आरईसी पावर डिस्ट्रीब्यूशन कम्पनी लिमिटेड
REC POWER DISTRIBUTION COMPANY LIMITED
(A wholly owned subsidiary of REC Ltd., a 'Navratna CPSE' under Ministry of Power, Govt. of India)
CIN No. RECPDCL-U40101DL2007GOI165779
Corporate Office: 4th Floor, KRIBHCO Bhawan, A-10, Sector-1, Noida, Gautam Budh Nagar-201301 (UP)
Tel.: 0120 - 4383783, Fax: 0120 - 4383768, Website: www.recpdcl.in, E-Mail: co.delhi@recpdcl.in
Regd. Office: Core - 4, SCOPE Complex, 7, Lodhi Road, New Delhi - 110003, Phone: 011 - 43091506, Fax: 011 - 24366815

NIT No: RECPDCL/TECH/ARP/18-19/1692 **Date: 20.07.2018**

(Domestic Competitive Bidding)

Notice Inviting Tender

(Bid Invited through e-Tendering mode only)

for

Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme

REC Power Distribution Company Limited (RECPDCL)

(A wholly owned subsidiary of REC Ltd., a 'Navaratna CPSE'
Under Ministry of Power, Govt. of India)
CIN No. of RECPDCL: U40101DL2007GOI165779

Corporate office

4th Floor, KRIBHCO Bhawan,
A10, Sector-1, Noida (U.P.)-201301
Phone: 0120-4383783
Website: **www.recpdcl.in**

Description of task, e-tender submission format and procedure is provided in the tender document available on RECPDCL website (**www.recpdcl.in**), REC website (**www.recindia.nic.in**), e-tendering website (**www.tenderwizard.com/REC**), Central Public Procurement Portal (**www.eprocure.gov.in**)

Important Dates	
Date of Release of tender	**20.07.2018**
Date of Pre-bid Meeting	**27.07.2018 at 12:00 Hours**
Last date of submission of Bid	**06.08.2018 up to 16:30 Hours**
Date of opening of Technical Bids	**06.08.2018 at 17:00 Hours**
Date of opening of Financial Bids	**To be intimated later**

Note: Online registration has to be done at e-tendering website i.e. **www.tenderwizard.com/REC** in general, activation of registration may take about maximum 24 hours subject to the submission of all requisite documents required in the process.

-Sd-
(Ajay Kumar Gupta)
CTO

[This document is meant for the purpose of engaging of Agencies against this tender and should not be transferred, reproduced or otherwise used for purposes other than specified/issued.]

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SECTION-I

TENDER INFORMATION

NAME OF ASSIGNMENT:

Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme

IMPORTANT INFORMATION

S. No.	Event	Date/ Information	
1	Date of Release of Tender	**20.07.2018**	
2	Last Date of Submission of Pre-Bid Queries	**27.07.2018 up to 11:00 Hours**	
3	Date of Pre-Bid Meeting	**27.07.2018 at 12:00 Hours**	
4	Venue for Pre-Bid Meeting	REC Power Distribution Company Limited, 4th Floor, KRIBHCO Bhawan, A10, Sector-1, Noida (U.P.)-201301 Phone: 0120-4383783/767 Email: co.delhi@recpdcl.in	
5	Last date of submission of Bid	**06.08.2018 up to 16:30 Hours**	
6	Date of Opening of Technical Bids	**06.08.2018 at 17:00 Hours**	
7	Date of Opening of Financial Bids	**To be intimated later**	
8	Tender document	The tender document can be downloaded and viewed from any of the website: **www.recpdcl.in** (or) **www.recindia.nic.in** (or) **www.eprocure.gov.in** (or) (**www.tenderwizard.com/REC**) at free of cost.	
9	Earnest Money Deposit (EMD)	All participating bidders have to submit EMD in original as per Clause No. 2 under Section-VI in the form of Demand Draft (DD) in favour of REC Power Distribution Company Ltd. payable at New Delhi (or) in the form of Bank Guarantee (bid bank guarantee) from a scheduled bank as per format of Annexure-V.	
10	Address for Bid Submission	Addl. Chief Executive Officer REC Power Distribution Company Limited, 4th Floor, KRIBHCO Bhawan, A10, Sector-1, Noida (U.P.)-201301 Email: co.delhi@recpdcl.in	
11	Validity of Bid	180 days from the last date of bid submission	
12	Contact Person	Shri Ajay Kumar Gupta Chief Technical Officer RECPDCL Email: co.delhi@recpdcl.in	Shri Sunil Bisht Dy. Manager (Tech.) RECPDCL, Phone: 0120-4383759/767 Email: co.delhi@recpdcl.in

SECTION-II

PREFACE & INTENT

REC Power Distribution Company Limited (RECPDCL) is a wholly owned subsidiary of Rural Electrification Corporation Ltd. (REC), a *"Navratna CPSE"* under the Ministry of Power, Govt. of India. RECPDCL is also an Empaneled Government Agency with Ministry of New & Renewable Energy (MNRE), Govt. of India.

RECPDCL is engaged in providing value added consultancy services in power sector arena covering Power Generation, Renewable Energy Sector and Energy Efficiency programs including Govt. of India's power schemes for power utilities across the country and various regulatory assignments with CERC/SERCs. It includes the project works under Rural Electrification, Project Management Consultancy (PMC) works, Detailed Project Report (DPR) preparation for R-APDRP/DDUGJY/RGGVY/NEF and other power project schemes, Third Party Inspection of DDUGJY/ RGGVY/other projects, Feeder Renovation Program, Feeder separation, HVDS program, Lender's Engineers assignment, IT related assignments in Distribution sector including Energy Audit, Evaluation study for HVDS/Distribution network, AT&C Loss assessment, System study, MRI based billing and Cost Book Data Preparation.

Government of India has launched Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) for strengthening & augmentation of power distribution network, separation of agriculture & non-agriculture feeders and rural electrification works. This scheme is already under implementation by various states in the country.

In addition to this, Government of India has recently launched SAUBHAGYA scheme to ensure last mile connectivity and electricity connections to all remaining un-electrified households in the country. This scheme aims for providing service connections to un-connected households in rural and urban areas through available grid or by incremental infrastructure.

Electrification works under SAUBHAGYA is a flagship programme of Govt. of India which is required to be completed latest by December-2018, therefore time is the essence of the contract. In no case, delay shall be permitted from the agreed timeline commensurate with entire scheme.

RECPDCL, which expression shall also include its successors and permitted assigns, hereby invites Bids from the agencies which are technically and professionally qualified, experienced and capable of supplying materials for sub-transmission & distribution network such as Distribution Transformers, ACSR Conductors, LT XLPE Cables, LTDB, Insulators, Lightning Arrestors etc. in large quantum as per Scope of Work detailed in Section-V of this tender document and are able to deliver the job in a time bound and efficient manner as per the requirements of RECPDCL.

Arunachal Power Development Agency (hereinafter referred as "APDA") shall be Owner of the project however, REC Power Distribution Company Limited (hereinafter referred as "RECPDCL") shall act as Employer for the Contract under this NIT.

RECPDCL shall be responsible for procurement of the materials under this NIT & timely supply to the respective store(s) located in the operational area of the Owner on behalf of Owner.

Employer shall make payments promptly on the submission of requisite documents and fulfillment of stipulated conditions by the successful bidder(s) under the Contract. All invoices/ claims shall be raised by the successful bidder(s) in the name of Owner acting through RECPDCL.

SECTION-III

INSTRUCTIONS TO BIDDING AGENCIES

SUBMISSION PROCESS OF BID DOCUMENTS:

A. Downloading & viewing of Tender Document:

Bidders can download and view tender document from RECPDCL web site **www.recpdcl.in** (or) e-tender website **www.tenderwizard.com/REC** (or) REC website **www.recindia.nic.in** (or) Central Public Procurement Portal **www.eprocure.gov.in** at free of cost.

B. Participation through e-Bid Submission:

Bidders shall submit their bid documents online through website www.tenderwizard.com/REC

1) In order to participate in e-Bid submission, it is mandatory for agencies to have log-in User ID and Password. For this purpose, the agency has to register with RECPDCL through tender Wizard website as per procedure given below.

Steps for Online Registration:

(i) Go to website https://www.tenderwizard.com/REC
(ii) Click the link 'Register Me'
(iii) Enter the details about the E-tendering as per format
(iv) Click 'Create Profile'
(v) System will provide / confirmation with Login ID and Password

Note:

- While accessing tenderwizard.com website, please type 'REC' in capital letters only to get access of e-tender portal.
- Activation of On-Line registration may take about maximum 24 hours. It is the responsibility of the bidder to register in advance.

2) Please note that the agencies have to obtain digital signature token for applying the bid. Bidders may also obtain the same from Tender Wizard.

Steps for applying for Digital Signature from Tender Wizard:

Download the Application Form from the website https://www.tenderwizard.com/REC. Follow the instructions as provided therein. In case of any assistance you may contact RECPDCL officials whose address is given in this tender document.

C. Submission of Bid Documents:

Submission of bids will be through online e-tendering mode only from www.tenderwizard.com/RECwebsite.

Agencies should upload Bid documents (scanned copies) as mentioned below. Online submission of Bid documents is mandatory.

1) **Letter for Submission of Bid** has to be submitted on Company's letterhead duly signed and stamped as per format of **Annexure-I**. This is mandatory document for submission.
2) **Bidder's General Details** has to be submitted on Company's letterhead duly signed and stamped as per format of **Annexure-II**.
3) **Letter for Transmittal** has to be submitted on Company's letterhead duly signed and stamped as per format of **Annexure-III**.

4) **Financial Eligibility Criteria as per Section-IV** has to be submitted on Company's letterhead duly signed and stamped as per format of **Annexure-IV**.
5) Format for Evidence of Bidder's Access to or Availability of Credit/Facilities Bank Certificate has to be submitted on Company's letterhead duly signed and stamped as per format of **Annexure-V**. Scanned copy of Certificate has to be uploaded and ***original has to be submitted before last date & time of submission of bid***.
6) **Earnest Money Deposit (EMD)** as per Clause No. 2 under Section-VI has to be deposited in the form of Demand Draft (DD) in favour of 'REC Power Distribution Company Ltd.' payable at New Delhi (or) in the form of Bank Guarantee (Bid Bank Guarantee) from a scheduled bank as per format **Annexure-VI**. Scanned copy of DD or BG has to be uploaded and ***original of DD or BG has to be submitted before last date & time of submission of bid***. Exemption for payment of EMD amount will be given to Micro, Small & Medium Enterprises (MSMEs) as per conditions mentioned in SECTION-VI.
7) **Advance Bank Guarantee** has to be submitted issued by the Bidding Company, if bidder wants mobilization advance during commencement of work as per **Annexure-VII**.
8) **Performance Bank Guarantee** has to be submitted by bidder within 7 days from the award of work as per **Annexure-VIII.**
9) **Power of Attorney** has to be submitted issued by the Bidding Company in favour of the authorized person signing the Bid as per format of **Annexure-IX**. Scanned copy of Power of Attorney has to be uploaded and ***original has to be submitted before last date & time of submission of bid***.
10) **Undertaking towards not being black-**listed has to be submitted duly signed and stamped as per format of **Annexure-X**.
11) **Acceptance form for participation in reverse auction event** has to be submitted duly signed and stamped as per format of **Annexure-XI**.
12) **Integrity Pact** has to be submitted duly signed and stamped as per format of **Annexure-XII (two copies on Rs. 100/- non-judicial stamp paper)**. Scanned copies of integrity pact has to be uploaded and ***original has to be submitted before last date & time of submission of bid***.
13) Manufacturer's Authorization Form for all items covered under this NIT as per **Annexure-XIII**. Such Manufacturer's Authorization Form must be issued by Authorized Representative of OEM.
14) **PERT Chart** has to be submitted **through online** mode as per format of **Annexure-XIV** and ***original has to be submitted before last date & time of submission of bid***.
15) **Financial Bid** has to be submitted **through online** mode as per format of **Annexure-XV**.
16) All items/ materials being offered by the bidder under this NIT must have already been type tested. Bidder shall submit valid type test reports for the same design from CPRI/ERDA/NABL accredited laboratory not older than 5 (FIVE) years from the scheduled date of bid submission and shall be valid at the time of inspection and supply of materials. Bidder shall also furnish drawing of items/ materials submitted during type testing. **Those bidders who do not have valid type test reports all the items covered under this NIT, shall not be eligible for participation in this tender.**
17) **Complete set of this tender document** duly signed and stamped on each page has to be submitted as token of acceptance of its contents.

Note: All the documents which are to be submitted in original, shall be kept in an envelope with subject mentioning "Bid Documents for Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme" on the top of envelope and addressing to:

Addl. Chief Executive Officer,
REC Power Distribution Company Limited,
4th Floor, KRIBHCO Bhawan,
A10, Sector-1, Noida (U.P.)-201301

- In case sealed Financial Bid is submitted in hard copy, it will be returned to the bidder unopened at the time of opening of bids.

SECTION-IV

ELIGIBILITY CRITERIA

Bidder must meet the eligibility criteria independently as a bidding Company. Bidder will be declared as a technically qualified bidder based on meeting the eligibility criteria and as demonstrated based on documentary evidence submitted by the Bidder in the bid.

S. No.	Minimum Qualification Criteria	Documents Required
	General Eligibility Criteria	
1	Bidders should be a company incorporated under prevalent Indian Companies Act as amended from time to time at least for a period of last three years ending previous month of bidding month. Note: Joint Venture or Consortium Firms are not allowed.	Certificate of Incorporation issued under Indian Companies Act 1956 or 2013 from Registrar of Companies to be submitted.
2	Bidder should have valid GSTIN registration and PAN.	Copy of PAN and GSTIN registration should be submitted.
3	Bidder must be in relevant business similar to the scope of work under this NIT for minimum period of last 3 years ending previous month of bidding month.	Copy of relevant Work Order/any other documentary evidence in support of stipulated qualification requirement up to the satisfaction of RECPDCL.
4	Bidder should not be black-listed by any Central/State Govt. organization, PSU etc.	Bidder should submit an undertaking in this regard as per format of Annexure-X.
	Financial Eligibility Criteria	
5	Bidder's average annual turnover for last three financial years (FY 2017-18, 2016-17 & 2015-16) should be at least Rs. 87.29 Crores.	Audited annual accounts of last three FY 2017-18, 2016-17 & 2015-16 is to be submitted along with CA certificate as per Annexure-IV. In case, audited balance sheet of 2017-18 is not available, bidder shall submit provisional balance sheet duly certified by Chartered Accountant.
6	Net Worth for the each of the last three Financial Years should be positive. *Net worth means the sum total of the paid up capital and free reserves (excluding reserves created out of revaluation) reduced by aggregate value of accumulated loses (including debit balance in profit and loss account for current year) and intangible assets.*	Audited annual accounts for last three financial years i.e. FY 2017-18, 2016-17 & 2015-16.

7	Bidder shall have liquid assets (LA) and/ or evidence of access to or availability of fund based credit facilities of not less than Rs. 12.47 Crores and the Banker should confirm that the Credit facility is earmarked for the Work specified under Bid on receipt of the Bid. *Liquid assets would include cash (and equivalents), bank deposits, securities that can be freely traded and receivables which has general certainty of getting received.*	A certificate from banker (as per format of Annexure-V) 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, RECPDCL may make queries with the Bidders' bankers.
Technical Eligibility Criteria		
8	Bidder should have successfully supplied major items such as Distribution Transformers, Cables, Conductors to any Govt. Power Sector Utility in India in last 7 years from the originally scheduled bid submission date: Single Work Order of Rs. 99.76 Crores OR Two Work Orders of Rs. 62.35 Crores OR Three Work Orders of Rs. 49.88 Crores	Bidder should submit copy of Work order (mandatory) along with any other document from the list below: 1. Proof of receipt of complete payment towards work order. 2. Proof of release of performance bank guarantee against the said work order. 3. Work completion certificate from the client.

SECTION-V

DETAILED SCOPE OF WORK, TECHNICAL SPECIFICATIONS & CONDITIONS OF CONTRACT

A. Detailed scope of work for the bidder but not limited to following includes:

SCOPE

Design, engineering, manufacture, testing and supply of materials for sub-transmission & distribution network such as Distribution Transformers, ACSR Conductors, LT XLPE Cables, LTDB, Insulators, Lightning Arrestors etc. as per Scope of Work including transportation & insurance up to sub-divisional headquarters of APDA in the State of Arunachal Pradesh. Unloading of material on reaching the designated store shall be in the scope of respective APDA. All manpower, crane, truck etc. shall be arranged and paid by APDA. On successful delivery of material up to designated store, it shall be handed over to authorized representative of APDA.

ACSR CONDUCTOR

This section covers design, manufacture, testing before dispatch, packing, supply and delivery of ACSR Squirrel and Weasel Conductors.

1. STANDARDS

The Conductor shall also comply in all respects with IS: 398(Part-II)-1996 with latest amendments unless otherwise stipulated in this specification or any other International Standards which ensure equal or higher quality material.

The ACSR Conductor shall also conform to the following standards:

Sl.	Indian	Title	International
1	IS:209-1979	Specification for Zinc	BS-3436-1961
2	IS:398-1996	Specification for aluminum conductors for overhead transmission purposes	
	Part-II	Aluminum conductors	IEC-209-1966
		Galvanized steel reinforced	BS-215(Part-II)
3	IS:1521-1972	Method of Tensile Testing of Steel wire	ISO/R89-1959
4	IS:1778-1980	Reels and Drums for Bare conductors	BS-1559-1949
5	IS:1841-1978	E.C. Grade Aluminum rod produced by rolling	
6	IS:2629-1966	Recommended practice for Hot Dip Galvanizing of iron and steel	
7	IS:2633-1986	Method of testing uniformity of coating of zinc coated articles	
8	IS:4826-1968	Galvanized coatings on round steel wires	ASTM A472-729
9	IS:5484-1978	E.C. Grade Aluminium rod produced by continuous casting and rolling	

10	IS:6745-1972	Methods of determination of weight of zinc-coating of zinc coated iron and steel articles	BS-443-1969

Offers conforming to standards other than IS-398 shall be accompanied by the English version of relevant standards in support of the guaranteed technical particulars to be furnished as per format enclosed.

2. GENERAL TECHNICAL REQUIREMENTS

The General Technical Requirements are given in clause no. 31 of this section. The Conductor shall conform to these technical requirements.

The Bidder shall furnish guaranteed technical particulars of offered conductors in line with technical requirements as furnished in clause no. 31 of this section.

2.1. **MATERIALS/WORKMANSHIP**

2.1.1. The material offered shall be of best quality and workmanship. The steel cored Aluminium conductor strands shall consist of hard drawn Aluminium wire manufactured from not less than 99.5% pure electrolytic Aluminium rods of E.C. grade and copper content not exceeding 0.04%. They shall have the same properties and characteristics as prescribed in IEC: 889-1987. The steel wire shall be made from material produced either by the acid or basic open hearth process or by electric furnace process or basic oxygen process. Steel wire drawn from Bessemer process shall not be used.

2.1.2. The steel wires shall be evenly and uniformly coated with electrolytic high grade, 99.95% purity zinc complying with the latest issue of IS-209 for zinc. The uniformity of zinc coating and the weight of coating shall be in accordance clause no. 32 of this section and shall be tested and determined according to the latest IS-2633 or any other authoritative standard.

2.1.3. The steel strands shall be hot dip galvanized as per IS: 4826. The coating shall be smooth, continuous, and of uniform thickness, free from imperfections and shall withstand minimum three dips after stranding in standard Preece test. The steel strands shall be pre-formed and post-formed in order to prevent spreading of strands in the event of cutting of composite core wire. The properties and characteristics of finished strands and individual wires shall be as prescribed in IEC: 888-1987. If tested after stranding, reference shall also be made to cl. 4.1.1 and cl. 4.2.3 of IS: 4826.

3. CONDUCTOR PARAMETERS

The Parameters of individual strands and composite steel cored aluminum conductor, shall be in accordance with the values given in clause no. 31 of this section.

Creep in a conductor is attributed partly due to settlement of strands and partly due to non-elastic elongation of metal when subjected to load. The manufacturer of conductor shall furnish the amount of creep which will take place in 10, 20, 30, 40 and 50 years along with the supporting calculations. The calculations should be based on everyday temperature of 32 ºC and everyday tension of 25% of UTS of conductor of 11/33 KV Lines.

4. TOLERANCES

The tolerances on standard diameter of Aluminum and Steel wires shall be as detailed in specific technical requirements.

The cross-section of any wire shall not depart from circularity by more than an amount corresponding to the tolerance on the standard diameter.

The details of diameters, lay ratios of Aluminum and steel wires shall be in accordance with the clause no. 31 of this section.

5. SURFACE CONDITIONS

All aluminum and steel strands shall be smooth, and free from all imperfections, spills/and splits. The finished conductor shall be smooth, compact, uniform and free from all imperfections including spills and splits, die marks, scratches, abrasions, scuff marks, kinks (protrusion of wires), dents, pressmarks, cut marks, wire cross-over, over-riding looseness, pressure and/or unusual bangle noise on tapping, material inclusions, white rust, powder formation or black spots (on account of reaction with trapped rain water etc.), dirt, grit etc. The surface of conductor shall be free from points, sharp edges, abrasions or other departures from smoothness or uniformity of surface contour that would increase radio interference and corona losses. When subjected to tension up to 50% of the ultimate strength of the conductor, the surface shall not depart from the cylindrical form nor any part of the component parts or strands move relative to each other in such a way as to get out of place and disturb the longitudinal smoothness of the conductor.

6. JOINTS IN WIRES

6.1. **Aluminum wires**

During stranding, no aluminum wire welds shall be made for the purpose of achieving the required conductor length.

No joint shall be permitted in the individual aluminum wires in the outer most layer of the finished Conductor. However, joints in the 12 wire & 18 wire inner layer of the conductor are permitted but these joints shall be made by the cold pressure butt welding and shall be such that no two such joints shall be within 15 meters of each other in the complete stranded conductor.

6.2. **Steel wires**

There shall be no joints in finished steel wires forming the core of the steel reinforced aluminum conductor.

7. STRANDING

The wires used in construction of the stranded conductor, shall, before stranding, satisfy all requirements of IS-398 (Part-II) 1996.

In all constructions, the successive layers shall be stranded in opposite directions. The wires in each layer shall be evenly and closely stranded round the underlying wire or wires. The outer most layer of wires shall have a right hand lay. The lay ratio of the different layers shall be within the limits given under clause no. 31 of this section.

8. PACKING

8.1. The conductor shall be supplied in non-returnable strong wooden drums provided with lagging of adequate strength constructed to protect the conductor against any damage and displacement during transit, storage and subsequent handling and stringing operations in the field. The drums shall generally conform to IS: 1778-1980 and latest version except as otherwise specified hereinafter. The conductor drums shall be adequate to wind one or more standard length of 2500 meters of SQUIRREL/WEASEL ACSR conductor.

8.2. The drums shall be suitable for wheel mounting and for letting off the conductor under a minimum controlled tension of the order of 5KN. The conductor drums shall be provided with necessary clamping arrangements so as to be suitable for tension stringing of power conductor.

8.3. The bidders should submit their drawings of the conductor drums along with the bid. After placement of Letter of Intent, the Manufacturer shall submit four copies of fully dimensioned drawing of the drum for Employer's approval. After getting approval from the Employer, Manufacturer shall submit 30 more copies of the approved drawings for further distribution and field use.

8.4. 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 for anti-termite/ anti-fungus shall be applied to the entire drum with preservatives of a quality which is not harmful to the conductor.

8.5. All flanges shall be 2-ply construction with 64 mm thickness. Each ply shall be nailed and clenched together at approximately 90 degrees. Nails shall be driven from the inside face of the flange, punched and then clenched on the outer face. Flange boards shall not be less than the nominal thickness by more than 2 mm. There shall not be less than 2 nails per board in each circle.

8.6. 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.

8.7. Barrel studs shall be used for 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.

8.8. 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 countersunk. The ends of the barrel shall generally be flushed with the top of the nuts.

8.9. The inner cheek of the flanges and drum barrel surface shall be painted with bitumen based paint.

8.10. Before reeling, card board or double corrugated or thick bituminized waterproof bamboo paper or HDPE sheet shall be secured to the drum barrel and inside of flanges of the drum by means of a suitable commercial adhesive material. The paper should be dried before use. After reeling the conductor, the exposed surface of the outer layer of conductor shall be wrapped with thin polythene sheet across the flanges to preserve the conductor from dirt, grit and damage during transportation and handling and also to prevent ingress of rain water during storage/transport.

8.11. A minimum space of 75 mm shall be provided between the inner surface of the external protective lagging and outer layer of the conductor. Outside the protective lagging, there shall be minimum of two binders consisting of hoop iron/galvanised steel wire. Each protective lagging shall have two recesses to accommodate the binders.

8.12. 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 nail shall not protrude above the general surface and shall not have exposed sharp edges or allow the battens to be released due to corrosion.

8.13. The conductor ends shall be properly sealed and secured with the help of U-nails on one side of the flanges.

8.14. Only standard lengths of conductor shall be wound on each drum. The method of lagging to be employed shall be clearly stated in the tender.

8.15. As an alternative to wooden drum, Bidder may also supply the conductors in non-returnable painted steel drums. The painting shall conform to IS:9954-1981, reaffirmed in 1992. Wooden/ steel drum will be treated at par for evaluation purpose and accordingly the Bidder should quote the package.

9. LABELLING AND MARKING

The drum number shall be branded or gauged or stencilled into the flange. An arrow shall be marked on the sides of the drum, together with the words "Roll this way". Each drum shall have the following information provided on the outside of the flange stencilled with indelible ink.

i) Manufacturer's name and address.
ii) Contract/Specification number.
iii) Size and type of conductor.
iv) Net weight of the conductor.
v) Gross weight of the conductor and drum.
vi) Length of the conductor.
vii) Position of the conductor end.
viii) Drum and lot number.
ix) Name and address of the consignee.
x) Month and year of manufacture.
xi) The drum may also be marked with standard specification as per which the conductor is manufactured.
xii) Name of scheme “DDUGJY/SAUBHAGYA”

10. STANDARD LENGTHS

10.1. The standard length of the conductor shall be 2500 meters. A tolerance of plus or minus 5% on the standard length offered by the bidder shall be permitted. All lengths outside this limit of tolerance shall be treated as random lengths.

10.2. Random lengths will be accepted provided no length is less than 70% of the standard length and total quantity of such random length shall not be more than 10% of the total quantity order. 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 above six random lengths shall be dispatched in the same shipment. At any point, the cumulative quantity supplied including 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 length as specified.

10.3. Bidder shall also indicate the maximum single length, above the standard length, he can manufacture in the guaranteed technical particulars of offer. This is required for special stretches like river crossing etc. The Employer reserves the right to place orders for the above lengths on the same terms and conditions applicable for the standard lengths during the pendency of the Contract.

11. QUALITY ASSURANCE PLAN

A Quality Assurance Plan including customer hold points covering the manufacturing activities of the material shall be required to be submitted by the tenderer to the Employer along with the tender. The Quality Assurance Plan after the same is found acceptable, will be approved by the Employer.

The contractor shall follow the approved Quality Assurance Plan in true spirit. If desired by the Employer, he shall give access to all the documents and materials to satisfy the Employer that the Quality Assurance Plan is being properly followed.

12. TESTING

12.1. SELECTION OF TEST SAMPLES FOR TYPE TESTS

12.1.1. The samples shall be taken from a continuous length of conductor and subjected to all the tests specified in clause 14.

12.2. SELECTION OF TEST SAMPLES FOR ACCEPTANCE TESTS

12.2.1. Before dispatch from the works individual wire and finished steel cored aluminum conductor shall be subjected to the tests as specified in IS:398 or any other authoritative standard.

12.2.2. Sample for individual wires for test shall be taken before stranding from outer ends of not less than ten per cent of the spools in the case of aluminum wire and ten per cent of the wire coils in the case of steel wires. If samples are taken after stranding, they shall be obtained by cutting 1.2 meters from the outer ends of the finished conductor from not more than 10 per cent of the finished reels.

12.2.3. The routine tests shall be same as acceptance test. The manufacturer will draw samples for routine tests as per Cl. 13.1.1 or 13.1.2 of IS: 398 (Part 2) and will maintain the record of routine tests for buyer's review. For acceptance tests, the sample shall be taken as per Cl.13.1.2 of IS: 398 (Part 2).

13. TESTS

The following tests shall be carried out on sample/samples of conductor:

14.1 **Type Tests**

(i) Visual examination
(ii) Measurement of diameters of individual aluminum and steel wires.
(iii) Measurement of lay ratio of each layer
(iv) Breaking load test
(v) Ductility test
(vi) Wrapping test
(vii) Resistance test on aluminum wires.
(viii) DC resistance Test on aluminum wires.
(ix) Galvanizing test
(x) Surface condition test
(xi) Stress Strain test
(xii) Procedure qualification test on welded joint of Aluminum Strands.

NOTE: The type test reports shall not be older than 10 (TEN) years and shall be valid at the time of inspection and supply of materials.

14.2 **Acceptance tests and Routine tests**

(ii) Visual and dimensional check on drum.
(iii) Visual examination
(iv) Measurement of diameters of individual aluminum and steel wires.
(v) Measurement of lay ratio of each layer
(vi) Breaking load test
(vii) Ductility test
(viii) Wrapping test
(ix) Resistance test on aluminum wires.
(x) DC resistance Test on Composite Conductor.
(xi) Galvanizing test

14.3 **Tests During Manufacture**

The following tests during manufacture shall be carried out:

(i) Chemical analysis of zinc used for galvanizing,
(ii) Chemical analysis of aluminum used for making aluminum strands,
(iii) Chemical analysis of steel used for making steel strands,

14.4 **Visual examination**

The conductor shall be examined visually for good workmanship and general surface finish of the conductor. The conductor drums shall be rewound in the presence of Inspecting Officer. The Inspector will initially check for Scratches, Joints etc., and that the conductor shall generally conform to the requirements of the specifications/IS:398 (Part-II)-1996.

14.5 **Measurement of diameters of individual Aluminum and Steel Wires**

The diameters of individual Aluminum and Steel Wires shall be checked to ensure that they conform to the requirements of this specification.

14.6 **Measurement of lay-ratios**

The lay-ratios of each layer of the conductor shall be measured and checked to ensure that they conform to the requirements of this specification and IS:398 (Part-II)-1996.

14.7 **Breaking load test**

a) **Breaking load test on complete conductor**

Circles perpendicular to the axis of the conductor shall be marked at two places on a sample of conductor of minimum 5m 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 UTS 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 the value recorded.

b) **Breaking load test on individual aluminum and galvanized steel wires**

This test shall be conducted on both Aluminum and Galvanized steel wires. The breaking load of one specimen cut from each of the samples taken shall be determined by means of suitable tensile testing machine. The load shall be applied gradually and the rate of separation of the jaws of the testing machine shall be not less than 25 mm/min. and not greater than 100 mm. / min. The ultimate breaking load of the specimens shall be not less than the values specified in the clause no. 31 of this section.

14.8 **Ductility Test**

For the purpose of this test both torsion and elongation tests shall be carried out on galvanized steel wires only.

14.9 **Torsion Test**

One specimen cut from each of the samples taken shall be gripped in two vices exactly 15 cms. apart. One of the vices shall be made to revolve at a speed not exceeding one revolution per second and the other shall be capable of moving longitudinally to allow for contraction or expansion during testing. A small tensile load not exceeding 2 (two) percent of the breaking load of the wire shall be applied to the samples during testing. The test shall be continued until fracture occurs and the fracture shall show a smooth surface at right angles to the axis of the wire. After fracture, the specimen shall be free from helical splits. The sample shall withstand a number of twists equivalent to not less than 18 on length equal to 100 times the diameter. When twisted after stranding, the number of complete twists before fracture occurs shall be not less than 16 on a length equal to 100 times the diameter of the wire. 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 the next higher whole number. The fracture shall show a smooth surface at right angles to the axis of the wire.

