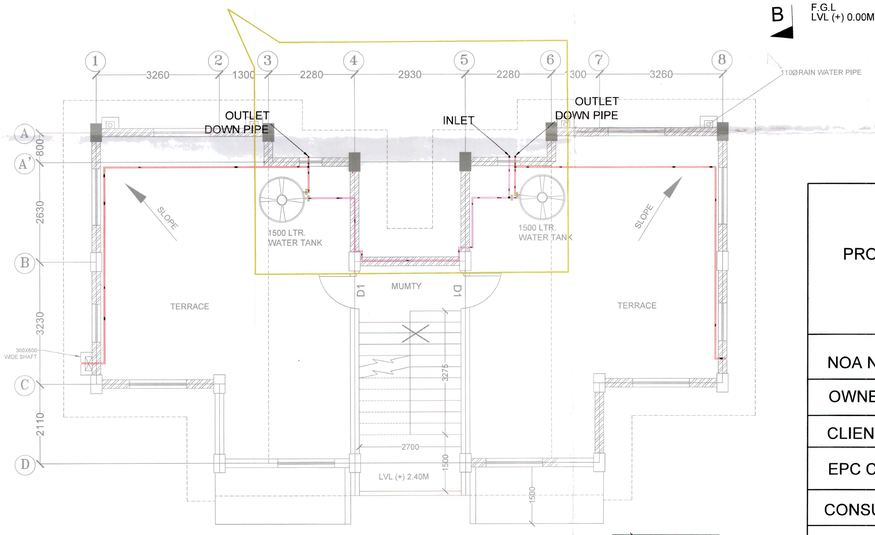


GROUND FLOOR PLAN
LVL (+0.600)

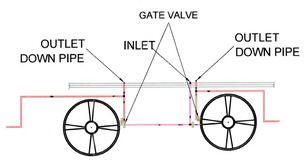


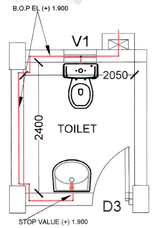
FIRST FLOOR PLAN
LVL (+3.75)

DETAIL 'C'

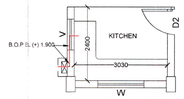


DETAIL 'C'
2 NOS. 1500 LTR. WATER TANK





DETAIL 'A'
WASHBASIN & EUROPEAN CLOSET
JE QUARTER



DETAIL 'B'
KITCHEN (JE QUARTER)

LEGEND:

FFL	FINISHED FLOOR LEVEL
WB	WASH BASIN
U	URINAL
EWC	EUROPIAN WATER CLOSET
IWC	INDIAN WATER CLOSET
KS	KITCHEN SINK
PW	POTABLE PIPE
B.O.P	BOTTOM OF PIPE
O.W.T	OVERHEAD WATER TANK
W.T	WATER TANK
U.G.T	UNDERGROUND WATER TANK
T.E.W	TAP FOR EXTERNAL WATER POINT

25Ø CPVC PIPE
40Ø CPVC PIPE
50Ø CPVC PIPE
200Ø CPVC PIPE
PUMP
GATE VALVE

NOTES:

1. ALL DIMENSIONS ARE INDICATED IN MILLIMETERS AND LEVELS IN METERS.
2. ALL DIMENSIONS MARKED ARE FINISHED FLOOR LEVELS UNLESS INDICATED OTHERWISE.
3. DRAWINGS SHALL NOT BE SCALED, ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
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6. C.I PIPES TO BE USED FOR ALL SANITARY WORK ABOVE GROUND.
7. R.C.C PIPES TO BE USED FOR SANITARY WORK BELOW GROUND.
8. FOR DETAILED SPECIFICATION REFER T.S.
9. QUANTITIES IN SCHEDULE ARE AS PER DRAWING, IT MAY VARY AS PER SITE CONDITION.
10. AS PER ACTUAL REQUIREMENTS DURING EXECUTION OF THE PROJECT AT SITE, WHEREVER REQUIRED , ADDITIONAL WATER PIPELINE WILL BE EXTENDED AND CONNECTIONS PROVIDED.

ITEM SCHEDULE:

ITEM	DIMENSIONS AS PER TS
WASHBASIN WITH TAP	550 X 400 MM
KITCHEN SINK WITH TAP	STAINLESS STEEL
URINAL	430 X 260 X 350 MM
TOWEL RAIL	600 MM
MIRROR	600 X 450 X 178 MM

ITEM SCHEDULE:

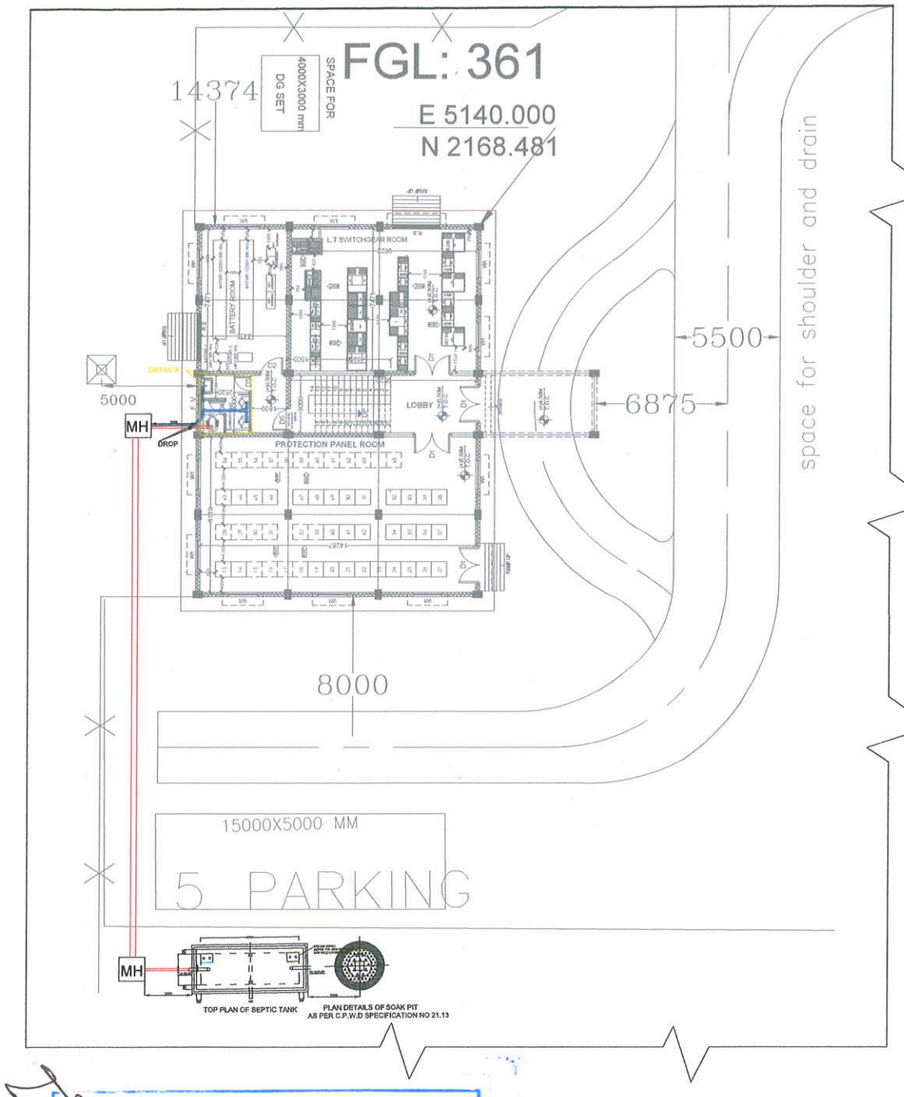
ITEM	QUANTITY
WASHBASIN WITH TAP	4 NOS.
KITCHEN SINK WITH TAP	4 NOS.
URINAL	0 NOS.
EUROPEAN CLOSET	4 NOS.
WATER TANK	2 NOS. 1500 LTR.

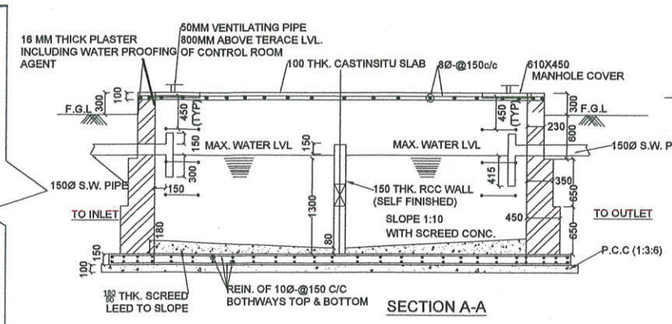
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	PLUMBING & SANITARY OF JE QUARTER OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/131	SHEET NO.	6 OF 6	
SCALE	As shown in Drawing	REV- 01	SIZE - A2	
AREA	91.6 KANAL 46336.5 SQM			
	NAME	DATE	SIGN	
PREPARED BY	AZEEM	06.08.2022	Azeem Ahmad	KDBIL
CHECKED BY	G.H	06.08.2022		
SUBMITTED BY	Mr.ANURAG	06.08.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

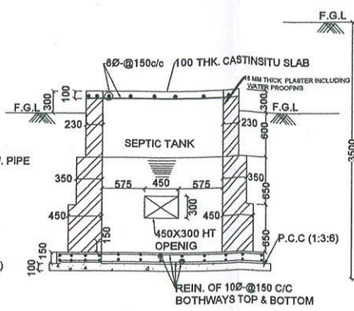
☐ More Information Date.....

CN-20704





SECTION A-A



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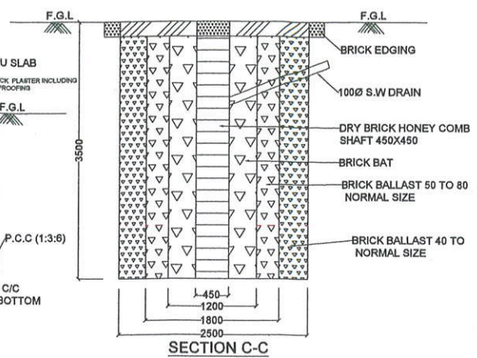

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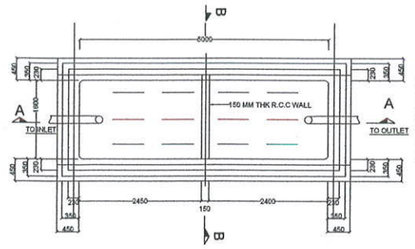
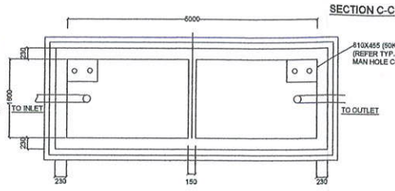
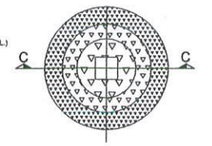


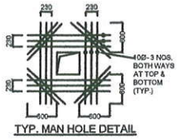
SECTIONAL PLAN OF SEPTIC TANK



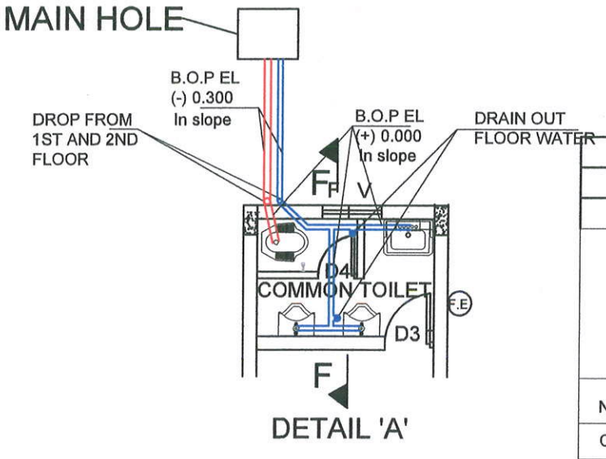
TOP PLAN OF SEPTIC TANK



PLAN DETAILS OF SOAK PIT
(AS PER C.PW.D SPECIFICATION NO 21.13)



TYP. MAN HOLE DETAIL



DETAIL 'A'

01	07.10.2022	REVISED AS PER CLIENT COMMENT
00	25.07.2022	FIRST SUBMISSION
REV.	REV. DATE	MODIFICATION

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	DETAILING OF SEPTIC TANK OF CONTROL ROOM Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/132
SCALE	As shown in Drawing — SH.NO.: 1 OF 1
AREA	91.6 KANAL 46336.5 SQM — SHEET SIZE: A3

	NAME	DATE	SIGN
PREPARED BY	AMIT	07.10.2022	
CHECKED BY	G.H	07.10.2022	
SUBMITTED BY	ANURAG	07.10.2022	

Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Categories
श्रेणियां
I. Issued for Fabrication/Construction/Manufacturing.
II. Approved/ Issued for Fabrication/ Construction/ Manufacturing.
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
III. Incorporate comments and submit again for approval.
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अस्वीकृत की।

(Signature) (हस्ताक्षर) Manager
(Designation) (पदनाम)
(Date) (तिथि)

CN-21109
18/10/22

Note:-

1. IN THIS DRAWING Ø DENOTES FOR STEEL CONFORMING TO I.S 1786 GRADE FE 500.
2. LAP LENGTH SHALL BE 50 TIMES DIA OF BAR.
3. PROVIDE CLEAR COVER TO REINF. S UNDER.
   * 50 MM FOR BOTTOM & 40 MM TOP & SIDE REINFORCEMENT OF RAFT.
   * 40 MM FOR WALL SOIL FACE.
   * 25 MM FOR WATER FACE.
   * 25 MM FOR TOP SLAB.
4. 16 MM THICK PLASTER 1:4 RATIO PROVIDED BOTH, INNER AND OUTER SIDE OF WALL INCLUDING WATER PROOFING AGENT PER SQ. METER = 4.4KG .
5. DO NOT SCALE THE DRAWING ONLY WRITTEN DIMENSION SHALL BE FOLLOW.
6. UNLESS OTHERWISE NOTED ALL CONCRETE SHALL BE OF GRADE M-25.
7. INTERNAL W.P COMP. SHALL BE USED WHILE CONCRETING AS PER MFD'S MAN HOLE 40 MM FOR WATERPROOF.
8. ALL DIMENSION IN MM .

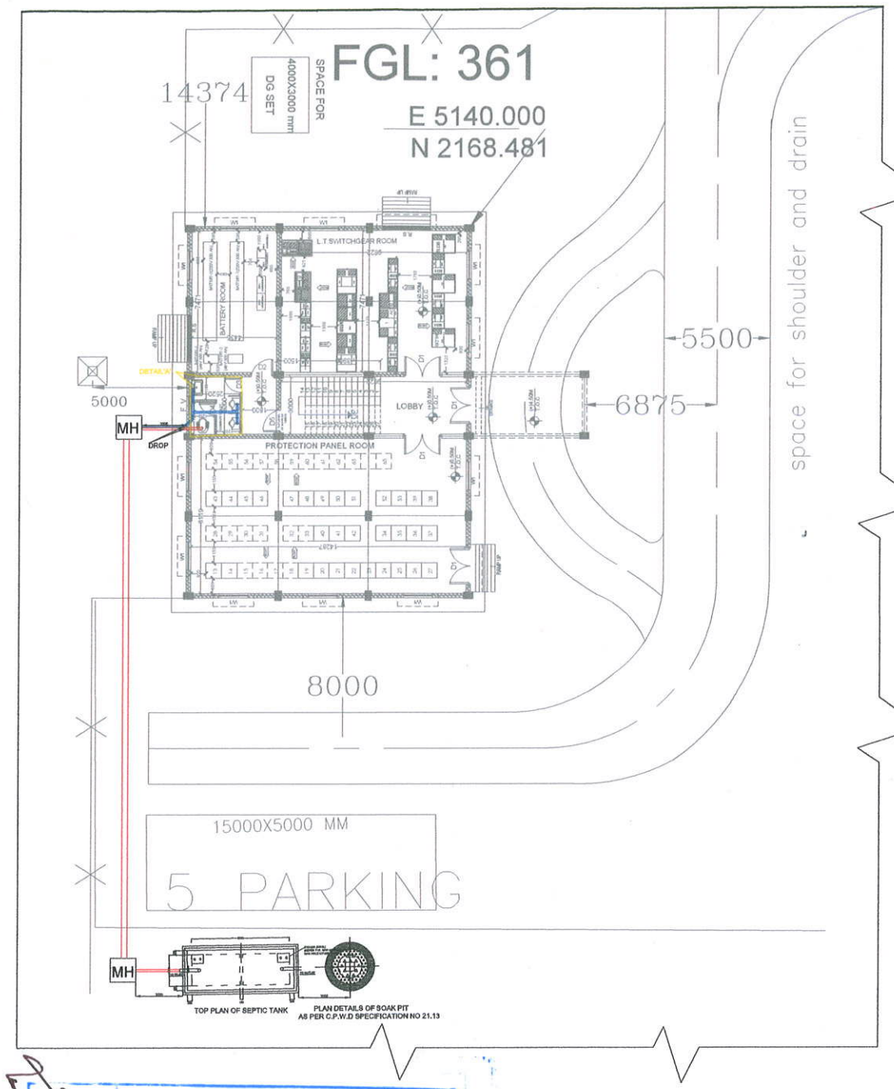
LEGEND:

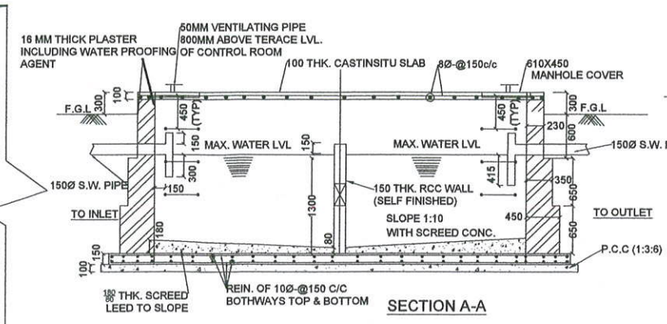
FFL	FINISHED FLOOR LEVEL
WB	WASH BASIN
U	URINAL
EWC	EUROPIAN WATER CLOSET
IWC	INDIAN WATER CLOSET
KS	KITCHEN SINK
B.O.P	BOTTOM OF PIPE
O.W.T	OVERHEAD WATER TANK
U.G.T	UNDERGROUND WATER TANK

110mm Ø CI PIPE

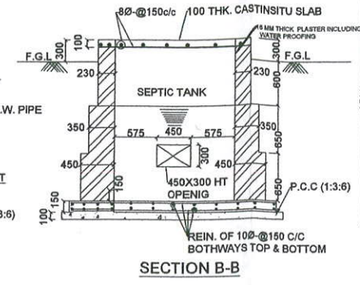
60mm Ø CI PIPE

DRAIN OUT FLOOR WATER





SECTION A-A



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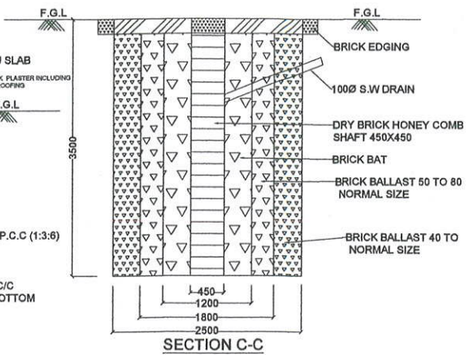
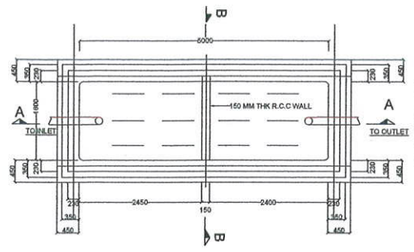
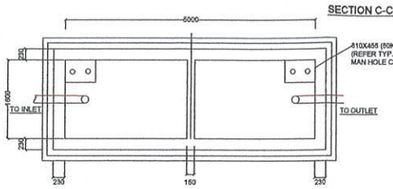


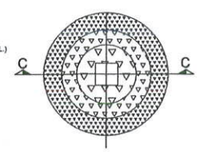
SECTION C-C



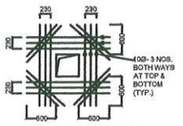
SECTIONAL PLAN OF SEPTIC TANK



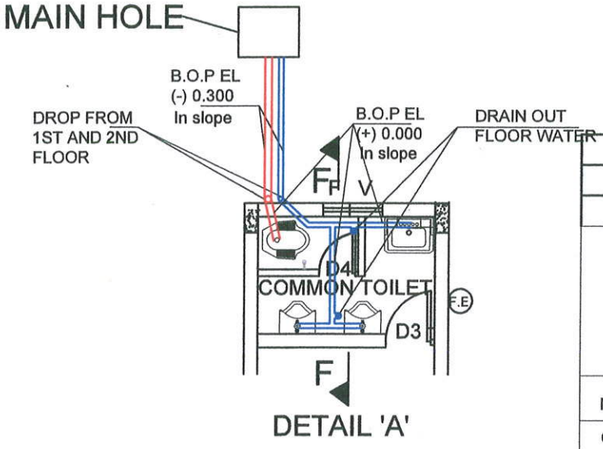
TOP PLAN OF SEPTIC TANK



PLAN DETAILS OF SOAK PIT
(AS PER C.PW.D SPECIFICATION NO 21.13)



TYP. MAN HOLE DETAIL



DETAIL 'A'

Categories
श्रेणियां
I. Approved/ Issued for Fabrication/Construction/Manufacturing.
फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued for Fabrication/Construction/Manufacturing Subject to condition that statement & and comments are included. Please submit the revised documents for approval.
फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी। बशर्ते कि इन टिप्पणियों को शामिल किया जाए। पुनरीक्षित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः प्रस्तुतीकरण हेतु।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
Manager
(Designation) (पदनाम)
(Date) (तिथि)

REC Power Development and Consultancy Limited 123001 Gurugram

CN-21109
18/10/22

LEGEND:

FFL	FINISHED FLOOR LEVEL
WB	WASH BASIN
U	URINAL
EWC	EUROPIAN WATER CLOSET
IWC	INDIAN WATER CLOSET
KS	KITCHEN SINK
B.O.P	BOTTOM OF PIPE
O.W.T	OVERHEAD WATER TANK
U.G.T	UNDERGROUND WATER TANK

110mm Ø CI PIPE

60mm Ø CI PIPE

DRAIN OUT FLOOR WATER

Note:-

1. IN THIS DRAWING Ø DENOTES FOR STEEL CONFORMING TO I.S 1786 GRADE FE 500.
2. LAP LENGTH SHALL BE 50 TIMES DIA OF BAR.
3. PROVIDE CLEAR COVER TO REINF. S UNDER.
   * 50 MM FOR BOTTOM & 40 MM TOP & SIDE REINFORCEMENT OF RAFT.
   * 40 MM FOR WALL SOIL FACE.
   * 25 MM FOR WATER FACE.
   * 25 MM FOR TOP SLAB.
4. 16 MM THICK PLASTER 1:4 RATIO PROVIDED BOTH, INNER AND OUTER SIDE OF WALL INCLUDING WATER PROOFING AGENT PER SQ. METER = 4.4KG .
5. DO NOT SCALE THE DRAWING ONLY WRITTEN DIMENSION SHALL BE FOLLOW.
6. UNLESS OTHERWISE NOTED ALL CONCRETE SHALL BE OF GRADE M-25.
7. INTERNAL W.P COMP. SHALL BE USED WHILE CONCRETING AS PER MFD'S MAN HOLE 40 MM FOR WATERPROOF.
8. ALL DIMENSION IN MM .

REV.	REV. DATE	MODIFICATION
~~00~~ 01	07.10.2022	REVISED AS PER CLIENT COMMENT
00	25.07.2022	FIRST SUBMISSION

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	DETAILING OF SEPTIC TANK OF CONTROL ROOM Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/132
SCALE	As shown in Drawing — SH.NO.: 1 OF 1
AREA	91.6 KANAL 46336.5 SQM — SHEET SIZE: A3

	NAME	DATE	SIGN
PREPARED BY	AMIT	07.10.2022	
CHECKED BY	G.H	07.10.2022	
SUBMITTED BY	ANURAG	07.10.2022	

KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR

Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

10.08.2022	R0	FOR APPROVAL	A.Z.	G.H.	G.H.
DATE	**REV. NO.**	**DESCRIPTION**	**Designed**	**Checked**	**Submitted**

CLIENT :		**REC POWER DEVELOPMENT AND CONSULTANCY LIMITED (JKPTCL)**
CONTRACTOR:		**Kailash Devbuild (India) Pvt. Ltd.** **817, Hathital, Jabalpur-482001 (M.P.)**
PROJECT :	**Construction of 2x50MVA, 220/33KV Nagrota (NEW) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Desing , Engineering, Supply & Construction of Residental Staff Quarters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.**	

TOTAL NO. OF PAGES			**TITLE :**
	NAME	**DATE**	
DSGN	A.Z.	10.08.2022	**DESIGN OF RRM RETAINING WALL, HEIGHT=2m, NAGROTA**
CHKD	G.H.	10.08.2022	
SUBM	G.H.	10.08.2022	

DRG. No.	KDBIL/250 PJ/20-21/D1/135	**REV.** R0

RELEASED FOR	☐ **PRELIMINARY**	☐ **TENDER**	☐ **INFORMATION**	☑ **APPROVAL**	☐ **CONSTRUCTION**

GENERAL DATA

Height above existing ground level(NGL)	=	2	m
Net Safe bearing capacity q	=	87.40	kN/m2
ϕ	=		
μ	=	0.7	
Unit weight of soil	=	18	KN/m3
Required base width	=	0.6H to 0.65H	m
	=	1.86 to 2.0	m
Base width at depth, 1 m	=	1.86	m
Projection in base slab at each side	=	0.15	m
Base width at depth, 1.1 m	=	2.16	m
Top width	=	0.5 to 1	m
	=	0.6 m	(Assumed)
Unit weight of soil	=	18	KN/m3
Unit weight of Masonary	=	24	KN/m3
Provide depth of foundation	=	1 + 0.1	
	=	1.1	
Overall height H	=	3.1	m
surcharge	=	12	KN/m

1) Coefficient of static earth pressure

Ka	=	1 - sin(30)/ 1 + sin(30)	
	=	1 - 0.50 / 1 + 0.50	
	=	0.31	
Kp	=	1 / Ka	
	=	3.26	
Horizontal static active pressure at base	=	17.14	KN/m2

2) Stability calculation

Horizontal load

Load type	Horizontal load(KN)	Load applying at Ht. from base	Moment(KNm)
active static earth pressure	26.6	1.03	27.45
passive static earth pressure	0.0	0.37	0.00
Due to vertical Surcharge	11.4	1.55	17.71
Dynamic increment active earth pressure	-10.6	1.55	-16.37

Sliding force Pah = 27.4 KN Overturning moment Mo = 28.796 KNm

Vertical load

Load type	V load(KN)	Load application pt. from toe	Moment in KNm
Stem-W1	43.2	1.71	73.872
Stem-W2	45.4	0.99	44.9064
Base Slab	5.2	1.08	5.59872
Soil wt. retained on heel	8.1	2.09	16.8885
Total	101.8 KN		141.27 KNm

Total downward load = 101.8 KN

Resisting moment Mr = 141.27 KNm

a) Check for overturning

FOS (for static loads)	=	2.815	>	2	safe
FOS (with seismic loads)	=	4.415	>	1.5	safe

b) Check for sliding

FOS (for static loads)	=	1.69	>	1.5	safe
FOS (with seismic loads)	=	2.339	>	1	safe

c) Check for Bearing pressure

Distance of C.G. of vert. forces from face of toe, x = 1.10 m

Eccentricity, e = 0.02 < (B/6) = 0.36

Maximum pressure at toe

Pmax = 50.34 KN/m2 < 87.40 safe

Minimum pressure at heel

Pmin = 43.964 KN/m2 > 0 safe

No tension at base

Calculation of Active and passive earth pressure coefficients due to backfill in seismic condition

Z		0.24				
I		1.5				
R		1.5				
Sa/g	=	2				
Ah	=	0.24		Ah/(1+Av)	Ah/(1-Av)	
				0.2069	0.2857	
Av	=	0.16				
						degree
λ	11.70	15.95	take maximum	15.95		15.95
α	0					0
i=β	0					0
δ	15					15
ϕ	30					30

1+Av=	1.16	
1-Av=	0.84	
cos^2(ϕ-λ-α)=	0.3227	
cosλcos^2αcos(δ+α+λ)=	0.7854	
sin(ϕ+δ)sin(ϕ-i-λ)=	-0.3038	
cos(α-i)cos(δ+α+λ)=	-0.8302	
(1+Av)*cos^2(ϕ-λ-α)/cosλcos^2αcos(δ+α+λ)=	0.477	
(1-Av)*cos^2(ϕ-λ-α)/cosλcos^2αcos(δ+α+λ)=	0.345	
((1/(1+sqrt((sin(ϕ+δ)sin(ϕ-i-λ)/cos(α-i)cos(δ+α+λ)))^2	0.388	
Ca=	0.1851	
Ca=	0.1340	

take maximum

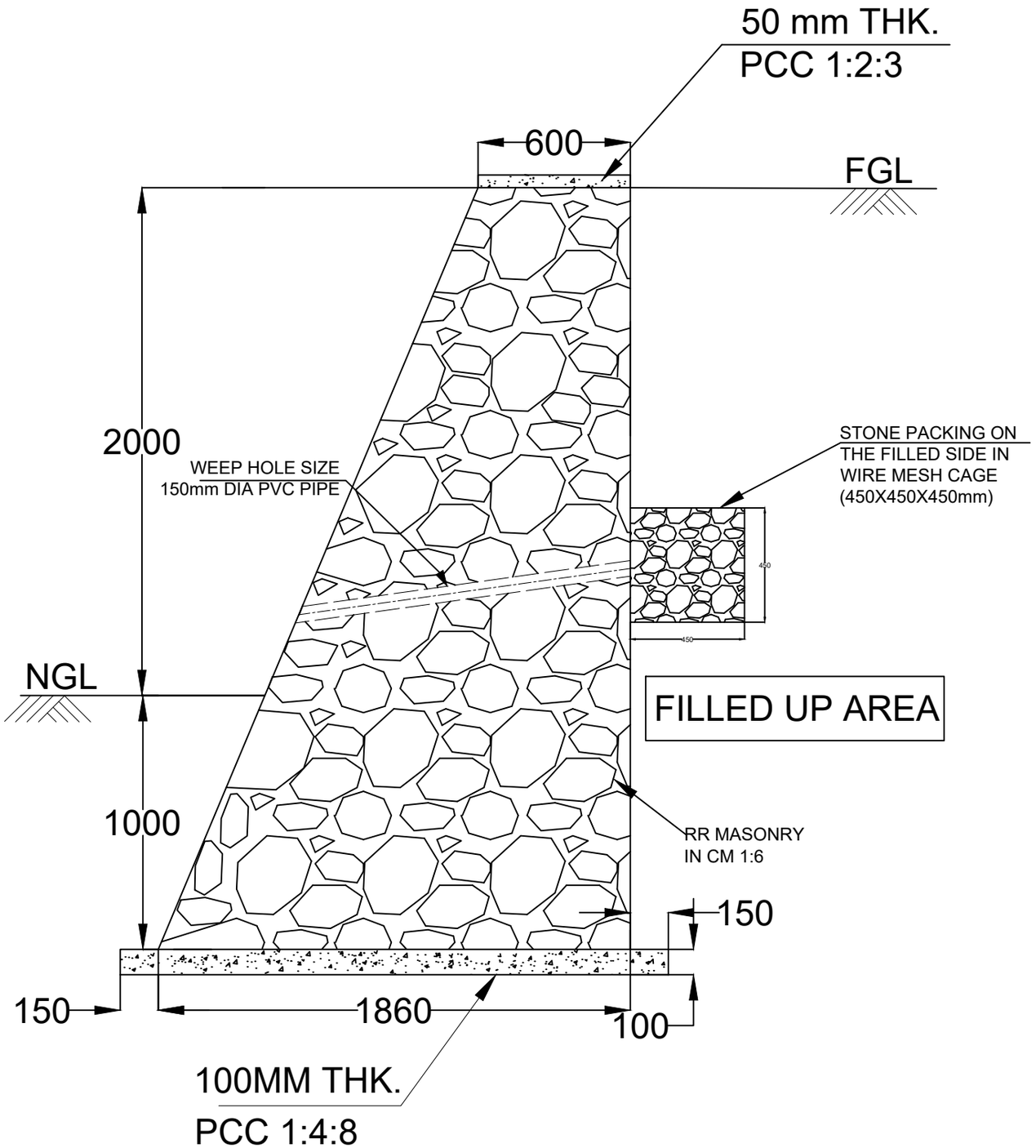
Ca= 0.1851

cos^2(ϕ+α-λ)=	0.3207	
cosλcos^2αcos(δ-α+λ)=	0.7854	
sin(ϕ+δ)sin(ϕ+i-λ)=	-0.3038	
cos(α-i)cos(δ-α+λ)=	-0.8302	
(1+Av)*cos^2(ϕ-λ-α)/cosλcos^2αcos(δ+α+λ)=	0.474	
(1-Av)*cos^2(ϕ-λ-α)/cosλcos^2αcos(δ+α+λ)=	0.343	
((1/(1-sqrt((sin(ϕ+δ)sin(ϕ-i-λ)/cos(α-i)cos(δ+α+λ)))^2	6.406	
Cp=	3.0339	
Cp=	2.1969	

take minimum

Cp= 2.196934

Total active earth pressure(static + dynamic)	16.007
Dynamic increment active earth pressure	-10.562
Total passive earth pressure(static + dynamic)	190.013
Dynamic increment passive earth pressure	190.013



DETAIL OF RETAINING WALL FOR 2M HIGH FROM ABOVE FGL

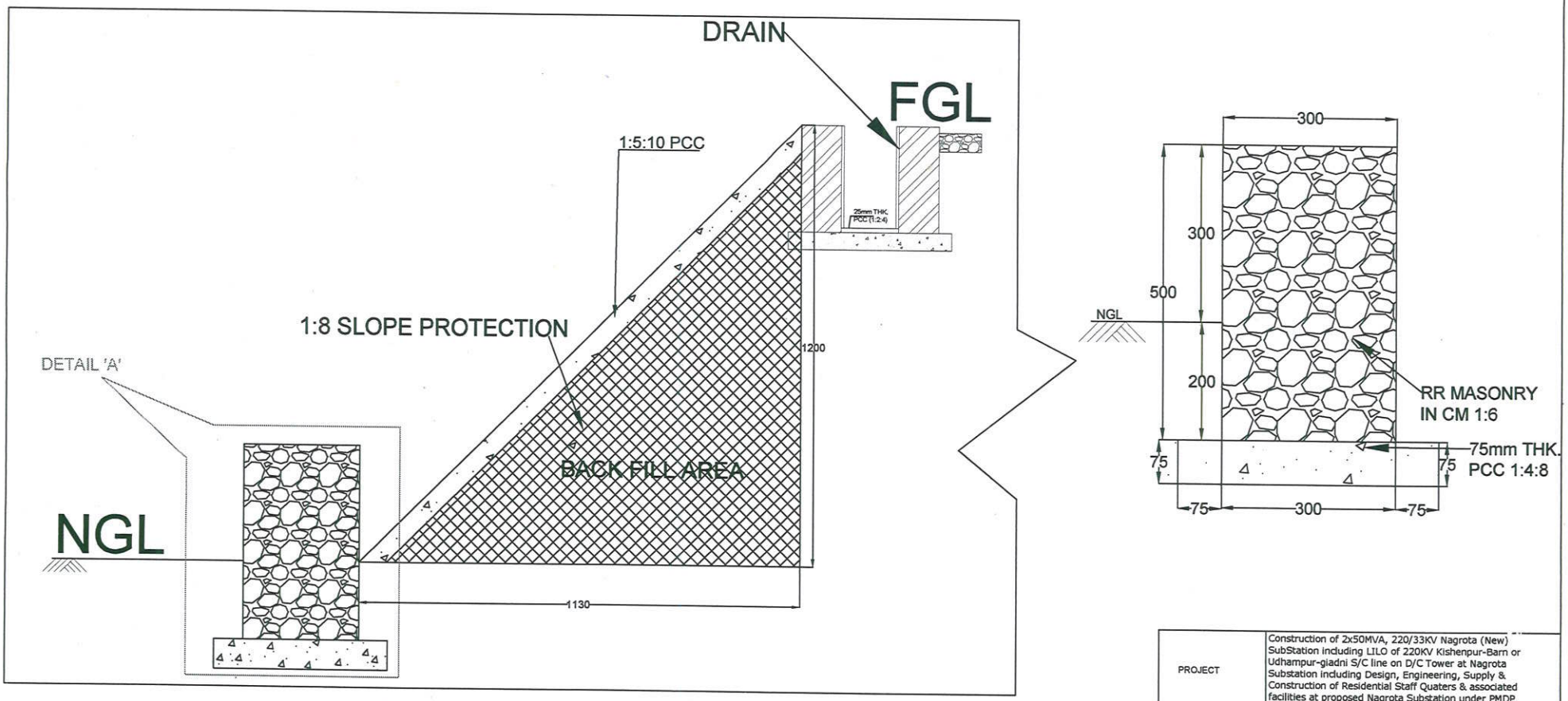
NOTES:

1. THIS DRAWING CONFORMS THE REQUIREMENT OF IS:14458(PART–1).
2. ALL DIMENSIONS ARE IN "MM".
3. USING R–R MASONARY WITH PROPORTION 1:6.
4. USING "ONE LAYER GEO–TEXTILE MEMBRANE" AT BACKFILL SIDE OF WALL FOR WATER SEEPAGE AT MOUTH OF WEEP HOLES. WEEP HOLES SHALL BE PROVIDED @ 1.5m C/C IN STAGGERED PATTERN.
5. 150mm DIA PVC PIPE OF 4KG PRESSURE TO BE PROVIDED IN THE WEEP HOLE.
6. EXPANSION JOINT IN EVERY 15M & IN CORNER SHALL BE OF 50MM.
7. LENGTH OF WALL AS PER SITE CONDITION.
8. NET BEARING CAPACITY IS CONSIDERED AS 87.40 KN/m2 @ 1.5M DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	2M RRM RETAINING WALL DETAILS, NAGROTA			
DRG. NO.	KDBIL/250 PJ/20-21/D1/135	SHEET NO.	1 OF 1	
SCALE	As shown in Drawing	REV- 0	SIZE - A3	
AREA	91.6 KANAL 46336.5 SQM			
	NAME	DATE	SIGN	KDBIL
PREPARED BY	AZEEM	10.08.2022		
CHECKED BY	G.H	10.08.2022		
SUBMITTED BY	Mr.ANURAG	10.08.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



SLOPE EDGE PROTECTION TOE WALL

CN-20704

Categories
श्रेणिया

I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
स्वीकृत/जारी/निर्माण/विनिर्माण/हेतु अनुमोदित/जारी।

II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
स्वीकृत/जारी/निर्माण/विनिर्माण हेतु अनुमोदित/जारी। बशर्ते दी गई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।

III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।

IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।

V. Not approved.
अनुमोदित नहीं।

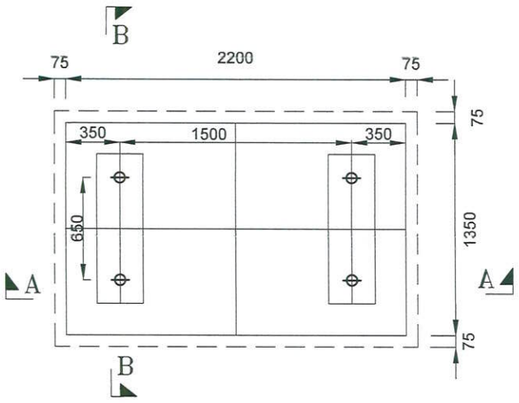
(Signature) (हस्ताक्षर) Manager
(Designation) (पदनाम)
03/10/22 (Date) (तिथि)

03/10/22

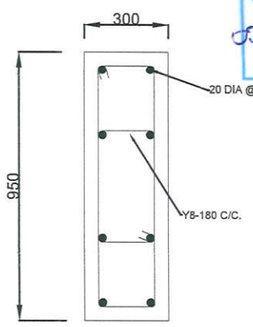
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(i) CSP/IA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/705 Dt. 06.11.2020 (ii) CSP/IA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC POWER DEVELOPMENT AND CONSULTANCY LIMITED (RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	SLOPE EDGE PROTECTION TOE WALL			
DRG. NO.	KDBIL/250 PJ/20-21/D1/136		SHEET NO. 1 OF 1	
SCALE	As shown in Drawing		REV- 0	SIZE - A3
AREA	91.6 KANAL 46336.5 SQM			
	NAME	DATE	SIGN	
PREPARED BY	AZEEM	13.08.2022		KDBIL
CHECKED BY	G.H	13.08.2022		
SUBMITTED BY	Mr.ANURAG	13.08.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

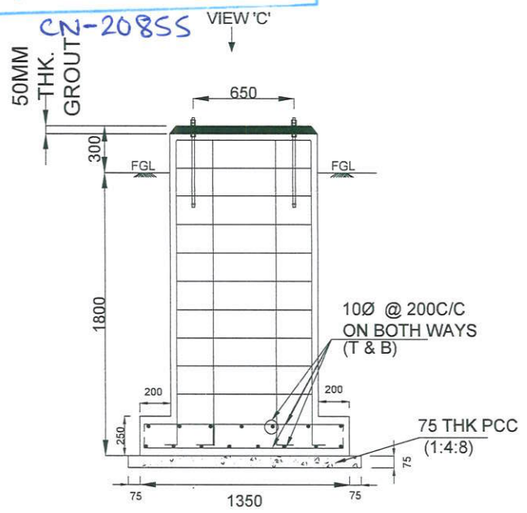
☐ More Information Date.....