14.10 **Elongation Test**

The elongation of one specimen cut from each of the samples taken shall be determined. The specimen shall be straightened by hand and an original gauge length of 200 mm. shall be marked on the wire. A tensile load shall be applied as described in Clause No. 16 & 17 below and the elongation shall be measured after the fractured ends have been fitted together. If the fracture occurs outside the gauge marks, or within 25 mm. of either mark and the required elongation is not obtained, the test shall be disregarded and another test conducted. When tested before stranding, the elongation shall be not less than 4 percent and when tested after stranding, the elongation shall be not less than 3.5 percent.

14.11 **Wrapping Test**

This test shall be conducted on both Aluminum and Galvanized steel wires.

14.11.1 **Aluminum wires**

One specimen cut from each of the samples of aluminum wires shall be wrapped round a wire of its own diameter to form a close helix of 8 turns. Six turns shall then be unwrapped and closely wrapped in the same direction as before. The wire shall not break or show any crack.

14.11.2 **Galvanized steel wires**

One specimen cut from each of the samples of galvanized steel wire taken shall be wrapped round a mandrel of diameter equal to 4 times the wire diameter to form a close helix of 8 turns. Six turns shall then be unwrapped and again closely wrapped in the same direction as before. The wire shall not break.

14.12 **Resistance Test**

This test shall be conducted on aluminum wires only, conforming to procedure as per IEC:889. The electrical resistance of one specimen of aluminum wire cut from each of the samples taken shall be measured at ambient temperature. The measured resistance shall be corrected to the value corresponding to 20 degrees C by means of following formula.

$R_{20} = R_T [1+ \text{alpha} \times (T-20)]$

Where

R_{20} = Resistance corrected at 20 degrees C.

R_T = Resistance measured at T degrees C.

alpha = Constant mass temperature coefficient of resistance; 0.004, T = Ambient temperature during measurement

This resistance calculated to 20 degrees C shall be not more than the maximum value specified in clause no. 32 of this section.

14.13 **Galvanizing Test**

This test shall be conducted on galvanized steel wires only. The uniformity of zinc coating and the weight of coating shall be in accordance with IS:4826 - 1979.

14.14 **Surface Condition Test**

A sample of the finished conductor for use in 11/33 KV system having a minimum length of 5 meters with compression type dead end clamps compressed on both ends in such manner as to permit the conductor to take its normal straight line shape, shall be subjected to a tension of 50 percent of the UTS of the conductor. The surface shall not depart from its cylindrical shape nor shall the strands move relative to each other so as to get out of place or disturb the longitudinal smoothness of conductor. The measured diameter at any place shall be not less than the sum of the minimum specified diameters of the individual aluminum and steel strands as indicated in clause no. 31 of this section.

14.15 **Stress-Strain Test**

The test is contemplated only to collect the creep data of the conductor from the manufacturer. A sample of conductor of minimum 10 meters' length shall be suitably compressed with dead end clamps. (applicable only for conductors of nominal Aluminium area 100 sq. mm and above)

15. TEST SET-UP

15.1. The test sample shall be supported in a trough over its full length and the trough adjusted so that the conductor will not be lifted by more than 10mm under tension. This shall be ascertained by actual measurement.

15.2. The distance between the clamp and the sleeve mouth shall be monitored with calipers during the test to ensure that, after the test, it does not change by more than 1mm + 0.1mm from the value before the test.

15.3. The conductor strain shall be evaluated from the measured displacements at the two ends of the gauge length of the sample. The gauge reference targets shall be attached to the clamps which lock the steel and aluminum wires together. Target plates may be used with dial gauges or displacement transducers and care shall be taken to position the plates perpendicular to the conductor. Twisting the conductor, lifting it and moving it from side-to-side by the maximum amounts expected during the test should introduce no more than 0.3mm error in the reading.

16. TEST LOADS FOR COMPLETE CONDUCTOR

The loading conditions for repeated stress-strain tests for complete conductor shall be as follows:

16.1. 1KN load shall be applied initially to straighten the conductor. The load shall be removed after straightening and then the strain gauges are to be set at zero tension.

16.2. For non-continuous stress-strain data, the strain readings at 1KN intervals at lower tensions and 5 KN intervals above 30% of UTS shall be recorded.

16.3. The sample shall be reloaded to 30% of UTS and held for 1 hour. Readings are to be noted after 5, 10, 15, 30, 45 and 60 minutes during the hold period. The load shall be released then after the hold period.

16.4. The sample shall be reloaded to 50% of UTS and held for 1 hour. Readings are to be noted after 5, 10, 15, 30, 45 and 60 minutes during the hold period. The load shall be released then after the hold period.

16.5. Reloading up to 70% of UTS shall be done and held for 1 hour. Readings are to be noted after 5, 10, 15, 30, 45 and 60 minutes. The load shall be released.

16.6. Reloading up to 85% of UTS shall be done and held for 1 hour. Readings are to be noted after 5, 10,15, 30, 45 and 60 minutes and the load shall be released then.

16.7. Tension shall be applied again and shall be increased uniformly until the actual breaking strength is reached. Simultaneous readings of tension and elongation shall be recorded up to 90% of UTS at the intervals described under Clause 16.

17. TEST LOADS FOR STEEL CORE ONLY (applicable only for conductors of nominal aluminum area 100 sq. mm and above)

The loading conditions for repeated stress-strain tests for the steel core of ACSR shall be as follows:

17.1. The test shall consist of successive applications of load applied in a manner similar to that for the complete conductor at 30%, 50%, 70% and 85% of UTS.

17.2. The steel core shall be loaded until the elongation at the beginning of each hold period corresponds to that obtained on the complete conductor at 30%, 50%, 70% and 85% of UTS respectively.

18. STRESS-STRAIN CURVES

The design stress-strain curve shall be obtained by drawing a smooth curve through the 0.5 and 1 hour points at 30%, 50% and 70% of UTS loadings. The presence of any aluminum slack that can be related to any observed extrusion entering the span from the compression dead ends shall be removed from the lower ends of the design curves. Both the laboratory and standard stress-strain curves shall be submitted to the Employer along with test results. The stress-strain data obtained during the test shall be corrected to the standard temperature i.e. 20 deg. C.

19. DC RESISTANCE TEST ON COMPOSITE CONDUCTOR

On a conductor sample of minimum 5m length, two contact clamps shall be fixed with a pre-determined bolt torque. The resistance of the sample shall be measured by a Kelvin double bridge by placing the clamps initially zero meter and subsequently one meter 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 deg. C as per clause no. 12.8 of IS:398 (Part-II)-1982/ 1996. The corrected resistance value at 20 deg. C shall conform to the requirements of this specification.

20. PROCEDURE QUALIFICATION TEST ON WELDED ALUMINUM STRANDS

Two Aluminum wires 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 guaranteed breaking strength of individual strands.

21. CHEMICAL ANALYSIS OF ALUMINUM AND STEEL

Samples taken from the Aluminum and Steel ingots / coils/ strands shall be chemically/ spectrographically analyzed. The same shall be in conformity with the requirements stated in this specification.

22. CHEMICAL ANALYSIS OF ZINC

Samples taken from the zinc ingots shall be chemically / spectrographically analyzed. The same shall be in conformity with the requirements stated in this specification.

23. 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.

24. REJECTION AND RETEST

24.1. In case of failure in any type test, the Manufacturer is either required to manufacture fresh sample lot and repeat all the tests 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.

24.2. If samples are taken for test after stranding and if any selected reel fails in the retest, the manufacturer may test each and every reel and submit them for further inspection. All rejected material shall be suitably marked and segregated.

25. CHECKING AND VERIFICATION OF LENGTH OF CONDUCTOR

The contractor should arrange for inspection by the representative of the Employer specially authorized for this purpose. At least 50% of the total number of drums of conductor subject to minimum of two taken at random should be checked to ascertain the length of conductor. Arrangements should be made available in the works of the manufacturer for transferring the conductor from one reel to another at the same time measuring the length of the conductor so transferred by means of a meter.

26. ADDITIONAL TESTS

The Employer reserves the right of having at his own expenses any other test(s) of reasonable nature carried out at Bidder's premises, at site, or in any other standard Laboratory in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the materials comply with the specifications.

27. TESTING EXPENSES

27.1. Bidder shall indicate the laboratories in which they propose to conduct the type test. 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.

27.2. 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 the conductor, except for the expenses of the inspector/Employer's representative.

27.3. 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 Manufacturer'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.

28. TEST REPORTS

28.1. Copies of type test reports shall be furnished in at least three 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.

28.2. Record of Routine test reports shall be maintained by the Manufacturer at his works for periodic inspection by the Employer's representative.

28.3. Test certificates of Tests during manufacture shall be maintained by the Manufacturer. These shall be produced for verification as and when desired by the Employer.

29. TEST FACILITIES

The following additional test facilities shall be available at the Manufacturer's works:

(i) Calibration of various testing and measuring equipment including tensile testing machine, resistance measurement facilities, burette, thermometer, barometer etc.

(ii) Standard resistance for calibration of resistance bridges.

(iii) 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 be free of vibrations, jerks etc. with traverse laying facilities.

30. INSPECTION

30.1. 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 the representative shall have full facilities for unrestricted inspection of the Bidder's works, raw materials and process of manufacture and conducting necessary tests as detailed herein.

30.2. The Bidder 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.

30.3. The bidder will intimate the Employer about carrying out of the tests at least 7 days in advance of the scheduled date of tests during which the Employer will arrange to depute his representative(s) to be present at the time of carrying out of the tests. Three (3) copies of the test reports shall be submitted.

30.4. 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 later case also, the conductor shall be dispatched only after satisfactory testing for all tests specified herein has been completed and approved by the employer.

30.5. The acceptance of any quantity of material shall in no way relieve the Bidder of any of his responsibilities for meeting all requirements of the specification, and shall not prevent subsequent rejection if such material is later found to be defective.

30.6. At least 50% of the total number of drums subject to minimum of two in any lot put up for inspection, shall be selected at random to ascertain the length of conductor by the following method:

"At the works of the manufacturer of the conductor, the conductor shall be transferred from one drum to another at the same time measuring its length with the help of a graduated pulley and Cyclometer. The difference in the average length thus obtained and as declared by the Bidder in the packing list shall be applied to all the drums if the conductor is found short during checking".

31. GENERAL TECHNICAL REQUIREMENTS

This section of the specification covers technical particulars, schedule of requirements & desired deliveries, for conductor of 11/33 kV lines. All isoceraunic and ambient conditions are as prevailing in North-eastern states of India.

(i) TECHNICAL REQUIREMENTS

CONDUCTOR: 1. Conductor: Rabbit/Raccoon/Weasel/Squirrel ACSR 2. IS applicable: IS-398 (part-II) 1996 latest revision		
3. Wire Diameter	**Weasel**	**Squirrel**
Aluminium (mm)	6/2.59	6/2.11
Steel(mm)	1/2.59	1/2.11
4. Number of strands:		
Steel centre	1	1
1st Aluminium layer	6	6
5. Sectional Area of Aluminium (sq. mm.)	31.61	20.98
6. Total Sectional Area (sq.mm.)	36.88	24.5
7. Overall diameter(mm)	7.77	6.33
8. Approximate weight (Kg./Km.)	128	85

9. Calculated D.C. resistance of conductor at 20 degrees C., maximum (Ohms/Km)	0.9289	1.394
10. Ultimate tensile strength (KN)	11.12	7.61
11. Final modulas of elasticity (GN/sq.m)	79	79
12. Coefficient of linear expansion x 10^6 per deg. C	19.1	19.1
13. Lay ratio	Max Min	Max Min
Aluminium 1st layer	14 10	14 10

Particulars	Weasel		Squirrel	
	Al	Steel	Al	Steel
1. Diameter (mm)				
Standard	2.59	2.59	2.59	2.59
Maximum	2.62	2.64	2.62	2.64
Minimum	2.56	2.54	2.56	2.54
2. Cross sectional area of nominal diameter wire (sq. mm)	5.269	5.269	5.269	5.269
3. Approximate weight (Kg./Km.)	14.24	41.09	14.24	41.09
4. Minimum breaking load (KN)				
Before stranding	0.89	6.92	0.89	6.92
After stranding	0.85	6.57	0.85	6.57
5. Calculated D.C. resistance of each Al strand at 20 degrees C., maximum (Ohms/Km)	5.490		5.490	

- Zinc coating of steel core:
  (i) The steel strands shall be hot dip galvanized as per IS: 4826
  (ii) Process of Galvanizing: Hot dip
  (iii) Quality of Zinc: IS: 209/1979 or latest edition.

- Joints in strands
  (i) Steel: Not permitted
  (ii) **Aluminium:** No joint shall be permitted in the Aluminum wires in the outer most layer of the ACSR conductor but permitted in the inner layers such that no two such joints are within 15 meters of each other in the complete stranded conductor.

- Chemical composition of high carbon steel wire:

Element	%Composition
i) Carbon	0.5 to 0.85
ii) Manganese	0.5 to 1.10
iii) Phosphorus	Not more than 0.035
iv) Sulphur	Not more than 0.045
v) Silicon	0.10 to 0.35

SINGLE CORE LT XLPE Insulated Cable (up to 1100V)

This specification covers the design, manufacture inspection and testing of the finished ISI marked LT (1100 volts), stranded, compact aluminum conductor with XLPE insulated, PVC inner sheathed, galvanized steel strip armored and overall PVC sheathed Black colour cable conforming to IS:7098 /88 with latest amendments and as per specification detailed.

1. **RATED VOLTAGE:**

(i) The rated voltage of the cable shall be 1100 Volts AC with the highest system voltage of 1100 Volts between phases of the effectively earthed three-phase transmission system.
(ii) The cables shall be capable of operating continuously under the system frequency variation of ± 3 Hz, voltage variation of ± 10% and a combine d frequency – voltage variation of ± 10%.

2. **APPLICABLE STANDARDS:**

Unless otherwise stipulated in the specifications, the latest version of the following Standards shall be applicable:

- IS 7098 (Part 2)-Cross-linked Polyethylene insulation for Cables.
- IS 8130-Conductors for insulated electrical cables and flexible cords.
- IS 10810(series)-Methods of tests for cables.
- IS 10418-Drums for electric cables.
- IS 3975-Specification for mild steel wires, strips and tapes for armouring of cables.
- IS 5831-Specification for PVC insulation sheath for electric cables.
- IS 10462-Fictitious calculation method for determination of dimensions of protective coverings of cables Part 1 - Elastomeric and thermoplastic insulated cables.

The cables manufactured to any other International Standards like BSS, IEC or equivalent standards not less stringent than Indian Standards are also acceptable. In such cases the Manufacturer shall enclose a copy of the equivalent international standard, in English language.

3. **CONSTRUCTION:**

(i) **Conductor:** The cable conductor shall be made from stranded aluminum to form compact sector shaped conductor having resistance within the limits specified in IS:8130/1984 and any amendment thereof. The wires shall be laid up together with a suitable right hand lay. Stranded Class 2 – as per the IS:8 130 / IEC 60228/ BS 6360 standards.

(ii) **Insulation:** The insulation shall be cross linked polyethylene applied by extrusion and shall be

steam (wet) cured as pre IS:7098(1)1988 and curing in hot water tank/bath is not accepted:

S. No.	Properties	Requirements
1.	Tensile Strength	12.5N/mm², Min.
2.	Elongation to break	200 percent, Min
3.	Aging in air oven: a) Treatment: Temperature: Duration: b) Tensile Strength variation: c) Elongation variation:	 135±3°C 7 days ±25 percent, Max ±25 percent, Max
4.	Hot set: a) Treatment: Temperature: Time under load Mechanical stress b) Elongation under load c) Permanent elongation (set) after cooling	 200±3°C 15 min 20N/cm² 175 percent, Max 15 percent, Max
5.	Shrinkage: a) Treatment: Temperature Duration b) Shrinkage	 130±3°C 1 hour 4 percent, Max
6.	Water absorption (Gravimetric): a) Treatment: Temperature: Duration b) Water absorbed	 85±2°C 14 days 1 mg/cm², Max
7.	Volume Resistivity a) at 27°C b) at 70°C	 1x1014 ohm-cm, Min 1x1013 ohm-cm, Min
8	Thermal Resistivity	350 degrees C cm/W
9	Power factor at maximum conductor temperature	0.008
10	Dielectric strength	22 kV/mm

- The XLPE insulation should be suitable for specified 1.1 KV system voltage.
- The manufacturing process shall ensure that insulations shall be free from voids.
- The insulation shall withstand mechanical and thermal stresses under steady state and transient operating conditions.
- The insulation of the cable shall be high stranded quality, specified in IS:7098 (Part-II/1985). Withstand continuous conductor temperature of 90°C, which means higher continuous rated current carrying capacity.
- The cables can operate even at conductor temperature of 130 deg C continuously and 250°C during a Short Circuit condition

(iii) **SHEATH:** The sheath shall be suitable to withstand the site conditions and the desired temperature. It should be of adequate thickness, consistent quality and free from all defects. The PVC sheath shall be extruded as per IS:7098 (Part – I/1988). IEC:60502 Part– I, BS:6622, LSOH to BS:7835.

(iv) **ARMOUR:** Armoring shall be applied over the inner sheath with single galvanized steel complying with the requirements of IS:3975/1979. The dimensions of the galvanized strip shall be as specified in table 4 of the IS:7098/Part-I/1988. The armour wire shall be applied as closely as practicable. The direction of the lay of the armour shall be left hand. The joints in armour wire shall be made by brazing or welding and the surface irregularities shall be removed. A joint in any wire shall be at least 300mm from the nearest joint in any other armour wire in the complete cable and shall be as per IS:7098 Part 1, IS: 3975.

(iv) **OUTER SHEATH:** Extruded PVC ST2, outer sheath as per IS:5831/1984, IS:7098 Part 1, IEC:60502 Part – 1, BS:6622, LSOH to BS:78 35. shall be applied over armoring with suitable additives to prevent attack by rodents and termites. Outer sheathing shall be designed to offer high degree of mechanical protection and shall also be heat, oils, chemicals, abrasion and weather resistant. Common acids, alkalis, saline solutions etc., shall not have adverse effects on the PVC sheathing material used.

(v) The cables should be suitable for use in solidly earthed system.

(vi) The power cables shall be manufactured to the highest quality, best workmanship with scientific material management and quality control. The Manufacturer shall furnish the quality plan, giving in detail the quality control procedure / management system.

(vii) The cable shall be suitable for laying in covered trenches and/or buried underground to meet the outdoor application purposes.

(viii) The parameters of the LT power cables to be supplied shall be as specified below:

Nom. cross sectional area (Sq.mm)	Nom. Thickness of XLPE Insulation mm main core	Armoured			Max.DC	AC current rating	
		Nom. Thickness Steel Armour size (mm)	Approx. Overall dia. (mm)	Approx. Weight (kg/km)	Conductor Resistance at 20oC (ohm/km)	In air (amps)	In Ground (amps)
16	1.0	1.4	13.0	220	1.91	76	73
35	1.2	1.4	15.1	297	.868	116	112
50	1.3	1.4	16.4	358	.641	139	149
70	1.4	1.4	18.2	448	.443	171	190

(ix) The short circuit current of the LT cable to be as specified below

Sq.mm of LT Cable	Short Circuit Current(KA)
16	1.50
35	3.29
50	4.70
70	6.58

4. SYSTEM DETAILS:

General Technical particulars

Nominal system voltage (rms) (U)	0.44KV
Highest system voltage (rms) (Um)	1.1 KV

Number of Phase	3
Frequency	50Hz
Variation in Frequency	+/- 3%
Type of Earthing	Solidly Earthed
Total relay & circuit breaker Operating time	15 – 20 cycles

5. CLIMATIC CONDITIONS:

The cables to be supplied against this specification shall be suitable for satisfactory continuous operation under the climatic conditions of North-eastern states (including Sikkim).

6. DESIGN CRITERIA:

(i) The cables that are covered in these specifications are intended for use outdoor, under the climatic conditions and installation conditions described in the technical specification.
(ii) For continuous operation of the cables, at specified rating, the maximum conductor temperature shall be limited to the permissible value as per the relevant standard, generally not exceeding 90°C under normal operation and 250°C under short – circuit conditions.
(iii) The cables in service will be subject to daily load cycles, of two peaks during a day; morning peak and evening peak, with around 25% to 50% loading during the nights.
(iv) The materials used for outer sheaths shall be resistant to oils, acids and alkalis.
(v) The cables shall have the mechanical strength required, during handling and laying.
(vi) The cables shall be designed to withstand the thermo-mechanical forces and electrical stresses during normal operation and transient conditions.
(vii) The cables shall be designed to have a minimum useful life span of Thirty-five years.
(viii) The detailed design drawings shall be submitted along with Purchase order.

7. MANUFACTURE PROCESS:

Cross-linking of the insulation materials (pre compounded polyethylene) shall be conforming to IS: 7098 (Part – II) and the proof of purchase of the above insulating material shall be submitted and is to be offered for stage inspection.

8. MATERIALS:

(i) Conductor: -The conductor shall be of stranded construction. The material for conductor shall consist of the plain aluminum of H2 or H4 grade as per clause – 3 of IS 8130/ 1984.
(ii) The minimum number of wires shall be 53 for circular compacted 400 sq. mm aluminum conductor as per table – 2 of IS 8130/ 1984.

9. INNER SHEATH (COMMON COVERING):

(i) The laid up cores shall be provided with inner sheath applied either by extrusion. It shall be ensured that the shape is as circular as possible. The inner sheath shall be so applied that it fits closely on the laid up cores and it shall be possible to remove it without damage to the insulation.
(ii) The thickness of the inner sheath (common covering) shall be given as follows:

CALCULATED DIAMETER IN MM OVER LAID UP CORES [REF IS 10462 (PART 1)]		THICKNESS OF INNER SHEATH (Min) mm
Over	Up to and including	
_	25	0.3
25	35	0.4
35	45	0.5
45	55	0.6
55	_	0.7

(iii) When one or more layers of binder tapes are applied over the laid up cores, the thickness of such tapes shall not be construed as a part of inner sheath.

10. ARMOURING:

(i) Armouring shall be single strip steel wire applied over the inner sheath as closely as practicable. The direction of the lay of the armour shall be left hand.
(ii) The armour shall consist of galvanized strip steel The dimensions of the galvanized steel wires shall be 4 X 0.8 mm (Nominal)
(iii) The joints in the armour strip shall be made by brazing or welding and the surface irregularities shall be removed. A joint in the wire shall be at least 300-mm from the nearest joint in any other wire in the complete cable.
(iv) Manufacturers shall furnish the calculation/data sheet for the short circuit carrying capability of the Armour.

11. OUTER SHEATH:

(i) The outer sheath shall be applied by extrusion. It shall be applied over the armouring shall consist of poly-vinyl chloride (PVC) compound, conforming to the requirements of type ST-2 of IS 5831. Suitable additives shall be added to give anti termite protection.

(ii) The minimum thickness of the PVC outer sheath shall be as per IS:10462 and as detailed.

Calculated diameter under the outer sheath [IS 10462 Part 1] – mm		Nominal thickness of the outer sheath (ts) - mm
Over	Up to and including	
_	15	1.24
15	25	1.40
25	35	1.56
35	40	1.72
40	45	1.88
45	50	2.04
50	55	2.20
55	60	2.36
60	65	2.52
65	70	2.68
70	75	2.84
75	_	3.0

12. IDENTIFICATION:

The outer sheath shall have the following information embossed or indented on it; ISI marking,

the manufacturer's name or trade mark, the voltage grade, the year of manufacture and the letters "DDUGJY, Name of Employer" The identification shall repeat every 300/350mm along the length of the cable. Outer sheath of cable shall be black in permanent colour.

13. INSPECTION AND QUALITY CONTROL:

The Manufacturer shall furnish a complete and detailed quality plan for the manufacturing process of the cable. All raw materials shall conform to relevant applicable standards and tested for compliance to quality and requirement. During the manufacturing process, at all stages, inspections shall be made to check the physical and dimensional parameters, for verification to compliance to the standards. The Manufacturer shall arrange, for inspection by the purchaser, during manufacture with 7 days' advance notice for verifying the various stage inspections as specified in the quality assurance plan enclosed to verify the quality control process of the Manufacturer.

14. TYPE TESTS:

Type test certificates from Accredited NABL Testing Laboratories for 1.1 kV XLPE, shall be submitted along with bid. The Type Tests should have been conducted not later than 5 years from originally scheduled bid submission date.

(i) Bidder who does not possess a valid type test report for the same design at the time of bidding are not eligible for bidding

(ii) Stage wise Inspection: The Manufacturer shall offer the stage wise inspection as detailed in the in the quality assurance plan

(iii) All acceptance tests shall be conducted in the presence of the Employer's representative.

(iv) The supplier shall give 7 days' advance notice for inspections, and witnessing of tests by the Employer representative.

(v) The following type tests shall be conducted on the cable.

S. No.	Test	Requirement	Test method Ref Part no of IS: 10810
a)	Tests on conductor i) Tensile test ii) Wrapping test iii) Resistance test	 IS:8130 IS:8130 IS:8130	 2 3 4
b)	Tests for armoured wires and strips	Clause 15.2 & IS:3975	36 to 42
c)	Test for thickness of insulation and Sheath	Clause 4.3, 14.2 & 16.2	6
d)	Physical tests for insulation: i) Tensile strength and elongation at Break ii) Aging in air oven iii) Hot test iv) Shrinkage test v) Water absorption (gravimetric)	Clause 4.2	 7 11 30 12 33
e)	Physical tests for outer sheath i) Tensile strength and elongation at Break	IS: 5831	 7

	ii) Aging in air oven iii) Shrinkage test iv) Hot deformation		11 12 15
f)	High voltage test	Clause 22.7	45
g)	Flammability test	Clause 22.8	53

15. ACCEPTANCE TEST:

(i) The sampling plan for acceptance test shall be as per IS 7098 part -II, Appendix 'A'.

(ii) The following shall constitute the acceptance test.

a. Tensile test for aluminum.
b. Wrapping test for aluminum.
c. Conductor resistance test.
d. Test for thickness of insulation.
e. Test for thickness of inner and outer sheath.
f. Hot-set test for insulation.
g. Tensile strength and elongation at break test for insulation and outer sheath.
h. High voltage test.
i. Insulation resistance (volume resistivity) test.

16. ROUTINE TEST:

The following shall constitute routine tests:

- Conductor resistance test.
- High voltage test.

17. DETAILS OF TESTS:

(i) Unless otherwise mentioned in this specification, the tests shall be carried out in accordance with appropriate part of IS: 10810.

(ii) High Voltage Test at room temperature: The cables shall withstand a voltage of 3KV AC (rms) at a frequency of 40 to 60 Hz or an AC voltage of 7.2kV, between conductors and between conductors and ECC (if any) for a period of 5 minutes each test connection.

(iii) Flammability test: Period of burning after removal of the flame shall not exceed 60 seconds and the unaffected (uncharred) portion from the lower edge of the top clamp shall be at least 50-mm. Employer reserves the right to select a random sample of 1.1 kV UG cable from the Manufacturer's end which are ready to dispatch and also ongoing cable laying works and the same samples will be sent to any testing laboratory as desired by Employer. If the testing results are found to be not satisfactory Employer reserves the right to reject the entire batch of cable received and insists for replacement of material free of cost. The decision of Employer in this regard is final.

18. PACKING:

The cables, as per specified delivery lengths, shall be securely wound /packed in non-returnable wooden drums, capable of withstanding rough handling during transport by Rail, Road, etc. The packing should withstand storage conditions in open yards. The cable drums shall conform to IS 10418-1982 or equivalent standard. The dimensional drawings of wooden drums shall be furnished with the Purchase order. The drum shall be provided with circumferential lagging of strong wooden planks. The end of the cable shall be sealed with good quality heat shrink sealing caps. The sufficiently required additional sealing caps shall be supplied for use of testing during

laying and jointing at site and to seal spare lengths of cable. The packing should be able to withstand the rigorous of transport. The following information in bold letters in English shall be painted on the flanges.

a. Name & Address of the manufacturer, Trade name/Trade mark/Brand
b. ISI Marking
c. Size of cable (Cross section) rated voltage, standard, insulation, cable code, drum No., and year of manufacture.
d. Length of cables (Meters)
e. Direction of rolling
f. Net weight (in Kg)
g. Gross weight (in Kg)
h. Owners purchase order reference.

19. SEALING OF CABLE ENDS ON DRUMS:

(i) The cable ends shall be sealed properly so that ingress of moisture is completely prevented. The individual core endings shall be sealed effectively with water resistant compound applied over the core and provided with a heat shrinkable or push-on or Tapex or cold shrinkable type cap of sufficient length with adequate cushion space so that the conductor does not puncture the cap in case of movement of the core during unwinding or laying. Before sealing, the semi conducting layer on the cores may be removed for about 2 mm at each end, to facilitate checking the insulation resistance from one end, without removing the sealing cap at the other end.

(ii) The three cores should have an overall heat shrinkable or push-on or Tapex or cold shrinkable type cap with adequate end clearance, and sufficient cushioning to prevent puncturing of the overall sealing cap due to stretching of the cores. The sealing cap shall have sufficient mechanical strength and shall prevent ingress of moisture into the cable. The ends of single core cables shall also be sealed on the same lines to prevent entry of moisture.

20. CABLE LENGTHS:

The cables shall be supplied in continuous lengths of 500 m or more with 5% tolerance and cable shall on the wooden drums only.

21. QUANTITY TOLERANCE:

A +3% tolerance shall be allowed on the ordered quantity including 300-m cable as spare.

22. MARKING:

The packed cable drum shall carry the following information, clearly painted or stenciled.

a. The letters 'DDUGJY/ SAUBHAGYA, Name of Employer'
b. Reference to Standard and ISI mark.
c. Manufacturer's Name or trade mark.
d. Type of cable & voltage grade.
e. Number of cores.
f. Nominal cross- sectional area of conductor.
g. Cable code.
h. Length of cable on the drum.
i. Direction of rotation.
j. Gross weight.
k. Country of Manufacture.

l. Year of Manufacture.
m. Purchase order and date.
n. Address of consignee.

23. DRAWING & LITERATURE:

The following shall be furnished along with the tender:

a. Cross sectional drawings of the cables, giving dimensional details.
b. An illustrated literature on the cable, giving technical information, on current ratings, cable constants, short circuit ratings, de rating factors for different types of installation, packing date, weights and other relevant information.

24. GUARANTEE: The cable manufactured shall be guaranteed for the period of 18 months from the date of receipt at stores or 12 months from the date of installation whichever is earlier.

25. The Manufacturer shall furnish a copy of valid BIS licence for ISI marking without which the cable shall not be accepted.

SINGLE PHASE OIL IMMERSED DISTRIBUTION TRANSFORMERS (OUTDOOR TYPE)

1. This specification covers design, engineering, manufacture, assembly, stage testing, inspection and testing before supply and delivery at site of oil immersed naturally cooled 5 KVA, 10 KVA & 16 KVA 11kV/240V single phase distribution transformer for outdoor use.

2. The equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance there with. The offered equipment shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

3. The transformer and accessories shall be designed to facilitate operation, inspection, maintenance and repairs. The design shall incorporate every precaution and provision for the safety of equipment as well as staff engaged in the operation and maintenance of equipment.

4. All outdoor apparatus, including bushing insulators with their mountings, shall be designed so as to avoid any accumulation of water.

5. STANDARDS

(i) The materials shall conform in all respects to the relevant Indian Standard, with latest amendments thereof unless otherwise specified herein; some of them are listed below.

(ii) Material conforming to other internationally accepted standards, which ensure equal or better quality than the standards mentioned above would also be acceptable. In case the bidder who wishes to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out along with guaranteed technical particulars to be furnished as per format enclosed. A copy of such standards with authentic English translations shall be furnished along with the offer.