FOUNDATION PLAN

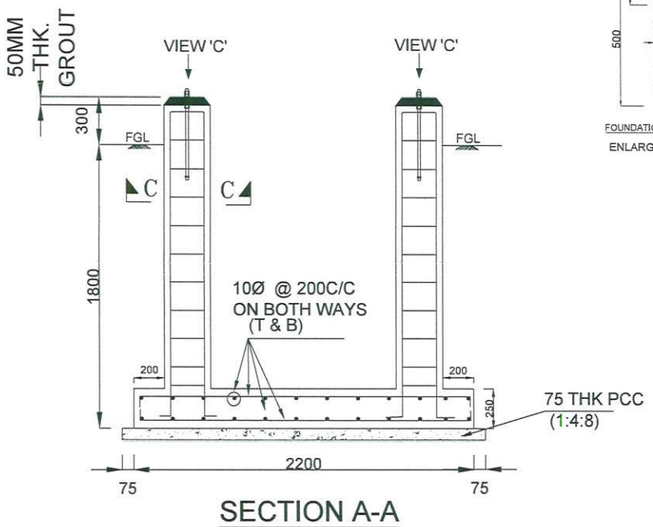


SECTION C-C
ENLARGED



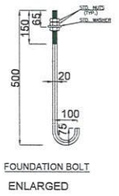
SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)

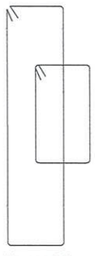


SECTION A-A

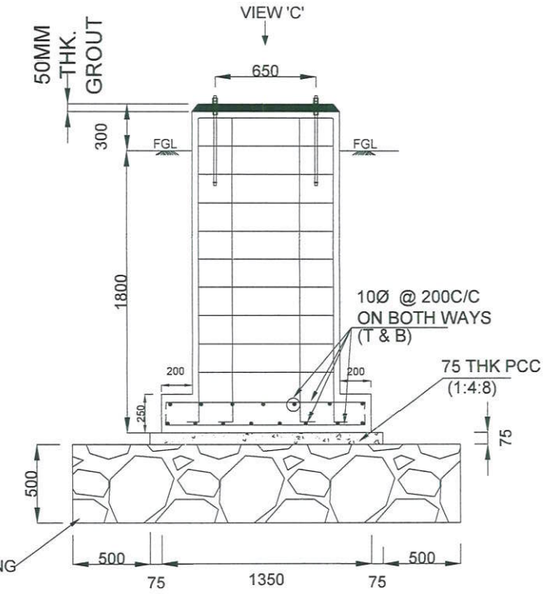
(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



FOUNDATION BOLT
ENLARGED

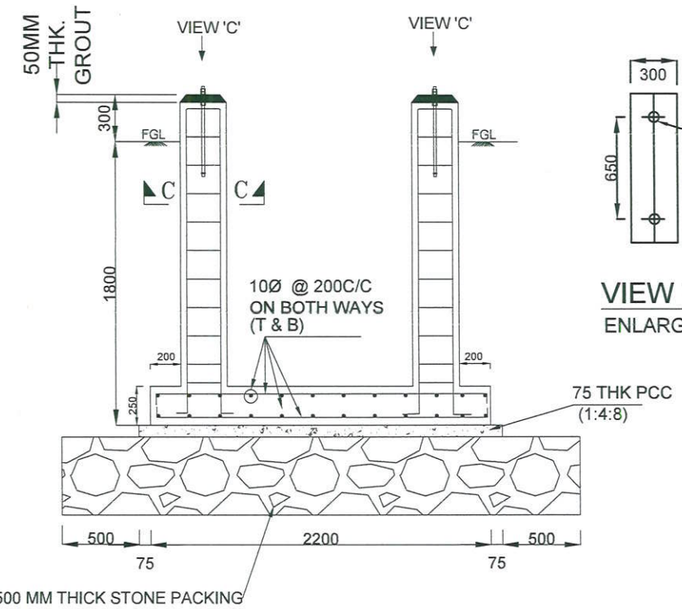


RING ARRANGEMENT
ENLARGED



SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)

VIEW 'C'
ENLARGED

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M20 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5 T/SQM AT 1.8MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	33KV VCB FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/137			REV- 0
SCALE	As shown in Drawing			SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM			SH.NO.: 1 OF 1
	NAME	DATE	SIGN	
PREPARED BY	SHIVAM	27.09.2022		
CHECKED BY	G.H	27.09.2022		
SUBMITTED BY	ANURAG	27.09.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

Kailash Devbuild (India) Pvt. Ltd. Jabalpur

(Signature) (हस्ताक्षर) Manager (Designation) (पदनाम) 03/10/22 (Date) (तिथि)

Categories श्रेणियां

I. Approved/ Issued for Fabrication/Construction/Manufacturing. स्वीकृति/जारी/निर्माण/विनिर्माण हेतु

II. Approved/ Issued for Fabrication/Construction/Manufacturing subject to condition that attached comments are included. संलग्न टिप्पणियों को शामिल करने की शर्त पर निर्माण/विनिर्माण हेतु स्वीकृत/जारी

III. Please submit the revised documents for approval. संशोधित दस्तावेज/ड्रॉइंग/डिजाइन हेतु अनुमोदन करें। कृपया संशोधित दस्तावेजों को अनुमोदित किया जाए।

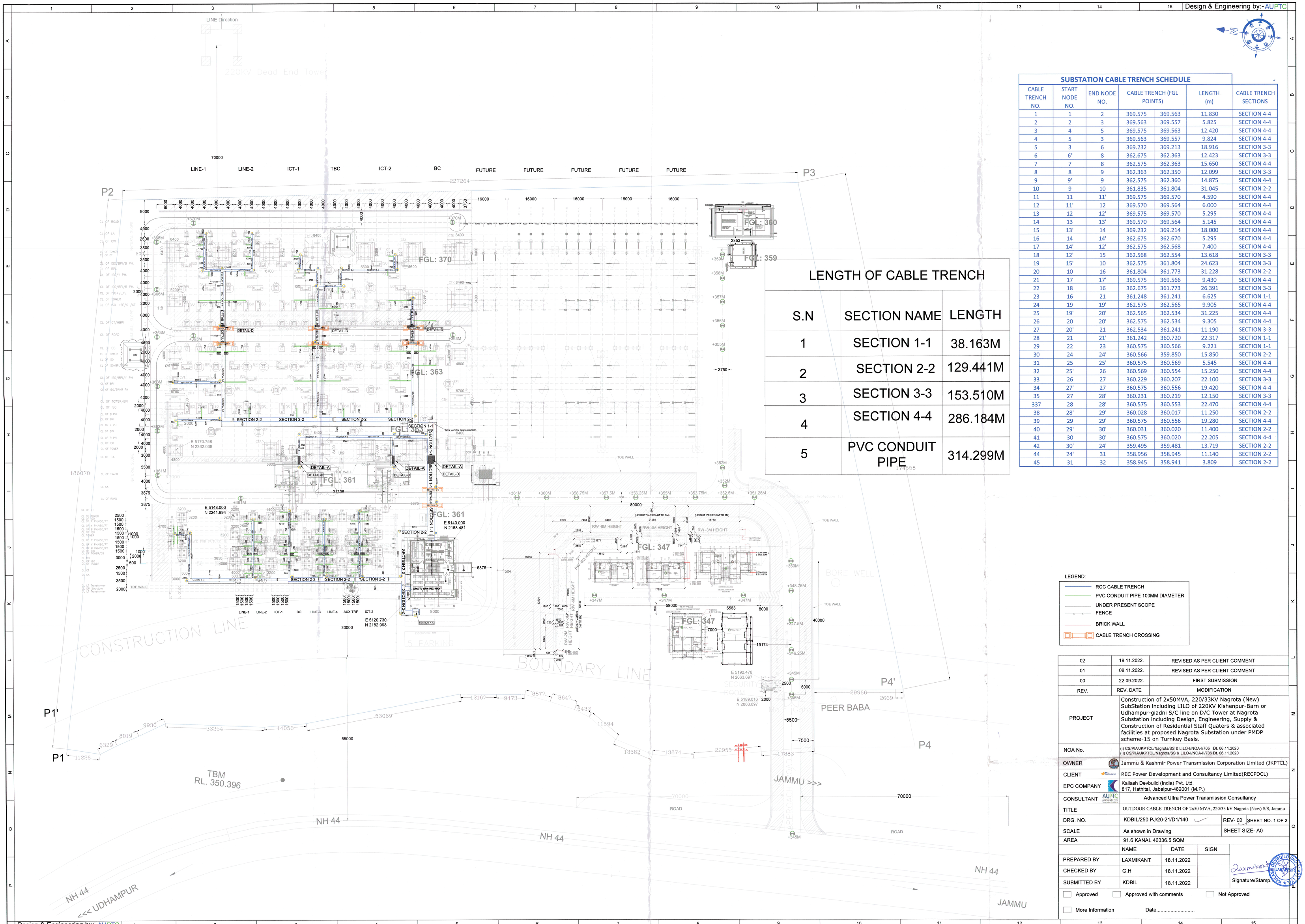
IV. For Information and record. सूचना एवं रिकॉर्ड हेतु।

V. Not approved. अनुमोदित नहीं।

CN-20855

03/10/22

Design & Engineering by:- AUPTC



SUBSTATION CABLE TRENCH SCHEDULE

CABLE TRENCH NO.	START NODE NO.	END NODE NO.	CABLE TRENCH (FGL POINTS)		LENGTH (m)	CABLE TRENCH SECTIONS
1	1	2	369.575	369.563	11.830	SECTION 4-4
2	2	3	369.563	369.557	5.825	SECTION 4-4
3	4	5	369.575	369.563	12.420	SECTION 4-4
4	5	3	369.563	369.557	9.824	SECTION 4-4
5	3	6	369.232	369.213	18.916	SECTION 3-3
6	6'	8	362.675	362.363	12.423	SECTION 3-3
7	7	8	362.575	362.363	15.650	SECTION 4-4
8	8	9	362.363	362.350	12.099	SECTION 3-3
9	9'	9	362.575	362.360	14.875	SECTION 4-4
10	9	10	361.835	361.804	31.045	SECTION 2-2
11	11	11'	369.575	369.570	4.590	SECTION 4-4
12	11'	12	369.570	369.564	6.000	SECTION 4-4
13	12	12'	369.575	369.570	5.295	SECTION 4-4
14	13	13'	369.570	369.564	5.145	SECTION 4-4
15	13'	14	369.232	369.214	18.000	SECTION 4-4
16	14	14'	362.675	362.670	5.295	SECTION 4-4
17	14'	12'	362.575	362.568	7.400	SECTION 4-4
18	12'	15	362.568	362.554	13.618	SECTION 3-3
19	15'	10	362.575	361.804	24.623	SECTION 3-3
20	10	16	361.804	361.773	31.228	SECTION 2-2
21	17	17'	369.575	369.566	9.430	SECTION 4-4
22	18	16	362.675	361.773	26.391	SECTION 3-3
23	16	21	361.248	361.241	6.625	SECTION 1-1
24	19	19'	362.575	362.565	9.905	SECTION 4-4
25	19'	20'	362.565	362.534	31.225	SECTION 4-4
26	20	20'	362.575	362.534	9.305	SECTION 4-4
27	20'	21	362.534	361.241	11.190	SECTION 3-3
28	21	21'	361.242	360.720	22.317	SECTION 1-1
29	22	23	360.575	360.566	9.221	SECTION 1-1
30	24	24'	360.566	359.850	15.850	SECTION 2-2
31	25	25'	360.575	360.569	5.545	SECTION 4-4
32	25'	26	360.569	360.554	15.250	SECTION 4-4
33	26	27	360.229	360.207	22.100	SECTION 3-3
34	27'	27	360.575	360.556	19.420	SECTION 4-4
35	27	28'	360.231	360.219	12.150	SECTION 3-3
337	28	28'	360.575	360.553	22.470	SECTION 4-4
38	28'	29'	360.028	360.017	11.250	SECTION 2-2
39	29	29'	360.575	360.556	19.280	SECTION 4-4
40	29'	30'	360.031	360.020	11.400	SECTION 2-2
41	30	30'	360.575	360.020	22.205	SECTION 4-4
42	30'	24'	359.495	359.481	13.719	SECTION 2-2
44	24'	31	358.956	358.945	11.140	SECTION 2-2
45	31	32	358.945	358.941	3.809	SECTION 2-2

LENGTH OF CABLE TRENCH

S.N	SECTION NAME	LENGTH
1	SECTION 1-1	38.163M
2	SECTION 2-2	129.441M
3	SECTION 3-3	153.510M
4	SECTION 4-4	286.184M
5	PVC CONDUIT PIPE	314.299M

LEGEND:

- RCC CABLE TRENCH
- PVC CONDUIT PIPE 100MM DIAMETER
- UNDER PRESENT SCOPE
- FENCE
- BRICK WALL
- CABLE TRENCH CROSSING

REV.	REV. DATE	MODIFICATION
02	18.11.2022.	REVISED AS PER CLIENT COMMENT
01	08.11.2022.	REVISED AS PER CLIENT COMMENT
00	22.09.2022.	FIRST SUBMISSION

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	OUTDOOR CABLE TRENCH OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/140 — REV- 02 — SHEET NO. 1 OF 2
SCALE	As shown in Drawing — SHEET SIZE- A0
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	LAXMIKANT	18.11.2022	
CHECKED BY	G.H	18.11.2022	
SUBMITTED BY	KDBIL	18.11.2022	

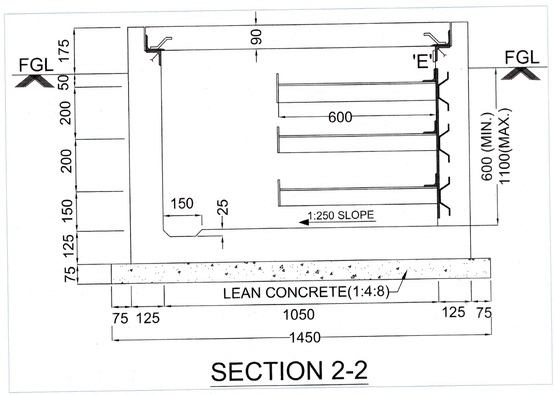
Signature/Stamp.

☐ Approved ☐ Approved with comments ☐ Not Approved

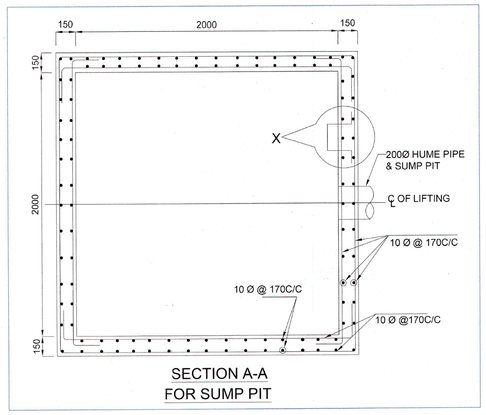
☐ More Information Date.....

CN-22419
24/11/22

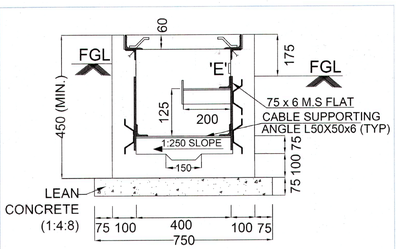
Design & Engineering by:- AUPTC



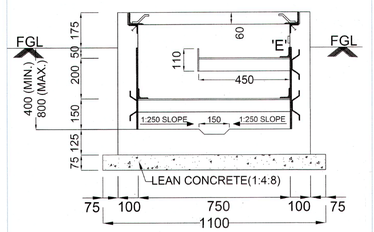
SECTION 2-2



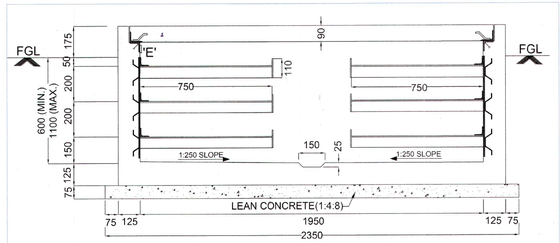
SECTION A-A
FOR SUMP PIT



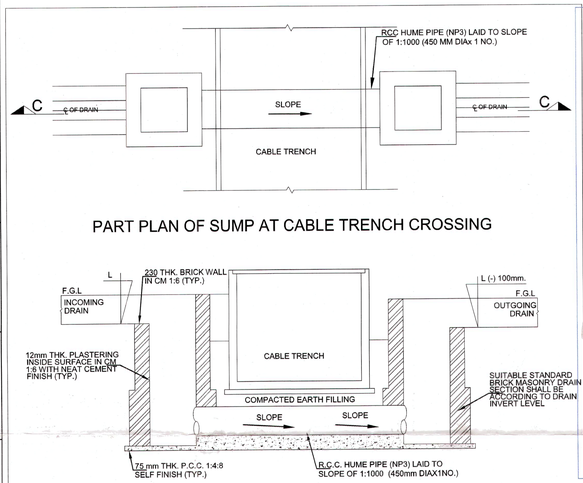
SECTION 4-4



SECTION 3-3

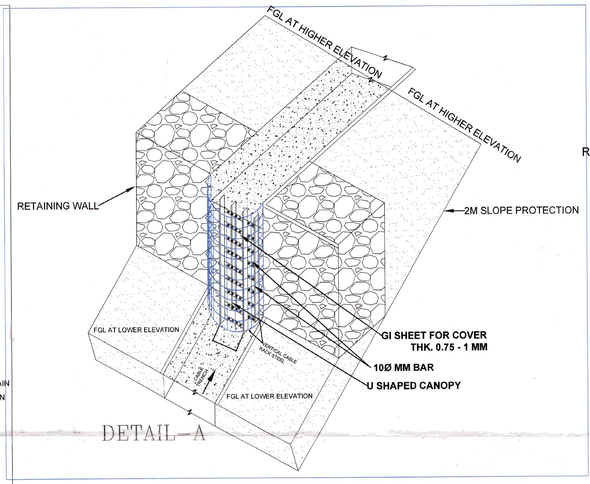


SECTION 1-1

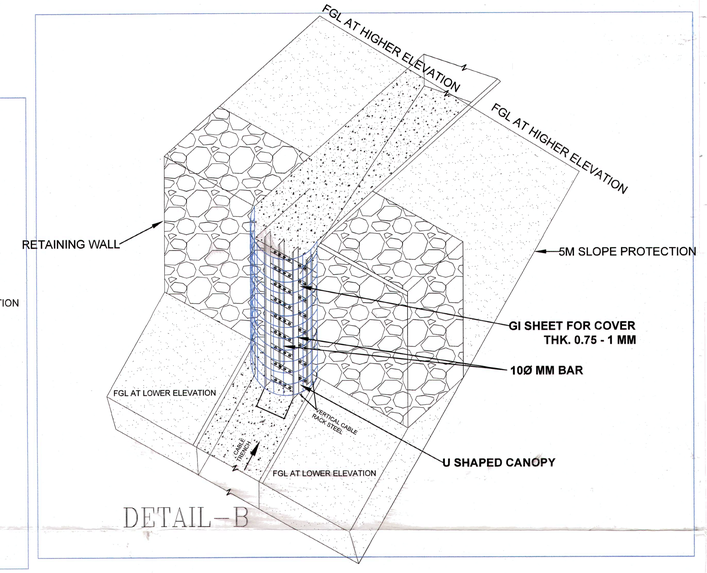


PART PLAN OF SUMP AT CABLE TRENCH CROSSING

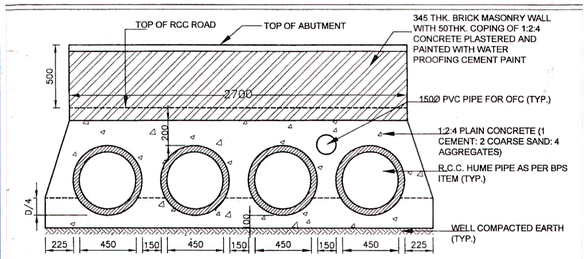
SECTION C-C



DETAIL-A

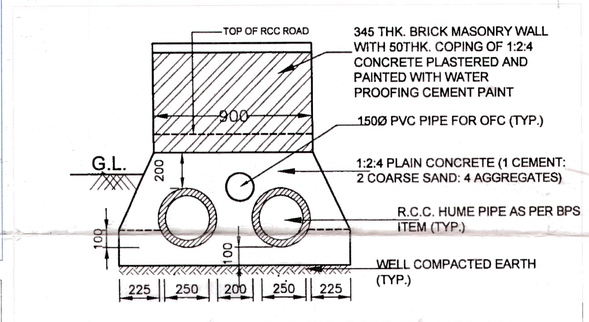


DETAIL-B



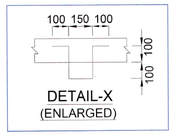
ROAD CROSSING SECTION FOR CABLE TRENCH FOR "SEC-1-1 & 2A-2A"

DETAIL-F

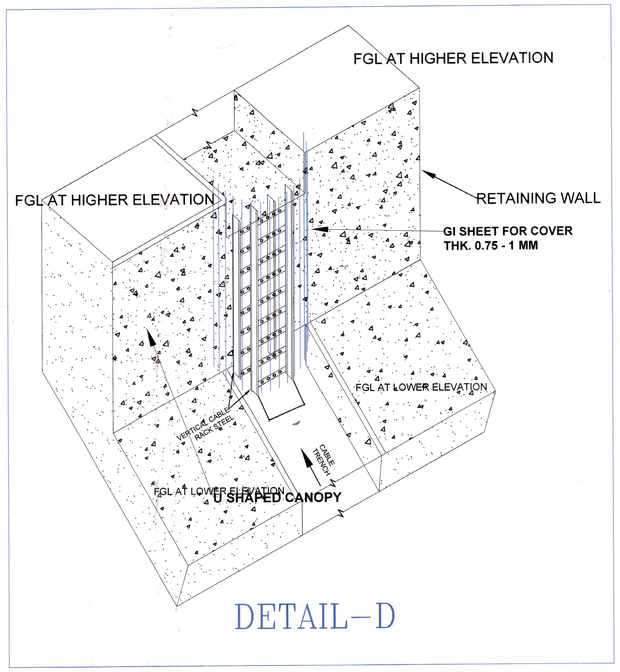


ROAD CROSSING SECTION FOR CABLE TRENCH "SEC.-3-3"

DETAIL-E



DETAIL-X
(ENLARGED)



DETAIL-D

NOTE:-

1. ALL THE DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED.
2. 50mm*6mm MS Flat shall run on the top tier and all along the cable trenches.It will be welded to each of the racks. The Flat shall be earthed at both ends and at an interval of 30meters. The MS Flat shall be finally painted with two coats of Red oxide primer and two coats of Zinc riched enamel paint.
3. PVC pipe shall be provided to take cable out from trench to respective equipment,which shall be buried in ground at a depth of 250mm below finish formation level.
4. After laying the cable,the ends of conduit shall be suitably sealed at site to prevent the passage of water inside the conduits.
5. Separate PVC pipe shall be provided for power and control cables.
6. Necessary opening in cable trench shall be provided for PVC conduits at appropriate locations.
7. Conduits shall be kept at least 300mm away from hot pipes, heating devices,etc.
8. PVC pipe used shall be class-4 as per IS 4985.
9. Power and control cables in the cable trench shall be laid in separate tiers.Power cables to be laid in top tiers. Control instrumentation & other service cables in bottom tiers.
10. The size of the conduit/pipe shall be selected on the basis of 40% fill (i.e 60% void) criteria.
11. Minor changes if required in cable trench route can be carried as directed by site I/C of REC.
12. Construction details of Cable Trench shall be as per Civil Drawing.
13. For Road crossing & Cable Trench crossing as marked up,respective drawing shall be referred.
14. They shall be located on both side of road and drain crossings as per standard.
15. 230mm thick brick wall shall be provided where main trench is to be extended in the future.
16. The tentative location of PVC pipes is shown and shall be laid as per the exact location of operating box of equipments.