Indian Standards	Title	International Standards

IS-2026	Specification for Power Transformers	IEC76
IS1180 (Part-I): 2014	Outdoor Type Oil Immersed Distribution Transformers up to and including 2500kVA, 33kV-Specification	
IS-12444	Specification for Copper wire rod	ASTMB-49
IS-335	Specification for Transformer/Mineral Oil	IEC Pub296
IS-5	Specification for colors for ready mixed paints	
IS-104	Ready mixed paint, brushing zinc chromate, priming	
IS-2099	Specification for high voltage porcelain bushing	
IS-649	Testing for steel sheets and strips and magnetic circuits	
IS-3024	Cold rolled grain oriented electrical sheet sand strips	
IS-4257	Dimensions for clamping arrangements for bushings	
IS-7421	Specification for Low Voltage bushings	
IS-3347	Specification for Outdoor Bushings	DIN42531 to 33
IS-5484	Specification for Al Wire rods	ASTMB- 233
IS-9335	Specification for Insulating Kraft Paper	IEC554
IS-1576	Specification for Insulating Press Board	IEC641
IS-6600	Guide for loading of Oil Immersed Transformers	IEC76
IS-2362	Determination of water content in oil for porcelain Bushing of transformer	
IS-6162	Paper covered Aluminum conductor	
IS-6160	Rectangular Electrical conductor for electrical machines	
IS-5561	Electrical power connector	
IS-6103	Testing of specific resistance of electrical Insulating liquids	
IS-6262	Method of test for power factor and dielectric constant of electrical insulating liquids	
IS-6792	Determination of electrical strength of insulating oil	
IS-10028	Installation and maintenance of transformers.	

The distribution transformers to be supplied against this specification shall be suitable for satisfactory continuous operation under the following climatic conditions as per IS 2026 (Part-I).

1	Location	At various locations in the country
2	Maximum ambient air temperature (°C)	50
3	Minimum ambient air temperature (°C)	-5
4	Maximum average ambient air temperature (°C)	40
5	Maximum yearly weighted average ambient air temperature (°C)	32
6	Maximum altitude above altitude of 5000 meters above	For North-Eastern States in India

mean sea level(meters) (including Sikkim)

- The climatic conditions specified above are indicative and can be changed by the user as per requirements.
- The equipment shall generally be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth unless otherwise specified.

6. PRINCIPAL PARAMETERS:

(i) The Transformer shall be suitable for outdoor installation with single phase, 50Hz, 11kV system in which the neutral is effectively earthed and they should be suitable for service under fluctuations in supply voltage up to +12.5% to -12.5%.

(ii) The transformer shall conform to the following specific parameters. Rated HV side value (11kV) shall be specified in the detailed bill of quantity by purchaser.

S. No.	ITEM	SPECIFICATION
1.	System voltage(max)	12kV
2.	Rated HV voltage Rated LV voltage	11 kV 240 V*
3.	Frequency	50 Hz+/-5%
4.	No. of Phases	Single
5.	Type of cooling	ONAN

INSULATION LEVELS

Voltage(Volts)	Impulse Voltage (kV Peak)	Power Frequency(kV)
433	-	3
11000	75	28

7. TECHNICAL REQUIREMENTS:

(i) **CORE MATERIAL:**

A. Transformer core shall be wound core type construction using new and high quality cold rolled grain oriented (CRGO)steel with heat resistant insulating coating or Amorphous metal.

B. The bidder shall procure CRGO Steel for Core only from vendors having a valid BIS certificate.

C. The transformer shall be suitable for over fluxing (due to combined effect of voltage and frequency) up to 12.5% without injurious heating. The operating flux density shall be such that there is a clear safe margin over the over fluxing limit of 12.5%.

D. No-load current shall not exceed 3% of full load current and will be measured by energizing the transformer at rated voltage and frequency. Increase of 12.5% of rated voltage shall not increase the no-load current by 6% of full load current.

(ii) **WINDINGS MATERIALS:**

A. HV and LV windings shall be wound from Aluminum conductors covered with double paper/enamel for transformers up to 16KVA and with double paper for transformers above 16KVA. The interlayer insulation shall be of nomex/epoxy resin dotted kraft paper. It may be noted that 16KVA (3Phase) transformer shall be copper wound only.
B. Proper bonding of inter layer insulation with the conductor shall be ensured. Test for bonding strength to be conducted.
C. The core coil assembly shall be dried in an oven. The type of winding shall be indicated in the tender. Whether LV windings are of conventional type or foil wound shall be indicated.
D. Dimensions of winding coils are very critical. Dimensional tolerances for winding coils shall be within limits.
E. The core coil assembly shall be securely held in position to avoid any movement under short circuit conditions.
F. Joints in the winding shall be avoided. However, if jointing is necessary the joints shall be properly brazed and the resistance of the joints shall be less than that of parent conductor. In case of foil windings, welding of leads to foil can be done within the winding.

(iii) **WINDING CONNECTION AND TERMINAL ARRANGEMENTS:** For 11kV transformers both ends of primary winding shall be brought out through HV bushings. The secondary winding shall be connected to two LV bushings.

(iv) **OIL:**

A. The insulating oil shall comply with the requirements of IS:335. Use of recycled oil is not acceptable. The specific resistance of the oil shall not be less than $2.5x10^{12}$ ohm-cm at 27^0C when tested as per IS:6103.
B. Oil shall be filtered and tested for break down voltage(BDV) and moisture content before filling.
C. The design and all materials and processes used in the manufacture of the transformer, shall be such as to reduce to a minimum the risk of the development of acidity in the oil.

(v) **LOSSES:**

A. The bidder shall guarantee individually the no-load loss and load loss without any positive tolerance. The bidder shall also guarantee the total losses (no load+ load losses at 75^0C) at the 50% of rated load and total losses at 100% of rated shall not exceed the maximum total loss values given in Table-9 of IS:1180 (Part-1):2014.
B. The maximum allowable losses at rated voltage and rated frequency permitted at 75^0C shall be as per Table-9 equivalent to Energy Efficiency Level-2 specified in IS:1180 (Part-1):2014 for single phase distribution transformers.
C. The above losses are maximum allowable and there would not be any positive tolerance. Bids with higher losses than the above specified values would be treated as non-responsive. However, the manufacturer can offer losses less than above stated values.

(vi) **PERCENTAGE IMPEDANCE:** The percentage impedance of single-phase transformers at 75^0C for different ratings up to 25kVA shall be as per Table 9 of IS:1180(Part-1):2014.

(vii) **TEMPERATURE RISE:**

A. The permissible temperature rise shall be as per IS: 1180
B. Bids not conforming to the above limits of temperature rise will be treated as non-responsive.

(viii) **PENALTY FOR NON PERFORMANCE:**

A. During testing at supplier's works if it is found that the actual measured losses are more than the values quoted by the bidder, the purchaser shall reject the transformer and he shall also have the right to reject the complete lot.
B. Purchaser shall reject the entire lot during the test at supplier's works, if the temperature rise exceeds the specified values.
C. Purchaser shall reject any transformer during the test at supplier's works, if the impedance values differ from the guaranteed values including tolerance and if they do not meet the requirements of clause (vi) above.

(ix) **BUSHINGS:**

A. The bushings shall be either porcelain or epoxy type and shall conform to the relevant standards specified. Polymer insulator bushings conforming with relevant IEC can also be used.
B. For HV, 12 kV class bushings shall be used and for LV, 1 kV class bushings shall be used.
C. The terminal arrangement shall not require a separate oil chamber not connected to oil in the main tank.
D. For transformers up to 25kVA (without conservator), HV bushings & LV bushing shall be fixed on sides and in the same plane.
E. For transformers above 25KVA (with conservator), HV bushings shall be fixed to the top cover of the transformer and the LV bushings shall be fixed to transformer on sides and in the same plane.
F. The bushing rods and nuts shall be of brass.
G. Arcing horns will be provided on HV bushings shall not have arcing horns and 1 clamp for LA shall also be provided for each HT bushing. Supply of LA is not included in DT supplier's scope.
H. Bushings shall be marked with manufacturer's name, month and year of manufacture.

(x) **BUSHING TERMINALS**: HV terminal shall be designed to directly receive ACSR conductor up to 7/2.59 mm (without requiring the use of lug) and the LV terminals shall be suitable for directly receiving LT cables (aluminum) ranging from 10sq.mm to 25sq.mm both in vertical and horizontal position and the arrangements should be such as to avoid bimetallic corrosion. Terminal connectors must be type tested as per IS:5561.

(xi) **TANK:**

A. The oil volume inside the tank shall be such that even under the extreme operating conditions, the pressure generated inside the tank does not exceed 0.4kg/sq.cm positive or negative. There must be sufficient space from the core to the top cover to take care of oil expansion.
B. The tank cover shall have plasticized surface at the top to guard against bird faults. Alternately, suitable insulating shrouds shall be provided on the bushing terminals.
C. The Transformer tank shall be of robust construction round/rectangular in shape and shall be built up of tested CRCA/Mild Steel Sheet.
D. The tank shall be capable of withstanding a pressure of 1kg/cm^2(g) and a vacuum of 760mm of Hg

for 30 minutes without any permanent deflection (Air pressure test shall be conducted as per IS-1180 (Part-I):2014.

E. The L-seam joint, C-seam joint and all fittings and accessories shall be oil tight and no deflection / bulging should occur during service.
F. Manufacturer should carry out the all the welding operations as per the relevant ASME standards and submit a copy of the welding procedure and welder performance qualification certificates to the Purchaser.
G. The circular bottom plate edges of the tank should be folded upward, for at least 25mm, to have sufficient overlap with vertical side wall of the transformer.
H. The Transformer tank and the top cover shall be designed in such a manner as to leave no external pockets in which water can lodge.
I. Tank shall have permanent lugs for lifting the transformer body and there shall be facilities for lifting the core coil assembly separately.
J. The transformer shall be provided with two mounting lugs suitable for fixing the transformer to a single pole by means of 2 bolts of 20 mm diameter as per ANSI C 57.12.20-1988.
K. Both mounting lugs are made with steel of minimum 5 mm thickness.
L. Jump proof lips shall be provided for upper mounting lug.
M. Mounting lug faces shall be in one plane.
N. Minimum Oil level mark shall be embossed inside the tank (at25 ^{0}C).
O. The top cover shall be fixed to the tank through clamping only.
P. HV bushing pocket shall be embossed to top side of the top cover so as to eliminate ingress of moisture and water.
Q. The edges of the top cover shall be formed, so as to cover the top end of the tank and gasket.
R. Nitrile/polyurethane/neoprene rubber gaskets conforming to latest IS:4253 part-II shall be provided between tank and top cover.
S. The gaskets shall be continuous i.e. without any joint.

(xii) **TANK SEALING:** The space on the top of the oil shall be filled with dry air or nitrogen. The nitrogen plus oil volume inside the tank shall be such that even under extreme operating conditions, the pressure generated inside the tank does not exceed 0.4kg/sq.cm positive or negative. The nitrogen shall conform to commercial grade of the relevant standards.

8. SURFACE PREPARATION AND PAINTING:

(i) **GENERAL:**

A. All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.
B. All primers shall be well marked into the surface, particularly in areas where painting is evident, and the first priming coat shall be applied as soon as possible after cleaning. The paint shall be applied by air less spray according to manufacturer's recommendations.

(ii) **CLEANING AND SURFACE PREPARATION:**

A. After all machining, forming and welding has been completed, all steel work surfaces shall be thoroughly cleaned of rust, scale, welding slag or spatter and other contamination prior to any painting. Steel surfaces shall be prepared by Shot blast cleaning(IS:9954) to grade Sa.2.5 of IS:8501-1 or chemical cleaning including phosphating (IS:3618).
B. The pressure and volume of the compressed air supply for blast cleaning shall meet the work requirements and shall be sufficiently free from all water contamination to ensure that the cleaning process is not impaired.
C. Chipping, scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill-scale and shall only be used where shot blast cleaning is impractical.

Manufacturer shall indicate such location, for purchaser's information, in his offer.

(iii) **PROTECTIVE COATING:** As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anti-corrosion protection.

(iv) **PAINT MATERIAL:** Following are the types of paint that may be suitably used for the items to be painted at shop and supply of matching paint to site:

A. The painting shall be as per specifications given below in this section.
B. For external surfaces one coat of Thermo Setting paint or 1coat of epoxy primer followed by 2 coats of polyurethene base paint. These paints can be either air-drying or stoving.
C. In case of highly polluted area, chemical atmosphere or at a place very near the sea coast, paint as above with one intermediate coat of high build MIO (Micaceous iron oxide)as an intermediate coat may be used to give a total dry film thickness of 150 to 180 microns.

(v) **PAINTING PROCEDURE:**

A. All prepared steel surfaces should be primed before visible re-rusting occurs or within 4 hours, whichever is sooner. Chemical treated steel surfaces shall be primed as soon as the surface is dry and while the surface is still warm.
B. Where the quality of film is impaired by excess film thickness (wrinkling, mud cracking or general softness) the supplier shall remove the unsatisfactory paint coating and apply another. In all instances where two or more coats of the same paint are specified, such coatings may or may not be of contrasting colours.

(vi) **DAMAGED PAINT WORK:**

A. Any damage occurring to any part of a painting scheme shall be made good to the same standard of corrosion protection and appearance as that was originally employed.
B. Any damaged paint work shall be made good as follows:
   - The damaged area, together with an area extending 25mm around its boundary, shall be cleaned down to bare metal.
   - A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50mm around the perimeter of the original damage.
   - The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the painted surface before and after priming.

(vii) **DRY FILM THICKNESS:**

A. To the maximum extent practicable the coats shall be applied as a continuous film of uniform thickness and free of pores. Overspray, skips, runs, sags and drips should be avoided. The different coats may or may not be of the same colour.
B. Each coat of paint shall be allowed to harden before the next is applied as per manufacturer's recommendation.
C. Particular attention must be paid to full film thickness at edges.

(viii) **TESTS:**

A. The painted surface shall be tested for paint thickness.
B. The painted surface shall pass the cross hatch adhesion test and impact test as routine test, Salts

pray and Hardness test as type test as per the relevant ASTM standards.

C. The paint shade shall be as per specifications given below in this section.

Note: Supplier shall guarantee the painting performance requirement for a period of not less than 5 years.

9. RATING AND TERMINAL PLATES:

(i) Each transformer shall be provided with rating plate made of anodized aluminum/stainless steel material securely fixed on the outer body, easily accessible, showing the information given in Fig.2 of IS:1180 (Part-1):2014 for single phase transformers. The entries on the rating plates shall be indelibly marked by engraving.

(ii) Each transformer shall be provided with a terminal marking plate in accordance with Fig.5 of IS:1180(Part-1):2014. The rating and terminal marking plates may be combined into one plate at the option of manufacturer.

(iii) The distribution transformer be marked with the Standard Mark and the use of Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and regulations made there under. As per Quality Control Order for Electrical Transformers- 2015, issued by Dept. of Heavy Industries, the Standard / ISI marking on Distribution Transformers is mandatory and the product should be manufactured in compliance with IS 1180 Part-1:(2014).

10. PRESSURE AND VACCUM REQUIREMENTS: For single phase transformers up to 25kVA, the transformer tank shall be of robust construction, round in shape shall be capable of withstanding a pressure of 100kPa and a vacuum of 760mm of mercury.

11. FITTINGS: The following standard fittings shall be provided:

- Two earthing terminals with earthing symbol.
- Lifting lugs for the complete transformer as well as for core and winding assembly.
- Rating and terminal marking plates. (Non-detachable type)
- Pressure relief device or self-ventilating cover
- HV bushings
- LV bushings
- HV and LV terminal connectors
- Top cover fixing clamps
- Mounting lugs -2Nos.
- Bird guard.
- LV earthing arrangement.
- Any other fitting required as per IS: 1180 (Part 1)

12. FASTENERS:

(i) All bolts, studs, screw threads, pipe threads, bolt heads and nuts shall comply with the appropriate Indian Standards for metric threads, or the technical equivalent.

(ii) Bolts or studs shall not be less than 6mm in diameter except when used for small wiring terminals.

(iii) All nuts and pins shall be adequately locked.

(iv) Wherever possible bolts shall be fitted in such a manner that in the event of failure of locking resulting in the nuts working loose and falling off, the bolt will remain in position.

(v) All bolts/nuts/washers exposed to atmosphere should be as follows:

a) Size 12 mm or below – Stainless steel

b) Above 12 mm- steel with suitable finish like electro galvanized with passivation or hot dip galvanized.

(vi) Each bolt or stud shall project at least one thread but not more than three threads through the nut, except when otherwise approved for terminal board studs or relay stems. If bolts and nuts are placed so that they are inaccessible by means of ordinary spanners, special spanners shall be provided.

(vii) The length of the screwed portion of the bolts shall be such that no screw thread may form part of a shear plane between members.

(viii) Taper washers shall be provided where necessary. Protective washers of suitable material shall be provided front and back or the securing screws.

13. OVER LOAD CAPACITY: The transformer shall be suitable for loading as per latest IS:6600.

14. TESTS:

(i) All the equipment offered shall be fully type tested in a CPRI/NABL accredited laboratory by the bidder as per the relevant standards for all tests as mentioned in clause 16 below. The type test must have been conducted on a transformer of same design during the last five years at the time of bidding and at the time of conducting acceptance test by employer or its representatives. The bidder shall furnish four sets of type test reports along with the offer.

(ii) Bidder who does not possess a valid type test report for the same design at the time of bidding are not eligible for bidding.

(iii) Special tests other than type and routine tests, as agreed between purchaser and bidder shall also be carried out as per the relevant standards.

(iv) The test certificates for all routine and type tests for the transformers and also for the bushings and transformer oil shall be submitted with the bid. However, if the same are not available at the time of bidding, the same may be submitted after order but before commencement of supply.

(v) The procedure for testing shall be in accordance with IS:1180(Part-1): 2014/2026as the case may be except for temperature rise.

(vi) Before dispatch each of the completely assembled transformer shall be subjected to the routine tests at the manufacturer's works.

15. ROUTINE TESTS:

- Ratio, polarity tests.
- No load current and losses at service voltage and normal frequency.
- Load losses at rated current and normal frequency.
- Impedance Voltage test.
- Resistance of windings cold (at or near the test bed temperature).
- Insulation resistance.
- Induced over voltage withstand test.
- Separate source voltage withstand test.
- Oil sample test (one sample per lot) to comply with IS:1866.
- Air pressure test on empty tank as per IS:1180

16. TESTS TO BE CONDUCTED ON ONE UNIT: In addition to the tests mentioned above following tests shall be conducted:

- Temperature rise test for determining the maximum temperature rise after continuous full load run. The ambient temperature and time of test should be stated in the test certificate.

- Impulse voltage withstand test: As per IS 2026 part-III. Basic insulation level (BIL) for 11 kV shall be 75 kV peak.
- Air pressure test as perIS1180 (Part-I):2014.
- Short circuit withstand test: Thermal and dynamic ability.
- Oil samples (Post short circuit and temperature rise test) - Only DGA & BDV test shall be conducted.
- Permissible flux density and over fluxing withstand test.
- Type test certificates for the tests carried out on transformer of same specifications shall be submitted along with the technical bid.
- **Short Circuit Test and Impulse Voltage Withstand Test**:
  A. The purchaser intends to procure transformers designed and successfully tested for short circuit and impulse test. In case the transformers proposed for supply against the order are not exactly as per the tested design, the supplier shall be required to carry out the short circuit test and impulse voltage withstand test at their own cost in the presence of the representative of the purchaser.
  B. The supply shall be accepted only after such test is done successfully, as it confirms on successful withstand of short circuit and healthiness of the active parts thereafter on un-tanking after a short circuit test.
  C. Apart from dynamic ability test, the transformers shall also be required to withstand thermal ability test or thermal withstand ability will have to be established by way of calculations.
  D. It may also be noted that the purchaser reserved the right to conduct short circuit test and impulse voltage test in accordance with the IS, afresh on each ordered rating at purchaser's cost, even if the transformers of the same rating and similar design are already tested. This test shall be carried out on a transformer to be selected by the purchaser either at their works when they are offered in a lot for supply or randomly from the supplies already made to purchaser's Stores. The findings and conclusions of these tests shall be binding on the supplier.

17. ACCEPTANCE TESTS:

(i) The transformers shall be subjected to the following routine/acceptance test in the presence of purchaser's representative at the place of manufacture before dispatch without any extra charges. The testing shall be carried out in accordance with IS:1180, Part-1(2014) and IS:2026. Checking of mass, dimensions, fitting and accessories, tank sheet thickness, oil quality, material, finish and workman ship as per QA plan and contract drawings.
(ii) Physical verification of core coil assembly and measurement of flux density of one unit of each rating, in every inspection with reference to short circuit test report.
(iii) All tests as specified in clause 16 above.
Note:- At the time of routine/acceptance test, manufacturer should have a valid type test report for the same design from CPRI/ERDA/NABL accredited laboratory.

18. TESTS AT SITE: The purchaser reserves the right to conduct all tests on transformer after arrival at site and the manufacturer shall guarantee test certificate figures under actual service conditions.

19. INSPECTION:

(i) The bidder will intimate the Employer about carrying out of the tests at least 7 days in advance of the scheduled date of tests during which the Employer will arrange to depute his representative(s) to be present at the time of carrying out of the tests. Three (3) copies of the

test reports shall be submitted.

(ii) In respect of raw material such as core stampings, winding conductors, insulating paper and oil, supplier shall use materials manufactured/supplied by standard manufacturers and furnish the manufacturer's test certificate as well as the proof of purchase from the manufacturer's (excise gate pass) for information of the purchaser. The bidder shall furnish following documents along with their offer in respect to the raw materials:

- Invoice of supplier.
- Mill's certificate.
- Packing List.
- Bill of landing.
- Bill of entry certificate by custom.

(iii) To ensure about the quality of transformers, the inspection shall be carried out by the purchaser's representative at following stages:

- Online anytime during receipt of raw material and manufacture/assembly whenever the purchaser desires.
- When the raw material is received and the assembly is in process in the shop floor.
- At finished stage i.e. transformers are fully assembled and are ready for dispatch.

(iv) After the main raw-materials i.e. core and coil materials and tanks are arranged and transformers are taken for production on shop floor and a few assembly have been completed, the firm shall intimate the purchaser in this regard, so that an officer for carrying out such inspection could be deputed, as far as possible within seven days from the date of intimation. During the stage inspection a few assembled core shall be dismantled (only in case of CRGO material) to ensure that the CRGO laminations used are of good quality. Further, as and when the transformers are ready for dispatch, an offer intimating about the readiness of transformers, for final inspection for carrying out tests as per relevant IS and as in clauses above, shall be sent by the firm along with routine test certificates. The inspection shall normally be arranged by the purchaser at the earliest after receipt of offer for pre-delivery inspection.

(v) In case of any defect/defective workmanship observed at any stage by the purchaser's inspecting officer; the same shall be pointed out to the firm in writing for taking remedial measures. Further processing should only be done after clearance from the Inspecting officer/purchaser.

(vi) All tests and inspection shall be carried out at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall offer the inspector representing the purchaser all reasonable facilities, without charges, to satisfy him that the material is being supplied in accordance with this specification. This will include stage inspection during manufacturing stage as well as active part inspection during acceptance tests.

(vii) The manufacturer shall provide all services to establish and maintain quality of workmanship in his works and that of his sub-contractors to ensure the mechanical/electrical performance of components, compliance with drawings, identification and acceptability of all materials, parts and equipment as per latest quality standards of ISO:9000.

(viii) Along with the bid the manufacturer shall prepare Quality Assurance Plan (QAP) identifying the various stages of manufacture, quality checks performed at each stage and the customer hold points. The document shall also furnish details of method of checking, inspection and acceptance

standards/values and get the approval of purchaser or his representative before proceeding with manufacturing. However, purchaser or his representative shall have the right to review the inspection reports, quality checks and results of manufacturer's in house inspection department which are not customer hold points and the manufacturer shall comply with the remarks made by purchaser or his representative on such reviews with regards to further testing, rectification or rejection etc. Manufacturer should submit the list of equipment for testing along with latest calibration certificates to the purchaser.

(ix) Purchaser shall have every right to appoint a third party inspection to carry out the inspection process. The purchaser has the right to have the test carried out at his own cost by an independent agency wherever there is a dispute regarding the quality of supply. Purchaser has right to test 1% of the supply selected either from the stores or field to check the quality of the product. In case of any deviation purchaser has every right to reject the entire lot or penalize the manufacturer, which may lead to blacklisting among other things.

20. QUALITY ASSURANCE PLAN:

(i) The bidder shall invariably furnish following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.
(ii) Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials in presence of bidder's representative and copies of test certificates.
(iii) Information and copies of test certificates as above in respect of bought out accessories.
(iv) List of manufacturing facilities available.
(v) Level of automation achieved and list of areas where manual processing exists.
(vi) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
(vii) List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports shall be furnished with the bid. Manufacturer shall possess 0.1 accuracy class instruments for measurement of losses.
(viii) Quality assurance plan with hold points for purchaser's inspection.
(ix) The successful bidder shall within 30 days of placement of order, submit following information to the purchaser.
(x) List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with offer.
(xi) Type test certificates of the raw materials and bought out accessories.
(xii) The successful bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing.
(xiii) ISI marking on the transformer is mandatory. As per Quality Control Order for Electrical Transformers- 2015, issued by Dept. of Heavy Industries, the Standard / ISI marking on Distribution Transformers is mandatory and the product should be manufactured in compliance with IS:1180 Part-1:(2014).

21. DOCUMENTATION:

(i) Completely dimensioned drawings indicating general arrangement and details of fittings, clearances and winding details shall accompany the tender.
(ii) Drawings of internal constructional details and fixing details of coils should also be indicated. Tank dimensions, position of fittings, clearances between leads within the transformer, core grade of laminations, distance of core centers, area of conductor bare and with insulation. No. of coils, No.

of turns per coil material of bushing metal parts etc., shall also be furnished with tender.

22. PACKING & FORWARDING:

(i) The packing shall be done as per the manufacturer's standard practice. However, he should ensure the packing is such that, the material should not get damaged during transit by rail/road.
(ii) The marking on each package shall be as per the relevant IS.

23. GUARANTEE:

(i) The manufacturers of the transformer shall provide a guarantee of 60 months from the date of receipt of transformer at the stores of the DISCOM/ Power Department. In case the transformer fails within the guarantee period, the supplier will depute his representative within 15 days from date of intimation by DISCOM/ Power Department for joint inspection. In case, the failure is due to the reasons attributed to supplier, the transformer will be replaced/ repaired by the supplier within 2 months from date of joint inspection.
(ii) The outage period i.e. period from the date of failure till unit is repaired/replaced shall not be counted for arriving at the guarantee period.
(iii) In the event of the supplier's inability to adhere to the afore said provisions, suitable penal action will be taken against the supplier, which may interalia include blacklisting of the firm for future business with the purchaser for a certain period.

THREE PHASE OIL IMMERSED DISTRIBUTION TRANSFORMERS (OUTDOOR TYPE)

1. This specification covers design, engineering, manufacture, assembly, stage testing, inspection and testing before supply and delivery at site of oil immersed naturally cooled 16, 25, 63, 100KVA & 200 KVA 11kV/433V three phase distribution transformer for outdoor use.
2. The equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance there with. The offered equipment shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.
3. The transformer and accessories shall be designed to facilitate operation, inspection, maintenance and repairs. The design shall incorporate every precaution and provision for the safety of equipment as well as staff engaged in the operation and maintenance of equipment.
4. All outdoor apparatus, including bushing insulators with their mountings, shall be designed so as to avoid any accumulation of water.

5. STANDARDS

(i) The materials shall conform in all respects to the relevant Indian Standard, with latest amendments thereof unless otherwise specified herein; some of them are listed below.
(ii) Material conforming to other internationally accepted standards, which ensure equal or better quality than the standards mentioned above would also be acceptable. In case the bidder who wishes to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out along with guaranteed technical particulars to be furnished as per format enclosed. A copy of such

standards with authentic English translations shall be furnished along with the offer.

Indian Standards	Title	International Standards
IS-2026	Specification for Power Transformers.	IEC 76
IS1180 (Part-I):2014	Outdoor Type Oil Immersed Distribution Transformers Up to and including 2500kVA, 33kV-Specification.	
IS-12444	Specification for Copper wire rod	ASTM B-49
IS-335	Specification for Transformer/Mineral Oil.	IEC Pub296
IS-5	Specification for colors for ready mixed paints.	
IS-104	Ready mixed paint, brushing zinc chromate, priming.	
IS-2099	Specification for high voltage porcelain bushing.	
IS-649	Testing for steel sheets and strips and magnetic circuits.	
IS-3024	Cold rolled grain oriented electrical sheets and strips.	
IS -4257	Dimensions for clamping arrangements for bushings.	
IS -7421	Specification for Low Voltage bushings.	
IS -3347	Specification for Outdoor Bushings.	DIN 42531 to 33
IS -5484	Specification for Al Wire rods.	ASTM B- 233
IS -9335	Specification for Insulating Kraft Paper.	IEC554
IS -1576	Specification for Insulating Press Board	IEC641
IS -6600	Guide for loading of oil Immersed Transformers	IEC 76
IS -2362	Determination of water content in oil for porcelain bushing of transformer.	IS -2362
IS -6162	Paper covered Aluminium conductor.	IS -6162
IS -6160	Rectangular Electrical conductor for electrical machines	IS -6160
IS -5561	Electrical power connector.	IS -5561
IS -6103	Testing of specific resistance of electrical insulating Liquids.	IS -6103
IS -6262	Method of test for power factor and dielectric constant of Electrical insulating liquids.	IS -6262
IS -6792	Determination of electrical strength of insulating oil.	IS -6792
IS -10028	Installation and maintenance of transformers.	IS -10028
IS -2362	Determination of water content in oil for porcelain bushing of transformer.	IS -2362

The distribution transformers to be supplied against this specification shall be suitable for

satisfactory continuous operation under the following climatic conditions as per IS 2026 (Part-I).

1	Location	At various locations in the country
2	Maximum ambient air temperature (°C)	50
3	Minimum ambient air temperature (°C)	-5
4	Maximum average ambient air temperature (°C)	40
5	Maximum yearly weighted average ambient air temperature (°C)	32
6	Maximum altitude above altitude of 5000 meters above mean sea level(meters)	For Arunachal Pradesh

- The climatic conditions specified above are indicative and can be changed by the user as per requirements.
- The equipment shall generally be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth unless otherwise specified.

6. PRINCIPAL PARAMETERS:

(i) The Transformer shall be suitable for outdoor installation with single phase, 50Hz, 11kV system in which the neutral is effectively earthed and they should be suitable for service under fluctuations in supply voltage up to +12.5% to -12.5%.

(ii) The transformer shall conform to the following specific parameters. Rated HV side value (11kV) shall be specified in the detailed bill of quantity by purchaser.

S. No.	ITEM	SPECIFICATION
1.	System voltage(max)	12kV
2.	Rated HV voltage Rated LV voltage	11 kV 433V-250V*
3.	Frequency	50 Hz+/-5%
4.	No. of Phases	Three
5.	Connection HV	Delta
6.	Connection LV	Star (Neutral brought out)
7.	Vector Group	Dyn-11
8.	Type of cooling	ONAN

Audible sound levels (decibels) at rated voltage and frequency for liquid immersed distribution transformers shall be as below (NEMA Standards):

kVA rating	Audible sound levels(decibels)
0-50	48
51-100	51
101-300	55

INSULATION LEVELS

Voltage(Volts)	Impulse Voltage (kV Peak)	Power Frequency(kV)
433	-	3
11000	75	28

7. TECHNICAL REQUIREMENTS:

(i) **CORE MATERIAL:**

A. The core shall be stack/wound type of high grade Cold Rolled Grain Oriented or Amorphous Core annealed steel lamination having low loss and good grain properties, coated with hot oil proof insulation, bolted together and to the frames firmly to prevent vibration or noise. The core shall be stress relieved by annealing under inert atmosphere if required. The complete design of core must ensure permanency of the core loss with continuous working of the transformers. The value of the maximum flux density allowed in the design and grade of lamination used shall be clearly stated in the offer.

B. The bidder should offer the core for inspection and approval by the purchaser during manufacturing stage. CRGO steel for core shall be purchased from vendors having valid BIS certificate.

C. The transformers core shall be suitable for over fluxing (due to combined effect of voltage and frequency) up to 12.5% without injurious heating at full load conditions and shall not get saturated. The bidder shall furnish necessary design data in support of this situation.