CN-22419
24/11/22

02	18.11.2022.	REVISED AS PER CLIENT COMMENT
01	08.11.2022.	REVISED AS PER CLIENT COMMENT
00	22.09.2022.	FIRST SUBMISSION
REV.	REV. DATE	MODIFICATION

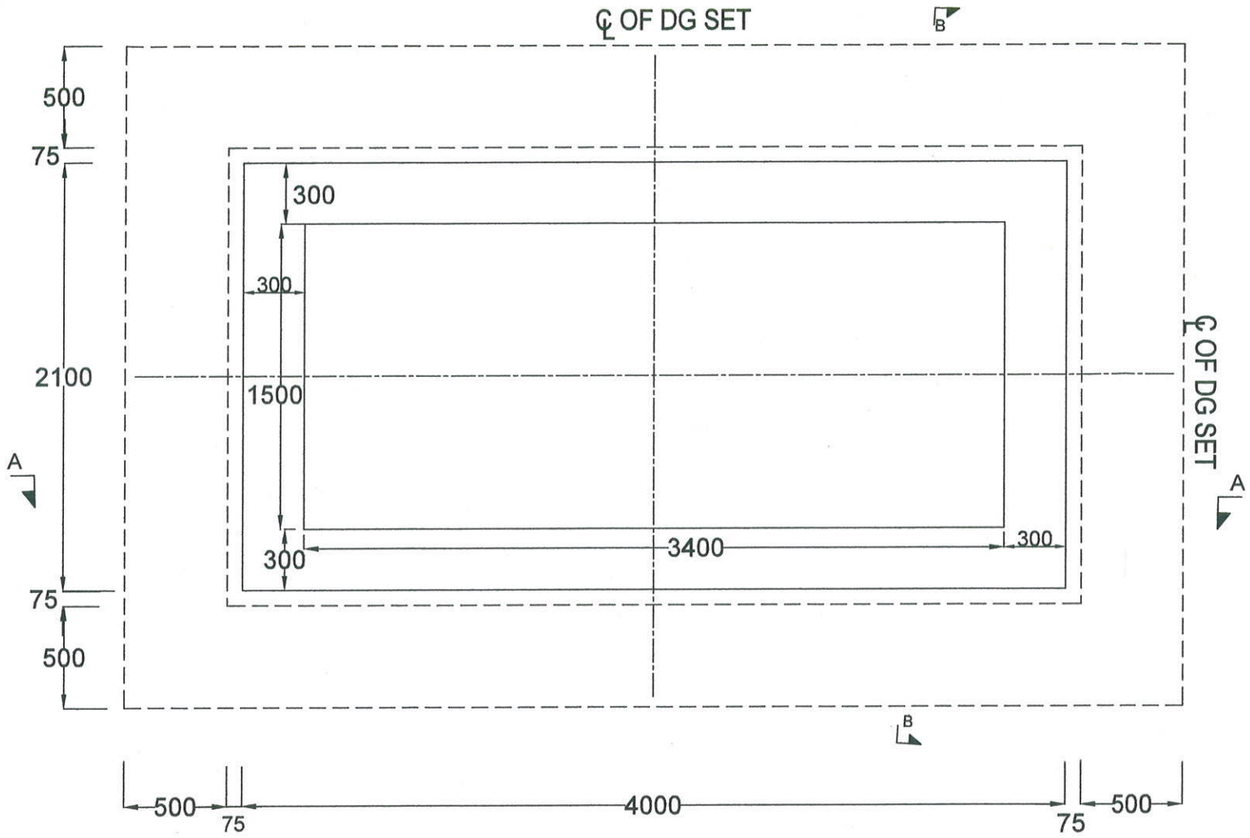
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited(RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	OUTDOOR CABLE TRENCH OF 2x50 MVA, 220/33 kV Nagrota (New) S/S, Jammu
DRG. NO.	KDBIL/250 PJ/20-21/D1/140 — REV- 02 — SHEET NO. 2 OF 2
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	91.6 KANAL 46336.5 SQM

	NAME	DATE	SIGN
PREPARED BY	LAXMIKANT	18.11.2022	
CHECKED BY	G.H	18.11.2022	
SUBMITTED BY	KDBIL	18.11.2022	

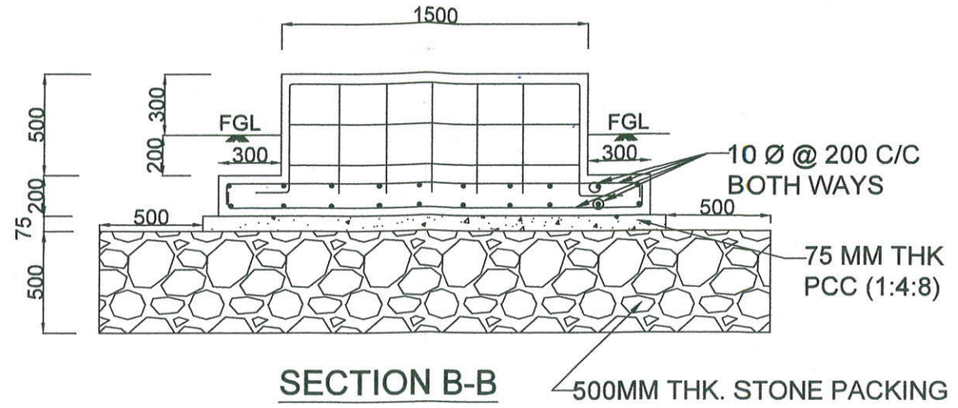
Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

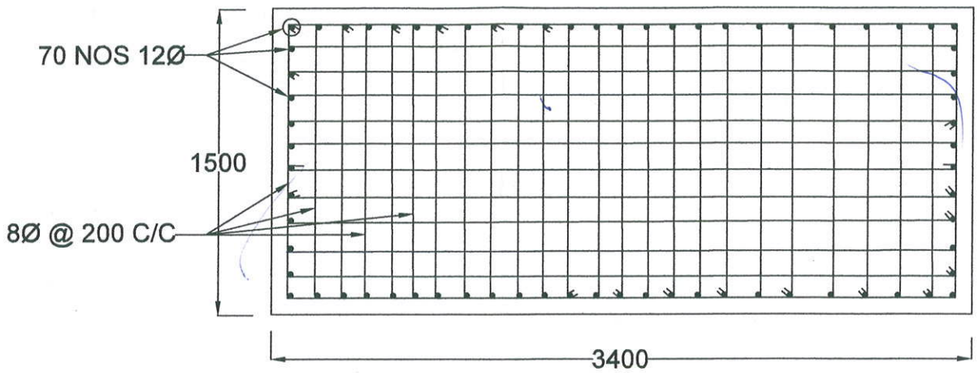
☐ More Information Date.....



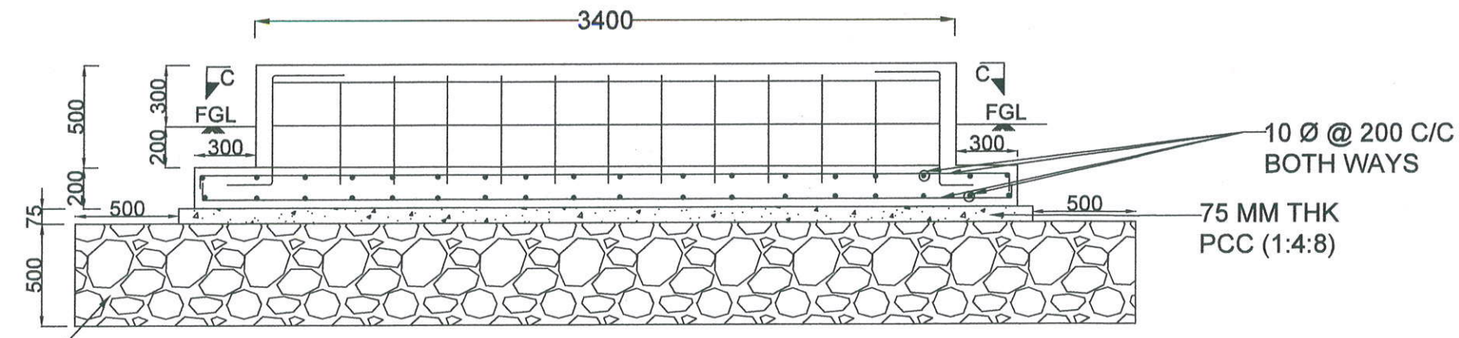
FOUNDATION PLAN



SECTION B-B



SECTION C-C



SECTION A-A

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फैब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी बशर्ते कि यह टिप्पणियों को शामिल किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature) (हस्ताक्षर)
Manager
(Designation) (पदनाम)
(Date) (तिथि)

CN-20877
7/10/22

NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. CONC.FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS: 1786 AS PER BPS.
5. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS .
   A) 50 MM FOR BOTTOM , TOP AND SIDE REINFORCEMENT OF FOOTING.
   B) 40 MM FOR COLUMN.
6. LAP & ANCHORAGE LENGTH OF REINF. BARS SHALL BE 50 TIMES THE DIAMETER OF BAR.
7. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
8. REINFORCEMENT OF COLUMNS,PEDESTAL, WALL ETC SHALL BE PROVIDED 100% ANCHORAGE IN FDN. RAFTS AND SLABS.
9. NET SBC CONSIDERED 5 T/SQM.
10. MOUNTING ARRANGEMENT OF DG SET SHALL BE AS PER THE MANUFACTURE.

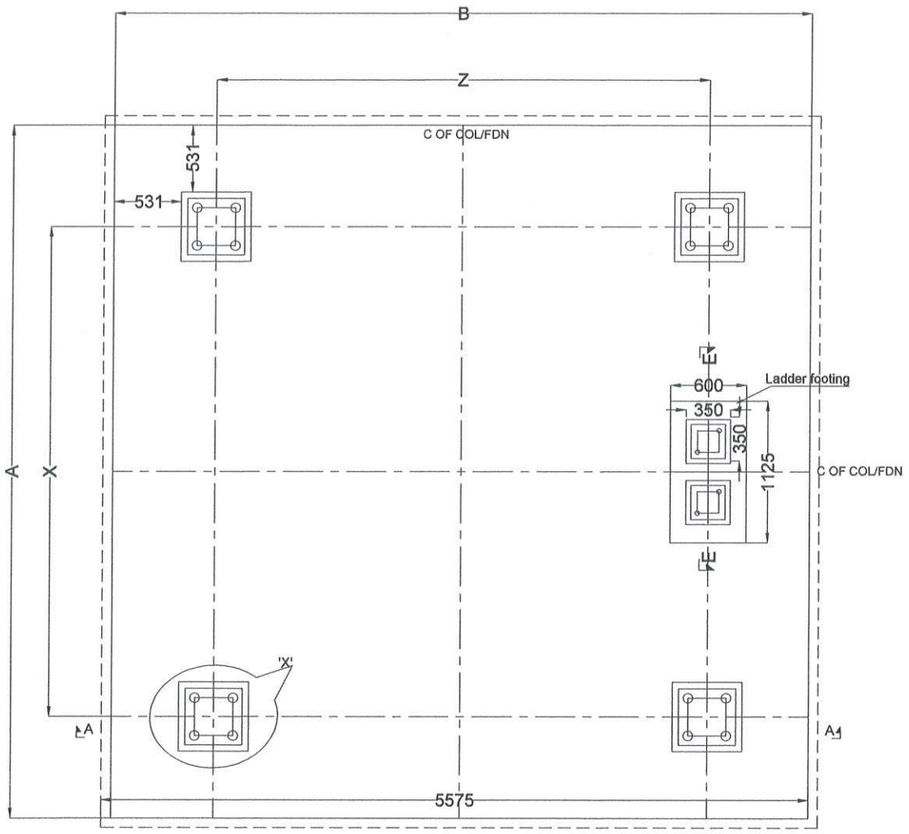
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 08.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	DG SET FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/141		REV- 0	
SCALE	As shown in Drawing		SHEET SIZE- A2	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1	
	NAME	DATE	SIGN	
PREPARED BY	AZEEM	30.09.2022	Azeem	
CHECKED BY	G.H	30.09.2022		
SUBMITTED BY	ANURAG	30.09.2022		

KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR
Signature/Stamp...

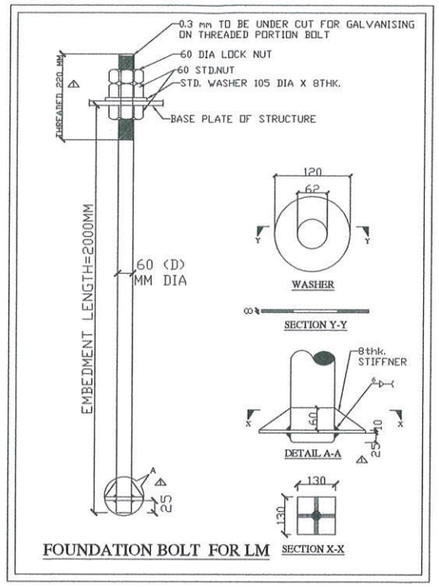
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

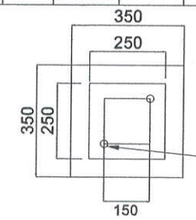
S.NO.	TOWER	H	A	B	X	Z	dxd	D	(1)	(2)	(3)	(4)
1	LM	2500	5500	5500	3888	3888	550x550	400	16Ø @ 180C/C	16Ø @ 180C/C	4-32Ø	12-25Ø
										(5)	(6)	(7)
										4-12Ø	10Ø @ 180C/C	10Ø @ 180C/C



FOUNDATION PLAN

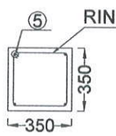


FOUNDATION BOLT FOR LM



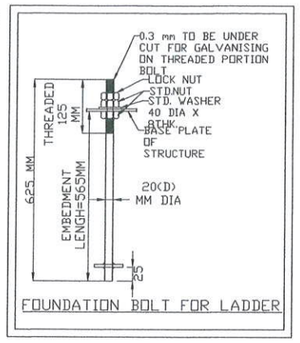
2-20MM Ø FDN BOLTS FOR LADDER

VIEW C

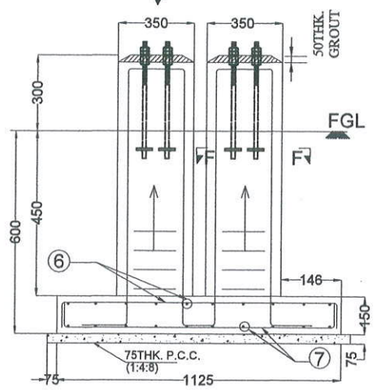


RINGS 8Ø @ 180 C/C

SECTION F-F

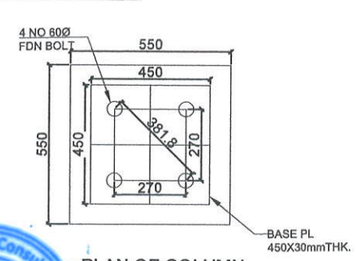


FOUNDATION BOLT FOR LADDER

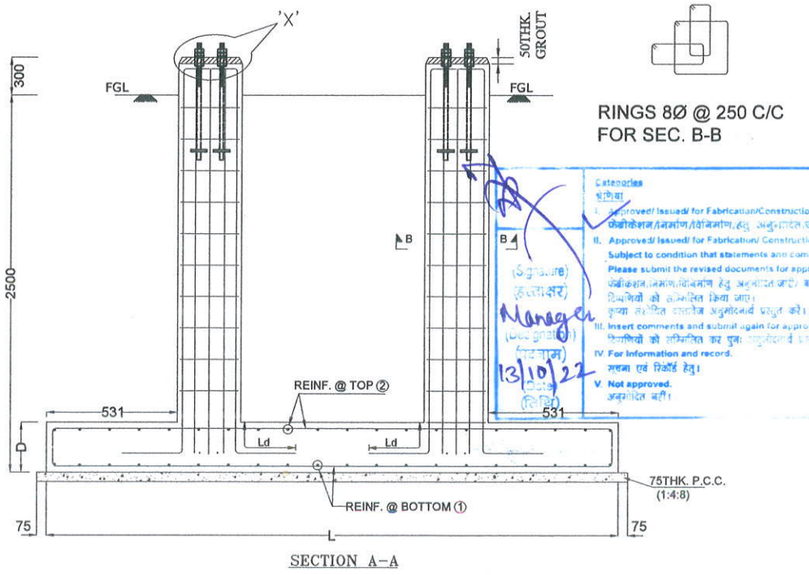


SECTION E-E (ELEV.)

RING ARRANGEMENT FOR SEC F-F

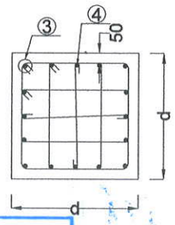


PLAN OF COLUMN DETAIL X



SECTION A-A

RINGS 8Ø @ 250 C/C FOR SEC. B-B



SECTION B-B

Categories
श्रेणियां
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing.
स्वीकृत/जारी/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval
स्वीकृत/जारी/निर्माण/विनिर्माण हेतु अनुमोदित/जारी/ बशर्ते टिप्पणियों को शामिल किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature)
(हस्ताक्षर)
Manager
(Designation)
(पदनाम)
13/10/22
(Date)
(दिनांक)

CN-21039
13/10/22

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE GRADE SHALL BE M25 (1:1:2) AS PER TS.
3. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 500 CONFIRM TO IS:1786-1985.
4. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR BOTTOM, TOP & SIDE OF RAFT AND 50mm COVER FOR COLUMN.
5. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
6. NET BEARING CAPACITY IS CONSIDERED 16.17T/sqm AS PER SOIL INVESTIGATION REPORT.
7. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
8. ALL HOOKS, BENDS AND SPLICES SHALL BE AS PER IS:456 AND IS:2502.
9. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.