D. No-load current up to 200kVA shall not exceed 3% of full load current and will be measured by energizing the transformer at rated voltage and frequency. Increase of 12.5% of rated voltage shall not increase the no-load current by 6%of full load current.

or

No-load current above 200kVA and up to 2500kVA shall not exceed 2% of full load current and will be measured by energizing the transformer at rated voltage and frequency. Increase of 12.5% of rated voltage shall not increase the no-load current by 5%of full load current.

(ii) **WINDINGS MATERIALS:**

A. HV and LV windings shall be wound from Super Enamel covered /Double Paper covered Aluminum/Electrolytic Copper conductor. Transformers of 25KVA & above shall be covered with double paper only.

B. LV winding shall be such that neutral formation will be at top.

C. The winding construction of single HV coil wound over LV coil is preferable.
D. Inter layer insulation shall be Nomex/Epoxy dotted Kraft Paper.
E. Proper bonding of interlayer insulation with the conductor shall be ensured. Test for bonding strength shall be conducted.
F. Dimensions of winding coils are very critical. Dimensional tolerances for winding coils shall be within limits as specified in Guaranteed Technical Particulars.
G. The core/coil assembly shall be securely held in position to avoid any movement under short circuit conditions.
H. Joints in the winding shall be avoided. However, if jointing is necessary the joints shall be properly brazed and the resistance of the joints shall be less than that of parent conductor. In case of foil windings, welding of leads to foil can be done within the winding.

(iii) **TAPPING RANGES AND METHODS:**

A. No tapping shall be provided for distribution transformers up to 100 kVA rating.
B. The tapping shall be as per provisions of IS: 1180 Part-I (2014).
C. Tap changing shall be carried out by means of an externally operated self-positions witch and when the transformer is in de-energised condition. Switch position No.1 shall correspond to the maximum plus tapping. Each tap change shall result in variation of 2.5% in voltage. Arrangement for pad locking shall be provided. Suitable aluminum anodized plate shall be fixed for tap changing switch to know the position number of tap.

(iv) **OIL:**

D. The insulating oil shall comply with the requirements of IS:335. Use of recycled oil is not acceptable. The specific resistance of the oil shall not be less than $2.5x10^{12}$ ohm-cm at 27^0C when tested as per IS:6103.
E. Oil shall be filtered and tested for break down voltage(BDV) and moisture content before filling.
F. The design and all materials and processes used in the manufacture of the transformer, shall be such as to reduce to a minimum the risk of the development of acidity in the oil.

(v) **LOSSES:**

A. For the transformer of HV voltage up to 11kV, the total losses (no-load + load losses at 75°C) at 50% of rated load and total losses at 100% of rated load shall not exceed the maximum total loss values given in Table-3 up to 200kVA & Table-6 for ratings above 200kVA of IS1180(Part-1):2014.
B. The maximum allowable losses at rated voltage and rated frequency permitted at 75°C for 11/0.433kV transformers shall be as per Table-3 up to 200kVA and Table-6 for ratings above 200kVA as per Energy Efficiency Level-2 specified in IS-1180(Part-1):2014 for all kVA ratings of distribution transformers.
C. The above losses are maximum allowable and there would not be any positive tolerance. Bids with higher losses than the above specified values would be treated as non- responsive. However, the manufacturer can offer losses less than above stated values.

(vi) **PERCENTAGE IMPEDANCE:** The percentage impedance of transformers at75°C for different ratings up to 200kVA shall be as per Table-3 of IS1180(Part-1):2014.

(vii) **TEMPERATURE RISE:**

A. The permissible temperature rise shall be as per IS: 1180 (Part-I):2014.

B. The transformer shall be capable of giving continuous rated output without exceeding the specified temperature rise. Bidder shall submit the calculation sheet in this regard.

(viii) **PENALTY FOR NON PERFORMANCE:**

A. During testing at supplier's works if it is found that the actual measured losses are more than the values quoted by the bidder, the purchaser shall reject the transformer and he shall also have the right to reject the complete lot.
B. Purchaser shall reject the entire lot during the test at supplier's works, if the temperature rise exceeds the specified values.
C. Purchaser shall reject any transformer during the test at supplier's works, if the impedance values differ from the guaranteed values including tolerance and if they do not meet the requirements of clause (vi) above.

(ix) **INSULATION MATERIAL:**

A. Electrical grade insulation epoxy dotted Kraft Paper/Nomex and pressboard of standard make or any other superior material subject to approval of the purchaser shall be used.
B. All spacers, axial wedges/runners used in windings shall be made of pre-compressed Pressboard-solid, conforming to type B3.1 of IEC641-3-2. In case of cross-over coil winding of HV all spacers shall be properly sheared and dovetail punched to ensure proper locking. All axial wedges/runners shall be properly milled to dovetail shape so that they pass through the designed spacers freely. Insulations hearing, cutting, milling and punching operations shall be carried out in such a way, that there should not be any burr and dimensional variations.

(x) **BUSHINGS:**

A. The bushings arrangement shall be decided by RECPDCL during detailed engineering.
B. For transformers below 500KVA, for 33kV - 33kV class bushings, for 11kV - 12 kV class bushings and for 0.433 kV - 1 kV class bushings shall be used.
C. Bushing can be of porcelain/epoxy material. Polymer insulator bushings conforming to relevant IEC can also be used.
D. Dimensions of the bushings of the voltage class shall conform to the Standards specified and dimension of clamping arrangement shall be as per IS-4257.
E. Minimum external phase to phase and phase to earth clearances of bushing terminals shall be as follows:

Voltage	**Clearance**	
	Phase to phase	**Phase to earth**
33 kV	350mm	320mm
11 kV	255mm	140mm
LV	75mm	40mm

F. For DTs of 200 KVA and above, the clearances of cable box shall be as below:

Voltage	**Clearance**

	Phase to phase	Phase to earth
33 kV	350mm	220mm
11 kV	130mm	80mm
LV	25mm	20mm

G. Arcing horns shall be provided on HV bushings

H. Brazing of all interconnections, jumpers from winding to bushing shall have cross section larger than the winding conductor. All the Brazes shall be qualified as per ASME, section–IX.

I. The bushings shall be of reputed make supplied by those manufacturers who are having manufacturing and testing facilities for insulators.

J. The terminal arrangement shall not require a separate oil chamber not connected to oil in the main tank.

(xi) **BUSHING TERMINALS**: The LV and HV bushing stems shall be provided with suitable terminal connectors as per IS-5082 so as to connect the jumper without disturbing the bushing stem. Connectors shall be with eye bolts so as to receive conductor for HV Terminal connectors shall be type tested as per IS- 5561.

(xii) **LIGHTNING ARRESTORS:** 9 kV, 5 kA metal oxide lightning arrestors of reputed make conforming to IS 3070 Part-III, one number per phase shall be provided.(To be mounted on pole or to be fitted under the HV bushing with GI earth strip 25x4 mm connected to the body of the transformer with necessary clamping arrangement as per requirement of purchaser.) Lightening arrestors with polymer insulators in conformance with relevant IEC can also be used. 1 clamp for LA shall also be provided for each HT bushing. Supply of LA is not included in DT supplier's scope.

(xiii) **CABLE BOXES:**

A. No cable box shall be provided in transformer below 200 kVA. Above 200kVA, Cable Boxes shall be provided on both HV & LV side.

B. In case HV/LV terminations are to be made through cables the transformer shall be fitted with suitable cable box on 11kV side to terminate one 11kV/3 core aluminium conductor cable up to 240 sq. mm. (Size as per requirement).

C. The bidder shall ensure the arrangement of HT Cable box so as to prevent the ingress of moisture into the box due to rain water directly falling on the box. The cable box on HT side shall be of the split type with faces plain and machined and fitted with Neo-k-Tex or similar quality gasket and complete with brass wiping gland to be mounted on separate split type gland plate with nut-bolt arrangement and MS earthing clamp. The bushings of the cable box shall be fitted with nuts and stem to take the cable cores without bending them. The stem shall be of copper with copper nuts. The cross section of the connecting rods shall be stated and shall be adequate for carrying the rated currents. On the HV side the terminal rod shall have a diameter of not less than 12mm. The material of connecting rod shall be copper. HT Cable support clamp should be provided to avoid tension due to cable weight.

D. The transformer shall be fitted with suitable LV cable box having non-magnetic material gland plate with appropriate sized single compression brass glands on LV side to terminate 1.1kV/single core XLPE armoured cable (Size as per requirement).

(xiv) **TERMINAL MARKINGS:**

A. High voltage phase windings shall be marked both in the terminal boards inside the tank and on

the outside with capital letter 1U, 1V, 1W and low voltage winding for the same phase marked by corresponding small letter 2U, 2V, 2W. The neutral point terminal shall be indicated by the letter 2N. Neutral terminal is to be brought out and connected to local grounding terminal by an earthing strip.

B. The following standard fittings shall be provided:
- Rating and terminal marking plates, non-detachable.
- Earthing terminals with lugs -2 Nos.
- Lifting lugs for main tank and top cover
- Terminal connectors on the HV/LV bushings(For bare terminations only).
- Thermometer pocketwithcap-1No.
- Air release device (for non-sealed transformer)
- HV bushings -3 Nos.
- LV bushings -4 Nos.
- Pulling lugs
- Stiffener
- Radiators- No. and length may be mentioned (as per heat dissipation calculations)/corrugations.
- Arcing horns on HT side - 3 no. Only clamps for lightning arrestor shall be provided.
- Prismatic oil level gauge.
- Drain cum sampling valve.
- One filter valve on upper side of the transformer (For transformers above 200 kVA)
- Oil filling hole having p.1-¼'' thread with plug and drain plug on the conservator.
- Silica gel breather (for non-sealed type transformer)
- Base channel 75x40mm for up to 100kVA and 100mmx50mm above 100kVA, 460mm long with holes to make them suitable for fixing on a platform or plinth.
- 4 No. rollers for transformers of 200kVA and above.
- Pressure relief device or explosion vent (above 200 kVA)
- Oil level gauge
  a) -5˚C and 90˚C marking for non-sealed type Transformers.
  b) -30˚C marking for sealed type transformers.
- Nitrogen / air filling device/ pipe with welded cover
- Capable of reuse (for sealed type transformers)
- Inspection hole for transformers above 200 kVA
- Pressure gauge for sealed type transformers above 200 kVA.
- Buchholz relay for transformers above 1000 KVA.

(xv) **TANK:**

A. Transformer tank construction shall conform in all respect to clause 15 of IS-1180(Part-1):2014.
B. The internal clearance of tank shall be such, that its hall facilitates easy lifting of core with coils from the tank without dismantling LV bushings.
C. All joints of tank and fittings shall be oil tight and no bulging should occur during service.
D. Inside of tank shall be painted with varnish/hot oil resistant paint.
E. The top cover of the tank shall be slightly sloping to drain rainwater.
F. The tank plate and the lifting lugs shall be of such strength that the complete transformer filled with oil may be lifted by means of lifting shackle/Hook Type.
G. Manufacturer should carry out all welding operations as per the relevant ASME standards and submit a copy of the welding procedure and welder performance qualification certificates to the customer.

PLAIN TANK:

The transformer tank shall be of robust construction rectangular/octagonal/round/elliptical in shape and shall be built up of electrically tested welded mild steel plates of thickness of 3.15 mm for the bottom and top and not less than 2.5 mm for the sides for distribution transformers up to and including 25kVA, 5.0 mm and 3.15 mm respectively for transformers of more than 25kVA and up to and including 100kVA and 6 mm and 4 mm respectively above100kVA. Tolerances as per IS-1852 shall be applicable.

In case of rectangular tanks above 100kVA the corners shall be fully welded at the corners from inside and outside of the tank to withstand a pressure of 0.8kg/cm² for 30 minutes. In case of transformers of 100kVA and below, there shall be no joints at corners and there shall not be more than 2 joints in total.

Under operating conditions the pressure generated inside the tank should not exceed 0.4 kg/ sq. cm positive or negative. There must be sufficient space from the core to the top cover to take care of oil expansion. The space above oil level in the tank shall be filled with dry air or nitrogen conforming to commercial grade of IS 1747 for DT up to 63 KVA. For DT of 63 KVA and above rating, conservator shall be provided.

The tank shall be reinforced by welded flats on all the outside walls on the edge of the tank.

Permanent deflection: The permanent deflection, when the tank without oil is subjected to a vacuum of 525mm of mercury for rectangular tank and 760mm of mercury for round tank, shall not be more than the values as given below:

(**All figures are in mm**)

Horizontal length of flat plate	**Permanent deflection**
Up to and including750	5.0
751to 1250	6.5
1251to 1750	8.0
1751to 2000	9.0

The tank shall further be capable of withstanding a pressure of 0.8kg/sq.cm and a vacuum of 0.7kg/sq. cm (g) without any deformation.

The radiators can be tube type or fin type or pressed steel type to achieve the desired cooling to limit the specified temperature rise.

CORRUGATED TANK:

The bidder may offer corrugated tanks for transformers of all ratings.

The transformer tank shall be of robust construction corrugated in shape and shall be built up of tested sheets.

Corrugation panel shall be used for cooling. The transformer shall be capable of giving continuous rated output without exceeding the specified temperature rise. Bidder shall submit the calculation sheet in this regard.

Tanks with corrugations shall be tested for leakage test at a pressure of 0.25kg/sq. cm measured at the top of the tank.

The transformers with corrugation should be provided with a pallet for transportation, the dimensions of which should be more than the length and width of the transformer tank with corrugations.

CONSERVATOR:

Transformers of rating 63kVA and above with plain tank construction, the provision of conservator is mandatory. For corrugated tank and sealed type transformers with or without inert gas cushion, conservator is not required.

When a conservator is provided, oil gauge and the plain or dehydrating breathing device shall be fitted to the conservator which shall also be provided with a drain plug and a filling hole [32 mm (1¼")] normal size thread with cover. In addition, the cover of the main tank shall be provided with an air release plug.

The dehydrating agent shall be silica gel. The moisture absorption shall be indicated by a change in the colour of the silica gel crystals which should be easily visible from a distance. Volume of breather shall be suitable for 500g of silica gel conforming to IS-3401 for transformers up to 200kVA and 1 kg for transformers above 200kVA.

The capacity of a conservator tank shall be designed keeping in view the total quantity of oil and its contraction and expansion due to temperature variations. The total volume of conservator shall be such as to contain 10% quantity of the oil. Normally 3% quantity the oil shall be contained in the conservator.

The cover of main tank shall be provided with an air release plug to enable air trapped within to be released, unless the conservator is so located as to eliminate the possibility of air being trapped within the main tank.

The inside diameter of the pipe connecting the conservator to the main tank should be within 20 to 50mm and it should be projected into the conservator so that it send is approximately 20mm above the bottom of the conservator so as to create a sump for collection of impurities. The minimum oil level (corresponding to-50°C) should be above the sump level.

8. SURFACE PREPARATION AND PAINTING:

(i) **GENERAL:**

A. All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.
B. All primers shall be well marked in to the surface, particularly in areas where painting is evident and the first priming coat shall be applied as soon as possible after cleaning. The paint shall be

applied by airless spray according to manufacturer's recommendations. However, where ever airless spray is not possible, conventional spray be used with prior approval of purchaser.

(ii) **CLEANING AND SURFACE PREPARATION:**

A. After all machining, forming and welding has been completed, all steel work surfaces shall be thoroughly cleaned of rust, scale, welding slag or spatter and other contamination prior to any painting.
B. Steel surfaces shall be prepared by shot blast cleaning (IS-9954) to grade Sq. 2.5 of ISO 8501-1 or chemical cleaning including phosphating of the appropriate quality (IS-3618).
C. Chipping, scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill-scale. These methods shall only be used where blast cleaning is impractical. Manufacturer to clearly explain such areas in his technical offer.

(iii) **PROTECTIVE COATING:** As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anti-corrosion protection.

(iv) **PAINT MATERIAL:** Following are the types of paint that may be suitably used for the items to be painted at shop and supply of matching paint to site:

A. The painting shall be as per specifications given below in this section.
B. For external surfaces one coat of Thermo Setting paint or 1coat of epoxy primer followed by 2 coats of polyurethene base paint. These paints can be either air-drying or stoving.
C. In case of highly polluted area, chemical atmosphere or at a place very near the sea coast, paint as above with one intermediate coat of high build MIO (Micaceous iron oxide) as an intermediate coat may be used to give a total dry film thickness of 150 to 180 microns.

(v) **PAINTING PROCEDURE:**

A. All prepared steel surfaces should be primed before visible re-rusting occurs or within 4 hours, whichever is sooner. Chemical treated steel surfaces shall be primed as soon as the surface is dry and while the surface is still warm.
B. Where the quality of film is impaired by excess film thickness (wrinkling, mud cracking or general softness) the supplier shall remove the unsatisfactory paint coating and apply another coating. As a general rule, dry film thickness should not exceed the specified minimum dry film thickness by more than 25%.

(vi) **DAMAGED PAINT WORK:**

A. Any damage occurring to any part of a painting scheme shall be made good to the same standard of corrosion protection and appearance as that was originally employed.
B. Any damaged paint work shall be made good as follows:
   - The damaged area, together with an area extending 25mm around its boundary, shall be cleaned down to bare metal.
   - A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50mm around the perimeter of the original damage.
   - The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the painted surface before and after priming.

(vii) **DRY FILM THICKNESS:**

A. To the maximum extent practicable the coats shall be applied as a continuous film of uniform thickness and free of pores. Overspray, skips, runs, sags and drips should be avoided. The different coats may or may not be of the same colour.
B. Each coat of paint shall be allowed to harden before the next is applied as per manufacturer's recommendation.
C. Particular attention must be paid to full film thickness at edges.

S. No.	Paint type	Area to be painted	No. of coats	Total dry film thickness min. microns
1.	Thermo setting powder paint	Inside Outside	01 01	30 60
2.	Liquid paint Epoxy(primer) P.U. Paint (Finish coat) Hot oil paint/ Varnish	Outside Outside Inside	01 02 01	30 25 each 35/10

(viii) **TESTS:**

A. The painted surface shall be tested for paint thickness.
B. The painted surface shall pass the cross hatch adhesion test and impact test as routine test, Salts pray and Hardness test as type test as per the relevant ASTM standards.
C. The paint shade shall be as per specifications given below in this section.

Note: Supplier shall guarantee the painting performance requirement for a period of not less than 5 years.

9. RATING AND TERMINAL PLATES:

(i) Each transformer shall be provided with rating plate made of anodized aluminum/stainless steel material securely fixed on the outer body, easily accessible, showing the information given in Fig.2 of IS:1180 (Part-1):2014 for single phase transformers. The entries on the rating plates shall be indelibly marked by engraving.
(ii) Each transformer shall be provided with a terminal marking plate in accordance with Fig.5 of IS:1180(Part-1):2014. The rating and terminal marking plates may be combined into one plate at the option of manufacturer.
(iii) The distribution transformer be marked with the Standard Mark and the use of Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and regulations made there under. As per Quality Control Order for Electrical Transformers- 2015, issued by Dept. of Heavy Industries, the Standard / ISI marking on Distribution Transformers is mandatory and the product should be manufactured in compliance with IS 1180 Part-1:(2014).

10. PRESSURE AND VACCUM REQUIREMENTS: For single phase transformers up to 25kVA, the

transformer tank shall be of robust construction, round in shape shall be capable of withstanding a pressure of 100kPa and a vacuum of 760mm of mercury.

11. FASTENERS:

A. All bolts, studs, screw threads, pipe threads, bolt heads and nuts shall comply with the appropriate Indian Standards for metric threads, or the technical equivalent.
B. Bolts or studs shall not be less than 6mm in diameter except when used for small wiring terminals.
C. All nuts and pins shall be adequately locked.
D. Wherever possible bolts shall be fitted in such a manner that in the event of failure of locking resulting in the nuts working loose and falling off, the bolt will remain in position.
E. All bolts/nuts/washers exposed to atmosphere should be as follows

a) Size 12 mm or below – Stainless steel

b) Above 12 mm- steel with suitable finish like electro galvanized with passivation or hot dip galvanized.

F. Each bolt or stud shall project at least one thread but not more than three threads through the nut, except when otherwise approved for terminal board studs or relay stems. If bolts and nuts are placed so that they are inaccessible by means of ordinary spanners, special spanners shall be provided.
G. The length of the screwed portion of the bolts shall be such that no screw thread may form part of a shear plane between members.
H. Taper washers shall be provided where necessary.
I. Protective washers of suitable material shall be provided front and back of the securing screws.

12. OVER LOAD CAPACITY: The transformer shall be suitable for loading as per latest IS:6600.

13. TESTS:

(i) All the equipment offered shall be fully type tested in a CPRI/ERDA/NABL accredited laboratory by the bidder as per the relevant standards including all tests mentioned in clause 15. The type test must have been conducted on a transformer of same design during the last five years at the time of bidding and at the time of conducting acceptance test by the employer or its representative.
(ii) Special tests other than type and routine tests, as agreed between purchaser and bidder shall also be carried out as per the relevant standards.
(iii) The test certificates for all routine and type tests for the transformers and also for the bushings and transformer oil shall be submitted with the bid. However, if the same are not available at the time of bidding, the same may be submitted after order but before commencement of supply.
(iv) The procedure for testing shall be in accordance with IS:1180(Part-1): 2014/2026as the case may be except for temperature rise.
(v) Before dispatch each of the completely assembled transformer shall be subjected to the routine tests at the manufacturer's works.

14. ROUTINE TESTS:

- Ratio, polarity tests.
- No load current and losses at service voltage and normal frequency.
- Load losses at rated current and normal frequency.
- Impedance Voltage test.
- Resistance of windings cold (at or near the test bed temperature).
- Insulation resistance.
- Induced over voltage withstand test.

- Separate source voltage withstand test.
- Neutral current measurement-The value of zero sequence current in the neutral of the star winding shall not be more than 2% of the full load current.
  Oil samples (one sample per lot) to comply withIS1866.
- Measurement of no load losses and magnetizing current at rated frequency and 90%, 100% and 110% rated voltage.
- Pressure and vacuum test for checking the deflection on one transformer of each type in every inspection.

15. TYPE TESTS TO BE CONDUCTED ON ONE UNIT: In addition to the tests mentioned above following tests shall be conducted:

- Temperature rise test for determining the maximum temperature rise after continuous full load run. The ambient temperature and time of test should be stated in the test certificate.
- Impulse voltage test with chopped wave as per IS-2026 part-III. BIL for 11kV shall be 75kVpeak.
- Short circuit withstand test: Thermal and dynamic ability.
- Air Pressure Test as per IS –1180 (Part-1):2014.
- Magnetic Balance Test.
- Un-balanced current test: The value of unbalanced current indicated by the ammeter shall not be more than 2% of the full load current.
- Noise - level measurement.
- Measurement of zero-phase sequence impedance.
- Measurement of Harmonics of no-load current.
- Transformer tank shall be subjected to specified vacuum. The tank designed for vacuum shall be tested at an internal pressure of 0.35 kg per sq cm absolute (250mmofHg) for one hour. The permanent deflection of flat plates after the vacuum has been released shall not exceed the values specified below:

Horizontal length of flat plate (in mm)	Permanent deflection (in mm)
Up to and including 750	5.0
751 to 1250	6.5
1251 to 1750	8.0
1751 to 2000	9.0

- Transformer tank together with its radiator and other fittings shall be subjected to pressure corresponding to twice the normal pressure or 0.35kg/sq.cm whichever is lower, measured at the base of the tank and maintained for an hour. The permanent deflection of the flat plates after the excess pressure has been released, shall not exceed the figures for vacuum test.
- Pressure relief device test: The pressure relief device shall be subject to increasing fluid pressure. It shall operate before reaching the test pressure as specified in the above class. The operating pressure shall be recorded. The device shall seal-off after the excess pressure has been released.
- Short Circuit Test and Impulse Voltage Withstand Tests: The purchaser intends to procure transformers designed and successfully tested for short circuit and impulse test. In case the transformers proposed for supply against the order are not exactly as per the tested design, the supplier shall be required to carry out the short circuit test and impulse voltage with stand test at their own cost in the presence of the representative of the purchaser.
  The supply shall be accepted only after such test is done successfully, as it confirms on successful

with stand of short circuit and healthiness of the active parts thereafter on un -tanking after as short circuit test.

Apart from dynamic ability test, the transformer shall also be required to withstand thermal ability test or thermal withstand ability will have to be established by way of calculations.

It may also be noted that the purchaser reserves the right to conduct short circuit test and impulse voltage withstand test in accordance with the IS, afresh on each ordered rating at purchaser cost, even if the transformers of the same rating and similar design are already tested. This test shall be carried out on a transformer to be selected by the purchaser either at the manufacturer's works when they are offered in a lot for supply or randomly from the supplies already made to purchaser's stores. The findings and conclusions of these tests shall be binding on the supplier.

16. ACCEPTANCE TESTS:

(i) At least 10% transformers of the offered lot (minimum of one) shall be subjected to the following routine/acceptance test in presence of purchaser's representative at the place of manufacture before dispatch without any extra charges. The testing shall be carried out in accordance with IS: 1180 (Part-1):2014 and IS: 2026.

(ii) Checking of weights, dimensions, fitting and accessories, tank sheet thickness, oil quality, material, finish and workmanship as per GTP and contract drawings on one transformer of each type in every inspection.

(iii) Physical verification of core coil assembly and measurement of flux density of one unit of each rating, in every inspection with reference to short circuit test report.

(iv) Temperature rise test on one unit of the total ordered quantity.

17. TESTS AT SITE: The purchaser will conduct the following test on receipt of transformers in their store. The respective DISCOM/ Power Department shall arrange all equipment, tools & tackle and manpower for the testing. The bidder will depute his representative to witness the same. All such test shall be conducted by respective DISCOM/ Power Department not later than 10 days from receipt of transformers.

i) Megger Test

ii) Ratio test

18. INSPECTION:

(i) The bidder will intimate the Employer about carrying out of the tests at least 7 days in advance of the scheduled date of tests during which the Employer will arrange to depute his representative(s) to be present at the time of carrying out of the tests. Three (3) copies of the test reports shall be submitted.

(ii) In respect of raw material such as core stampings, winding conductors, insulating paper and oil, supplier shall use materials manufactured/supplied by standard manufacturers and furnish the manufacturers test certificate as well as the proof of purchase from these manufacturers (excise gate pass) for information of the purchaser. The bidder shall furnish following documents along with their offer in respect of the raw materials:

- Invoice of supplier.

- Mill's certificate.
- Packing list.
- Bill of landing.
- Bill of entry certificate by custom.

19. INSPECTION AND TESTING OF TRANSFORMER OIL: To ascertain the quality of the transformer oil, the original manufacturer's tests report should be submitted at the time of inspection. Arrangements should also be made for testing of transformer oil as per IS: 335, after taking out the sample from the manufactured transformers and tested in the presence of purchaser's representative.

(i) To ensure about the quality of transformers, the inspection shall be carried out by the purchaser's representative at following two stages:-
- Anytime during receipt of raw material and manufacture/assembly whenever the purchaser desires.
- At finished stage i.e. transformers are fully assembled and are ready for dispatch.

(ii) After the main raw material i.e. core and coil material and tanks are arranged and transformers are taken for production on shop floor and a few assembly have been completed, the firm shall intimate the purchaser in this regard, so that an officer for carrying out such inspection could be deputed, as far as possible within seven days from the date of intimation. During the stage inspection a few assembled core shall be dismantled to ensure that the laminations used are of good quality. Further, as and when the transformers are ready for dispatch, an offer intimating about the readiness of transformers, for final inspection for carrying out tests as per relevant IS shall be sent by the firm along with Routine Test Certificates. The inspection shall normally be arranged by the purchaser at the earliest after receipt of offer for pre-delivery inspection.

(iii) In case of any defect/defective workmanship observed at any stage by the purchaser's Inspecting Officer, the same shall be pointed out to the firm in writing for taking remedial measures. Further processing should only be done after clearance from the Inspecting Officer/purchaser.

(iv) All tests and inspection shall be carried out at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall offer the Inspector representing the Purchaser all reasonable facilities, without charges, to satisfy him that the material is being supplied in accordance with this specification. This will include Stage Inspection during manufacturing stage as well as Active Part Inspection during Acceptance Tests.

(v) The manufacturer shall provide all services to establish and maintain quality of workmanship in his works and that of his sub-contractors to ensure the mechanical/electrical performance of components, compliance with drawings, identification and acceptability of all materials, parts and equipment as per latest quality standards of ISO-9000.

(vi) Purchaser shall have every right to appoint a third party inspection to carry out the inspection process.

(vii) The purchaser has the right to have the test carried out at his own cost by an independent agency wherever there is a dispute regarding the quality supplied. Purchaser has right to test 1% of the supply selected either from the stores or field to check the quality of the product. In case of any deviation purchaser have every right to reject the entire lot or penalize the manufacturer, which may lead to blacklisting, among other things.

20. QUALITY ASSURANCE PLAN:

(i) The bidder shall invariably furnish following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.

(ii) Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials in presence of bidder's representative and copies of test certificates.
(iii) Information and copies of test certificates as above in respect of bought out accessories.
(iv) List of manufacturing facilities available.
(v) Level of automation achieved and list of areas where manual processing exists.
(vi) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
(vii) List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports shall be furnished with the bid. Manufacturer shall possess 0.1 accuracy class instruments for measurement of losses.
(viii) Quality assurance plan with hold points for purchaser's inspection.
(ix) The successful bidder shall within 30 days of placement of order, submit following information to the purchaser.
(x) List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with offer.
(xi) Type test certificates of the raw materials and bought out accessories.
(xii) The successful bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing.
(xiii) ISI marking on the transformer is mandatory. As per Quality Control Order for Electrical Transformers- 2015, issued by Dept. of Heavy Industries, the Standard / ISI marking on Distribution Transformers is mandatory and the product should be manufactured in compliance with IS:1180 Part-1:(2014).

21. DOCUMENTATION:

(i) The bidder shall furnish along with the bid the dimensional drawings of the items offered indicating all the fittings.
(ii) Dimensional tolerances.
(iii) Weight of individual components and total weight.
(iv) An outline drawing front (both primary and secondary sides) and end-elevation and plan of the tank and terminal gear, where in the principal dimensions shall be given.
(v) Typical general arrangement drawings of the windings with the details of the insulation at each point and core construction of transformer.
(vi) Typical general arrangement drawing showing both primary and secondary sides and end-elevation and plan of the transformer.

22. PACKING & FORWARDING:

(i) The packing shall be done as per the manufacturer's standard practice. However, he should ensure the packing is such that, the material should not get damaged during transit by rail/road.
(ii) The marking on each package shall be as per the relevant IS.

23. GUARANTEE:

(i) The manufacturers of the transformer shall provide a guarantee of 60 months from the date of receipt of transformer at the stores of the DISCOM/ Power Department. In case the transformer fails within the guarantee period, the supplier will depute his representative within 15 days from date of intimation by DISCOM/ Power Department for joint inspection. In case, the failure is due to the reasons attributed to supplier, the transformer will be replaced/ repaired by the supplier within 2 months from date of joint inspection.

(ii) The outage period i.e. period from the date of failure till unit is repaired/replaced shall not be counted for arriving at the guarantee period.

(iii) In the event of the supplier's inability to adhere to the afore said provisions, suitable penal action will be taken against the supplier, which may interalia include blacklisting of the firm for future business with the purchaser for a certain period.

24. DEVIATIONS:

(i) The bidders are not allowed to deviate from the principal requirements of the Specifications. However, the bidder is required to submit with his bid in the relevant schedule a detailed list of all deviations without any ambiguity. In the absence of a deviation list in the deviation schedules, it is understood that such bid conforms to the bid specifications and no post-bid negotiations shall take place in this regard.

(ii) The discrepancies, if any, between the specification and the catalogues and/or literatures submitted as part of the offer by the bidders, shall not be considered and representations in this regard shall not be entertained.

(iii) If it is observed that there are deviations in the offer in guaranteed technical particulars other than those specified in the deviation schedules then such deviations shall be treated as deviations.

(iv) All the schedules shall be prepared by vendor and are to be enclosed with the bid.

PAINTING - TRANSFORMER MAIN TANK, PIPES, CONSERVATOR TANK, RADIATOR ETC.