REV.	REV. DATE	MODIFICATION
01	07.10.2022.	REVISED AS PER CLIENT COMMENT
00	30.09.2022.	FIRST SUBMISSION

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FDN DRG OF 50-M LIGHTENING MAST MKD. 'LM', FOR 220kV Nagrota (New) S/S, Jammu FOR (LM-1 & LM-3)
DRG. NO.	KDBIL/250 PJ/20-21/D1/142(B) A
SCALE	As shown in Drawing — SHEET NO.- 1 OF 1
AREA	91.6 KANAL 46336.5 SQM — SHEET SIZE - A3

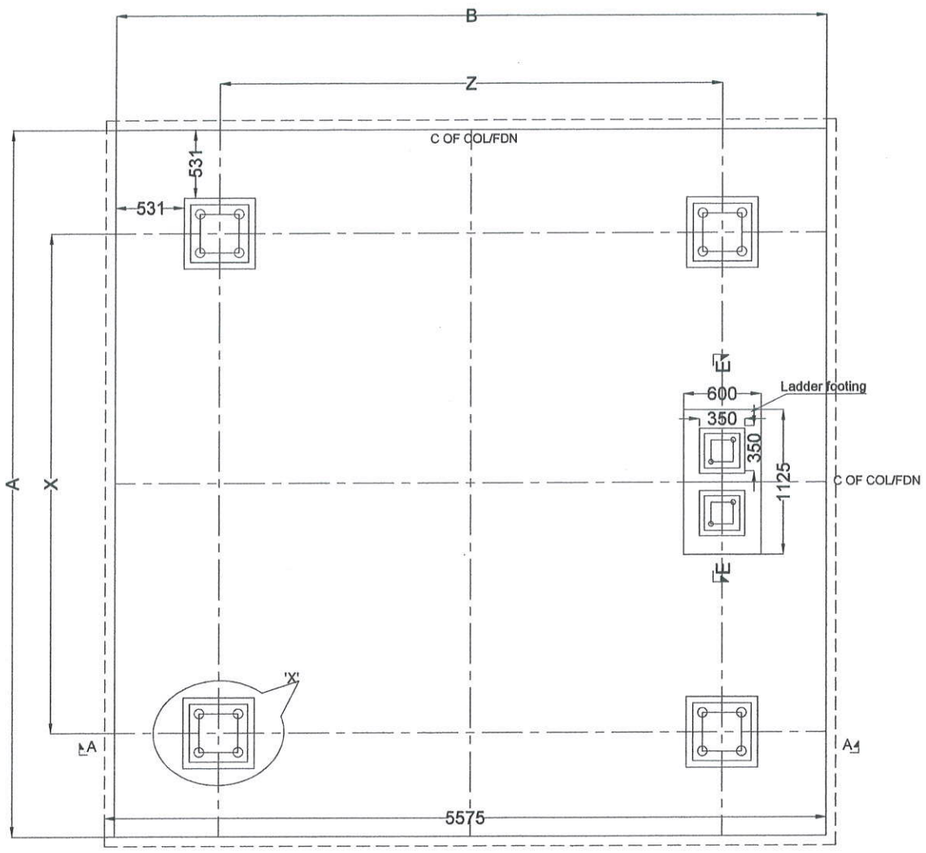
	NAME	DATE	SIGN
PREPARED BY	PURNIMA	07.10.2022	Purnima
CHECKED BY	G.H	07.10.2022	
SUBMITTED BY	Er. ANURAG	07.10.2022	

KDBIL JABALPUR Signature/Stamp

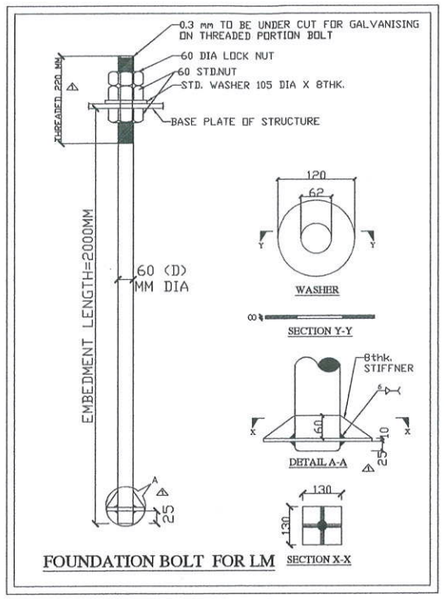
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

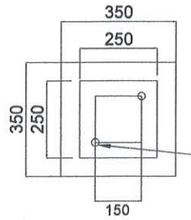
S.NO.	TOWER	H	A	B	X	Z	dxd	D	(1)	(2)	(3)	(4)
1	LM	2500	5500	5500	3888	3888	550x550	400	16Ø @ 180C/C	16Ø @ 180C/C	4-32Ø	12-25Ø
										(5)	(6)	(7)
										4-12Ø	10Ø @ 180C/C	10Ø @ 180C/C



FOUNDATION PLAN

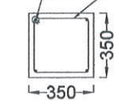


FOUNDATION BOLT FOR LM



2-20MM Ø FDN BOLTS FOR LADDER

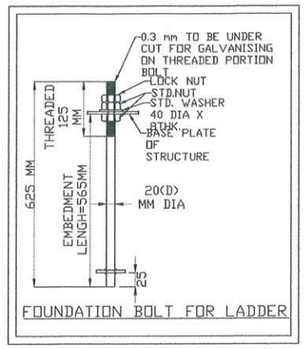
VIEW C



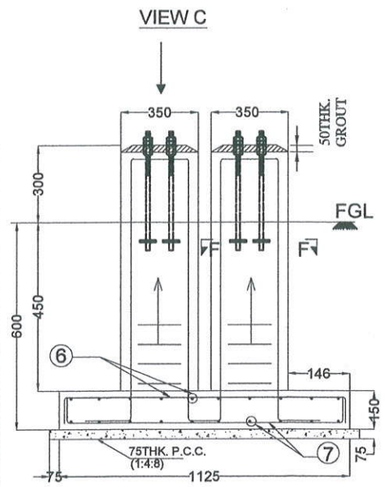
RINGS 8Ø @ 180 C/C

SECTION F-F

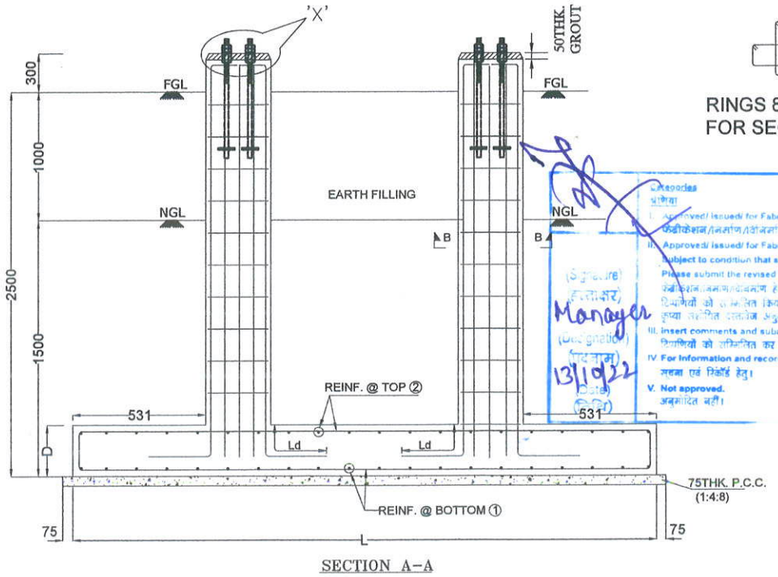
RING ARRANGEMENT FOR SEC F-F



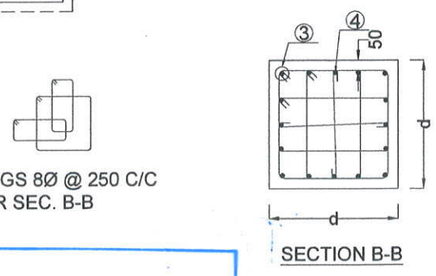
FOUNDATION BOLT FOR LADDER



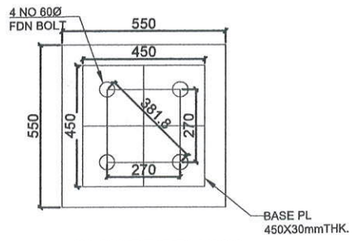
SECTION E-E (ELEV.)



SECTION A-A



SECTION B-B



PLAN OF COLUMN

DETAIL X

RINGS 8Ø @ 250 C/C FOR SEC. B-B

Approved/ Issued/ for Fabrication/Construction/Manufacturing.
अनुमोदित/जारी/निर्माण/कार्यान्वयन हेतु अनुमोदित/जारी।
Approved/ Issued/ for Fabrication/ Construction/Manufacturing subject to condition that statements and comments are incorporated.
Please submit the revised documents for approval.
अनुमोदित/जारी/निर्माण/कार्यान्वयन हेतु अनुमोदित/जारी। परन्तु टिप्पणियों को शामिल किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
Insert comments and submit again for approval.
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
For Information and record.
सूचना एवं रिकॉर्ड हेतु।
Not approved.
अनुमोदित नहीं।
(Signature)
(हस्ताक्षर)
Manager
(Designation)
(पदनाम)
13/10/22
(Date)
(दिनांक)

CN-21039
13/10/22

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. ALL STRUCTURAL CONCRETE GRADE SHALL BE M25 (1:1:2) AS PER TS.
3. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 500 CONFIRM TO IS:1786-1985.
4. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR BOTTOM, TOP & SIDE OF RAFT AND 50mm COVER FOR COLUMN.
5. FOUNDATION BOLTS SHALL BE PLACED IN POSITION BEFORE CONCRETE IS CAST.
6. NET BEARING CAPACITY IS CONSIDERED 13.05 T/sqm AS PER SOIL INVESTIGATION REPORT.
7. NOT MORE THAN 50% OF BARS SHALL BE LAPPED AT ONE SECTION.
8. ALL HOOKS, BENDS AND SPLICES SHALL BE AS PER IS:456 AND IS:2502.
9. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.

01	07.10.2022	REVISED AS PER CLIENT COMMENT
00	01.10.2022	FIRST SUBMISSION
REV.	REV. DATE	MODIFICATION

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	Advanced Ultra Power Transmission Consultancy
TITLE	FDN DRG OF 50-M LIGHTENING MAST MKD. 'LM', FOR 220kV Nagrota (New) S/S, Jammu FOR (LM-2 IN 1.0m FILLING)
DRG. NO.	KDBIL/250 PJ/20-21/D1/142(B)
SCALE	As shown in Drawing — SHEET NO.- 1 OF 1
AREA	91.6 KANAL 46336.5 SQM — SHEET SIZE - A3

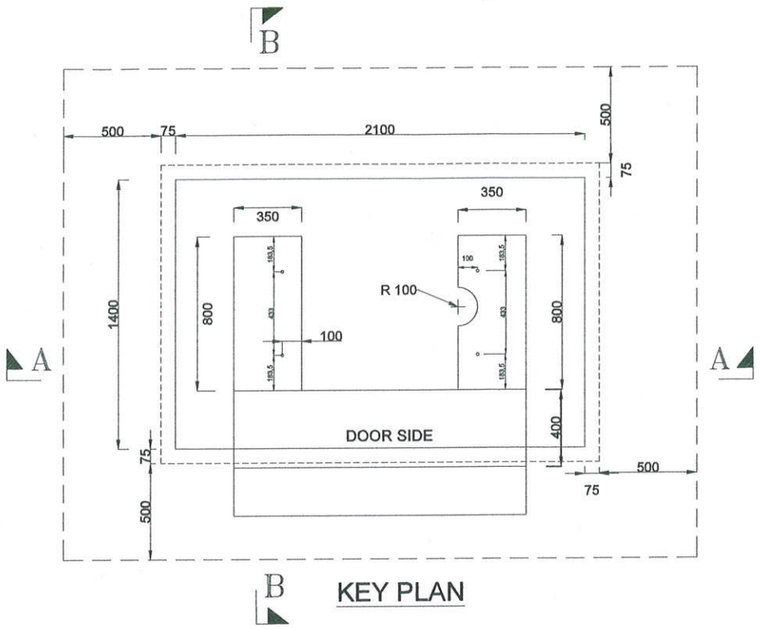
	NAME	DATE	SIGN	
PREPARED BY	PURNIMA	07.10.2022	Purnima	KDBIL
CHECKED BY	G.H	07.10.2022		
SUBMITTED BY	Er. ANURAG	07.10.2022		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

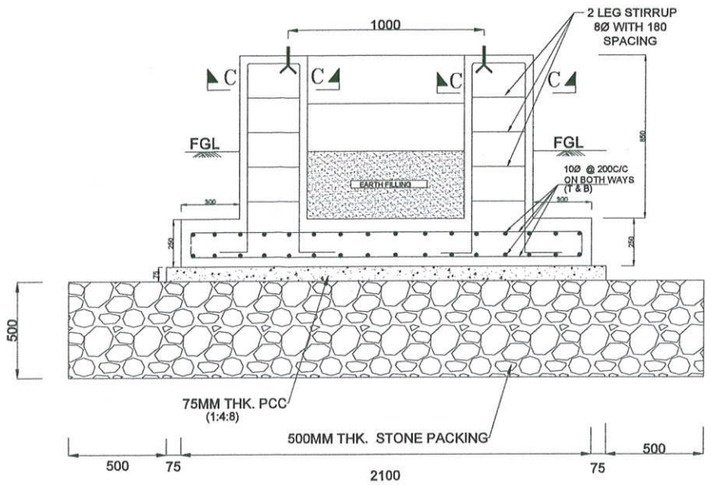
☐ More Information Date.....

KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR

REC Power Development and Consultancy Limited Gurugram

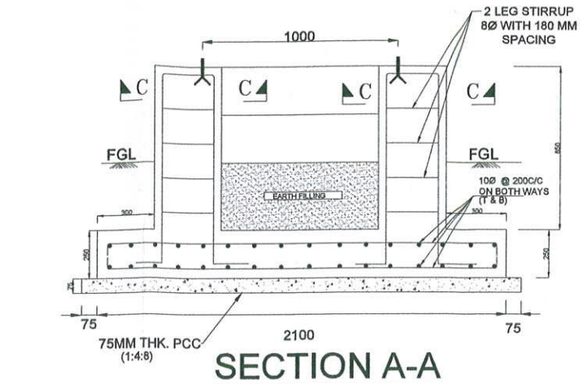


KEY PLAN



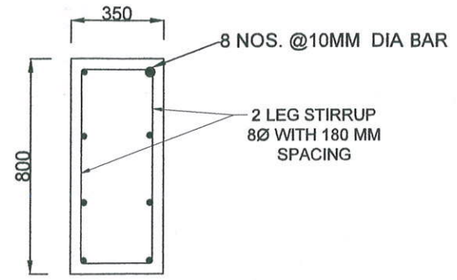
SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



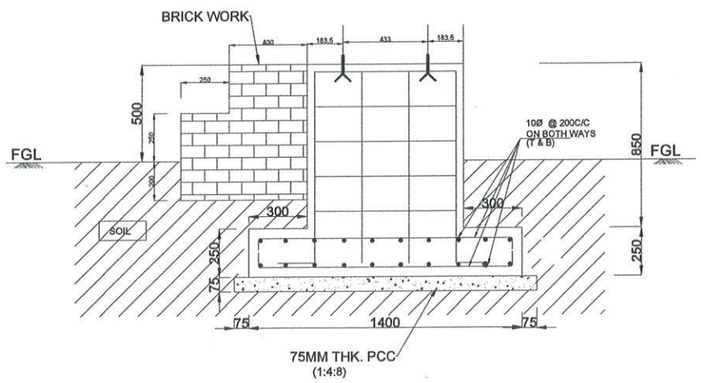
SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



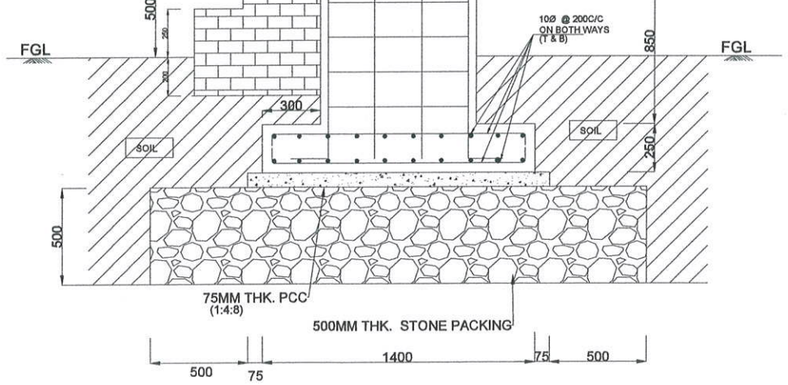
SECTION C-C

ENLARGED



SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)

Categories
I. Approved/issued for
II. Approved/issued for
Subject to
Please submit
III. Insert comments and
IV For Information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।
(Signature)
(हस्ताक्षर)
Manager
(Designation)
(पदनाम)
(Date)
(तिथि)

REC Power Development and Consultancy Limited
Gurugram

CN-22601
30/11/22

NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. CONC.FOR RCC WORK SHALL BE OF GRADE M25.
4. REINF. BARS SHALL BE HYSD BARS OR TMT BARS CONFORMING TO IS: 1786 AS PER BPS.
5. CLEAR COVER TO MAIN REINF. SHALL BE AS FOLLOWS .
   A) 50 MM FOR BOTTOM , TOP AND SIDE REINFORCEMENT OF FOOTING.
   B) 40 MM FOR COLUMN.
6. LAP & ANCHORAGE LENGTH OF REINF. BARS SHALL BE 50 TIMES THE DIAMETER OF BAR.
7. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
8. REINFORCEMENT OF COLUMNS,PEDESTAL, WALL ETC SHALL BE PROVIDED 100% ANCHORAGE IN FDN. RAFTS AND SLABS.
9. NET SBC CONSIDERED 5 T/SQM.
10. MOUNTING ARRANGEMENT OF DG SET SHALL BE AS PER THE MANUFACTURE.
11. BRICK AND PLASTER WORK TO BE TAKEN AFTER COMPLETION OF PIPE CONNECTION BETWEEN F.E.CUBICAL AND OIL PIT

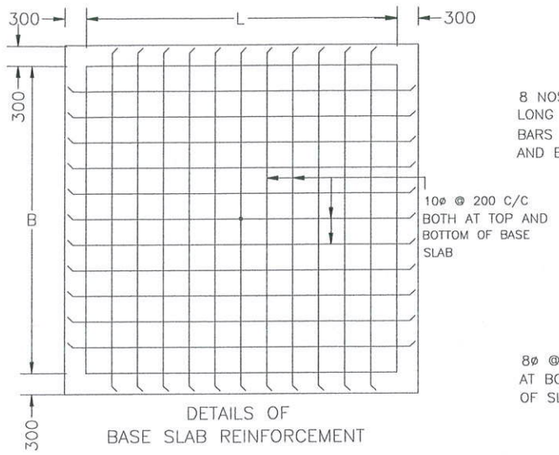
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	NIFPS FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu			
DRG. NO.	KDBIL/250 PJ/20-21/D1/143			REV- 0
SCALE	As shown in Drawing			SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM			SH.NO.: 1 OF 2
	NAME	DATE	SIGN	
PREPARED BY	SHIVAM	23.11.2022		
CHECKED BY	G.H	23.11.2022		
SUBMITTED BY	ANURAG	23.11.2022		

☐ Approved ☐ Approved with comments ☐ Not Approved

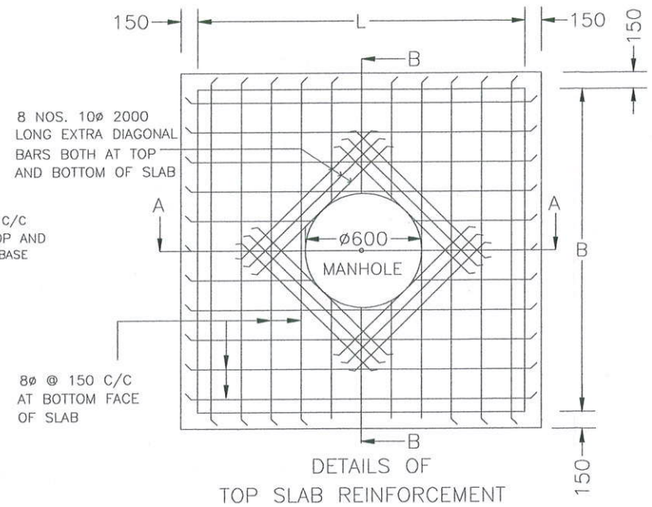
☐ More Information Date.....

KAILASH DEVBUILD (INDIA) P. LTD. JABALPUR

Signature/Stamp...

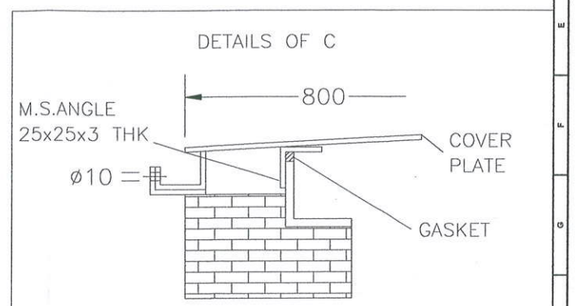


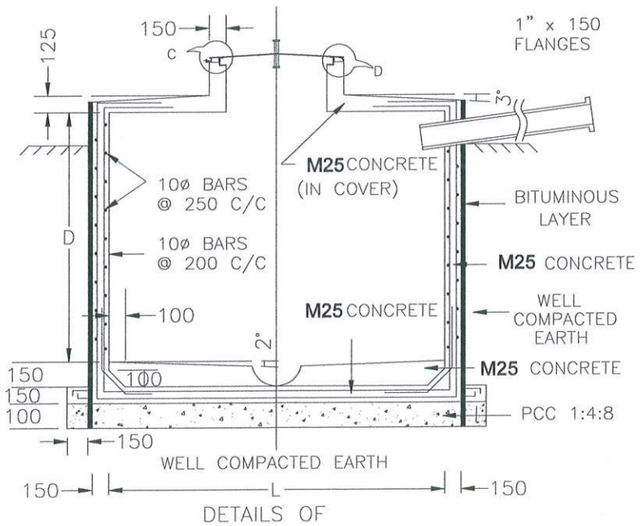
DETAILS OF
BASE SLAB REINFORCEMENT



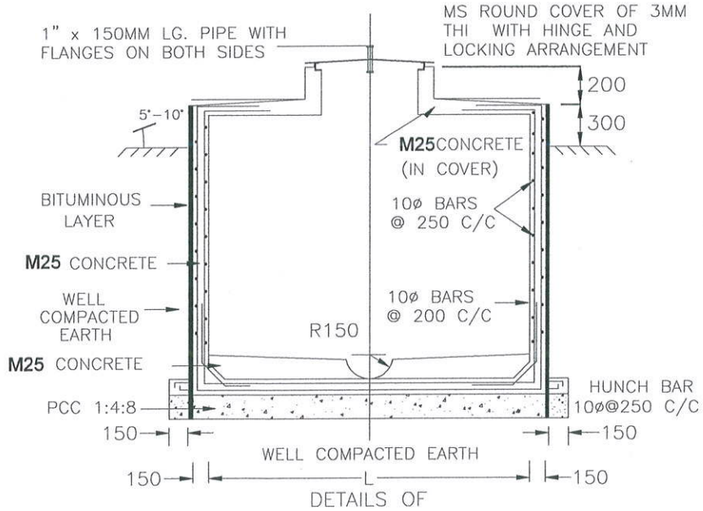
DETAILS OF
TOP SLAB REINFORCEMENT

TRS.RATING (MVA) (LARGEST IN S\S)	OIL PIT CAPACITY (LITRES)	DIMENSIONS (METER) L x B x D
UP TO 20	2000	1.5 x 1.5 x 1.0
20–50	3000	1.5 x 1.5 x 1.5
50–100	5000	2.0 x 2.0 x 1.5
ABOVE 100	10000	2.0 x 3.0 x 2.0





DETAILS OF
WALL REINFORCEMENT
SECTION AT B–B



DETAILS OF
WALL REINFORCEMENT
SECTION AT A–A

NOTES:
1) **M25** CONCRETE SHALL BE USED UNLESS OTHERWISE SPECIFIED.
2) COLD WORKED HIGH STRENGTH DEFORMED BARS Fe–415 SHALL CONFIRM TO IS1786.
3) SUITABLE WATERPROOF COMPOUND BE USED IN THE CONCRETE/PLASTER WORK OF SIDE WALLS (INNER) AND BOTTOM SLAB.
4) CLEAR COVER TO REINFORCEMENT SHALL BE 50 MM IN WALL AND BOTTOM SLAB AND 20 MM IN TOP SLAB.
5) G.I. PIPE (MEDIUM CLASS) OF 2m LENGTH (APPROX.) WITH FLANGE (F TABLE,BS–10) TO BE EMBEDED AS SHOWN WITH 5 TO 10° INCLINATION FROM GROUND LEVEL OF SIZE 100 NB FOR PNT MXXX B10 AND SIZE 150 NB FOR PNT MXXX C10

6- WE DIDN'T CHANGE IN OIL PIT DRAWING. WE HAVE ONLY CHANGE GRADE OF CONCRETE AS PER GIVEN COMMENTED LIST

Approved for Fabrication/Construction/Manufacturing.
Approved for Fabrication/Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
Resubmit after incorporating the comments.
Insert comments and submit again for approval.
For information and record.
Not approved.
Manager
(Date)

30/11/22
CN-22601

REC Power Development and Consultancy Limited 122001

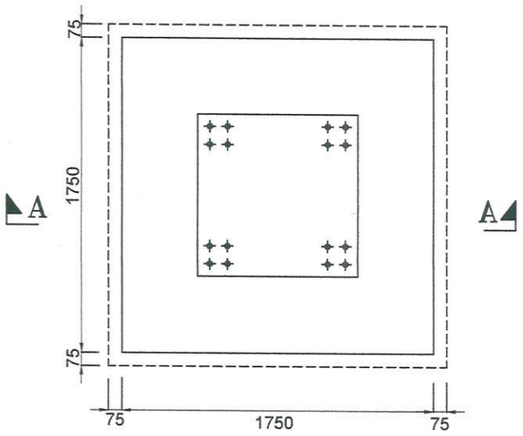
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	OIL PIT FDN. DRAWING FOR PNT FIRE SYSTEM OF 220/33 kV Nagrota (New) S/S, Jammu		
DRG. NO.	KDBIL/250 PJ/20-21/D1/143		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A2
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 2 OF 2
	NAME	DATE	SIGN
PREPARED BY	SHIVAM	23.11.2022	
CHECKED BY	G.H	23.11.2022	
SUBMITTED BY	ANURAG	23.11.2022	

KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR

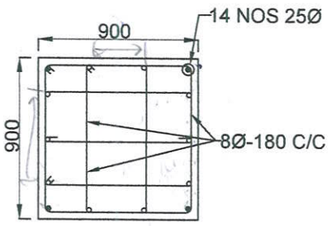
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

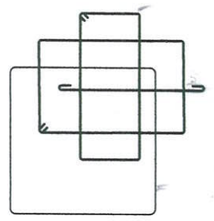
☐ More Information Date.....



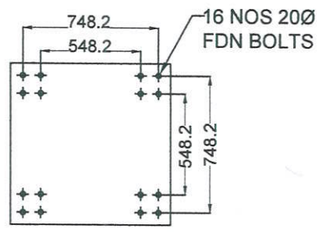
FOUNDATION PLAN



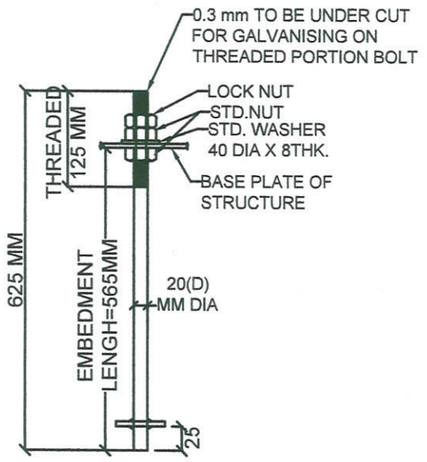
SECTION B-B



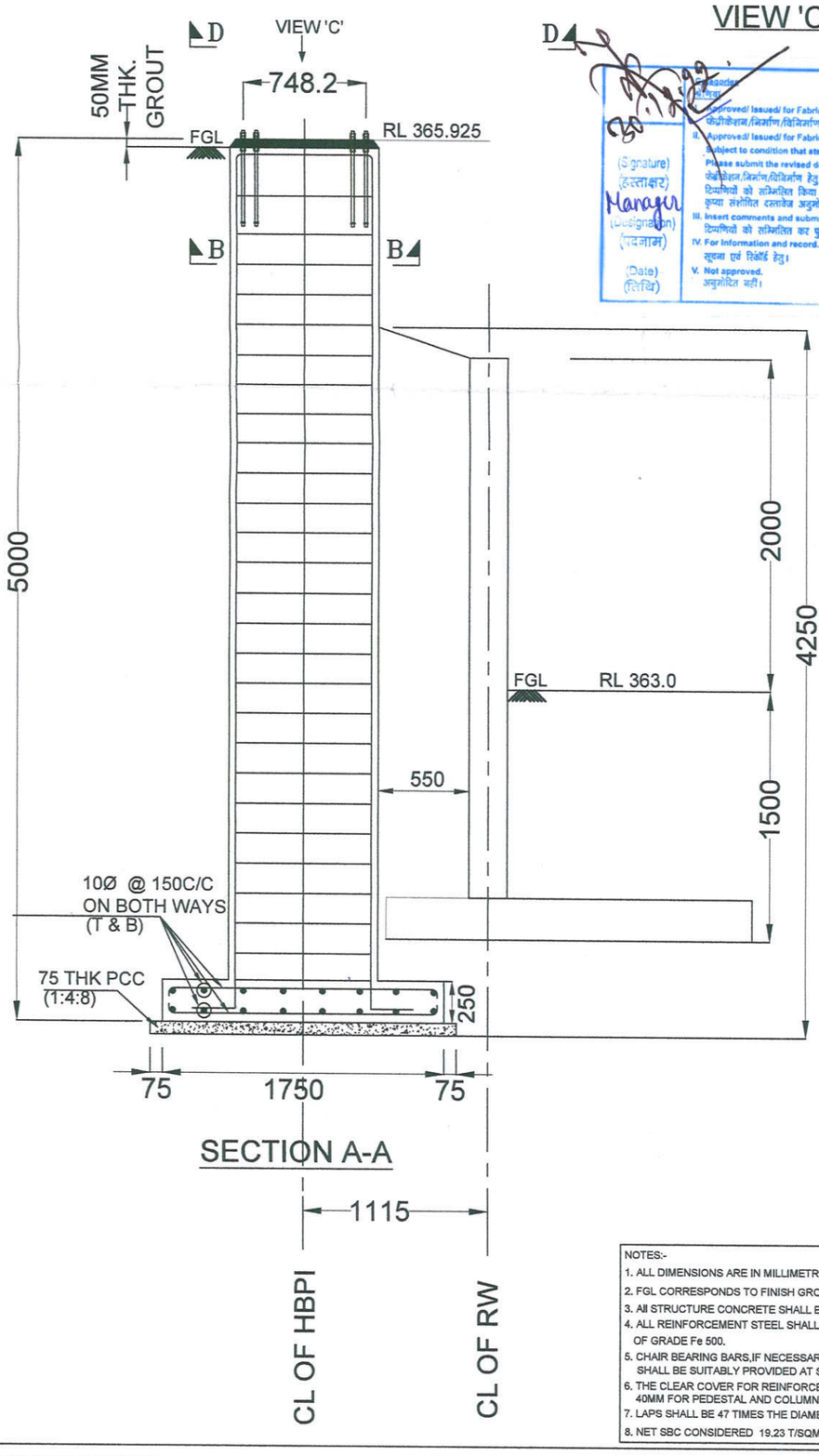
RING ARRANGEMENT



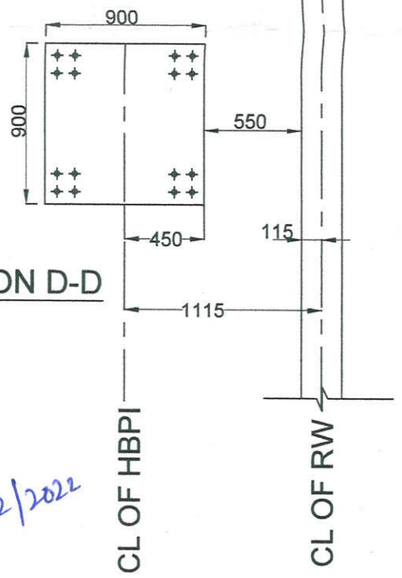
VIEW 'C'



FOUNDATION BOLT







SECTION D-D



NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 19.23 T/SQM AT 2.0MT DEPTH.

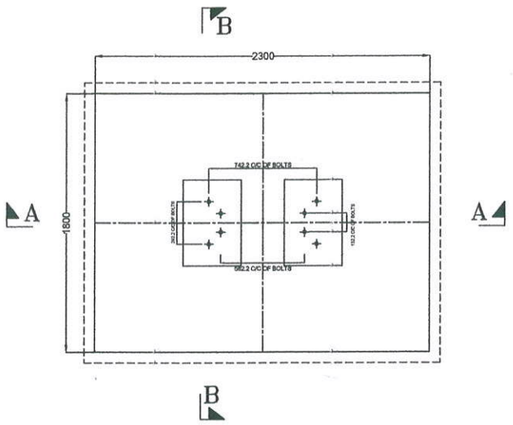
0	16.12.2022	FIRST SUBMISSION
REVISION	REV. DATE	MODIFICATION
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.	
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020	
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)	
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)	
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)	
CONSULTANT	Advanced Ultra Power Transmission Consultancy	
TITLE	220KV HBPI FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu	
DRG. NO.	KDBIL/250 PJ/20-21/D1/146	
SCALE	As shown in Drawing	SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM	SH.NO.: 1 OF 1

	NAME	DATE	SIGN
PREPARED BY	PURNIMA	16.12.2022	
CHECKED BY	G.H	16.12.2022	
SUBMITTED BY	ANURAG	16.12.2022	

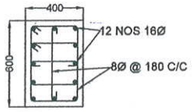
D.P
Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

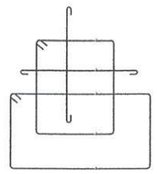
☐ More Information Date.....



FOUNDATION PLAN

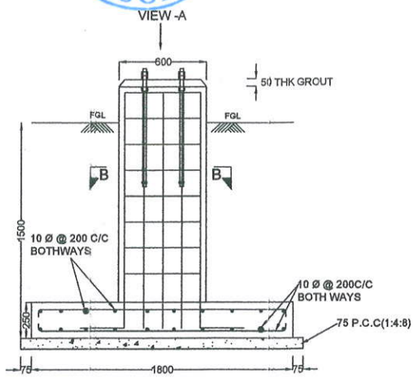


SECTION B-B
ENLARGED



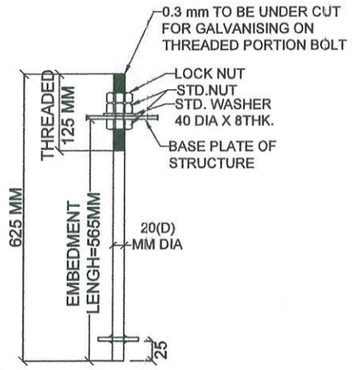
8 Ø @ 180mm

RING ARRANGEMENT

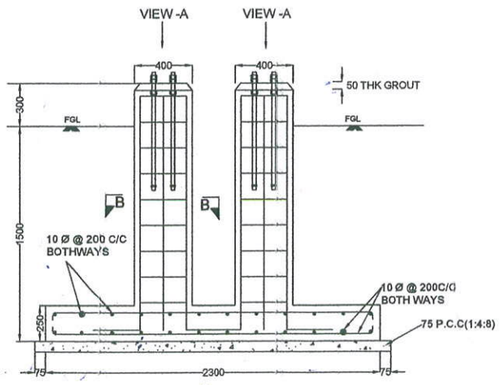


SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)

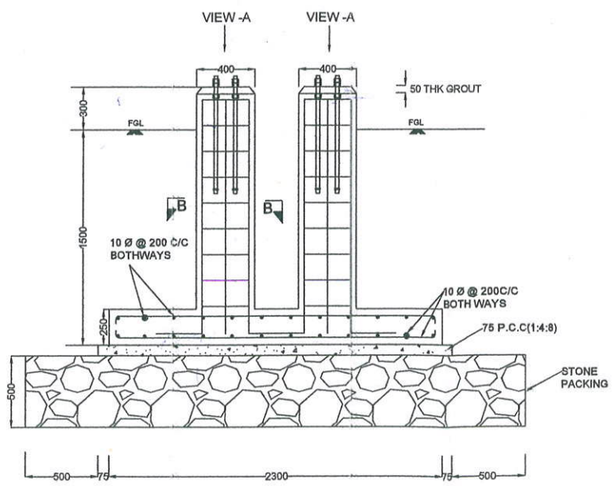


FOUNDATION BOLT



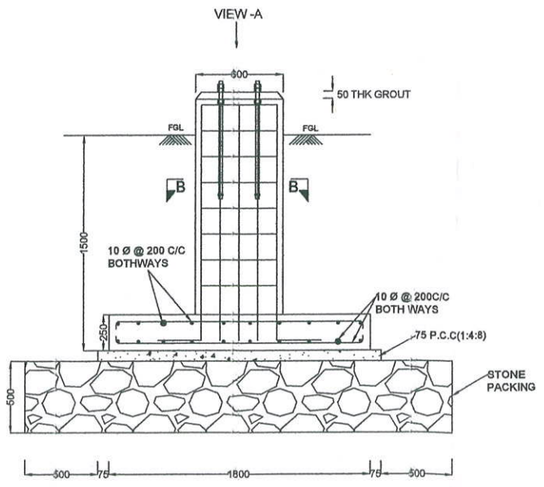
SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5 T/SQM AT 1.5MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-4/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	33KV TANDEM I/O FDN. DRAWING OF 220/33 kV Nagrota (New) S/S,Jammu (TYPE 'A')			
DRG. NO.	KDBIL/250 PJ/20-21/D1/150(A)			REV- 0
SCALE	As shown in Drawing			SHEET SIZE- A3
AREA	91.6 KANAL 48336.5 SQM			SH.NO.: 1 OF 3
	NAME	DATE	SIGN	
PREPARED BY	PURNIMA	11.02.2023		
CHECKED BY	G.H	11.02.2023		
SUBMITTED BY	ANURAG	11.02.2023		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

(Signatures) (हस्ताक्षर) Manager (Designation) (पदनाम) 02/03/23 (Date) (दिनांक)

CN-25275 02/03/23

RECPDCL GURUGRAM

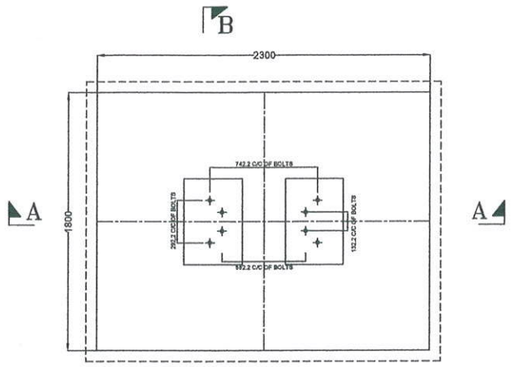
KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR

CN-25275

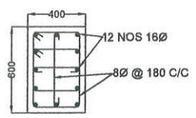
REC PDCL GURUGRAM 02/03/23

Categories :
Approved/ Issued for Fabrication/Construction/Manufacturing
Approved/ Issued for Fabrication/Construction/Manufacturing Subject to condition that statements and comments are included Please submit the revised documents for approval
Insert comments and submit again for approval
For information and record
Not approved

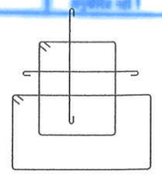
(Signature) (सचिव)
Manager
(Designation) (पदनाम)
02/03/23
(Date) (दिनांक)



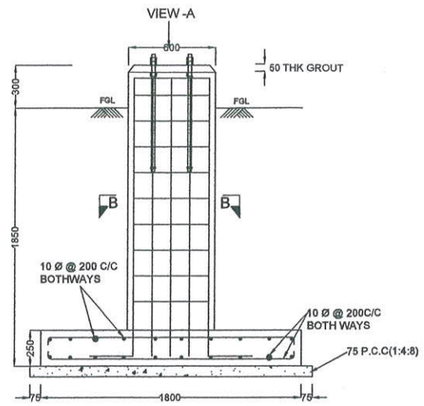
FOUNDATION PLAN



SECTION B-B
ENLARGED

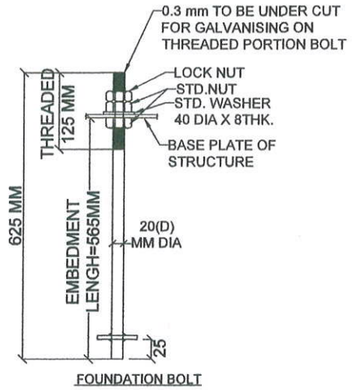


8 Ø @ 180mm
RING ARRANGEMENT

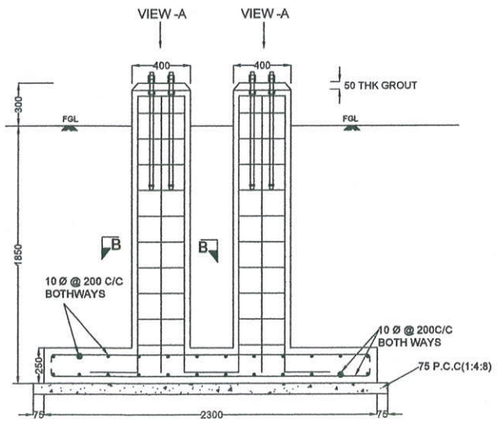


SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)

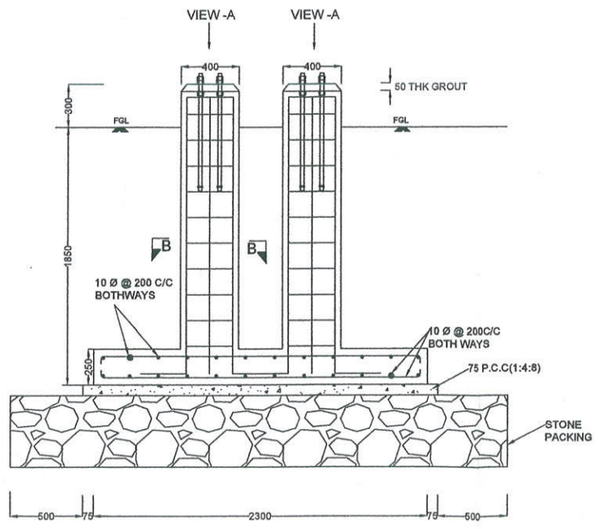


FOUNDATION BOLT



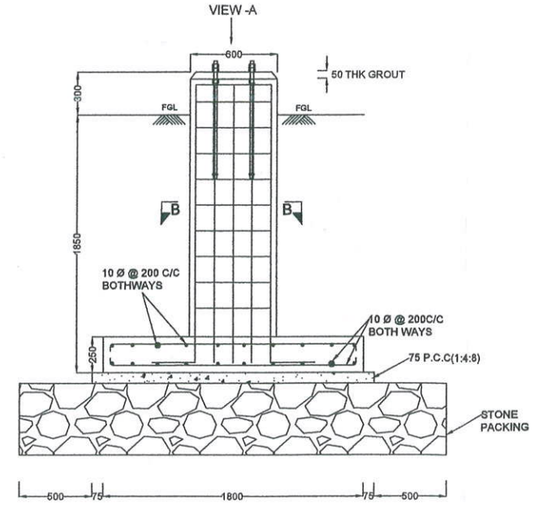
SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)

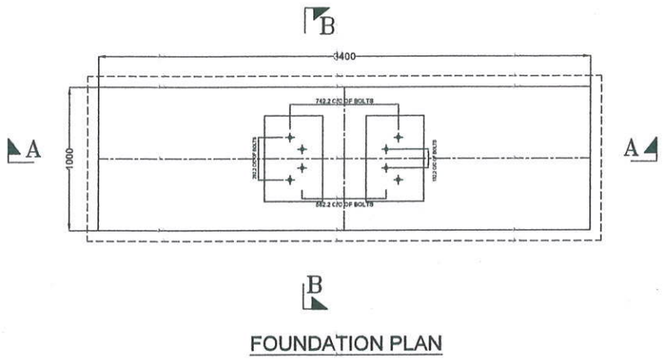
NOTES:-
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5 T/SQM AT 1.85 MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-gladni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.		
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020		
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)		
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)		
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)		
CONSULTANT	Advanced Ultra Power Transmission Consultancy		
TITLE	33KV TANDEM ISO FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu (TYPE 'B')		
DRG. NO.	KDBIL/250 PJ/20-21/D1/150(B)		REV- 0
SCALE	As shown in Drawing		SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 2 OF 3
	NAME DATE	SIGN	
PREPARED BY	PURNIMA 11.02.2023		
CHECKED BY	G.H 11.02.2023		
SUBMITTED BY	ANURAG 11.02.2023		Signature/Stamp...