Parts	Surface Preparation	Primer Coat	Intermediate under coat	Finish coat	Total DFT	Colour shade
Main tank, pipes, conservator tank, etc. (External surfaces)	Blast cleaning Sa2½	Epoxy base Zincprimer 30-40 micron	Epoxy base Zinc primer 30-40 micron	Aliphatic Polyurethane (PU Paint) (min 50 micron)	Min 110 micron	541 shade of IS:5
Main tank, pipes (above 80 NB), conservator tank, etc (Internal surfaces)	Blast cleaning Sa2½	Hot oil resistant, non-corrosive varnish or paint	--	--	Min 30 micron	Glossy white for paint
Radiator (External surfaces)	Chemical/ blast cleaning Sa2½	Epoxy base zinc primer 30-40 micron	Epoxy base Zinc primer Min. 30-40 micron	Aliphatic Polyurethane (PU Paint) min 50 micron	Min 110 micron	541 shade of IS:5
Radiator and pipes up to 80 NB (Internal surfaces)	Chemical cleaning if required	Hot oil proof low viscosity varnish or hot oil resistant non corrosive paint	--	--	--	Glossy white for paint

INSULATORS

This specification covers the design, manufacture, testing and supply of 11KV Composite Insulators. The composite insulators shall be of the following type:

i) Long rod insulators for conductors in tension application at angle / cut points; the insulators shall be of tongue & clevis type.

ii) Line post insulators or pin insulators for straight line locations.

1. SERVICE CONDITIONS:

The equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the climatic conditions of North-eastern states (including Sikkim).

2. SYSTEM PARTICULARS:

a) Nominal System Voltage	11 kV
b) Corresponding highest system Voltage	12 kV
c) Frequency	50 Hz with 3% tolerance
d) Number of phase	3
e) Neutral earthing	Effectively grounded.

3. STANDARDS:

Unless otherwise specified elsewhere in the specifications insulators shall confirm to the latest revisions of all relevant standards available at the time of placement of the order. The standards are listed below:

S. No.	Indian Standard	Title	International Standard
1	-	Definition, test methods and acceptance criteria for composite insulators for A.C. overhead lines above 1000V	IEC: 61109
2	IS: 731	Porcelain insulators for overhead power lines with a nominal voltage greater than 1000V	IEC: 60383
3	IS: 2071	Methods of High Voltage Testing	IEC: 60060-1
4	IS: 2486	Specification for Insulator fittings for Overhead power Lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements Locking Devices	IEC: 60120 IEC: 60372
5	-	Thermal Mechanical Performance test and mechanical performance test on string insulator units	IEC: 60575
6	IS: 13134	Guide for the selection of insulators in respect of polluted condition	IEC: 60815
7	-	Characteristics of string insulator units of the long rod type	IEC: 60433
8	-	Hydrophobicity Classification Guide	STRI guide 1.92/1
9	-	Radio interference characteristics of overhead power lines and high-voltage equipment.	CISPR: 18-2 Part 2
10	IS: 8263	Methods of RI Test of HV insulators	IEC: 60437
11		Standard for Insulators- Composite-	ANSI C29.13-2000
		Distribution Dead-end Type	
12	IS: 4759	Hot dip zinc coatings on structural steel & other allied products	ISO: 1459 ISO: 1461
13	IS: 2629	Recommended Practice for Hot, Dip Galvanization for iron and steel	

14	IS: 6745	Determination of Weight of Zinc Coating on Zinc coated iron and steel articles	ISO: 1460
15	IS: 3203	Methods of testing of local thickness of electroplated coatings	
16	IS: 2633	Testing of Uniformity of Coating of zinc coated articles	
17	-	Standard specification for glass fiber strands	ASTM D 578-05
18	-	Standard test method for compositional analysis by Thermo-gravimetry	ASTM E 1131-03
19	IS:4699	Specification for refined secondary Zinc	

4. GENERAL REQUIREMENTS:

(i) The composite insulators shall generally conform to latest Standards as listed in Annexure 'A'.

(ii) The Composite Insulators will be used on lines on which the conductors will be A.A.A. Conductor of size up to 200 sq. mm. and ACSR of any size up to Panther (0.2 sq. inch copper equivalent). The insulators should withstand the conductor tension, the reversible wind load as well as the high frequency vibrations due to wind.

(iii) Supplier must be an indigenous manufacturer and manufacturer of composite insulators of rating 33 kV or above OR must have developed proven in house technology and manufacturing process for composite insulators of above rating OR possess technical collaboration /association with a manufacturer of composite insulators of rating 33kV or above. The Manufacturer shall furnish necessary evidence in support of the above, which can be in the form of certification from the utilities concerned, or any other documents to the satisfaction of the Employer.

(iv) Insulator shall be suitable for both the suspension and strain type of load & shall be of tongue & clevis type. The diameter of Composite Insulator shall be less than 200 mm. The center-to-center distance between tongue & clevis shall be max. 300 mm for 11 kV.

(v) Insulators shall have sheds with good self-cleaning properties. Insulator shed profile, spacing, projection etc. and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC-60815/IS: 13134.

(vi) The size of Composite insulator, minimum creepage distance and mechanical strength along with hardware fittings shall be as follows:

S. No.	Type of Composite insulators	Nominal System Voltage kV (rms)	Highest System Voltage kV(rms)	Visible Discharge Test Voltage kV(rms)	Wet Power Frequency Withstand Voltage kV(rms)	Impulse Withstand voltage kV(rms)	Minimum Creepage Distance (mm) (Heavily Polluted 25mm/kV)	Center to Center Distance Between Tongue & Clevis (mm)	Min. Failing load kN	Shed Diameter (mm) (min)
i.	Long Rod insulator	11	12	9	35	75	320	300	45	75-100
ii.	Post/Pin Insulator	11	12	9	35	75	320		5	

(vii) Dimensional Tolerance of Composite Insulators:
The tolerances on all dimensions e.g. diameter, length and creepage distance shall be allowed as follows in line with-IEC 61109:

(0.04d+1.5) mm when d≤300mm.
(0.025d+6) mm when d>300 mm.

Where, d being the dimensions in millimeters for diameter, length or creepage distance as the case may be. However, no negative tolerance shall be applicable to creepage distance.

(viii) Interchangeability:
The composite insulator together with the tongue & clevis fittings shall be of standard design suitable for use with the hardware of any other indigenous make conforming to relevant standards referred above.

(ix) 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 not generate any radio interference beyond specified limit under the operating conditions.

5. TECHNICAL DESCRIPTION OF COMPOSITE INSULATORS:

Polymeric Insulators shall be designed to meet the high quality, safety and reliability and are capable of withstanding a wide range of environmental conditions.

Polymeric Insulators shall consist of THREE parts, at least two of which are insulating parts :-
(a) Core- the internal insulating part
(b) Housing- the external insulating part
(c) Metal end fittings.

(i) CORE
It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibers shall be Boron free electrically corrosion resistant (ECR) glass fiber or Boron free E-Glass and shall exhibit both high electrical integrity and high resistance to acid corrosion. The matrix of the FRP rod shall be Hydrolysis resistant. The FRP rod shall be manufactured through Pultrusion process. The FRP rod shall be void free.

(ii) HOUSING:
The FRP rod shall be covered by a seamless sheath of a silicone elastometric compound or silicone alloy compound of a thickness of 3mm minimum. It shall be one-piece housing using Injection Molding Principle to cover the core. The elastomer housing shall be designed to provide the necessary creepage distance and protection against environmental influences. Housing shall conform to the requirements of IEC 61109/92-93 with latest amendments

(iii) WEATHERSHEDS:
The composite polymer weather sheds made of a silicone elastometric compound or silicone alloy compound shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and shall be free from imperfections It should protect the FRP rod against environmental influences, external pollution and humidity. The weather sheds should have silicon content of minimum 30% by weight. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids.

(iv) METAL END FITTINGS:
End fitting transmit the mechanical load to the core. They shall be made of spheroidal graphite cast iron, malleable cast iron or forged steel or aluminum alloy. They shall be connected to the rod by means of a controlled compression technique. Metal end fittings shall be suitable for tongue & clevis hard wares of respective specified mechanical load and

shall be hot dip galvanized after, all fittings have been completed. The material used in fittings shall be corrosion resistant. As the main duty of the end fittings is the transfer of mechanical loads to the core the fittings should be properly attached to the core by a coaxial or hexagonal compression process & should not damage the individual fibers or crack the core. The gap between fitting and sheath shall be sealed by a flexible silicone elastomeric compound or silicone alloy compound sealant. System of attachment of end fitting to the rod shall provide superior sealing performance between housing, i.e. seamless sheath and metal connection. The sealing must be moisture proof. The dimensions of end fittings of insulators shall be in accordance with the standard dimensions stated in IEC: 60120/ IS: 2486 - Part-II /1989.

6. WORKMANSHIP:

(i) All the materials shall be of latest design and conform to the best engineering practices adopted in the high voltage field. Manufacturers shall offer only such insulators as are guaranteed by them to be satisfactory and suitable for continued good service in power transmission lines.

(ii) 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.

(iii) 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.

(iv) The core shall be sound and free of cracks and voids that may adversely affect the insulators.

(v) Weather sheds shall be uniform in quality. They shall be clean, sound, smooth and shall be free from defects and excessive flashing at parting lines.

(vi) 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 without projecting points or irregularities, which may cause corona. All load bearing surfaces shall be sooth and uniform so as to distribute the loading stresses uniformly.

(vii) All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/sq.m. or 87 micron thickness and shall be in accordance with the requirement of IS:4759. the zinc used for galvanizing shall be of purity 99.5% as per IS:4699. 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 four successive dips each lasting for one (1) minute duration under the standard Preece test. The galvanizing shall be carried out only after any machining.

7. TESTS AND STANDARDS:

Insulators offered shall be manufactured with the same configuration & raw materials as used in the insulators for which design & type test reports are submitted. The manufacturer shall submit a certificate for the same. The design & type test reports submitted shall not be more than five years old. Bidder who does not possess valid type test report for the same design are not eligible for bidding.

(i) DESIGN TESTS:

For polymeric insulators it is essential to carry out design test as per clause 4.1 of IEC 61109 / 92-93 with latest amendments. The design tests are intended to verify the suitability of the design, materials and method of manufacture (technology). When a composite insulator is submitted to the design tests, the result shall be considered valid for the whole class of insulators, which are represented by the one tested and having the following characteristics:

- Same materials for the core, and sheds and same manufacturing method;
- Same material of the fittings, the same design, the same method of attachment;
- Same or greater layer thickness of the shed material over the core (including a sheath where used).
- Same or smaller ratio of the highest system voltage to insulation length;
- Same or smaller ratio of all mechanical loads to the smallest core diameter between fittings.
- Same or greater diameter of the core.

The tested composite insulators shall be identified by a drawing giving all the dimensions with the manufacturing tolerances.

Manufacturer should submit test reports for Design Tests as per IEC – 61109 (clause – 5). Additionally, following tests shall be carried out or reports for the tests shall be submitted after award of contract:

UV test: the test shall be carried out in line with clause 7.2 of ANSI C29.13.

(ii) TYPE TESTS:

The type tests are intended to verify the main characteristics of a composite insulator. The type tests shall be applied to composite insulators, the class of which has passed the design tests.

Following Type test shall be conducted on a suitable number of individual insulator units, components, materials or complete strings:

S. No.	**Description of type test**	**Test procedure / standard**
1	Dry lightning impulse withstand voltage test	As per IEC 61109(Clause 6.1)
2	Wet power frequency test	As per IEC 61109(Clause 6.2)
3	Mechanical load-time test	As per IEC 61109(Clause 6.4)
4	Radio interference test	As per IEC 61109(Clause 6.5) Revised
5	Recovery of Hydrophobicity test	Annexure-A below; This test may be repeated every 3yrs by the manufacturer
6	Chemical composition test for silicon content	Annexure-A below Or any other test method acceptable to the Employer
7	Brittle fracture resistance test	Annexure-A below

The Manufacturer shall submit type test reports as per IEC 61109. Additional type tests required if any shall be carried out by the manufacturer, after award of contract for which no additional charges shall be payable. In case, the tests have already been carried out, the manufacturer shall submit reports for the same. Bidder who does not possess valid type test report for the same design are not eligible for bidding

(iii) ACCEPTANCE TESTS:

The test samples after having withstood the routine test shall be subject to the following acceptance tests in order indicated below:

A	Verification of dimensions	Clause 7.2 IEC: 61109
B	Verification of the locking system (if applicable)	Clause 7.3 IEC: 61109
C	Verification of tightness of the interface Between end fittings & Insulator housing	Clause 7.4 IEC: 61109 amendment 1 of 1995

D	Verification of the specified mechanical load	Clause 7.4 IEC: 61109 amendment 1 of 1995
E	Galvanizing test	IS:2633/IS:6745

(iv) ROUTINE TESTS:

S. No.	Description	Standard
1	Identification of marking	As per IEC: 61109 Clause 8.1
2	Visual Inspection	As per IEC: 61109 Clause 8.2
3	Mechanical routine test	As per IEC: 61109 Clause 8.3

Every polymeric insulator shall withstand mechanical routine test at ambient temperature tensile load at RTL corresponding to at least 50 % of the SML for at least 10 sec.

(v) TESTS DURING MANUFACTURE:
Following tests shall also be carried out on all components as applicable
(a) Chemical analysis of zinc used for galvanizing
(b) Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.
(c) Chemical analysis, hardness tests and magnetic particle inspection for forgings.

(vi) SAMPLE BATCH FOR TYPE TESTING:
The Manufacturer shall offer material for sample selection for type testing only after getting Quality Assurance Plan approved by Employer. The sample for type testing will be manufactured strictly in accordance with the approved Quality Assurance Plan.

8. QUALITY ASSURANCE PLAN:

The Manufacturer shall submit following information:

(i) Test certificates of the raw materials and bought out accessories.
(ii) Statement giving list of important raw material, their grades along with names of sub-Manufacturers for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of Manufacturer's representative.
(iii) List of manufacturing facilities available.
(iv) Level of automation achieved and lists of areas where manual processing exists.
(v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
(vi) List of testing equipments available with the Manufacturer for final testing of equipment along with valid calibration reports.
(vii) The manufacturer shall submit Manufacturing Quality Assurance Plan (QAP) for approval & the same shall be followed during manufacture and testing.
(viii) The Manufacturer shall submit the routine test certificates of bought out raw materials/accessories and central excise passes for raw material at the time of inspection.
(ix) The Employer'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 Manufacturer's and sub-Manufacturer's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.
(x) The material for final inspection shall be offered by the Manufacturer only under packed condition. The Employer shall select samples at random from the packed lot for carrying out acceptance tests. The lot offered for inspection shall be homogeneous and shall contain

insulators manufactured in 3-4 consecutive weeks.

(xi) The Manufacturer shall keep the Employer 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.

(xii) No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the Employer in writing waives off the inspection. In the later case also the material shall be dispatched only after satisfactory testing specified herein has been completed.

(xiii) The acceptance of any quantity of material shall in no way relieve the Manufacturer 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

9. TEST CERTIFICATE:

The manufacturer shall furnish detailed type test reports of the offered composite Insulators as per clause 7(ii) of the Technical Specifications at the NABL approved laboratories to prove that the composite Insulators offered meet the requirements of the specification. These Type Tests should have been carried out within five years prior to the date of opening of this tender.

The Employer reserves right to demand repetition of some or all the Type Test in presence of Employer's representative. For this purpose, the manufacturer shall quote unit rates for carrying out each Type Test. However, such unit rates will not be considered for evaluation of the offer. In case the unit fails in the Type Tests, the complete supply shall be rejected.

10. TESTING FACILITIES:

The manufacturer must clearly indicate what testing facilities are available in the works of the manufacturer and whether facilities are adequate to carry out all Routine & acceptance Tests. These facilities should be available to Employer's Engineers if deputed or carry out or witness the tests in the manufacturer works. The insulators shall be tested in accordance with the procedure detailed in IEC 61109 / 92-93 with latest amendments.

11. DRAWINGS:

(i) The Manufacturer shall furnish full description and illustration of the material offered.

(ii) The Manufacturer shall furnish the outline drawing (3 copies) of each insulator unit including a cross sectional view of the long rod insulator unit. The drawing shall include but not be limited to the following information:

(a) Long rod diameter with manufacturing tolerances
(b) Minimum Creepage distance with positive tolerance
(c) Protected creepage distance
(d) Eccentricity of the long rod unit
    Axial run out
    Radial run out
(e) Unit mechanical and electrical characteristics
(f) Size and weight of ball and socket/tongue & clevis
(g) Weight of composite long rod units
(h) Materials
(i) Identification mark
(j) Manufacturer's catalogue number

(iii) After placement of award the Manufacturer shall submit fully dimensioned insulator crate drawing for different type of insulators for approval of the Employer.

12. RETEST AND REJECTION:

(i) Sample Procedure for testing of insulators shall be as per clause 7.1 to 7.6 of IEC 61109 for Acceptance & Routine Tests.

(ii) For the sampling tests, two samples are used, E1and E2. The sizes of these samples are indicated in the table below.

Lot Size (N)	Sample Size	
	E1	E2
N < 300	Subject to agreement	
300 < N < 2000	4	3
2000< N < 5000	8	4
5000< N < 10000	12	6

(iii) If more than 10000 insulators are concerned, they shall be divided into an optimum number of lots comprising between 2000 and 10000 insulators. The results of the tests shall be evaluated separately for each lot.

(iv) The insulators shall be selected by the Employer's representative from the lot at random.

(v) The samples shall be subjected to the applicable sampling tests.

The sampling tests are:

Verification of dimensions	- (E1 + E2)
Verification of the locking system	- (E2)
Verification of tightness of the interface between end fittings & Insulator housing	- (E2)
Verification of the specified mechanical load SML	- (E1)
Galvanizing test	- (E2)

(vi) In the event of a failure of the sample to satisfy a test, the retesting procedure shall be as follows:

- If only one insulator or metal part fails to comply with the sampling tests, a new sample equal to twice the quantity originally submitted to the tests shall be subjected to retesting. The retesting shall comprise the test in which failure occurs. If two or more insulator or metal parts fail to comply with any of the sampling tests or if any failure occurs during the retesting, the complete lot is considered as not complying with this standard and shall be withdrawn by the manufacturer.
- Provided the cause of the failure can be clearly identified, the manufacturer may sort the lot to eliminate all the insulators with these defects. The sorted lot then be resubmitted for testing. The number then selected shall be three times the first chosen quantity for tests. If any insulators fail during this retesting, the complete lot is considered as not complying with this standard and shall be withdrawn by the manufacturer.

(vii) Verification of dimensions (E1 + E2)

The dimensions given in the drawings shall be verified. The tolerances given in the drawing are valid. If no tolerances are given in the drawings the values mentioned in this specification shall hold good.

(viii) Verification of the locking system (E2)

This test applies only to the insulators equipped with socket coupling as specified by IEC 120 and is performed according to IEC 383.

(ix) Verification of tightness of the interface between end fittings & Insulator housing (E2)
One insulator selected randomly from the sample E2, shall be subjected to crack indication by dye penetration, in accordance with ISO 3452, on the housing in the zone embracing the complete length of the interface between the housing and metal fitting and including an additional area, sufficiently extended beyond the end of the metal part.
The indication shall be performed in the following way:

- the surface shall be properly pre-cleaned with the cleaner;
- the penetrant, which shall act during 20 minutes, shall be applied on the cleaned surface;
- within 5 minutes after the application of the penetrant, the insulator shall be subjected, at the ambient temperature, to a tensile load of 70 % of the SML, applied between the metal fittings; the tensile load shall be increased rapidly but smoothly from zero up to 70 % of the SML, and then maintained at this value for 1 minute;
- the surface shall be cleaned with the excess penetrant removed, and dried;
- the developer shall be applied if necessary;
- the surface shall be inspected.

Some housing materials may be penetrated by the penetrant. In such cases evidence shall be provided to validate the interpretation of the results.

After the 1 min. test at 70 % of the SML, if any cracks occur, the housing and, if necessary, the metal fittings and the core shall be cut, perpendicularly to the crack in the middle of the widest of the indicated cracks, into two halves. The surface of the two halves shall then be investigated for the depth of the cracks.

(x) Verification of the specified mechanical load SML
The insulators of the sample E1 shall be subjected at ambient temperature to a t ensile load, applied between the couplings. The tensile load shall be increased rapidly but smoothly from zero to approximately 75 % of the SML, and then be gradually increased to the SML in a time between 30 sec. to 90 sec.
If 100 % of the SML is reached in less than 90 s, the load (100 % of the SML) shall be maintained for the remainder of the 90 s. (This test is considered to be equivalent to a 1min withstand test at the SML.
The insulators have passed the test, if:
No failure (breakage or complete pull out of the core, or fracture of the metal fitting) occurs either during the 1 min. 70 % withstand test (a) or during the 1 min.100 % withstand test (b).
No cracks are indicated after the dye penetration method described in 13.4 above.
The investigation of the halves described in 13.4 above shows clearly that the cracks do not reach the core.

(xi) Galvanizing test
This test shall be performed according to IS: 2633/IS: 6745 on galvanized parts.

13. MARKINGS:

(i) Each insulator shall be legibly and indelibly marked with the following details as per IEC-61109:

a) Name or trademark of the manufacturer
b) Voltage & Type
c) Month and year of manufacturing
d) Min. failing load/guaranteed mechanical strength in kilo Newton followed by the word 'KN' to facilitate easy identification.
e) DDUGJY/SAUBHAGYA
f) 'Employer Name' Marking

(ii) One 10 mm thick ring or 20 mm thick spot of suitable quality of paint shall be marked on the end fitting of each composite long rod of particular strength for easy identification. The paint shall not have any deteriorating effect on the insulator performance.

Following codes shall be used as identification mark:
For 45 KN long rod units : Blue
For 70 KN long rod units : Red

14. PACKING:

(i) All insulators shall be packed in strong corrugated box of min. 7 ply duly paletted or wooden crates. The gross weight of the crates along with the material shall not normally exceed 100 Kg to avoid hackling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.
(ii) The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
(iii) Suitable cushioning, protective padding, or Dunn age or spacers shall be provided to prevent damage or deformation during transit and handling.
(iv) 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 wooden case /crate /corrugated box shall have all the markings stenciled on it in indelible ink.
(v) The Manufacturer shall provide instructions regarding handling and storage precautions to be taken at site.

15. GUARANTEE

The Manufacturer of insulators shall guarantee overall satisfactory performance of the insulators.

LT PIN & SHACKLE INSULATORS

The LT Pin Insulators shall conform to the following standards with latest amendments if any. The tenders shall go through the IS thoroughly before making their offer. The material shall be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth.

S. No.	Material	Indian Standards (amended up to date)
1	LT Pin Insulators	IS: 1445 -1977
2	11KV Pin Insulators	IS: 731 - 1971
3	Shackle Insulators	IS: 1445-1977 (Second Revision including amendment no. 1,2,3,4 & 5)

1. GENERAL REQUIREMENT:

i) The porcelain shall be sound, free from defects thoroughly verified and smoothly glazed.
ii) The design of Insulator should be such that, stresses due to expansion or and contraction in any part of the insulator shall not lead to its deterioration. The porcelain shall not engage directly with hard metal for 11 KV and 33 KV pin insulators.

iii) The glaze shall be Brown in colour –except for the screw threads and the top portion on which the conductor is supported during firing which may be left unglazed, all other surfaces of the insulator shall be effectively glazed.

2. TYPE AND DIMENSIONS:

The dimensions and construction of LT Pin Insulators should be as per IS mentioned in clause (16) with latest issues thereof.

3. ELECTRICAL AND MECHANICAL CHARACTERISTICS:

The electrical and mechanical particulars of LT Pin insulators shall be as per the Guaranteed Technical Particulars shown, measured at the following standard atmospheric conditions.

Ambient temperature	55 Deg. C
Barometric pressure	1013 mill bars
Absolute Humidity	11 Grams of water per cubic mtrs. Corresponding to 63% relative humidity at 20 Deg C.

b) **Shackle Insulator:**

Sr. No.	Type of Insulator	Dry P.F. withstand voltage KV (rms)	Wet P.F. withstand voltage KV (rms)	P.F. Puncture withstand voltage KV (rms)	Minimum Failing Load (KN)
1	Shackle	23	10	1.3x the actual dry flashover voltage	11.5 (Type-1)

4. BASIC INSULATION LEVELS

i. The test voltage of Pin insulators shall be as per the values given in Guaranteed Technical Particulars attached.

ii. In this specification power frequency voltages are expressed as peak values divided by √2 and impulse voltages are expressed as peak values.

iii. The withstand flashover voltages are referred to the reference atmospheric conditions.

5. As the insulators are to be used in Arunachal Pradesh, the creepage distances of insulators specified in GTP are minimum. However, the firm may offer insulators of higher creepage

distance, but the mechanical and electrical parameters of their product shall be as per the mechanical and electrical requirement in GTP attached.

6. TESTS:

i) All the tenderers must submit copies of type test certificates along with laboratory approved drawings for the products offered by them. The Certificates shall be from any NABL accredited laboratory, but not more than 5 years old as on originally scheduled bid submission date.
ii) Copy of type test certificate of each type offered must be submitted.
iii) The type test certificate shall be final and complete for all the tests as per the list of type tests given in specification Clause No. 6(a) below.
iv) Bidder who does not possess a valid type test report for the same design at the time of bidding are not eligible for bidding
v) Routine test shall be carried out on every insulator as specified in IS in clause no.2 with latest amendments. Details of test result on each of the insulator supplied, has to be submitted to inspector for his perusal and verification.
The insulators shall comply with the type tests as per IS in clause no.16 with latest amendments.

a) TYPE TESTS:

The following shall constitute the type tests. However, the test voltage value shall be as per GTP.

a) Visual examination.
b) Verification of dimensions.
c) Visible discharge test.
d) Impulse voltage withstand test (+ve wave & -ve wave)
e) Impulse voltage flashover test (+ve wave & -ve wave)
f) Dry and wet power frequency voltage withstands test.
g) Dry and wet power frequency flashover voltage test.
h) Temperature Cycle test.
i) Mechanical failing load test.
j) Puncture test.
k) Porosity test.
l) Galvanizing test.

b) ACCEPTANCE TESTS: -

From the offered lot, samples shall be drawn randomly as per the criteria given. The firm has to arrange for carrying out all following acceptance tests at firms works only at firm's cost in presence of inspector deputed by RECPDCL/REC/DISCOM.

a) Verification of dimensions and Visual examination.
b) Temperature cycle tests.
c) Mechanical failing load test
d) Puncture test.
e) Porosity test.
f) Galvanizing test.

c) ROUTINE TESTS: -

The following tests shall be carried out as routine tests by firm on each insulator before offering the lot for inspection.

a) Visual examination.
b) Mechanical routine test.
c) Electrical routine test.

d) TEST CERTIFICATES:

The test shall be carried out as per the IS before dispatch and the test certificates shall be furnished for approval. Copies of type test certificates of identical materials for each type with dimensional drawings shall invariably accompany the tender.

7. MARKINGS:

Each insulator shall be legibly and indelibly marked with the following details as per IEC-61109:

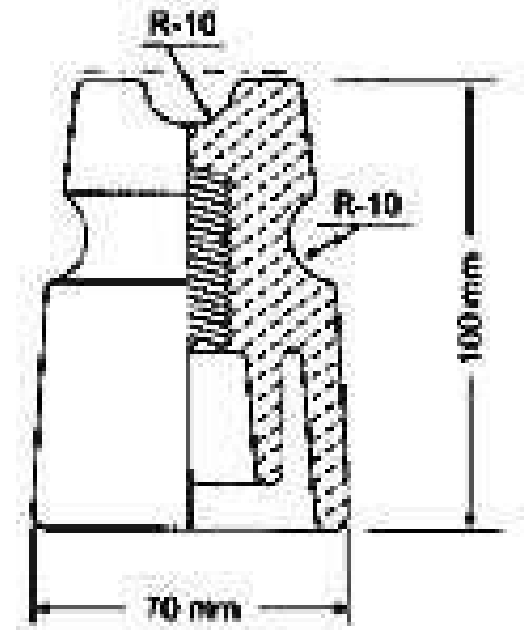
a) Name or trademark of the manufacturer.
b) Voltage & Type.
c) Month and year of manufacturing.
d) Min. failing load/guaranteed mechanical strength in kilo Newton followed by the word 'KN' to facilitate easy identification.
e) DDUGJY/SAUBHAGYA.
f) 'Employer Name' Marking.

8. PACKING:

(i) All insulators shall be packed in strong corrugated box of min. 7 ply duly paletted or wooden crates. The gross weight of the crates along with the material shall not normally exceed 100 Kg to avoid hackling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.
(ii) The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
(iii) Suitable cushioning, protective padding, or Dunn age or spacers shall be provided to prevent damage or deformation during transit and handling.
(iv) 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 wooden case /crate /corrugated box shall have all the markings stenciled on it in indelible ink.
(v) The Manufacturer shall provide instructions regarding handling and storage precautions to be taken at site.

9. GUARANTEED TECHNICAL PARTICULARS:

The technical particulars as specified in the IS shall be guaranteed



HC - LV - T-70X100

Type of Insulators Standards to which insulators will conform	Type I IS: 1445/1977 Latest amendment
Dimensions	70 mm X 100 mm
Color of Glaze	Brown
Dry Power freq. Withstand voltage (KV)	23 KV
Wet Power freq. Withstand voltage (KV)	10 KV
Puncture Withstand Voltage	1.3 x Actual Dry Power Frequency Voltage
Minimum failing Load (KN)	3.5 KN
Temp Cycle test (as per ISS)	As per clause 7.8 of IS 1445
Porosity test (as per ISS)	As per clause 7.11 of IS 1445
Furnished drawing no.	BPPL-LT-05

Annexure-A

Tests on Insulator units

1. RIV Test (Dry)

The insulator string along with complete hardware fittings shall have a radio interference voltage level below 100 micro volts at one MHz when subjected to 50 Hz AC voltage of 10kV & 30 kV for 11 kV & 33 kV class insulators respectively under dry condition. The test procedure shall be in accordance with IS:8263 /IEC:437/CISPR 18-2.

2. Brittle Fracture Resistance Test

Brittle fracture test shall be carried out on naked rod along with end fitting by applying "1n HNO_3 acid" (63 g conc. HNO_3 added to 937 g water) to the rod. The rod should be held 80% of SML for the duration of the test. The rod should not fail within the 96-hour test duration. Test arrangement should ensure continuous wetting of the rod with Nitric acid.

3. Recovery of Hydrophobicity & Corona test

The test shall be carried out on 4mm thick samples of 5cm X 7cm.

i. The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the Hydrophobicity classification in line with STRI guide for Hydrophobicity classification. Dry the sample surface.
ii. The sample shall be subjected to mechanical stress by bending the sample over a ground electrode. Corona is continuously generated by applying 12 kV to a needle like electrode placed 1mm above the sample surface. The test shall be done for 100 hrs.
iii. Immediately after the corona treatment, spray the surface with water and record the HC classification. Dry the surface and repeat the corona treatment as at clause 2 above. Note HC classification. Repeat the cycle for 1000 hrs. or until an HC of 6 or 7 is obtained. Dry the sample surface.
iv. Allow the sample to recover and repeat 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.

4. Chemical composition test for Silicon content

The content of silicon in the composite polymer shall be evaluated by EDX (Energy Dispersion X- ray) Analysis or Thermo-gravimetric analysis. The test may be carried out at CPRI or any other NABL accredited laboratory.

11KV AIR BREAK SWITCHES

This specification provides for manufacture, testing at works and supply of 11KV AB switches. The 11KV AB switches shall conform to IS: 9920 (Part-I to IV)

1. AB SWITCHES

The 11KV Air Break Switches are required with two poles in each phase. The AB Switches shall be supplied complete with phase coupling shaft, operating rod and operating handle. It shall be manually gang operated and vertically break and horizontal mounting type.

The equipment offered by the bidder shall be designed for a normal current rating of 200 Amps and for continuous service at the system voltage specified as under:

1	11 KV AB Switch	11 KV + 10%	Continuous 50 C/s solidly grounded earthed neutral system

The length of break in the air shall not be less than 400 mm for 11KV AB Switches.