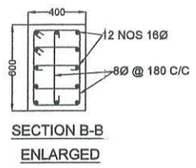
☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....

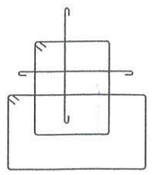
KAILASH DEVBUILD (INDIA) PVT LTD. JABALPUR



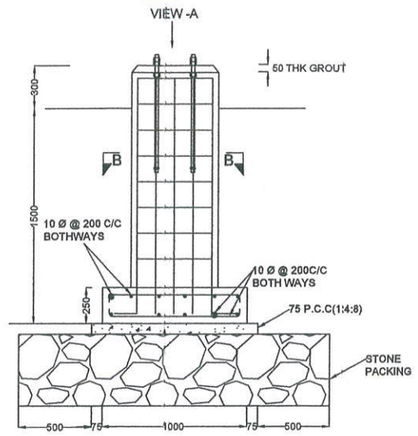
FOUNDATION PLAN



SECTION B-B
ENLARGED

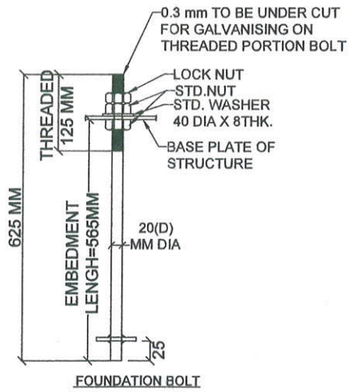


8 Ø @ 180mm
RING ARRANGEMENT

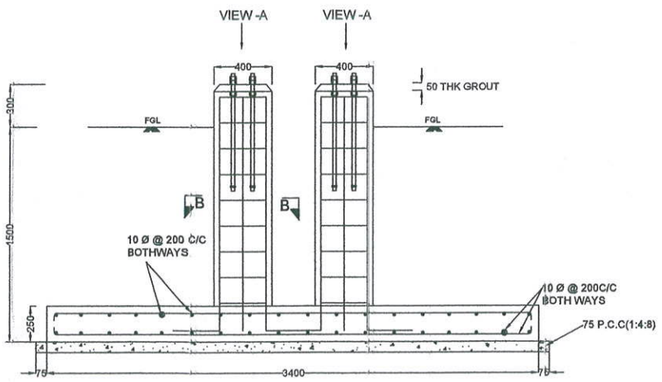


SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)

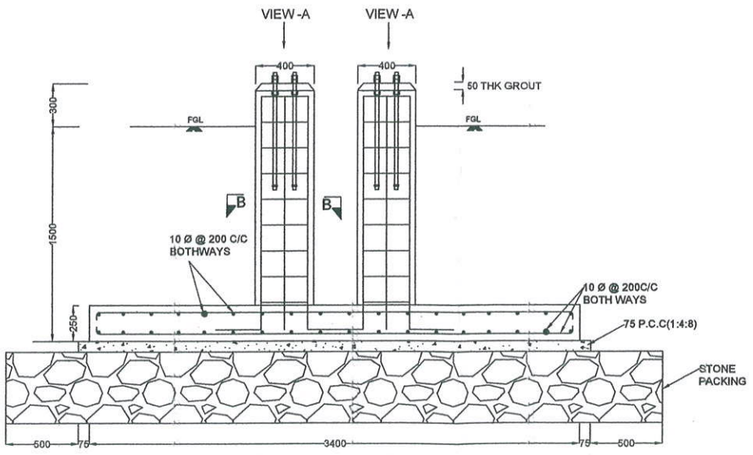


FOUNDATION BOLT



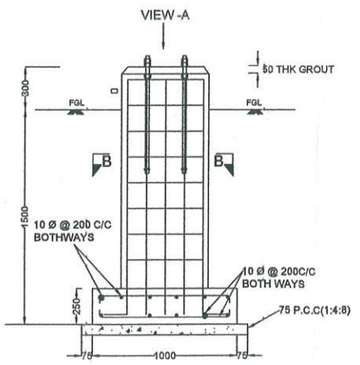
SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENGTH DEFORMED BAR OF GRADE Fe 500.
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7. LAPS SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5 T/SQM AT 1.5MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-jiadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(i) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/706 Dt. 06.11.2020 (ii) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	33KV TANDEM ISO FDN. DRAWING OF 220/33 kV Nagrota (New) S/S, Jammu (TYPE 'C')			
DRG. NO.	KDBIL/250 PJ/20-21/D1/150(C)			REV- 0
SCALE	As shown in Drawing			SHEET SIZE- A3
AREA	91.6 KANAL 46336.5 SQM			SH.NO.: 3 OF 3
	NAME	DATE	SIGN	
PREPARED BY	PURNIMA	11.02.2023		
CHECKED BY	G.H	11.02.2023		
SUBMITTED BY	ANURAG	11.02.2023		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

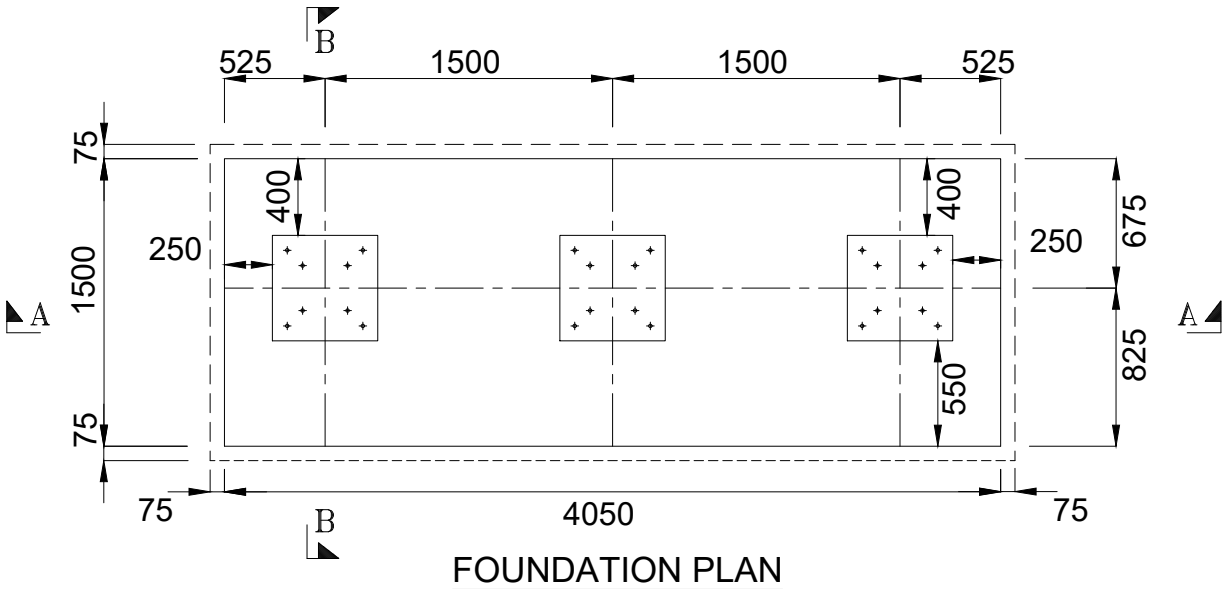
☐ More Information Date.....

Manager
02/03/23

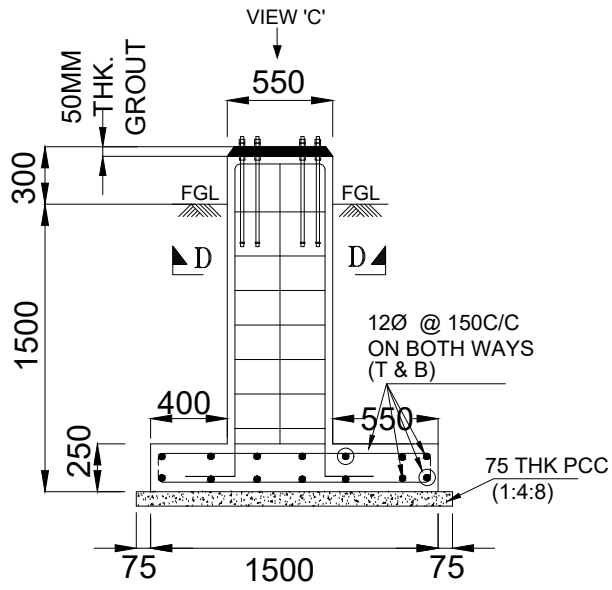
CN-25275 02/03/23

REC PDCL GURUGRAM

KAILASH DEVBUILD (INDIA) PVT. LTD. JABALPUR

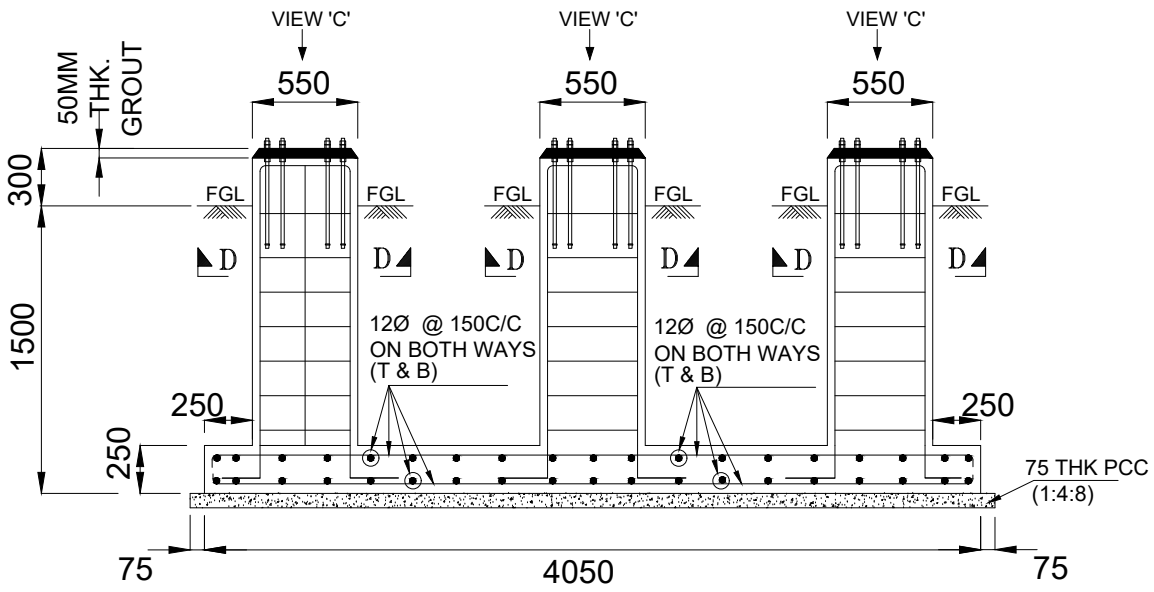


FOUNDATION PLAN



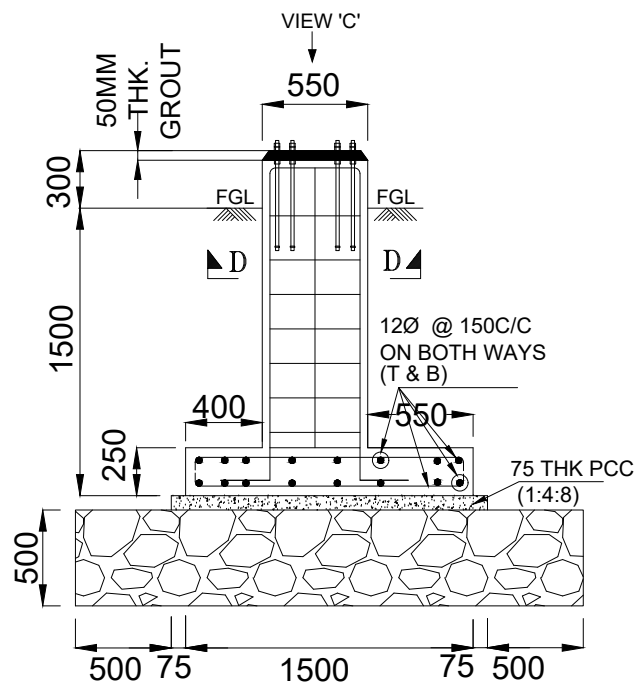
SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



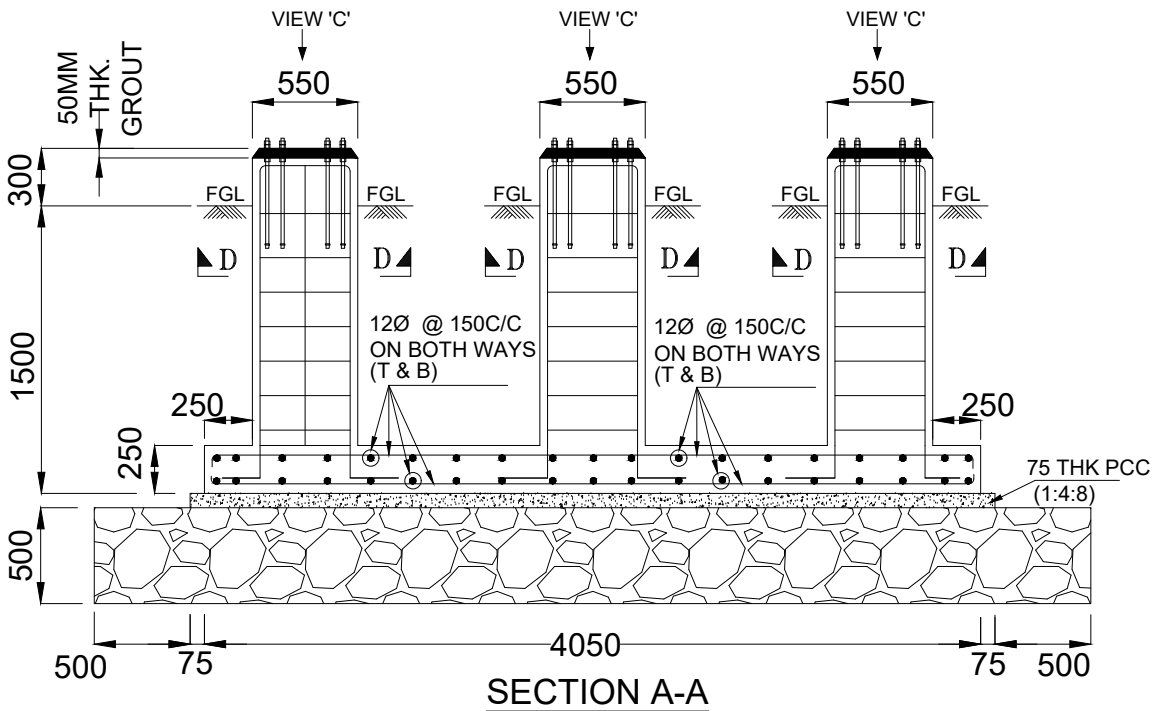
SECTION A-A

(NOTE :- IT IS APPLICABLE ONLY FOR CUTTING AREA)



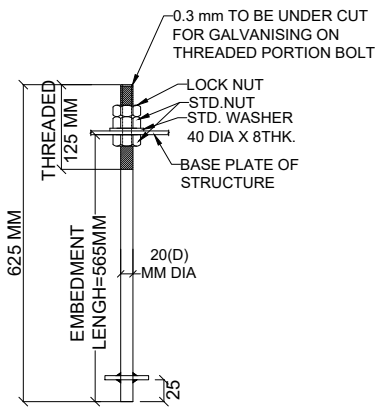
SECTION B-B

(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)

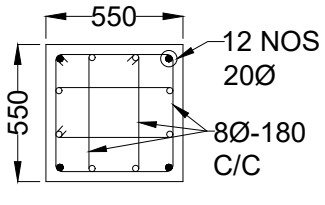


SECTION A-A

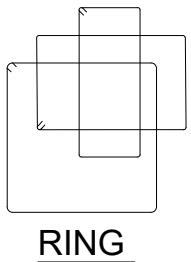
(NOTE :- IT IS APPLICABLE ONLY FOR FILLING AREA)



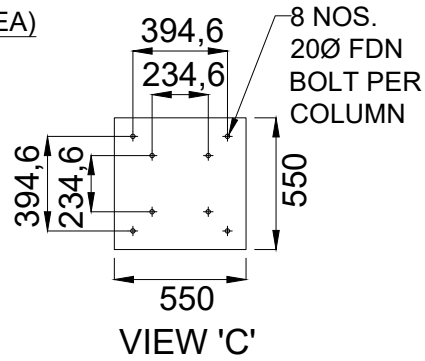
FOUNDATION BOLT



SECTION D-D



RING ARRANGEMENT



VIEW 'C'

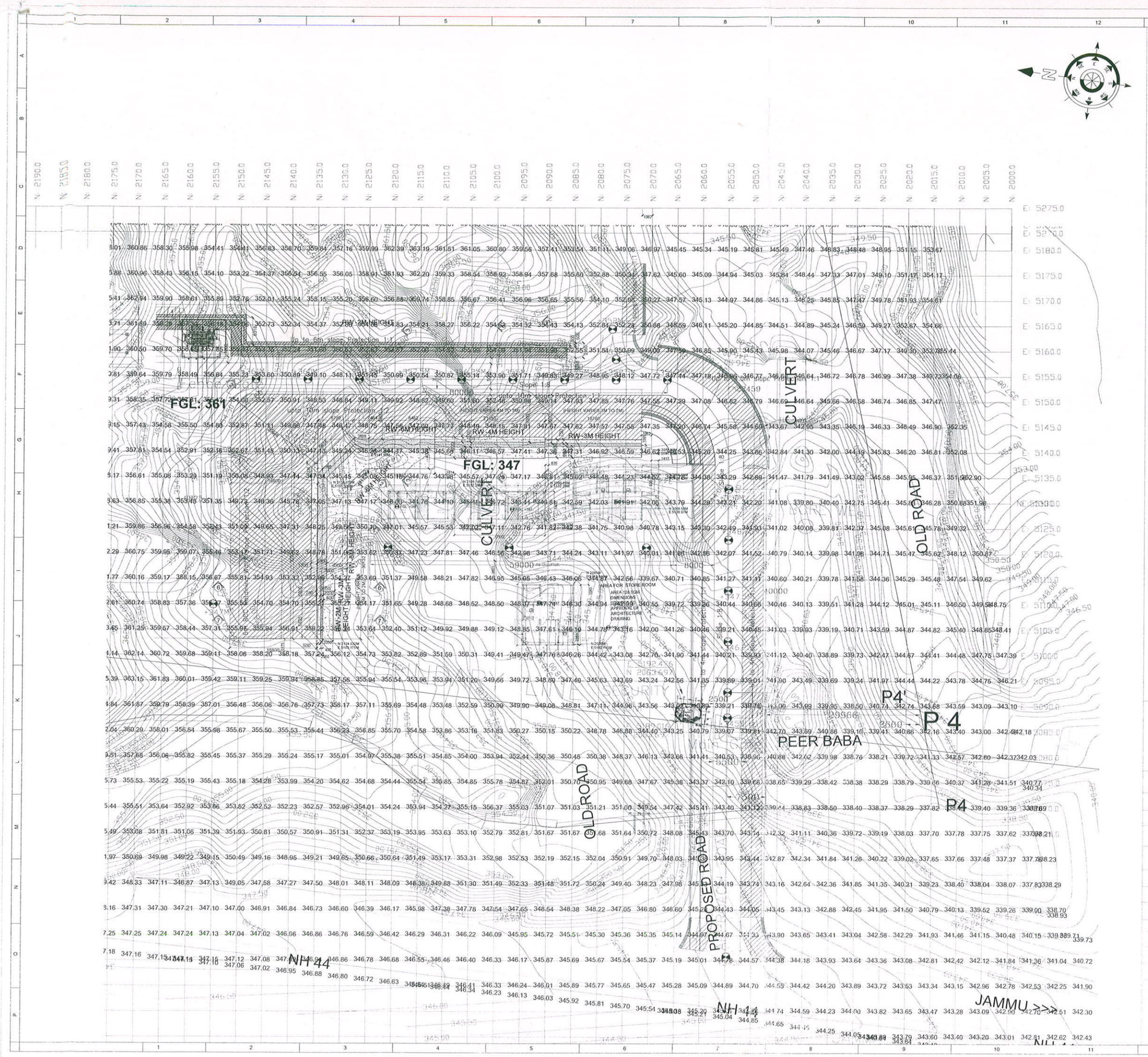
NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. FGL CORRESPONDS TO FINISH GROUND LEVEL AND CONSIDERED AS (+)0.00
3. All STRUCTURE CONCRETE SHALL BE GRADE M25 AS PER BPS.
4. ALL REINFORCEMENT STEEL SHALL BE HIGH YIELD STRENTH DEFORMED BAR OF GRADE Fe 500.
5. CHAIR BEARING BARS,IF NECESSARY FOR SUPPORTING REINFORCEMENT BARS SHALL BE SUITABLY PROVIDED AT SITE.
6. THE CLEAR COVER FOR REINFORCEMENT SHALL BE 50mm FOR FOOTING AND 40MM FOR PEDESTAL AND COLUMNS.
7. LAPS AND ANCHORS(Ld) SHALL BE 47 TIMES THE DIAMETER OF BARS.
8. NET SBC CONSIDERED 5 T/SQM AT 1.5MT DEPTH.