The 11KV AB Switches are required with post insulators. The AB switches should be suitable for mounting on the structure. The mounting structure will be arranged by the bidder. However, the AB Switches shall be supplied with base channel for mounting on the structure which will be provided by the owner. The phase to phase spacing shall be 750mm in case of 11KV AB Switches.

2. POST INSULATORS

The complete set of three phase AB Switches shall have stacks of post insulators.

11KV AB Switches : 3 No. 11KV Post Insulator per stack

The post insulators should conform to the latest applicable Indian standards IS: 2544 Specification for Porcelain Post insulator of compact solid core or long rod insulators are also acceptable. Creepage distance should be adequate for highly polluted outdoor atmosphere in open atmosphere. The porcelain used for manufacture of AB Switches should be homogeneous free from flaws or imperfections that might affect the mechanical dielectric quality. They shall be thoroughly vitrified, tough and impervious to moisture. The glazing of the porcelain shall be of uniform brown in colour, free from blisters, burns and other similar defects. Insulators of the same rating and type shall be interchangeable.

The porcelain and metal parts shall be assembled in such a manner that any thermal expansion differential between the metal and porcelain parts through the range of temperature variation shall not loose the parts or create undue internal stresses which may affect the electrical or mechanical strength. Cap and base of the insulators shall be interchangeable with each other. The cap and base shall be properly cemented with insulators to give perfect grip. Excess cementing must be avoided.

Each 11KV Post Insulators should have technical particulars as detailed below:

S. No.	Particulars	11 kV
i	Nominal system voltage kV (rms)	11
ii	Highest system voltage kV (rms.)	12
iii	Dry Power Frequency one kV minute withstand voltage (rms) in KV	35
iv	Wet Power frequency one minute withstand voltage (rms) in KV	35
V	Power Frequency puncture kV (rms) voltage	1.3 times the actual dry flash over voltage of the unit.
vi	Impulse withstand voltage kV (Peak)	75
vii	Visible discharge voltage kV (rms)	9
viii	Creepage distance in mm (minimum)	320

The rated insulation level of the AB Switches shall not be lower than the values specified below:

S. No.	Standard declared voltage KV/RMS	Rated Voltage of the AB Switches	Standard impulse withstand voltage (positive & negative polarity kV (Peak)		One Minute power frequency withstand voltage kV (rms)	
			Across the Isolating distance	To earth & between poles	Across the Isolating distance	To earth & between poles
i	11KV	12KV	85KV	75KV	32KV	28KV

3. TEMPERATURE RISE

The maximum temperature attained by any part of the equipment when in service at site under continuous full load conditions and exposed to the direct rays of Sun shall not exceed 45 degree above ambient.

4. MAIN CONTACTS

AB Switches shall have heavy duty self-aligning type contacts made of hard drawn electrolytic copper/brass. The various parts should be accordingly finished to ensure interchangeability of similar components. The moving contacts of the switch shall be made from hard drawn electrolytic copper brass. This contact shall have dimensions as per drawing attached so as to withstand safely the highest short-circuit currents and over voltage that may be encountered during service. The surface of the contact shall be rounded smooth and silver-plated. In nut shell the male and female contact assemblies shall ensure.

(i) Electro-dynamic withstands ability during short circuits without any risk of repulsion of contacts.
(ii) Thermal withstands ability during short circuits.
(iii) Constant contact pressure even when the lower parts of the insulator stacks are subjected to tensile stresses due to linear expansion of connected bus bar of flexible conductors either because of temperature variations or strong winds.
(iv) Wiping action during closing and opening.
(v) Fault alignment assuring closing of the switch without minute adjustments.

5. CONNECTORS

The connectors shall be made of hard drawn electrolytic copper or brass suitable for Raccoon/Dog ACSR conductor for 11KV AB Switches. The connector should be 4 -bolt type.

6. OPERATING MECHANISM

All AB Switches shall have separate independent manual operation. They should be provided with ON/OFF indicators and padlocking arrangements for locking in both the end positions to avoid unintentional operation. The isolating distances should also be visible for the AB Switches.

The AB Switch will be supplied with following accessories:

S. No.	Item	Size of 11KV AB Switch
i	Operating Rod (GI dia) ISI mark	Length 5.50 meter dia: 25MM
ii	Phase coupling square rod (GI) ISI mark	Length 1800 mm Size 25x25 mm
iii	Hot dip galvanized Operating handle (GI)	1 No.

The AB Switches shall be capable to resist any chance of opening out when in closed position. The operating Mechanism should be of robust constructions, easy to operate by single person and to be located conveniently for local operation in the switchyard. The GI pipe shall conform to ('B' class or Medium class Blue strip) ISS: 1239-68 and ISI marked by embossing. The vertical down rod should be provided with adequate joint in the mid section to avoid bending or buckling. Additional leverage should be provided to maintain mechanical force with minimum efforts.

All iron parts should be hot dip galvanized as per IS 4759-1979 and zinc coating shall not be less than 610 gm/sq. meter. All brass parts should be silver plated and all nuts and bolts should be hot dip galvanized.

7. ARCING HORNS

It shall be simple and replaceable type. They should be capable of interrupting line-charging current. They shall be of first make and after break type.

8. BUSH

The design and construction of bush shall embody all the features required to withstand climatic conditions specified so as to ensure dependable and effective operations specified even after long periods of inaction of these Air Break Switches. They shall be made from highly polished Bronze metal with adequate provision for periodic lubrication through nipples and vent.

9. DESIGN, MATERIALS AND WORKMANSHIP

All materials used in the construction of the equipment shall be of the appropriate class, well finished and of approved design and material. All similar parts should be accurately finished and interchangeable.

Special attention shall be paid to tropical treatment to all the equipment, as it will be subjected during service to extremely severe exposure to atmospheric moisture and to long period of high ambient temperature. All current carrying parts shall be of non-ferrous metal or alloys and shall be designed to limit sharp points/edges and similar sharp faces.

The firm should have the following type test certificate. The type test should be from CPRI or equivalent lab:

- Test to prove capability of rated peak short circuit current and the rated short time current. The rated short time current should correspond to minimum of 10K Amp and the peak short circuit current should correspond to minimum of 25K Amps.
- Lightning impulse voltage test with positive & negative polarity.

- Power Frequency voltage dry test and wet test
- Temperature rise test
- Millivolt drop test

The above tests should be performed on the AB Switches, manufactured as per owner approved drawing with the specification. Along with the type test certificate, the certified copy of the drawing (from the testing lab) should also be kept for inspection of our officer. Also the test certificates should not be older than 5 years from the date of opening of tender.

Dimension of 11KV AB Switches in (Max.) Tolerance 5%

S. No.	Particulars	11KV AB Switch
i	MS Channel	450x75x40
ii	Creepage distance of Post Insulator	320mm (Min)
iii	Highest of Port shell	254 mm

Fixed contact assembly

i	Base	165x36x8
ii	Contact	70x30x6
iii	GI cover	110x44
iv	Spring	6 Nos.

Moving Contact Assembly

i	Base Assembly	135x25x8
ii	Moving	180x25x9
iii	Bush	Bronze Metal
iv	Thickness of Grooves	7

Connectors

i	Connector	60x50x8 (Moving & fix both)

The bidder should provide AB Switches with terminal connectors, set of insulators, mechanical inter works and arcing horns sets. The base channel for the mounting of AB Switches shall also be

included in the scope of AB Switches. The operating mechanisms together with down pipe operating handle etc. are also included in the scope of supply.

11 KV DROP OUT FUSE CUT OUTS

This specification covers outdoor, open, drop-out expulsion type Fuse Cut outs suitable for installation in 50 Hz, 11 KV distribution system.

1. **APPLICATION**

   The distribution fuse cut outs are intended for use in distribution transformers and have no inherent load break capacity.

2. **APPLICABLE STANDARD**

   Unless otherwise modified in this specification, the cut out shall conform to IS:9385 (Part-I to III) as amended from time to time.

3. **RATED VOLTAGE**

   The rated voltage shall be 12 KV.

4. **RATED CURRENT**

   The rated current shall be 100 A.

5. **RATED LIGHTNING IMPULSE WITHSTAND VOLTAGE VALUES FOR THE FUSE BASE**

   The rated lightning impulse withstand voltages both for positive and negative polarities shall be as given below:

   a) To earth and between poles 75 KV (Peak)
   b) Across the isolating distance of fuse base 85 KV (Peak)

6. **RATED ONE MINUTE POWER FREQUENCY WITHSTAND VOLTAGE (DRY & WET) VALUES FOR THE FUSE BASE**

   a) To earth and between poles 28 KV (rms)
   b) Across the isolating distance 32 KV (rms)

7. **TEMPERATURE RISE LIMIT (In Air)**

a)	Copper contacts silver faced	65°C
b)	Terminals	50°C
c)	Metal parts acting as springs.	The temp. shall not reach such a value that elasticity of metal is changed

8. RATED BREAKING CAPACITY

The rated breaking capacity shall be 8 KA (Asymmetrical).

9. GENERAL REQUIREMENTS/CONSTRUCTIONAL DETAILS

(i) The cutouts shall be of single vent type (downward) having a front connected fuse carrier suitable for angle mounting.

(ii) All ferrous parts shall be hot dip galvanised in accordance with the latest version of IS:2633. Nuts and bolts shall conform to IS:1364. Spring washers shall be electro-galvanised.

(iii) Typical constructional details of the fuse cutout are shown in Fig. 1

10. FUSE BASE TOP ASSEMBLY

(i) The top current carrying parts shall be made of a highly conductive copper alloy and the contact portion shall be silver plated for corrosion resistance and efficient current flow. The contact shall have a socket cavity for latching and holding firmly the fuse carrier until the fault interruption is completed within the fuse.

(ii) The top contact shall be actuated by a strong steel spring which keeps it under sufficient pressure to maintain a firm contact with the fuse carrier during all operating conditions. The spring shall also provide flexibility and absorbs most of the stresses when the fuse carrier is pushed into the closing position.

(iii) The current carrying parts of the assembly shall be protected from water and dust formation by a stainless steel top cover.

(iv) The top contact assembly shall have a robust galvanized steel hook to align and guide the fuse carrier into the socket latch even when the fuse carrier is closed at an off-centre angle.

(v) The top assembly shall have an aluminum alloy terminal connector (refer clause 18).

(vi) The top assembly shall be robust enough to absorb bulk of the forces during the fuse carrier closing and opening operations and shall not over-stress the spring contact. It shall also prohibit accidental opening of the fuse carrier due to vibrations or impact.

11. FUSE BASE BOTTOM ASSEMBLY

(i) The conducting parts shall be made of high strength highly conductive copper alloy and the contact portion shall be silver plated for corrosion resistance and shall provide a low resistance current path from the bottom fuse carrier contacts to the bottom terminal connector.

(ii) The bottom assembly shall have hinge contacts made from highly conductive, anti-corrosive copper alloy and shall accommodate and make a firm contact with the fuse carrier bottom assembly. The fuse carrier shall be placed easily in or lifted from the hinges without any maneuvering. In addition, the bottom assembly shall perform the following functions:

- When opened manually or after fault interruption the fuse carrier shall swing through 180° to the vertical and its further travel shall be prevented by the fuse base bottom assembly.
- The fuse carrier shall be prevented from slipping out of the self-locking hinges during all operating conditions and only when the fuse carrier has reached its fully open position can it be removed from the hinge support.

(iii) The assembly shall have an aluminium alloy terminal connector (refer clause 18).

12. FUSE CARRIER TOP ASSEMBLY

(i) The fuse carrier top contact shall have a solid replaceable cap made from highly conductive, anti-corrosive copper alloy and the contact portion shall be silver plated to provide a low resistance current path from the Fuse Base Top Contact to the Fuse Link. It shall make a firm

contact with the button head of the fuse link and shall provide a protective enclosure to the fuse link to check spreading of arc during fault interruptions.

(ii) The fuse carrier shall be provided with a cast bronze opening eye (pull ring) suitable for operation with a hook stick from the ground level to pull-out or close-in the fuse carrier by manual operation.

13. FUSE CARRIER BOTTOM ASSEMBLY

(i) The fuse carrier bottom assembly shall be made of bronze castings with silver plating at the contact points to efficiently transfer current to fuse base. It shall make smooth contact with the fuse base bottom assembly during closing operation.

(ii) The bottom assembly shall have a lifting eye for the hook stick for removing or replacing the fuse carrier.

(iii) The bottom assembly shall have a suitable ejector which shall perform the following functions:

- It shall keep the fuse link in the centre of fuse tube and keep it tensioned under all operating conditions.
- It shall be capable of absorbing the shock when the fuse carrier is pushed into the closed position and shall not allow the fuse link to be damaged. This is especially important when the fuse link is of low-ampere rating.
- The ejector at the instant of interruption shall retain the fuse carrier in the closed position long enough to ensure that the arc is extinguished within the fuse tube thereby excluding the possibility of arcing and subsequent damage at the contact surfaces.
- The ejector shall help the fuse link separation after fault interruption, allowing the fuse carrier to drop out and clearing the pigtail of the blown fuse link through the bore of fuse tube.

14. FUSE BASE (PORCELAIN)

The fuse base shall be a bird-proof, single unit porcelain insulator with a creepage distance (to earth) not less than 320mm. The top and bottom assemblies as also the middle clamping hardware shall be either embedded in the porcelain insulator with sulphur cement or suitably clamped in position. For embedded components, the pull out strength should be such as to result in breaking of the porcelain before pull out occurs in a test. For porcelain insulators, the beam strength shall not be less than 1000 Kg.

15. FUSE TUBE

The fuse tube shall be made of fibre glass coated with ultraviolet inhibitor on the outer surface and having arc quenching bone fibre liner inside. The tube shall have high bursting strength to sustain high pressure of the gases during fault interruption. The inside diameter of the fuse tube shall be 17.5mm. The solid cap of the fuse carrier shall clamp the button head of the fuse link, closing the top end of the fuse tube and allowing only the downward venting during fault interruption.

16. TYPE TESTS

The cutout shall be subjected to the following type tests:

- Dielectric tests (rated impulse withstands and rated one minute power frequency with stand test voltages)

- Temperature rise test

The above tests shall be carried out in accordance with IS:9385 Part I & II.

For Porcelain Fuse Base only.

- Pull out test for embedded components of the fuse base
- Beam strength of porcelain base

17. MOUNTING ARRANGEMENT

(i) The cutouts shall be provided with a suitable arrangement for mounting these on 75x40mm or 100x50mm channel cross arm in such a way that the centre line of the fuse base is at an angle of 15° to 20° from the vertical and shall provide the necessary clearances from the support. Mounting arrangement shall be made of high strength galvanised steel flat and shall be robust enough to sustain the various stresses encountered during all operating conditions of the cutout. For more details, see enclosed figure 2.

(ii) Strength of the component marked 1 (see figure) shall be determined by clamping the member with the shorter leg at the top to a rigid support by M-10 carriage bolts. A downward force shall be applied along the axis of M-14 carriage bolt parallel to the longer leg and in the direction of longer leg of the member under test. A load of 50 Kg. shall be applied and then removed to take up any slack in the mounting arrangement before the measurement of position is taken, the permanent set measured at the axis of the M-14 carriage bolt shall not exceed 1.6mm when a load of 425 Kg is applied and removed.

(iii) The strength of the M-14 bolt shall in no case be less than1900 Kg and the strength of M-10 bolts not less than 3500 Kg.

18. TERMINAL CONNECTIONS

The cut-out shall be provided with two aluminium alloy (alloy designation 2280 (A-11) as per IS:617-1975) terminal connectors at top and bottom of fuse base assemblies to receive aluminium conductors of diameters between 6.3mm to10.05mm. These terminals shall be easily accessible irrespective of the cut-out location with respect to the pole. The terminals shall meet the test requirements of REC Construction Standard.

19. INSPECTION

All tests and inspection shall be made at the place of manufacture unless otherwise especially agreed upon by the manufacturer and the purchaser at the time to purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities without charge, to satisfy him that the material is being furnished in accordance with this specification.

The purchaser has the right to have the tests carried out at his own cost by an independent agency whenever there is dispute regarding the quality of supply.

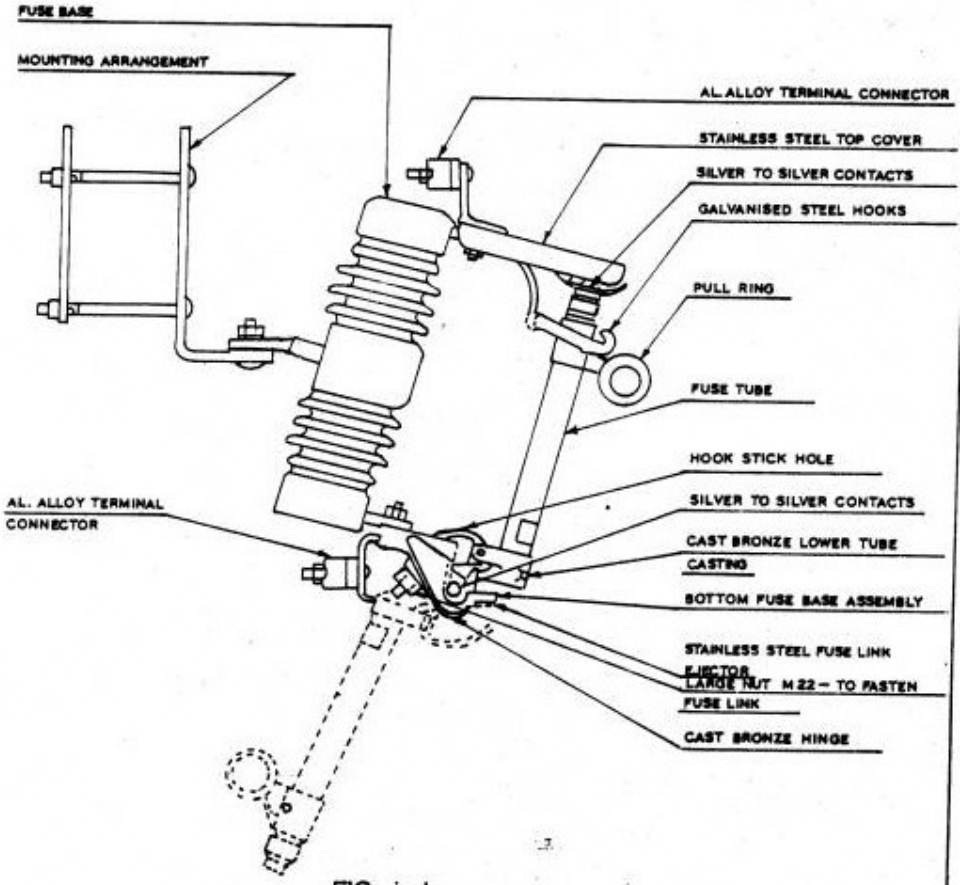
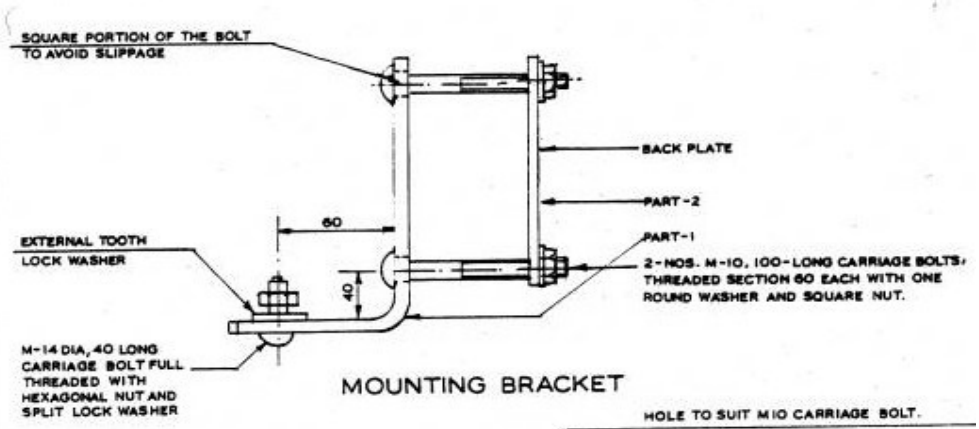


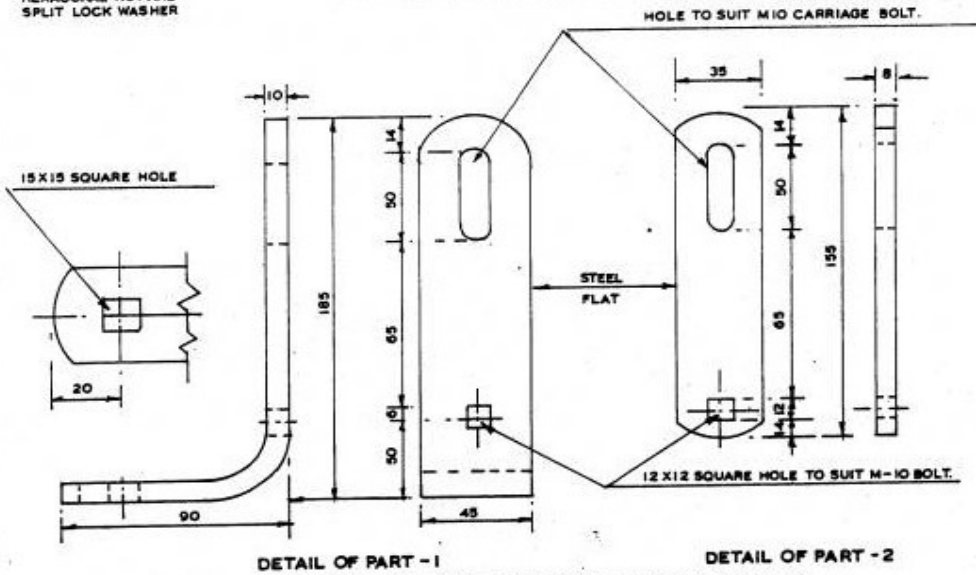
FIG. :- I

११ के० वी० फ्यूज कट-आउट का प्रारूपिक निर्माण विवरण

TYPICAL CONSTRUCTIONAL DETAILS OF 11KV FUSE CUT-OUT



MOUNTING BRACKET



DETAIL OF PART-1 DETAIL OF PART-2

FIG.2:- MOUNTING DETAILS OF 11KV FUSE CUTOUT

ALL DIMENSIONS ARE IN mm.

११ के॰वी॰ ड्राप-आउट फ्यूज कटआउट

11KV DROP-OUT FUSE CUTOUT

SCALE :- N.T.S	JULY, 1987

11kV STATION CLASS SURGE ARRESTORS

This section covers the specification of 11kV voltage station Surge Arrestors for installation on outdoor type 11kV switchgear, transmission lines, transformers etc. 11kV side of which is not enclosed in a cable box. Station class surge arrestors shall be complete with fasteners for stacking units.

1. STANDARDS

The design, manufacture and performance of Surge Arrestors shall comply with IS: 3070 Part-3 and other specific requirements stipulated in the specification. Unless otherwise specified, the equipment, material & processes shall conform to the latest amendments of the following:

IS:2071-1993 (Part-1)	Methods of High Voltage Testing General Definitions & Test Requirements.
IS:2071-1974 (Part-2)	Test Procedures.
IS: 2629-1985	Recommended Practice for hot dip galvanizing on Iron & Steel.
IS: 2633-1986	Method for Testing uniformity of coating of zinc coated Articles.
IS:3070-1993 (Part – 3)	Specification for surge arrestor for alternating current systems. Metal-Oxide lightening Arrestors without gaps.
IS: 4759-1996	Specification for hot dip zinc coating on structural steel and other allied products.
IS: 5621-1980	Hollow Insulators for use in Electrical Equipment.
IS: 6209-1982	Methods of Partial discharge measurement.
IS: 6745	Method for determination of mass of zinc coating on zinc coated iron and steel articles.
ANSI/IEEE-C.62.11	Metal oxide, Surge Arrestor for AC Power Circuits.
IEC –60099-4	Surge Arrestors.

The equipment complying with any other internationally accepted standards shall also be considered if it ensures performance equivalent to or superior to the Indian Standards.

2. GENERAL REQUIREMENT

(i) The metal oxide gap less Surge Arrestor without any series or shunt gap shall be suitable for protection of 11 kV side of power transformers, associated equipment and 11kV lines from voltage surges resulting from natural disturbance like lightning as well as system disturbances.

(ii) The surge arrestor shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of surge current.

(iii) The surge arrestor shall consist of non-linear resistor elements placed in series and housed in electrical grade porcelain housing / silicon polymeric of specified Creepage distance.

(iv) The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.

(v) The surge arrestor shall be provided with line and earth terminals of suitable size. The ground side terminal of surge arrestor shall be connected with 25x6mm galvanized strip, one end

connected to the surge arrestor and second end to a separate ground electrode. The bidder shall also recommend the procedure which shall be followed in providing the earthing system to the Surge Arrestor.

(vi) The surge arrestor shall not operate under power frequency and temporary over voltage conditions but under surge conditions, the surge arrestor shall change over to the conducting mode.

(vii) The surge arrestor shall be suitable for circuit breaker performing 0-0.3 min-CO-3 min-CO- duty in the system.

(viii) Surge arrestors shall have a suitable pressure relief system to avoid damage to the porcelain/ silicon polymeric housing and providing path for flow of rated fault currents in the event of arrestor failure.

(ix) The reference current of the arrestor shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

(x) The Surge Arrestor shall be thermally stable and the bidder shall furnish a copy of thermal stability test with the bid.

(xi) The arrestor shall be capable of handling terminal energy for high surges, external pollution and transient over voltage and have low losses at operating voltages.

(xii) The surge arrestor shall be provided with line and earth terminals of suitable size.

3. ARRESTOR HOUSING

(i) The arrestor housing shall be made up of porcelain/silicon polymeric housing and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing shall be of uniform brown (for porcelain)/Grey (for silicon polymeric) colour, free from blisters, burrs and other similar defects.

(ii) Arrestors shall be complete with fasteners for stacking units together and terminal connectors.

(iii) The housing shall be so coordinated that external flashover shall not occur due to application of any impulse or switching surge voltage upto the maximum design value for arrestor. The arrestors shall not fail due to contamination. The 11kV arrestors housing shall be designed for pressure relief class as given in Technical Parameters of the specification.

(iv) Sealed housings shall exhibit no measurable leakage.

4. ARRESTOR MOUNTING

The arrestors shall be suitable for mounting on 4 pole/2 pole structure used for pole/plinth mounted transformer and for incoming and outgoing lines. Arrestor may also be required to be mounted on a bracket provided in the Transformers.

5. FITTINGS & ACCESSORIES

(i) The surge arrestor shall be complete with fasteners and terminal connectors.

(ii) The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The top metal cap and base of surge arrestor shall be galvanized. The line terminal shall have a built in clamping device which can be adjusted for both horizontal and vertical takeoff.

6. TESTS

(i) Test on Surge Arrestors

The Surge Arrestors offered shall be type tested and shall be subjected to routine and acceptance tests in accordance with IS: 3070 (Part-3)-/IEC:600994. In addition, the suitability of the surge arresters shall also be established for the followings.

a) Acceptance tests

- Measurement of power frequency reference voltage of arrester units.
- Lightning impulse residual voltage on arrester units (IEC clause 6.3.2)
- Internal ionization or partial discharge test

b) Special Acceptance tests

- Thermal stability test (IEC clause 7.2.2)
- Watt loss test.

c) Routine tests

- Measurement of reference voltage
- Residual voltage test of arrester unit
- Internal ionization or partial discharge test
- Sealing test
- Verticality check on completely assembled surge arresters as a sample test on each lot if applicable.

(ii) Type Tests

Following shall be type test as per IS 3070 (Part 3): 1993 or its latest amendment

1.	Insulation Withstand test a) Lightning Impulse b) Power Frequency (Dry/Wet)
2.	Residual Voltage Test a) Steep current impulse residual voltage test b) Lightning impulse residual voltage test
3.	Long duration current impulse withstand test
4.	Switching surge operating duty test
5.	Power frequency voltage Vs. Time characteristics
6.	Accelerated Ageing test
7.	Pressure relief test a) High Current b) Low Current

8.	Artificial pollution test (for porcelain housing)
9.	Seismic Test
10.	Partial Discharge test
11.	Bending test
12.	a) Temperature cycle test (for porcelain housing) b) Porosity test (for porcelain housing)
13.	Galvanizing test on metal parts
14.	Seal Leakage test (for porcelain housing)
15.	Seal leak test and operation tests (for surge monitor)
16.	Weather ageing test (for polymer housing)

(iii) The maximum residual voltages corresponding to nominal discharge current of 10 kA for steep current, impulse residual voltage test, lightning impulse protection level and switching impulse level shall generally conform to Annex-K of IEC-99-4.

(iv) The contractor shall furnish the copies of the type tests and the characteristics curves between the residual voltage and nominal discharge current of the offered surge arrestor and power frequency voltage v/s time characteristic of the surge arrestor subsequent to impulse energy consumption as per clause 6.6 of IS:3070 (Part-3) offered before start of production.

(v) The surge arrestor housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS :5621.

(vi) **GALVANIZATION TEST**

All Ferrous parts exposed to atmospheric condition shall have passed the type tests and be subjected to routine and acceptance tests in accordance with IS:2633 & IS:6745.

7. NAME PLATE

(i) The name plate attached to the arrestor shall carry the following information:

- Rated Voltage
- Continuous Operation Voltage
- Normal discharge current
- Pressure relief rated current
- Manufacturers Trade Mark
- Name of Sub-station

- Year of Manufacturer
- Name of the manufacture
- Name of Client
- Purchase Order Number along with date

8. DRAWINGS AND INSTRUCTION MANUALS

Within 15 days of receipt of the order, the successful tenderer shall furnish to the purchaser, the following drawings and literature for approval:

(i) Outline dimensional drawings of Surge Arrestor and all accessories.
(ii) Assembly drawings and weights of main component parts.
(iii) Drawings of terminal clamps.
(iv) Arrangement of earthing lead.
(v) Minimum air clearance to be maintained of line components to ground.
(vi) Name plate
(vii) Surge monitor, if applicable.
(viii) Instructions manual
(ix) Drawing showing details of pressure relief valve
(x) Volt-time characteristics of surge arrestors
(xi) Detailed dimensional drawing of porcelain housing/Silicon polymeric i.e. internal diameter, external diameter, thickness, height, profile, creepage distance, dry arcing distance etc.

9. TECHNICAL PARTICULARS

The surge arrestors shall conform to the following standard technical requirements. The Insulation values shall be enhanced considering the altitude of operation & other atmospheric conditions.

(i) **System Parameters**

i)	Nominal system voltage	11kV
ii)	Highest system voltage	12 kV
iii)	System earthing	Effectively earthed system
iv)	Frequency (Hz)	50
v)	Lightning Impulse withstand	75 Voltage (kVP)
vi)	Power frequency withstand	28 Voltage (kV rms)
vii)	Arrestor duty	
	a) Connection to system	Phase to earth
	b) Type of equipment to be protected	transformers & switchgear

(ii) **Surge Arrestors**

i)	Type	Gapless Metal oxide outdoor

ii)	Arrestor rating (kV rms)	9
iii)	Continuous Operating voltage	7.65 (kV rms)
iv)	Standard Nominal Discharge Current	10 Rating (kA) (8x20 micro impulse shape)
v)	Degree of protection	IP 67
vi)	Line discharge Class	2
vii)	Steep current at 10 kA	45
viii)	Lightning Impulse at 10 kA	40
ix)	Energy capability corresponding to	
a)	Arrestor rating (kj/kV)	4.5
b)	COV (kj/kV)	4.9
x)	Peak current for high current impulse operating duty of Standard TS for arrestor classification 10 kA	100

(iii) **INSULATOR HOUSING**

a) Power frequency withstand test voltage (Wet) (kV rms) 28
b) Lightning impulse withstand/tests voltage (kVp) 75

(iv) **GALVANIZATION**

a) Fabricated Steel Articles
   5 mm thick cover 610 g/m²
   Under 5 mm but not less than 2 mm thickness 460 g/ m²
   Under 2 mm but not less than 1.2 mm thickness 340 g/ m²
b) Castings
   Grey Iron, malleable iron 610 g/ m²
c) Threaded works other than tubes & tube fittings
   Under 10 mm dia. 270 g/ m²
   10 mm dia. & above 300 g/ m²

NOTE: Surge Monitor shall have to be provided if covered in BPS.

GS STAY SETS (16 MM)

The stay sets (Line Guy set) will consist of the following components:

(i) **ANCHOR ROD WITH ONE WASHER AND NUT:** Overall length of rod should be 1800 mm to be made out of 16 mm dia. GS Rod, one end threaded up to 40mm length with a pitch of 5 threads per cm and provided with one square GS washer of size 40x40x1.6mm and one GS hexagonal nut conforming to IS:1367(1967) & IS:1363(1967). Both washer and nut to suit threaded rod of 16mm dia. The other end of the rod to be made into a round eye having an inner dia. of 40mm with best quality welding.

(ii) **ANCHOR PLATE SIZE 200x200x6MM:** To be made out of GS plate of 6mm thickness. The anchor plate should have 18mm dia. hole at its center.

(iii) **TURN BUCKLE & EYE BOLT WITH 2 NUTS:** To be made of 16mm dia. GS Rod having an overall length of 450 mm, one end of the rod to be threaded up to 300 mm length with a pitch of 5 threads per cm and provided with two GS Hexagonal nuts of suitable size conforming to IS:1363(1967) & IS:1367(1967). The other end of rod shall be rounded into a circular eye of 40mm inner dia. with proper and good quality welding.

(iv) **BOW WITH WELDED ANGLE:** To be made out of 16mm dia. GS rod. The finished bow shall have an overall length of 995mm and height of 450 mm, the apex or top of the bow shall be bent at an angle of 10 R. The other end shall be welded with proper and good quality welding to a GS angle 180mm long having a dimension of 50x50x6mm. The angle shall have 3 holes of 18mm dia. each.

(v) **THIMBLE:** To be made on 1.5 mm thick GS sheet into a size of 75x22x40mm and shape as per standard shall be supplied.

(vi) **Galvanizing:** The complete assembly shall be hot dip galvanized.

(vii) **WELDING:** The minimum strength of welding provided on various components of 16mm dia. stay sets shall be 3100 kg. Minimum 6 mm fillet weld or its equivalent weld area should be deposited in all positions of the job i.e. at any point of the weld length. The welding shall be conforming to relevant IS: 823/1964 or its latest amendment. Minimum length of weld to be provided at various places in the stay sets shall be indicated by the bidder. Welding if, found short in lengths as per final approved drawings shall be rejected.

(viii) **THREADING:** The threads on the Anchor Rod, Eye Bolt & Nuts shall be as per specification IS: 4218/1967 (ISO Metric Screw Threads). The nuts shall be conforming to the requirement of IS: 1367/1967 & have dimensions as per IS:163/1967. The mechanical property requirement of fasteners shall conform to property clause 4.6 each for anchor rod & Eye bolt and property clause 4 for nuts as per IS: 1367:1967.

Average weight of finished 16mm stay sets 7.702 kg. (minimum) (excluding nuts thimbles and washers) 8.445 kg. (maximum)

GS STAY SETS (20 MM)

The stay sets (Line Guy set) will consist of the following components:

(i) **ANCHOR ROD WITH ONE WASHER AND NUT:** Overall length of Rod should be 1800mm to be made out of 20mm dia GS Rod, one end threaded upto 40mm length with a pitch of a threads per cm. And provided with one square G.S. Washer of Size 50x50x1.6mm and one GS Hexagonal nut conforming to IS:1367:1967 & IS:1363:1967. Both washer & nut to suit the threaded rod of 20mm. The other end of the rod to be made into a round eye having an inner dia of 40mm with best quality welding. Dimensional and other details are indicated and submitted by bidders for owner‘s approval before start of manufacturing.

(ii) **ANCHOR PLATE:** Size 300x300x8mm: To be made out of G.S. Plate of 8mm thickness. The anchor plate to have at its centre 22mm dia hole.

(iii) **TURN BUCKLE, EYE BOLT WITH 2 NUTS:** To be made of 20mm dia G.S. Rod having an overall length of 450 mm. One end of the rod to be threaded upto 300mm length with a pitch of 4 threads per cm. The 20mm dia bolt so made shall be provided with two G.S. Hexagonal nuts of suitable size conforming to IS:1637/1967 & IS:1363/1967.

The other end of the rod shall be rounded into a circular eye of 40mm inner dia with proper and good quality of welding. Welding details are to be indicated by the bidder separately for approval.

(iv) **BOW WITH WELDED CHANNEL:** To be made out of 16mm dia G.S. Rod. The finished bow shall have and overall length of 995 mm ad height of 450 mm. The apex or top of the bow shall be bent at an angle of 10R. The other end shall be welded with proper and good quality welding to a G.S. Channel 200mm long having a dimension of 100x50x4.7 mm. The Channel shall have 2 holes of 18 mm dia and 22 dia hole at its centre.

(v) **THIMBLE 2 Nos.:** To be made of 1.5mm thick G.S. sheet into a size of 75x22x40mm and shape as per standard.

(vi) **GALVANISING:** The complete assembly shall be hot dip galvanised.

(vii) **WELDING:** The minimum strength of welding provided on various components of 20mm dia stay sets shall be 4900 kg. Minimum 6mm filet weld or its equivalent weld area should be deposited in all positions of the job i.e. at any point of the weld length. The welding shall be conforming to relevant IS: 823/1964 or its latest amendment.

(viii) **THREADING:** The threads on the Anchor Rods, Eye Bolts and Nuts shall be as per specification IS: 4218:1967 (ISO Metric Screw Threads). The Nuts shall be conforming to the requirements of IS: 1367:1967 and have dimension as per IS 1363:1967. The mechanical property requirement of fasteners shall confirm to the properly clause 4.6 each for anchor rods and Eye bolt and property clause 4 for nuts as per IS: 1367:1967.

1. **TEST CERTIFICATE:** The contractor shall be required to conduct testing of materials at Govt./Recognized testing laboratory during pre – dispatch inspection for Tensile Load of 3100 Kg/4900 Kg. applied for one minute on the welding & maintained for one minute for 16 mm and 20 mm dia. stay sets respectively.

2. **IDENTIFICATION MARK:** All stay sets should carry the identification mark of word DDUGJY/SAUBHAGYA and size of the stay set. This should be engraved on the stay plate and on stay rods to ensure proper identification of the materials.
   The nuts should be of a size compatible with threaded portion of rods and there should be no play or slippage of nuts.

Welding wherever required should be perfect and should not give way after erection.

3. **TOLERANCES:** The tolerances for various components of the stay sets are indicated below subject to the condition that the average weight of finished stay sets of 16mm dia. excluding nuts, thimbles and washers shall not be less than the weight specified above:

Item	Section Tolerances	Fabrication Tolerances	Material
Anchor Plate	6mm thick + 12.5% - 5%	200x200mm + 1%	GS plate 6mm thick
	8mm thick + 12.5% - 5%	300x300mm + 1%	GS plate 8mm thick
Anchor Rod	16mm dia. + 5%- 3%	Length 1800mm + 0.5%	GS Round 16mm dia.
		Rounded Eye 40 mm inside dia. + 3%. Threading 40mm+11% - 5	GS Round 16mm dia.
	20mm dia. + 3%- 2%	Length 1800mm + 0.5%	GS Round 20mm dia.
		Round Eye 40mm inside dia. + 3%. Threading 40mm +11% - 5%	GS Found 20mm dia.
Turn Buckle Bow	16 mm dia.+ 5%- 3%	Length 995mm + 1% 16mm dia.	GS Round 16mm dia.
		Length 180mm + 1% 50x50x6mm	GS Angle
		Channel length 200mm + 1%	GS Channel 100x50x4.7mm
Eye Bolt Rod	16mm dia. + 5%- 3%	Length 450mm + 1% Threading 300mm + 1% Round Eye 40mm inside dia. + 3%	GS Round 16mm dia.
	20mm dia. + 3%- 2%	Length 450mm + 1% Threading 300mm + 1% Round Eye 40mm inside dia. + 3%	GS Round 20mm dia.

GI STAY WIRE

1. APPLICABLE STANDARDS

Except when they conflict with the specific requirements of this specification, the G.I. Stranded Wires shall comply with the specific requirements of IS:2141/1979. IS:4826/1979 & IS:6594/1974 or the latest versions thereof.

2. APPLICATION AND SIZES

(i) The G.I. stranded wires covered in this Specification are intended for use on the overhead power line poles, distribution transformer structures etc.
(ii) The G.I. stranded wires shall be of 7/3.15mm standard sizes.

3. MATERIAL

The wires shall be drawn from steel made by the open hearth basic oxygen or electric furnace process and of such quality that when drawn to the size of wire specified and coated with zinc, the finished strand and the individual wires shall be of uniform quality and have the properties and characteristics as specified in this specification. The wires shall not contain sulphur and phosphorus exceeding 0.060% each.

4. TENSILE GRADE

The wires shall be of tensile grade 4, having minimum tensile strength of 700 N/mm² conforming to IS:2141.

5. GENERAL REQUIREMENTS

(i) The outer wire of strands shall have a right-hand lay.
(ii) The lay length of wire strands shall be 12 to 18 times the strand diameter.

6. MINIMUM BREAKING LOAD

The minimum breaking load of the wires before and after stranding shall be as follows:

No. of wires & const.	Wire dia. (mm)	Min. breaking load of Single wire before stranding (KN)	Min. breaking load of the standard wire (KN)
7(6/1)	3.15	5.45	36.26

7. CONSTRUCTION

(i) The galvanized stay wire shall be of 7-wire construction. The wires shall be so stranded together that when an evenly distributed pull is applied at the ends of completed strand, each wire shall take an equal share of the pull.

(ii) Joints are permitted in the individual wires during stranding but such joints shall not be less than 15 meters apart in the finished strands.

(iii) The wire shall be circular and free from scale, irregularities, imperfection, flaws, splits and other defects.

8. TOLERANCES

A tolerance of (±) 2.5% on the diameter of wires before stranding shall be permitted.

9. SAMPLING CRITERIA

The sampling criteria shall be in accordance with IS:2141.

10. TESTS ON WIRES BEFORE MANUFACTURE

The wires shall be subjected to the following tests in accordance with IS:2141.

- Ductility Test
- Tolerance on Wire Diameter

11. TESTS ON COMPLETED STRAND

The completed strand shall be tested for the following tests in accordance with IS:2141.

(i) Tensile and Elongation Test: The percentage elongation of the stranded wire shall not be less than 6%.

(ii) Chemical analysis

(iii) Galvanizing Test: The Zinc Coating shall conform to "Heavy Coating" as laid down in IS:4826

12. MARKING

Each coil shall carry a metallic tag, securely attached to the inner part of the coil, bearing the following information:

- Manufacturers' name or trade mark
- Lot number and coil number
- Size
- Construction
- Tensile Designation
- Lay
- Coating
- Length
- Mass
- ISI certification mark, if any

13. PACKING

The wires shall be supplied in 75-100 Kg. coils. The packing should be done in accordance with the provisions of IS:6594.

GI WIRES

1. APPLICABLE STANDARDS

Except when they conflict with the specific requirements of this specification, the G.I. wires shall comply with the provisions of IS:280-1978 and IS:7887-1975 or the latest version thereof.

2. APPLICATION & SIZES

G.I. wires covered in this Specification are intended for the following applications:

Application	Sizes (nominal dia.)
Earthing of Transformers, poles & Fittings.	4 mm
Continuous Earth wire for 11 KV lines	4 mm
Protective guarding at the crossing of over-head power lines with roads, railway tracks and telecommunication lines	4 mm

3. MATERIAL

(i) The wires shall be drawn from the wire rods conforming to IS:7887-1975 or the latest version thereof.
(ii) The requirements for chemical composition for the wires shall conform to IS:7887.
(iii) The wires shall be sound, free from split surface flaws, rough jagged and imperfect edges and other detrimental defects on the surface of the wires.

4. GALVANIZING

The wires shall be galvanized with 'Heavy Coating' as per IS:4826-1979 or the latest version thereof.

5. GRADES

GI wires shall be classified into two grades based on their tensile strength:

Grade	Tensile Strength (MPa)
Annealed	300-550
Hard	550-900

6. TOLERANCE IN DIAMETER

The tolerance on nominal diameter at any section of wire shall not exceed (±) 2.5%. Further, the maximum difference between the diameters at any two cross-sections of wires shall not exceed 2.5%.

7. TESTS

The following tests shall be carried out in accordance with IS:280-1978 or the latest version thereof as per sampling criteria stipulated therein:

- Dimensional check (dia.) - refer clause 6 above.
- Visual inspection regarding freedom from defects refer clause 3(iii) above.
- Tensile test
- Wrapping test (for wire diameters smaller than 5mm)
- Bend test (for wire diameters 5mm only)
- Coating test
- Chemical composition

NOTE: The type test reports shall not be older than 5 years and shall be valid at the time of inspection and supply of materials.

8. PACKING

The wires shall be supplied in 50-70 kg. coils, each coil having single continuous length. Each coil of wire shall be suitably bound and fastened compactly and shall be protected by suitable wrapping.

9. MARKING

Each coil shall be provided with a label fixed firmly on the inner part of the coil bearing the following information:

- Manufacturer's name or trade mark
- Lot number and coil number
- Size
- Grade (Annealed or Hard)
- Mass
- Length
- ISI Certification mark, if any

SPIKE ROD FOR EARTHING (AS PER IS 3043-1987)

This specification covers the technical details of G.I. Earthing Rod complete with the necessary fittings.

1. SPECIFICATIONS:

(i) The earthing rod should be 2500 mm (i.e. 25 + 2399 + 76) long fabricated from 20 mm dia. M.S. Rod, the bottom of which to be made cut of the same rod in the shape of a cone – 76 mm long and the forged head made out of the same rod with 30 mm (dia.) = 25 mm (height). The earthing arrangements should consist of G.I. Bolt/nut and washers. The raw materials, as required for manufacture, shall comply with the relevant latest Indian Standard with all amendments, additions and alternation, for obtaining the required strength.

(ii) The rod including the head portion should be smoothly and continuously hot dip galvanized as per relevant I.S. Other portion i.e. bolts, nuts and washers should be hot dip galvanized or Zinc electro-plated. For Zinc electro plating manufacturers will have to give undertaking for satisfactory performance in the Test Certificate while offering inspection.

(iii) No crack should develop and deformation in the top head and/or bending of rod should not be appreciable while the rods will be driven into the ground by the application of heavy intermittent block not less than 7.5 Kg. Hammer and in a manner as is usual for driving rods into the grounds.

2. GUARANTEE, TESTING & INSPECTION:

Three copies of test certificates should be furnished along with the offer of inspection. Following tests will be carried out by our inspecting Engineers before acceptance of any material:

- Galvanizing tests as per the relevant I.S. on 1% of the offered lot up to the maximum of 5 Nos.
- Dimensional check on 1% of the offered lot up to the maximum of 10 Nos.
- Stores test by hammering (7/8 times) the rods into the normal soil by a hammer (not less than 7.5 Kg) on 1% of the offered lot up to the maximum of 2 nos.

3. ACCEPTANCE CRITERIA

FOR 1st SAMPLE

(i) Failure in Galvanizing test and dimensional check up to 1/5th will conform the lot for acceptance. But in case of dimensional check failure up to 1/5th will be restricted up to as follows:
   - 1% on total length
   - 7½% on other dimension except 15 mm, 25 mm & 40 mm of small forged portion.
   - No failure will be accepted in 15 mm, 25 mm, & 40 mm of small forged portion.

   If the failure is beyond the above tolerance, re-sampling may be made as per clause (ii) below.

(ii) If the failure in each of the above tests are more than 1/5th but less than or equal to 2/5th resampling in the same manner will be made for the test(s) in which failed.

(iii) However, if the failure in any of the above tests is greater than 2/5th the whole lot will be rejected.

For 2nd Sample:

(i) In case of failure as (a) above the lot will conform for acceptance. However, if the failure in any of the above tests is greater than 1/5th the whole lot will be rejected.

(ii) No resampling will be made in case of failure in stress tests by hammering.

(iii) Any defect found during Inspection/Testing of the Earthing rod or after delivery in the site in respect of Galvanizing, welding and in the quality of the associated materials shall

make the whole lot liable for rejection. The rejected materials shall be taken back by the supplier at his own cost from the place of delivery within ten days from the date of intimation in this respect.

(iv) Earthing Rods with all fittings mounted on them shall be supplied in bundles of ten.

4. TOLERANCE:

- ½ % on total length.
- 5 % on other dimensions.
- 10 % on 15 mm, 25 mm, & 40 mm of small forged portion.
- Any tolerance on the positive side will be accepted.

5. MARKING:

Manufacturer's identification marking is to be punched on the Head of the Earth Rod.

10, 16 & 25 KVA L.T. DISTRIBUTION BOXES

This specification covers the design, manufacture, inspection, testing at manufacturer's place and supply of L.T. Distribution Box with energy meter for 5, 10, 16 & 25KVA transformers. Distribution Boxes shall be used for controlling the L.T. feeders from the L.T. side of Distribution Transformers. The system shall be A.C. 3-phase, 4 wires, 433V or AC single phase 2 wires, 230V, 50 Hz with effectively grounded neutral.

1. SERVICE CONDITIONS:

The equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the climatic conditions of North-eastern states (including Sikkim).

2. SYSTEM DETAILS:

Distribution Boxes are meant for metering, control and protection of Distribution Transformers with relevant parameters as under:

S. No.	Transformer Capacity kVA	Full Current Amps	Incoming Circuit Configuration	Outgoing Circuits Configuration
1	5 KVA (1-Phase)	32 Amp	35 A SPN MCCB	2 x 25A SP MCCB
2	10 KVA (1-Phase)	43 Amp	45 A SPN MCCB	2 x 32A SP MCCB
3	16 KVA (1-Phase)	70 Amp	80 A SPN MCCB	2 x 50 A SP MCCB
4	16 KVA (3-Phase)	22 Amp	25 A TPN MCCB	6 x 16 A SP MCCB
5	25 KVA (3-Phase)	34 Amp	40 A TPN MCCB	6 x 25A SP MCCB

Each Distribution box shall have provision for fixing of three phase tri-vector energy meter/single phase meter for DT metering depending upon capacity and type of transformer, 1No. single pole Neutral (SPN)/Three Pole Neutral (TPN) MCCB at incoming and 2 & 6 Nos. single pole MCCB at outgoing circuit as per above table. Incoming and Outgoing MCCB shall be connected through insulated connectors. Cable from the Distribution Transformer shall be connected to the incoming MCCB through energy meter. Cables from the outgoing terminals of the incoming MCCB

shall be connected respectively to the R-Y-B Phase and Neutral terminals of the insulated bus bars or insulated Multiple Outgoing Connectors. Cables from insulated bus bars or insulated Multiple Outgoing Connectors shall be connected to the outgoing MCCBs. Aluminium cable of 16mm2 for5KVA/10 KVA/16KVA and 35mm2 for 25KVA transformer shall be used. Cable shall be fixed with bus bar or connectors with minimum two screws of size not less than M6. Insulation provided shall be such that no live part including the screws for holding the cable shall be accessible by hand/finger.

3. MCCB:

MCCB shall be of reputed make and shall confirm to latest IS. MCCB shall be of fixed rating type. MCCB shall have rated service short circuit breaking capacity of 10 KA at 0.4 P.F. (lag) with rated insulation voltage of 660 V. The time current characteristics of MCCB shall be as per the following details:

Multiple of normal Current Setting	Tripping Time
1.05	More than 2.5 hrs.
1.2	More than 10 minutes and less than 2 hrs.
1.3	Less than 30 minutes
1.4	Less than 10 minutes
2.5	Less than 1 minute
6.0	Less than 5 Seconds

For above test, the reference calibration temperature of the MCCB shall be 50°C.

4. ENCLOSURE:

(i) The enclosure shall be made up of CRCA MS sheet of 18 SWG sheet thickness for 5/10/16 KVA single phase and of 16SWG for 16/25KVA three phase.

(ii) The inside dimensions of Distribution Box shall be 300 x 500 x 160mm for 5, 10 & 16 kVA single phase transformer and 1000 x 500 x 170 mm for 16 & 25 kVA three phase Transformer. However, the dimensions of the box is for reference only, internal clearance as per our requirement shall be strictly maintained. Overall dimensions of the box shall be such that the box will withstand temperature rise limits as per IS and Company's Specification and to have sufficient space for working during maintenance. The size of the box will depend on the size of Electrical components and other relevant provision made in IS:13947/(P1,2&3), IS:2086 and IS:4237 with latest amendment if any. Adequate slope on the top of box shall be provided to drain out rainwater from the top. The body and door of enclosure shall be individually in one piece without any welding, except for fixing of the accessories like hinges, clamps, mounting clamps, bolts etc. which shall be spot welded or MIG welded only. The door of Distribution box shall be fixed on three tamper proof inside hinges not visible from outside. Hinges shall be welded from inside of the box and door shall be fixed with the two

screws in each hinge. Hinges shall be made from 1.6mm MS sheet with hinge pin of diameter 3mm. The hinge pin shall have head on top so that it does not fall down during the normal usage. Base and door shall have flange / collars. Collar of Base and door shall overlap by minimum 8mm. Rubber gasket shall be provided in between base and doors, such that it provides proper sealing between the door and base of box to avoid ingress of water. Degree of protection shall be IP-33 as per IS-13947 (amended up to date). Rubber Gasket shall be fixed with suitable adhesive. Two numbers 'U' shaped latch arrangement shall be provided to seal the door with body for 5/10 KVA single phase and three numbers 'U' shaped latch arrangement shall be provided for 16/25KVA three phase. 2.5mm & 8mm diameter hole shall be provided in U-shaped latch for sealing wires & padlock. Holes provided for sealing & padlock should be aligned when latch is in closed position. 'U' shaped latch arrangement shall be made from 1.6 mm thick MS sheet and shall be welded from inner side of the box. U-latch shall be joined with stainless steel rivet.

(iii) Viewing window opening of 80mm x 90mm shall be provided with toughened glass of 5mm thickness. Size of glass shall be 100mm x 110mm. Glass shall be provided with a wraparound single piece rubber gasket (without joint) having minimum depth of 8mm made from good quality rubber so that it can withstand weather effect. Glass along with rubber gasket shall be fixed from inside of the door of distribution box with powder coated glass holder made of 20 SWG MS sheet without any welding joint and by draw process. Glass holder shall be fixed with minimum four welded screws & nuts from inside and not visible from outside.

(iv) Mounting arrangement of the meter: It should be raised from the base of box by 15mm (minimum). It should be suitable for different makes of meters. Galvanized/Zinc Plated adjustable strip shall be provided on meter mounting arrangement for fixing of the meter. Three mounting MS screws, one for upper hanger (M4 threads x length 12mm) & two (M4 threads x 25 or 35mm length) in moving slotted flat shall be provided for fixing of the meter.

(v) Two sets of Louvers (One set on each side) shall be provided. The perforated sheet of 20 SWG CRCA MS shall be welded from inside of the louvers.

(vi) The surface of the enclosure shall be properly Pre-treated / Phosphated in a 7-Tank process and shall be applied with a powder coating of about 40 micron thickness. The powder coating shall be of Light Admiralty Grey colour shade (IS-5:1993 Colour No. 697). Powder coating shall be suitable for outdoor use. Rating and Type of distribution box shall be printed or embossed on the door of the distribution box.

(vii) EC grade Aluminium Bus bars of 100mm2 (minimum) for Phase and Neutral, capable of carrying full load current shall be provided. Bus bar shall be completely insulated such that no live part including screwsare accessible by hand/finger after fixing of cables. Insulation shall be Fire retardant. Bus bars shall be isolated with respect to body.Twoearthing bolts of diameter 10mm and 25mm long shall be welded from inside of the box and shall be provided with 2 nuts & washer. Earth marking shall be duly embossed near the earth bolts. There shall be no powder coating on the earthing bolts.

(viii) 1 No. Incoming & 2 Nos. outgoing cable holes shall be provided. Cable holes shall be provided with superior quality rubber cable glands of internal diameter 30mm. Rubber glands shall be made such that internal diameter of glands provided for cables should be closed with the rubber film of minimum 1mm thickness. Cable will go through the glands by piercing the film of the glands.

(ix) For mounting of box on pole, four holes shall be provided the back side of the box.

(x) Danger marking shall be provided on the box in red color.
(xi) Name of Utility and name of scheme i.e. DDUGJY shall be embossed on the distribution box.
(xii) Each distribution box shall be supplied with proper packing in 3 ply corrugated box.
(xiii) Tolerance permissible on the overall dimensions of box shall be ±3%.

5. **FINISHING OF DISTRIBUTION BOX:** The surface of the box shall be properly pretreated/ phosphated in 7-tank process and shall be applied with powder coating. The process facility shall be in house of the manufacturer to ensure proper quality for outdoor application.

6. **ACCEPTANCE TESTS :**

Following acceptance tests shall be carried out while inspecting lot of material offered:

a) **Visual Examination:**
The Distribution box shall be inspected visually, externally and internally for proper Powder Coating layer, fitting of all the components in accordance with technical Specification.

b) **Verification of dimensions:**
Verification of dimensions, external/ internal clearances will be carried out as per technical specifications.

c) **Verification of fittings:**
Components like insulated bus bars, MCCBs, Hinges, Rubber Glands etc. will be verified as per technical specification.

d) **High voltage withstand test at 2.5KV:**
The A.C. voltage of 2.5KV, 50HZ shall be applied for one minute as follows:

i. Between Live Parts of each insulated bus bar.
ii. Between each insulated bus bar and earthing screw/bolts.
iii. On bus bar insulation.
iv. On PVC coating of PVC cables.

There shall not be any puncture or flash over during this test.

e) **MCCB:**
Time current characteristics of each rating of MCCB shall be checked as per the requirement of the specifications.

f) **Current Carrying Capacity:**
The current of 200 Amp shall be applied for 30 minutes through high current source on each insulated bus bar. There shall not be overheating of the insulated bus bars during this test.

7. **TESTING & MANUFACTURING FACILITIES:** The Tenderer must clearly indicate what testing and manufacturing facilities are available in the works of manufacturer and whether the facilities are adequate to carry out all Routine & Acceptance Tests. These facilities should be available to inspection Engineers, if deputed to carry out or witness the tests in the manufacturer's works. The tenderer must have all the in-house testing facilities to carry out the acceptance tests on the Box.

8. TESTS: The Distribution box shall comply with the requirement of IP33. Each type of LV Switchboard shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards and during manufacture and on completion.

i) Routine Test

The tests shall be carried out in accordance with IS 13947 and 8623 include including but not necessarily limited to the following:

(a) Visual Check

(b) Verification of Component Rating

(c) Other Checks

- Easy Accessibility and Maintenance
- Color Coding provided by colored tapes.
- Bus bar dimensions
- Degree of Protection check by paper.

(d) Dimension check

(e) Insulation Resistance Tests

(f) Mechanical Operation Tests

(g) Bus bar support and clearances

(h) Continuity of circuits and Function

(i) Powder Coating

(j) Overload Release setting of the Circuit Breakers

ii) Type Test

The box shall be fully type tested as per the requirement of IS 13947 (Part-1):1993 with latest amendment. The type test shall be carried out from the Govt. approved laboratories duly accredited by National Board of Testing & Calibration Laboratories (NABL) of Govt. of India. Type test report shall be submitted to RECPDCL along with bid. The type test reports shall not be older than 5 years and shall be valid at the time of inspection and supply of materials.

9. Prototype & Drawings:

The manufacturer has to manufacture the prototype Unit for each rating as per this specification before bulk manufacturing. The manufacturer should intimate the readiness of prototype to employer. The Project Manager will inspect the prototype for approval. The manufacturer should submit the final drawings in line with this specification and prototype to employer for approval before bulk manufacturing. The approval of prototype & drawings shall be a responsibility of manufacturer/Contractor.

63, 100, 200 KVA L.T. DISTRIBUTION BOXES

This Specification covers the design, manufacture, testing at works and supply of Distribution Boxes made out of CRCA MS for controlling the L.T. feeders from the L.T. side of Distribution Transformers. The system shall be A.C. 3 phase, 4 wire, 433 V, 50 HZ with effectively grounded neutral.

1. **SERVICE CONDITIONS:** The equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under isoceraunic and ambient conditions as prevailing in Arunachal Pradesh. Moderately hot and humid tropical climate conductive to rust and fungus growth.

2. **SYSTEM DETAILS:** Distribution Boxes are meant for control and protection of Distribution Transformers with relevant parameters as under:

S. No.	Particulars	Details		
1	KVA rating	63 KVA	100 KVA	200 KVA
2	Voltage	433 V, 3 Ph, (3x 250 V)		
3	Frequency	50 HZ		
4	Phases	3 phase, solidly grounded neutral		
5	Approximate full load current of transformer	84 A	133 A	270A
6	No. of Outgoing circuits	2 nos.		3 nos.

3. **APPLICABLE STANDARDS:**
   - IS:13947/ (Part 3) (amended up to date) for Isolator (Switch Disconnector)
   - IS: 13947/ (Part2) (amended up to date) for L.T. MCCBs.
   - IS: 8623 (amended up to date) for enclosure Box & for degree of protection provided by enclosures of electrical equipments.
   - IS: 4237, IS:8623 (amended up to date) – for general requirement of L.T. switchgears.
   - IS: 13703 (Part I & II amended up to date) for HRC Fuse Base and HRC Fuse Link.
   - IS: 5 /2007 -Colours of Ready Mixed paints and Enamels.
   - IS: 13871/1993 (amended up to date) – Powder coatings – specifications
   - IS : 6005/1998 (amended up to date) – Code of Practice for phosphating of iron and steel.
   - IS: 13411/1992 (amended up to date) – Glass Reinforced Polyester Dough Moulding Compounds

4. **MANUFACTURE/CONSTRUCTION OF BOXES:** Distribution Boxes shall have Isolator (Switch Disconnector) and HRC fuse base with links on incoming circuit and single pole MCCBs & Link Disconnector on outgoing circuits with necessary interconnecting Bus Bars/ Links. Standard General Arrangement of Isolators, HRC fuse base with links, MCCBs, Link Disconnector, Neutral Links, Bus Bars, connecting links, Cable termination arrangement etc. inside the Box shall be done by the manufacturer.

5. INCOMING CIRCUIT:

(i) **Isolator (Switch Disconnector):**

- Each distribution box shall have one triple pole Isolator (Switch Disconnector), conforming to relevant latest IS. The supplier shall indicate makes and types of offered isolator in GTP. The supplier shall submit Type Test Report of the Isolator as specified in Cl. No. 13.C (ii) in this specification for approval of Employer before commencement of production. The Switch disconnector to be provided in the Distribution Box will be as per Employer specification.
- The Isolator should be front operated triple pole type. The casing of Isolator shall be of non-tracking, heat resistant insulating material of Dough Moulding Compound (DMC) of D3 Grade as per IS:13411 (amended upto date), no separate enclosure is required. Isolator Base should withstand the breaking capacity of 80 kA. To extinguish the arc immediately in isolators, in each phase arc-chutes with minimum 12 strips shall be provided.
- The isolator shall be robust in construction and easy for operation. The handle of the isolator should be detachable easily for security purpose while working on L.T. circuits.
- The characteristics of Isolator shall be as follows:

S. No.	Characteristics	Rating		
		63 KVA	**100 KVA**	**200 KVA**
1	Basic uninterrupted duty	200 A		600 A
2	Mechanism	Manual quick make quick break		
3	Standard applicable	IS : 13947 amended up to date		
4	Utilization category	AC –23 A		
5	Mechanical Endurance	As per IS 13497 amended up to date		
6	Electrical Endurance	As per IS: 13947 amended up to date		
7	Rated Duty	Uninterrupted		
8	Making /Breaking capacity	Not less than requirement of AC –23 A category		
9	Two seconds rating	4 KA		8 KA
10	Rated insulation voltage	660 V		

- The terminal connector strips of the isolator shall be projecting out of isolator of 80 mm (minimum) in length on cable connection side and 60mm (minimum) on HRC fuse base side. In 63 & 100 KVA distribution box, the cross section of the strips on outside of the isolator shall be provided as below:

  63 & 100 KVA - 25X5 mm.
  200 KVA- 50X6 mm.
- The material of isolator strips shall be EC grade tin-plated copper. The terminal strips shall be continuous from the point of contact separation inside the Isolator with cross section as mentioned above throughout the length. Gap of 50mm shall be maintained between each terminal throughout the length.