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.			
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020			
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)			
CLIENT	REC Power Development & Consultancy Limited(RECPDCL)			
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)			
CONSULTANT	Advanced Ultra Power Transmission Consultancy			
TITLE	33KV CT COMBINED FDN. DRAWING (TYPE-A) FOR BUS COUPLER			
DRG. NO.	KDBIL/250 PJ/20-21/D1/154		REV- 0	
SCALE	As shown in Drawing		SHEET SIZE- A3	
AREA	91.6 KANAL 46336.5 SQM		SH.NO.: 1 OF 1	
	NAME	DATE	SIGN	
PREPARED BY	ANKIT PATEL	04.05.2023		
CHECKED BY	G.H	04.05.2023		
SUBMITTED BY	ANURAG	04.05.2023		Signature/Stamp...

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date.....



Notes:-

1. All dimensions are in mm
2. Do not scale any dimensions
3. Concrete grade shall be M25.
4. This drawing shall be read in conjunction with relevant structure/services drawings. Any discrepancy found therein consultant.
5. Steel R/F Fe 500 shall be used. and Steel R/F shall conform to IS: 1786
6. Expansion joint should be provide @ 10m c/c.
7. For Retaining wall Section & Reinforcement detail refer Dwg. No. -

   a. PJ/20-21/D1/01 (Sheet no 1 of 5). For 2m Height.
   b. PJ/20-21/D1/01 (Sheet no 2 of 5). For 3m Height.
   c. PJ/20-21/D1/01 (Sheet no 3 of 5). For 4m Height.
   d. KDBIL/250 PJ/20-21/NS/04. For 6m Height.

REC PDCL GURUGRAM

Categories
श्रेणियाँ
I. Approved/ Issued/ for Fabrication/Construction/Manufacturing
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued/ for Fabrication/Construction/Manufacturing
Subject to condition that statements and comments are included.
Please submit the revised documents for approval.
फेब्रीकेशन/निर्माण/विनिर्माण हेतु अनुमोदित/जारी। बशर्ते ही कई टिप्पणियों को सम्मिलित किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

(Signature) (हस्ताक्षर)
(Designation) (पदनाम)
(Date) (तिथि)

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	NS CONSULTING & ENGINEERING SERVICES PVT. LTD. Office : H-No. 11, Second floor -09, Ayanagar, New Delhi - 110047.
TITLE	PART PLAN RETAINING WALL LAYOUT NEAR GROUP HOUSING FOR 220/33 kV NAGROTA (NEW) S/S, JAMMU
DRG. NO.	KDBIL/250 PJ/20-21/NS/02 REV- 2
SCALE	As shown in Drawing SHEET SIZE- A1
AREA	95.33 KANAL 48180.4715 SQM SH.NO. 1 OF 1

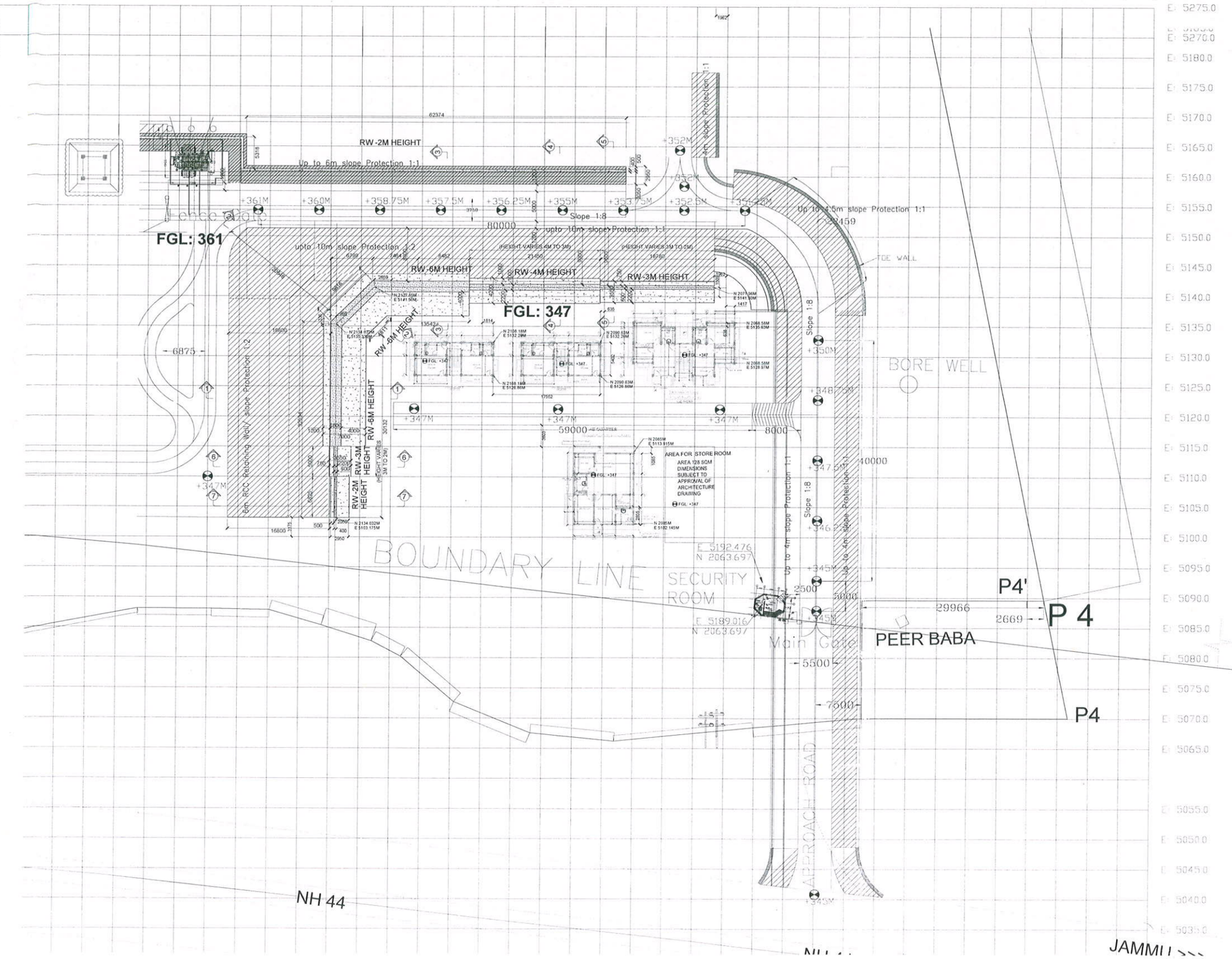
	NAME	DATE	SIGN
PREPARED BY	S.K.M.	20.12.2021	
CHECKED BY	P.C.	20.12.2021	
SUBMITTED BY	ANURAG TIWARI	20.12.2021	

Kailash Devbuild (India) Pvt. Ltd.

Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ Yours Information Date



Notes:-

1. All dimensions are in mm
2. Do not scale any dimensions
3. Concrete grade shall be M25.
4. This drawing shall be read in conjunction with relevant structure/services drawings. Any discrepancy found therein consultant.
5. Steel R/F Fe 500 shall be used. and Steel R/F shall conform to IS: 1786
6. Expansion joint should be provide @ 10m c/c.
7. For Retaining wall Section & Reinforcement detail refer Dwg. No. -

   a. PJ/20-21/D1/01 (Sheet no 1 of 5). For 2m Height.
   b. PJ/20-21/D1/01 (Sheet no 2 of 5). For 3m Height.
   c. PJ/20-21/D1/01 (Sheet no 3 of 5). For 4m Height.
   d. KDBIL/250 PJ/20-21/NS/04. For 6m Height.

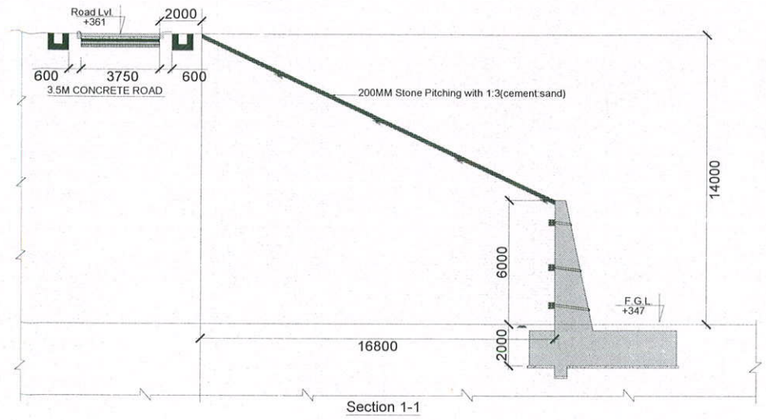
REC PDCL GURUGRAM

Category: Approved/ Issued for Fabrication/Construction/Manufacturing
Approved/ Issued for Fabrication/ Construction/ Manufacturing subject to condition that statements and comments are included.
Please submit the revised documents for approval.
Do not fabricate/ Construct/ Manufacture
Resubmit after incorporating comments
(Signature)
(Designation)
(Date)
I. Approved
II. Approved with comments
III. Insert comments and submit again for approval
IV. For information and record
V. Not approved

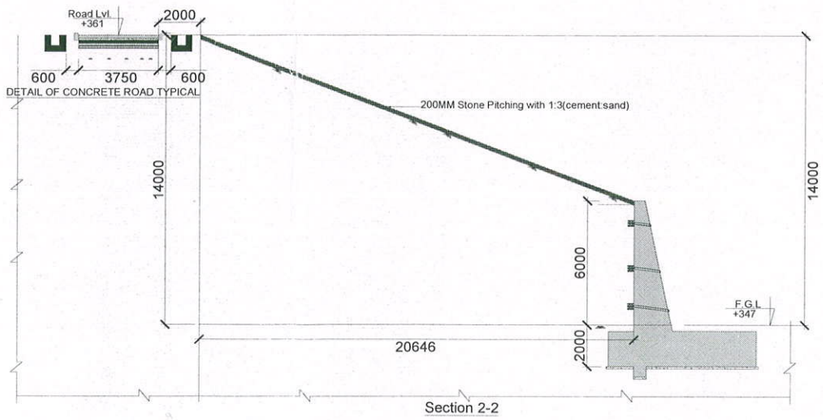
PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-II/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	NS CONSULTING & ENGINEERING SERVICES PVT. LTD. Office : H-No. 11, Second floor -09, Ayanagar, New Delhi - 110047.
TITLE	PART PLAN RETAINING WALL LAYOUT NEAR GROUP HOUSING FOR 220/33 kV NAGROTA (NEW) S/S, JAMMU
DRG. NO.	KDBIL/250 PJ/20-21/NS/02 REV- 2
SCALE	As shown in Drawing — SHEET SIZE- A1
AREA	95.33 KANAL 48180.4715 SQM — SH.NO.: 1 OF 1

	NAME	DATE	SIGN	
PREPARED BY	S.K.M	21.12.2021		Kailash Devbuild (India) Pvt. Ltd.
CHECKED BY	P.D	21.12.2021		
SUBMITTED BY	ANURAG TIWARI	21.12.2021		Signature/Stamp

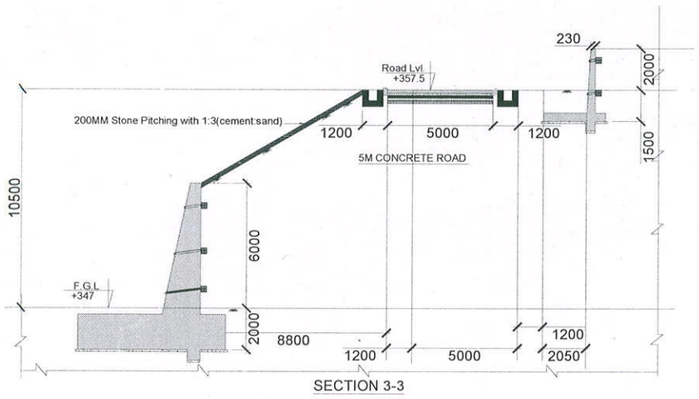
☐ Approved ☐ Approved with comments ☐ Not Approved
☐ More Information Date



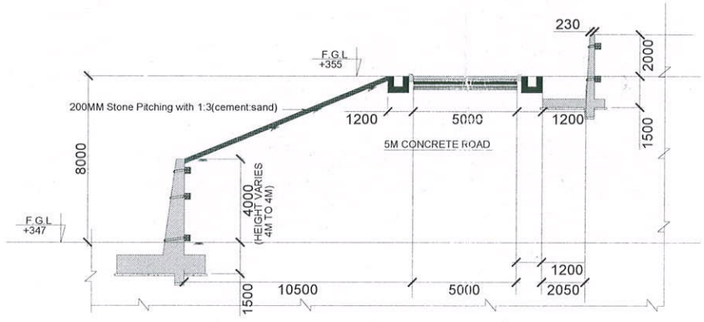
Section 1-1



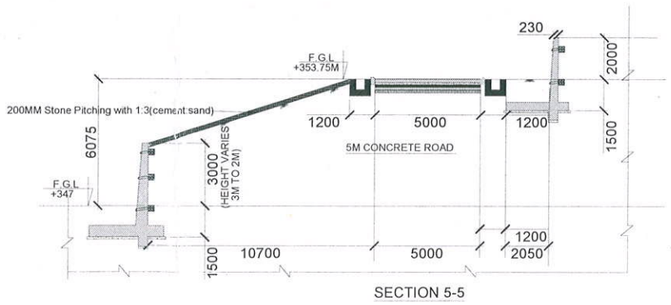
Section 2-2



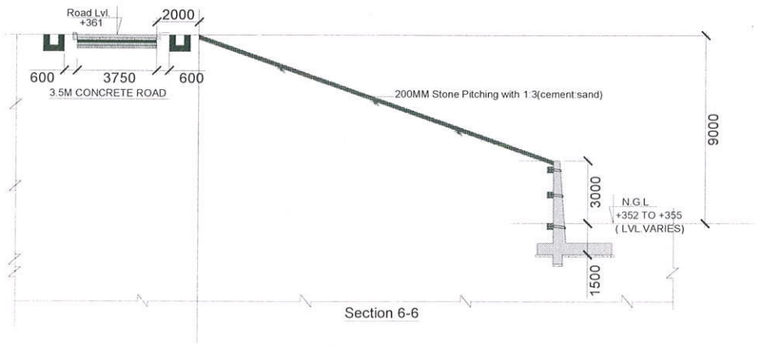
SECTION 3-3



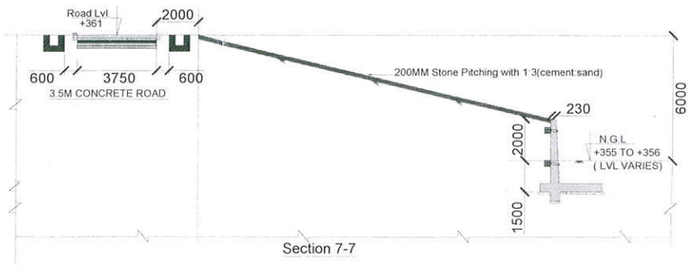
SECTION 4-4



SECTION 5-5



Section 6-6



Section 7-7

Notes:-

1. All dimensions are in mm
2. Do not scale any dimensions
3. Concrete grade shall be M25.
4. This drawing shall be read in conjunction with relevant structure/services drawings. Any discrepancy found therein consultant.
5. Steel R/F Fe 500 shall be used. and Steel R/F shall conform to IS: 1786
6. 6. Expansion joint should be provide @ 10m c/c.
7. For section marking refer dwg. no:- KDBIL/250 PJ/20-21/NS/02.

REC PDCL GURUGRAM

(Signature) (हस्ताक्षर)

(Designation) (पदनाम)

(Date) (तिथि)

Categories
श्रेणियां
I. Approved/ Issued for Fabrication/Construction/Manufacturing
पंजीकरण/विनिर्माण/निर्माण हेतु अनुमोदित/जारी।
II. Approved/ Issued for Fabrication/ Construction/Manufacturing Subject to condition that statements and comments are included.
Please submit the revised documents for approval
पंजीकरण/विनिर्माण/निर्माण हेतु अनुमोदित/जारी, बशर्ते कि टिप्पणियों को शामिल किया जाए।
कृपया संशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. Insert comments and submit again for approval
टिप्पणियों को सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. For information and record.
सूचना एवं रिकॉर्ड हेतु।
V. Not approved.
अनुमोदित नहीं।

PROJECT	Construction of 2x50MVA, 220/33KV Nagrota (New) SubStation including LILO of 220KV Kishenpur-Barn or Udhampur-giadni S/C line on D/C Tower at Nagrota Substation including Design, Engineering, Supply & Construction of Residential Staff Quaters & associated facilities at proposed Nagrota Substation under PMDP scheme-15 on Turnkey Basis.
NOA No.	(I) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-I/705 Dt. 06.11.2020 (II) CS/PIA/JKPTCL/Nagrota/SS & LILO-I/NOA-II/706 Dt. 06.11.2020
OWNER	Jammu & Kashmir Power Transmission Corporation Limited (JKPTCL)
CLIENT	REC Power Development and Consultancy Limited (RECPDCL)
EPC COMPANY	Kailash Devbuild (India) Pvt. Ltd. 817, Hathital, Jabalpur-482001 (M.P.)
CONSULTANT	NS CONSULTING & ENGINEERING SERVICES PVT. LTD. Office : H-No. 11, Second floor -09, Ayanagar, New Delhi - 110047.
TITLE	RETAINING WALL SECTION NEAR GROUP HOUSING FOR 220/33 kV NAGROTA (NEW) S/S, JAMMU
DRG. NO.	KDBIL/250 PJ/20-21/NS/03 — REV- 1
SCALE	As shown in Drawing — SHEET SIZE- A2
AREA	95.33 KANAL 48180.4715 SQM — SH.NO: 1 OF 1

	NAME	DATE	SIGN
PREPARED BY	S.K.M	21.12.2021	
CHECKED BY	P.D	21.12.2021	
SUBMITTED BY	ANURAG TIWARI	21.12.2021	

Kailash Devbuild (India) Pvt. Ltd.
Signature/Stamp

☐ Approved ☐ Approved with comments ☐ Not Approved

☐ More Information Date