(ii) **HRC FUSE:** HRC Fuse of suitable capacity shall be provided between outgoing terminal of Switch

Disconnector (Isolator) and incoming Busbar to facilitate electrical breaking of the circuit. Each Distribution Box shall have 3 Nos. of HRC Fuse Base with HRC Fuse Links (Blade type Contacts).

The supplier shall indicate in GTP, the make, type and capacity of HRC Fuse Base and Fuse Links offered.

a. HRC FUSE BASE

- The base of the HRC Fuse shall be of non-tracking, heat resistant insulating material of Dough Moulding Compound (DMC) of D3 Grade as per IS:13411/1992. The Fuse Base shall be sturdy in construction.
- The extension terminal connector strips of the Fuse Base shall be projecting out on both sides, made with two pieces (half portion of the terminal contact and extension strip should be continuous in one piece), as shown in the drawing. The dimensions shall be as shown in the drawing. The material for both strips shall be tin plated EC Grade copper. HRC Fuse Base & fuse link should have withstand the breaking capacity of 80 kA.
- HRC Fuse base shall be suitable for fuse of 200A for 63/100 KVA distribution box.

b. HRC FUSE LINK

- The HRC Fuse Links shall be sturdy in construction of "Din Type". Breaking Capacity shall be 80 kA. For fault indication red pop up indicator should come out instantly on fusing. Manufacturer's name, current rating, breaking capacity and type shall be marked on HRC fuse link.
- HRC Fuse link Current rating for 63/100 /200 KVA distribution box shall be as follows:

  63 KVA - 100 A

  100 KVA - 160 A

  200 KVA - 315 A

- The supplier shall submit Type Test Report of the HRC fuse base and HRC fuse link as specified in Cl. No. 13.C (iii) in this specification for approval of Employer before commencement of production. The HRC fuse base with links to be provided in the Distribution Box will be as per Employer approval given in the detailed purchase order.

6. OUTGOING CIRCUITS:

(i) **MCCBs**

- Each distribution box shall have 6 nos. of single-pole MCCBs in 63 KVA /100 KVA Box, 9 nos of single-pole MCCBs in 200 KVA box to protect outgoing circuits. MCCB shall be of reputed make and shall confirm to latest IS. The supplier shall indicate the makes and types of MCCBs offered in GTP. The supplier shall submit Type Test Report of the MCCB as specified in Cl. No. 13.C (iv) in this specification for approval of Employer before commencement of production. The MCCBs to be provided in the Distribution Box will be as per Employer approval as given in the detailed purchase order.
- MCCB shall have quick make quick break mechanism. Making of MCCB shall only be manual but breaking of MCCBs shall be electrical as well as manual.
- The detailed specification for MCCBs shall be as under.

S. No.	Particulars	Details		
1	KVA rating	63 KVA	100 KVA	200 KVA
2	Rated current	150 A		200 A
3	Fixed overload release setting (A)	60 A	90 A	120 A
4	No. of poles	Single pole		

5	Rated service short circuit breaking capacity (kA) which is equal to ultimate breaking capacity as per IS 13947 (amended up to date)	10 KA at 0.4 p. f. (lag)
	The sequence of operation for this test shall be, O - t - CO - t - CO, and t = 3 min.). The test shall be done at 250V at 0.4 p. f. (lag). Voltage rating phase to phase 433 V and phase to earth 250V.	
6	Power factor for short circuit (Max.)	0.4 lag
7.	Utilization category	A
8	Rated Insulation Voltage	660 V

- The Busbar dropper and Terminal connection strip of Link Disconnector shall be placed in contact terminal of MCCB.
- The rated service short circuit breaking capacity as specified above, shall be based on the rated service short circuit test carried out at specified power factors.
- To extinguish the arc immediately in MCCBs, arc-chutes with minimum 8 strips shall be provided.
- While the above stipulation regarding the test power factor and the sequence of operation shall be binding, the other procedure for making the short circuit test and circuit etc. shall generally be in accordance with the Indian Standard applicable to the type of circuit breakers under test.

(ii) **TIME CURRENT CHARACTERISTICS OF MCCB:**

The L.T. MCCBs shall have time current characteristics as follows:

Multiple of normal Current setting	**Tripping time**
1.05	More than 2.5 hrs.
1.2	More than 10 minutes and less than 2 hrs.
1.3	Less than 30 minutes
1.4	Less than 10 minutes
2.5	Less than 1 minute
4.0	Not less than 2 seconds
6.0	Less than 5 seconds
12.0	Instantaneous (less than 40 milli seconds.)

For above time/current characteristic, the reference calibration temperature of the breaker shall be 50°C. Deration, if any, up to 60°C. Ambient temperature shall not exceed 10% of the current setting indicated above.

7. LINK DISCONNECTOR:

- Link Disconnector of 200 A capacity shall be provided between outgoing terminal of MCCB & cable connection to facilitate mechanical breaking (manual isolation) of the circuit. 63 & 100 kVA Distribution Box shall have 6 Nos. of link Disconnectors. 200 kVA distribution box shall have 9 nos of link Disconnectors
- The supplier has to indicate the makes and types of Link Disconnector offered in GTP. The

supplier shall submit Type Test Report of Link Disconnector as specified in Cl.No. 12.3 (V) for approval of Employer before commencement of production. The link Disconnectors to be provided in the Distribution Box will be as per EMPLOYER's approval as given in the detailed purchase order.

- The base of the Link Disconnector shall be of non-tracking, heat resistant insulating material of Dough Moulding Compound (DMC) of D3 Grade as per IS:13411 (amended upto date). The Link Disconnector shall be sturdy in construction and easy in operation.
- The link of Link Disconnector shall be of Tin-plated E.C. grade copper. The construction of the Link Disconnector shall be such that it shall be hinged type on cable connection end and disconnectable at the MCCB end. The disconnection will be with the help of special handle/puller. One handle/puller shall be supplied alongwith each Distribution Box. The terminal connector strips of the Link Disconnector of 25 x 3 mm cross section, shall be projecting out of Link disconnector for minimum length of 80 mm. on cable connection side and 40 mm on MCCB outgoing side. The cross section of knife edge link shall be 20 x 5 mm. The material for both the strips and links shall be tin-plated E.C. grade copper. The size of bimetallic lugs hole & the hole on the disconnectors strip on cable side should be same.

8. BUSBARS AND CONNECTIONS:

- The Incomer feeder should be on right side of the distribution box and all outgoing feeders will be on left side of the distribution box, with phase sequence RYB to be maintained. The phase busbars, incoming droppers and feeder droppers from busbars shall be of EC Grade Aluminium. The phase busbar strips shall be of size 25X8 mm for 63 KVA & 100 KVA and 40X10 mm for 200 KVA. Feeder droppers shall be 25X8 mm. Incomer dropper of 25 x 8 mm cross section for 63 KVA & 100 KVA box and 40 x 10 mm cross section for 200KVA box. All busbars and droppers shall be properly drilled and de-burred. Each bus bar shall be of one single strip without any joint.
- Busbars shall be provided with durable PVC insulating sleeves of standard colour code for different phases. Corrugated/Spring & Plain washers shall be used for Nut-Bolt connections.
- Busbars shall be mounted on suitable size support insulators which should be tightened from inside. i.e. once fitted , should not be able to removed.
- Minimum clearances, wherever shown, shall be as per General Arrangement. Other clearances shall be as per requirement of IS: 4237amended up to date.

9. ENCLOSURE:

(i) The Box & Doors shall be made up of CRCA MS sheet of 2mm thickness.

(ii) The welding process of distribution boxes shall be done by MIG (Metal Inert Gas) welding and workmanship/finishing should be good enough.

(iii) The general clear dimensions of 63 KVA & 100 KVA Distribution Box shall be 1000 x 1010 x 325 (LXHXW) mm. The center height of distribution box on front side shall be 1000 mm. The center height of the distribution box on front side shall be 1050 mm. general clear dimensions of 200 kVA distribution box shall be 1305 x 1050 x 325 (LXHXW) mm and for 315 kVA distribution box shall be 1545 x 1050 x 325 (LXHXW) mm. The center height of the distribution box on front side shall be 1050 mm.

(iv) The Base and doors of enclosure shall be individually in one piece without any welding, except for fixing of the accessories like hinges, clamps, mounting clamps, bolts etc.

(v) 63 KVA & 100 KVA boxes shall have two doors fixed on right & left side of the box with four hinges provided from inside of box. On closing of doors, right door shall rest on the left door. Hinges shall not be visible and approachable after closing the box.

(vi) 200 kVA boxes shall have two doors as shown in drawing fixed on right side & left side of the box with four hinges on both sides shall be provided from inside of box. On closing of doors, right door shall rest on the left door. Hinges shall not be visible and approachable after closing the box.

(vii) Base and doors shall have flange / collars. Collar of Base and doors shall overlap by 10mm. Rubber gasket of suitable size shall be provided in between base and doors, such that it provides proper sealing between the door and base of box to avoid penetration of dust & ingress of water. Degree of protection shall be IP- 33 as per IS-8623 (amended up to date). Rubber Gasket shall be fixed with suitable adhesive. Four hinges on each side shall be provided from inside of the box to fix the doors. Hinges shall be minimum 50 mm in length & made from 2mm thick sheet. Hinge stainless steel pin diameter shall be 4mm. The hinges shall not be visible from outside.

(viii) The MCCBs, Link Disconnector, Isolator and HRC fuse base with link shall be housed inside the enclosure. Isolator operating handle shall be accessible only after opening of the doors.

(ix) Four set of Louvers (two sets on each side) of suitable size shall be provided. The louvers shall be provided such that heat dissipation is proper. The perforated sheet of 20 SWG with 2.5 mm holes shall be welded from inside of the louvers.

(x) Mounting of components inside the enclosure shall allow free air circulation keeping the clearances as per specification.

(xi) **Locking Arrangement to the Box:** The doors shall be closed with a push fit locking arrangement such that on pressing/pushing the right door, the distribution box gets locked from inside from top & bottom. This arrangement shall be operational for opening of the door with a handle provided outside the door. Handle shall be removable type only. A Nylon washer shall be provided between the handle and door to avoid penetration of water. One central lock with brass levers shall be provided inside the door. Key way shall be provided on the door for operating the central lock from outside. Key way shall be provided with cover.

(xii) A suitable cable termination arrangement with support insulators shall be provided on Isolators and Link Disconnectors. The bimetallic lugs of adequate size, as per enclosed specification, shall be provided. Clearances, Creepages and convenience in making connections shall be ensured.

(xiii) EC grade Aluminium Neutral Busbar of 300 x 25 x 8 mm for 63 KVA & 100 KVA box and 525 x 40 x 10 mm for 200 KVA box capable of carrying for full load current. Neutral Busbar shall be isolated with respect to body. The bimetallic lugs of adequate size, as per enclosed specification, shall be provided. Neutral Busbar shall be as per the specifications.

(xiv) Bolts of M10 mm and 35 mm length with 2 Nos. plain washer and two Nos. nut are to be provided on both the sides for earthing of the distribution box. Earthing bolt is to be fixed on U-structure (Earth Clamp) welded on both sides of the distribution box. Thickness of earth clamp shall be 2mm. The top surface of the earth clamp shall be properly Zinc plated. Earthing nut bolt and washer should be zinc plated. There should be no powder coating on top surface of the earthing clamps.

(xv) Three bottom plates for 63 KVA & 100 KVA and 4 bottom plates for 200 KVA shall be provided for incoming and outgoing cables. Bottom plate of size 125mm x 125mm fixed with four screws from inside shall be provided for incoming and outgoing cables. Bottom plates shall be provided with suitable holes and rubber glands for the cables. Rubber glands shall be made such that internal diameter of glands provided for cables should be closed with the rubber film of minimum 1mm thickness. Cable will go through the glands by cutting the film of the glands. Bottom plates shall also be provided with cable clamps.

(xvi) Necessary fixing arrangement shall be provided at the back of the enclosure to ensure proper fixing on double pole structure by means of suitable clamps at 4 places.

(xvii) Danger marking shall be provided in red colour on the right door of the distribution box. Marking shall be scratch proof and properly readable.

(xviii) All the components inside the Box shall be mounted on CRCA MS strips of 2mm thickness. The mounting strips shall be provided with required bends or ribs to give the extra strength and shall be powder coated or zinc plated.

(xix) All joints of current carrying parts shall be bolted with 8.8 grade High Tensile MS Nuts & Bolts, Corrugated/spring & Plain Washers. The nuts & bolts should be of hexagonal type. All the nuts, bolts & washers should be properly zinc plated.

(xx) Each distribution box shall be supplied with proper packing in five ply - corrugated box.

(xxi) Name plate having details such as Month & year of manufacturing, Sr. No., and rating of Distribution box, "Name of Employer" shall be riveted on the Distribution box door. Name of Manufacturer shall be duly embossed on the door of the distribution box. The name plate should be of stainless steel of thickness 1 mm.

(xxii) Incoming and outgoing circuit should be duly highlighted with paint by stencil printing.

(xxiii) Adequate slope on the top of box shall be provided to drain out rainwater from the top.

(xxiv) 3 Nos. MCCBs and 3 Nos. HRC fuse links in spare should be invariably provided with each box.

(xxv) Good-quality plastic sticker leaflet should be pasted inside of distribution box door. The matter of instruction leaflet shall be provided by the employer. All the instructions in leaflet should be in Hindi/English/Local language.

10. CABLE TERMINATION:

Adequate size of Bi-metallic lugs shall be provided for 3½ core, LT XLPE cable on incoming side and outgoing side for 63/100 KVA boxes as below:

	Incoming side	Outgoing Side
63 KVA	70 sq.mm	50/ 70 sq.mm
100 KVA	150 sq.mm	50/70 sq.mm
200 KVA	300 sq.mm	150 sq.mm

11. LUG: Bimetallic lug should be made for electrolytic grade aluminum. Each lug should be copper coated by electrolytic process and rich layer of tin should be mounted throughout the lug to protect from Galvanic Corrosion. The lugs shall be such that the rich layer of tin should not peel of during operation. Individual lot should be pre filled with conductive inhibition compound and lug should be duly capped to prevent oozing of compound. The ductility of material should be such that flow ability of material be adequate to flow in to the strand of the conductor and withstand on crimping pressure of 8500 PSI. The cut cross section of the joints shall be homogeneous.

12. FINISHING OF DISTRIBUTION BOX: The outer side and inside surface of the box shall be properly Pre-treated /Phosphated in seven tank process as per IS: 6005 and shall be applied powder coating of minimum 40 micron thickness. The Colour shade of light Admiralty gray (as per employer requirement) for 63, 100, 200 KVA box as per IS: 5/2007 (Colours of Ready Mixed paints and Enamels) shall be applied inside & outside surface of the box or as per state practice. Powder coating shall be suitable for outdoor use, conforming IS: 13871 (amended upto date) – Powder coatings. The process facility shall be in-house to ensure proper quality for outdoor application.

13. TESTS & TEST CERTIFICATES:

In case of bought out items, routine and acceptance tests as per relevant IS and this specification shall be carried out at the original manufacturers' works.

a) Routine Test (Carried out on all boxes):

- Overall Dimensions Checking.
- Insulation Resistance Tests.
- High Voltage Test at 2500 V, 50 Hz AC for one minute.
- Operation Test on MCCB/Isolator/Link Disconnector / HRC fuse base and fuse links.

b) Acceptance Tests (on complete Distribution Box):

Following tests shall be carried out as per acceptance tests in addition to routine tests on one

random sample of each rating out of the lot offered for inspection:

(i) Temperature rise test on one sample of each rating:

Temperature rise test will be carried out as per the procedure given below:

For temperature rise test, a distribution box with all assembly of MCCBs / Link Disconnectors / Isolator / HRC fuse base with link shall be kept in an enclosure such that the temperature outside the box shall be maintained at 50 ° C.

20% more current than transformer secondary capacity i.e. for 63 KVA Distribution Transformers full load current 84A, 20 % more is 100 A shall be kept in incoming circuit keeping outgoing circuits short, till the temperature stabilizes and maximum temperature rise should be recorded.

(ii) Time-Current Characteristics

The MCCB should be tested for time current characteristics at 1.05 & 1.2 times of overload release setting current and should pass the requirement given in Cl. No. 6 (ii) in this specification.

c) TYPE TESTS:

(i) **On complete box:**

- Temperature rise test: The temperature rise test should be carried out as per IS: 8623
- High voltage test shall be carried out as per IS:8623 amended upto date.
- Short Time Withstand Current Test on Distribution Box shall be carried out as per IS 8623 or latest version.
- The Distribution Box should be subjected to Short Time Withstand Current Test for 4KA for 2 seconds for 63/100 KVA Box) all the circuits independently. The test should be carried out after by- passing MCCBs.
- Degree of protection for **IP-33** on complete box shall be carried out as per IS: 13947/1993 or the latest version thereof.
- Time /current characteristic test on MCCBs shall be carried out as per Cl. No. 6 (ii) in this specification.

(ii) **On isolator (switch disconnector):** All type tests on Isolator (Switch Disconnector) as per IS: 13947 (Part III) amended up to date shall be carried out.

(iii) **On HRC fuses base and HRC fuse links:** All type tests on HRC fuses and HRC fuse links IS 13703 (Part I & II amended up to date) for HRC Fuse Base and HRC fuse link shall be carried out.

(iv) **On MCCB:** All type tests on MCCB as per IS-13947 amended up to date shall be carried out.

(v) **On Link Disconnector:** Following tests shall be carried out on link disconnector as per IS:

- Short Circuit Withstand Strength
- Temperature rise Limits
- Mechanical Operations

14. TYPE - TEST CERTIFICATES:

The Distribution Box, Isolator (Switch Disconnector), HRC fuse, HRC Fuse Link and MCCB offered shall be fully type tested as per relevant IS and this specification. The Supplier shall furnish detailed type test reports before commencement of production. The detailed Type Test Reports shall be furnished with relevant oscillogram and certified Drawings of the equipment tested. The purchaser reserves the right to demand repetition of some or all the Type Tests in presence of purchaser's representative at purchaser's cost.

All the type tests shall be carried out from laboratories accredited by National Accreditation

Board of Testing And Calibration Laboratories (NABL), Department of science & technology, Govt. of India to prove that the complete Box, Isolator, HRC fuse, Link Disconnector & MCCB meet the requirements of the specification. The Manufacturer should also furnish certificate from laboratories that laboratories are having all the requisite test facility available in house. The type test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.

The Supplier should furnish the particulars giving specific required details of Distribution Boxes, MCCBs, Isolator and Link Disconnector.

15. **TESTING & MANUFACTURING FACILITIES:** Supplier must be an indigenous manufacturer. The Supplier must clearly indicate what testing facilities are available in the works of manufacturer and whether the facilities are adequate to carry out all Routine & Acceptance Tests. These facilities should be available to Employer's Engineers, if deputed to carry out or witness the tests in the manufacturer's works. The supplier must have all the in-house testing facilities to carry out the acceptance tests on the Box.

    The supplier shall furnish detailed process of manufacturing & Powder coating.

16. **PROTOTYPE & DRAWINGS:** The manufacturer has to manufacturer the prototype Unit for each rating as per this specification before bulk manufacturing. The manufacturer should intimate the readiness of prototype to employer. The Project Manager will inspect the prototype for approval. The manufacturer should submit the final drawings in line with this specification and prototype to employer for approval before bulk manufacturing. The approval of prototype & drawings shall be a responsibility of manufacturer/Contractor.

THREE PHASE 4 WIRE L.T. DISTRIBUTION BOX FOR AERIAL BUNCHED CONDUCTOR

The LT Distribution box for ABC single phase is used for Connection through overhead conductors or ABC line and for giving connections to the consumers. This specification covers the design, manufacture, inspection, testing and supply of the LT Distribution box. The LT Distribution box suited for ABC single phase cable will be installed at the Poles and it shall withstand solar radiations, rain, wind pressure and pollution.

1. **CONSTRUCTIONAL AND TECHNICAL PARTICULARS:**

    - The Distribution Box shall be made from 20 SWG CRCA MS sheet. Internal size of the box shall be 225mm x 285mm x 120mm as shown in drawing. Roof of the box shall be tapered on both sides to drain the rain water.
    - Distribution Box shall have insulated Multiple Outgoing Connector for Phase and Neutral. Each Multiple Outgoing Connector shall have arrangement for one incoming cable of Single phase of size up to 25/35mm² and 4-8 outgoing cables of single phase of size up to 10mm². Each Incoming & outgoing cable shall be fixed inside the Multiple Outgoing Connector by two screws of size not less than M6. The Multiple Outgoing connector shall be such that the outgoing cables can be fixed or removed easily without disconnecting the power supply. No current carrying part shall be approachable by hand or finger. Any current carrying part should be at a minimum distance of 5mm from the outer edge of the insulation. Insulation shall be Fire retardant.
    - Multiple Outgoing Connectors shall be mounted horizontally. Mounting arrangement shall be such that minimum clearance of 40mm is maintained between phase and neutral. Fixing of

Multiple Outgoing Connectors preferably shall be non-removable type to avoid theft of connectors.

- Box shall be provided with U-latch sealing arrangement. A hole of 8mm & 2.5mm shall be provided in the U-latch to provide a padlock & sealing of the box respectively. U-latch shall be joined with stainless steel rivet. Box should be duly powder coated after 7-tank Phosphating process. Box should be of Light Admiralty Grey color (IS-5:1993, COLOUR NO-697). The LT Distribution box for ABC single phase shall be powder coated only. The facility for 7-Tank Phosphating and powder coating shall be in-house of the tenderer / manufacturer to ensure proper quality, since these boxes are for outdoor applications.
- One Hole for incoming cable and 8 Nos. holes for outgoing cables shall be provided on the lower wall of the box. Cable holes shall be provided with rubber / plastic glands duly pasted with the box. Incoming and outgoing cable gland shall have internal diameter of 30mm & 15mm respectively. Cable Glands shall be made such that internal diameter of glands provided for cables should be closed with the film of minimum 1mm thickness. Cable will go through the cable glands by piercing the film of the glands. Gap of minimum 100mm shall be maintained between the lower wall and neutral mounted inside the Distribution Box for easy handling of incoming and outgoing cables.
- **MARKING**: Following shall be provided on the cover of box.
  a) Manufacturers name duly embossed
  b) Utility name duly embossed
  c) Name of the scheme
  d) Danger marking in red color
  e) Name of Scheme "DDUGJY/SAUBHAGYA"

- M.S. Earthing screw of diameter 6mm with washer shall be provided in the threads of the earth clamp welded to the main body of the box.
- The box shall comply with the requirement of IP54. The box shall be fully type tested along with dimensional drawings as per the requirement of relevant Indian Standard (latest edition) IS13947: Part-I and latest amendments. Tests shall be carried out from laboratories which are accredited by the National Board of Testing & Calibration Laboratories (NABL) of Govt. of India to prove that the complete box meet the requirement of IP54. The tests report shall be submitted along with inspection call failing which the tender of the firm shall not be opened. Government approved laboratories should be accredited by the National Board of Testing & Calibration Laboratories (NABL) of Govt. of India. The type test reports shall not be older than 5 years. In case order is placed on a firm, no change in design / manufacturer of LT Distribution box shall be allowed in supplies.
- Box shall be duly packed in 3Ply corrugated box. The tolerance permissible on the overall dimensions shall be (±) 3%.

2. TESTS:

Following tests shall be performed on the box during inspection:

(i) **Visual Examination:** The L.T. Distribution box will be inspected visually, externally and internally for fitting of all the components in accordance with technical Specification.

(ii) **Verification of dimensions:** Verification of dimensions, external / internal clearances will be carried out as per technical specifications.

Verification of fittings: Components like insulated Multiple Outgoing Connectors, screws etc will be verified as per technical specification.

(iii) **High voltage withstand test at 2.5KV:** The A.C. voltage of 2.5KV, 50HZ shall be applied for one minute as follows:

a) Between each Phase
b) Between each Phase and earth screw
c) On the insulation of Multiple Outgoing Connectors.

There shall not be any puncture or flash over during this test.

Note: All items/ materials being offered by the bidder under this NIT must have already been type tested. Bidder shall submit valid type test reports for the same design from CPRI/ERDA/NABL accredited laboratory not older than 5 (FIVE) years from the original scheduled date of bid submission and shall be valid at the time of inspection and supply of materials. Bidder shall also furnish drawing of items/ materials submitted during type testing. Those bidders who do not have valid type test reports all the items covered under this NIT, shall not be eligible for participation in this tender.

B. Conditions of Contract:

1. Completion Period:

I. Total completion period for the Contract including but not limited to design, engineering, manufacture, testing and supply of materials as per Scope of Work including transportation & insurance up to sub-divisional headquarters of APDA in the State of Arunachal Pradesh is **60 days** from the date of issuance of Letter of Intent/Purchase Order (whichever is earlier) as per below mentioned schedule:

No. of days from issuance of Letter of Intent/Purchase Order (whichever is earlier)	Cumulative percentage of supply of materials
30 days	40% of each item mentioned in Financial Bid
45 days	Further 40% (i.e. cumulatively 80%) of each item mentioned in Financial Bid
60 days	Further 20% (i.e. cumulatively 100%) of each item mentioned in Financial Bid

However, RECPDCL reserves right to modify above schedule on case to case basis as per requirement of the project at its sole discretion.

II. In order to match above timeline, each bidder shall submit detailed delivery schedule in the prescribed format (PERT Chart) as per Annexure-XIV through soft as well as in hard copy. However, delivery schedule shall also be discussed with successful bidder at the time of award of contract and for the purpose of contractual delivery/ timeline, the same shall be treated as final.

2. Insurance: The bidder shall be responsible and take an Insurance Policy for transit for all the materials to cover all risks and liabilities for supply of materials up to destination stores. Being a difficult terrain and assignment, a copy of insurance shall also be submitted to RECPDCL.

3. Type & Quality of Materials and Workmanship: The design, engineering, manufacture, supply, testing and performance of material shall be in accordance with latest appropriate IEC/Indian

Standards as detailed in this section above. Any supplies which have not been specifically mentioned in this tender but which are necessary for the design, engineering, manufacture, supply & performance/ completeness of all materials covered under this NIT shall be provided by the bidder without any extra cost and within the time schedule for efficient and smooth operation and maintenance of the system.

4. **Warranty Period:** The bidder shall guarantee the materials/ items supplied against any defect of failure, which arise due to faulty materials, workmanship or design for the entire warranty period. The warranty period shall be 18 months from the date of delivery. Warranty shall be on-site comprehensive. Bidder shall provide a warranty certificate to this effect. If during the warranty period any materials / items are found to be defective, these shall be replaced or rectified by the bidder at his own cost within 45 days from the date of receipt of such intimation from RECPDCL. In case, bidder fails to replace/rectify the defective materials, RECPDCL reserves right to purchase/rectify such materials/ items from any third party at the cost of bidder. The expenditure so incurred shall be deducted from the Bidder's pending claims, security/ performance guarantee deposit or in other lawful manner by RECPDCL.

5. **Coordination & Report:** Bidder shall inform the name, address, contact number of the Nodal Officer(s), assigned by the agency for this work, who will report about their weekly/ fortnightly progress & performance of the assignment. In case, absence of any information is adversely affecting the progress of work, the issue could be escalated to Addl. CEO, RECPDCL. Bidder shall submit the progress report weekly/ fortnightly to RECPDCL in Prescribed Performa as desired. RECPDCL will have the right to depute its representatives to ascertain the progress of supply at the premises of works of the bidder or at site.

   In addition to this, bidder should also provide contact details and email id of Management & key Officials of the company.

6. **Inspection & Testing:**
   - The bidder shall comply with the testing requirements as mentioned in Part-A of this section. These tests shall be conducted at no extra cost to the RECPDCL.
   - The inspections and tests shall be conducted at the manufacturing unit of the Bidder or its sub-supplier(s), at point of delivery and/or at the Goods final destination. If conducted at the manufacturing unit of the Bidder or its sub-supplier(s), all reasonable facilities and assistance, including access to drawings and production data - shall be furnished to the inspectors at no cost to the RECPDCL.
   - Pre dispatch inspection shall be carried out on sampling basis (10% or as specified in applicable Indian Standard) by authorized representative of RECPDCL.
   - Should any inspected or tested Goods fail to conform to the specifications, the RECPDCL may reject the goods and the Bidder shall either replace the rejected Goods or make alterations necessary to meet specification requirements free of cost to the RECPDCL.
   - The RECPDCL's right to inspect, test and, where necessary, reject the Goods after the Goods' arrival at Project Site shall in no way be limited or waived by reason of the Goods having previously been inspected, tested and passed by the RECPDCL or its representative prior to the Goods shipment.
   - Nothing in this shall in any way release the Bidder from any warranty/guarantee or other obligations under this Contract.

Note: Materials may be inspected jointly by representative(s) of REPDCL/REC/DISCOM/Power Department or by RECPDCL alone as the case may be, for which a notice of minimum 5 working days shall be given by the successful bidder.

SECTION-VI

COMMERCIAL TERMS, CONDITIONS & OTHER PROVISIONS

1. PRICE:

1.1 Price should be quoted as per format of Annexure-XV which must be inclusive of all costs involved in the supply contract i.e. complete design, engineering, manufacture, testing and supply of all materials including transportation & insurance up to sub-divisional headquarters of APDA in the State of Arunachal Pradesh and all applicable taxes and duties of Central & State Governments etc.

1.2 If it is found that the tax quoted is higher than the applicable tax, in that case actual applicable taxes will only be paid by RECPDCL and if the tax quoted is lower than the applicable tax, in that case only the quoted taxes will be paid by the RECPDCL.

1.3 Bidder shall ensure timely payment of all taxes as per Income Tax & GST rules of Central & State Governments.

1.4 TDS will be deducted from the payment of the Bidder as per the prevalent laws and rules of Central & State Governments as the case may be.

1.5 Price quoted by the bidder shall remain firm & fixed and shall be binding on the Successful Bidder till completion of warranty period irrespective of actual cost of supply. No escalation/price variation will be granted on any reason whatsoever. The bidder shall not be entitled to claim any additional charges, even though it may be necessary to extend the completion period for any reasons whatsoever.

1.6 The offer must be kept valid for a period of 180 days from the last date of bid submission. No escalation clause would be accepted. The validity can be further extended with mutual consent.

1.7 Bids with non-conformity to above will be considered as non-responsive.

2. EARNEST MONEY DEPOSIT (EMD):

2.1 The Bidder shall furnish Earnest Money Deposit of Rs. 16,97,027/- (Rupees Sixteen Lakh Ninety Seven Thousand Twenty Seven Only) in the form of Demand Draft/ Bank Guarantee (BG) from a scheduled bank (as per Annexure-VI) drawn in favour of REC Power Distribution Company Ltd.' payable at New Delhi.

2.2 In case of inadequacy or non-submission of EMD amount, the submitted bid shall be deemed to be disqualified and summarily rejected in the technical evaluation.

2.3 The initial validity of EMD shall be for a period of 180 days from the last date of bid submission. The validity of EMD shall have to be suitably extended, if necessary, on request by RECPDCL, without which the tender/work order shall be rejected.

2.4 Request for adjustment of Earnest Money Deposit against any previous dues with RECPDCL will not be considered.

2.5 EMD will be refunded to the unsuccessful bidders within 30 days after finalization of the tender without any interest.

2.6 EMD of successful bidder will be returned after acceptance of Letter of Intent/ Purchase Order issued by RECPDCL and submission of required PBG.

2.7 MSMEs:

(i) The firms registered with National Small Industries Corporation (NSIC)/ Micro, Small and Medium Enterprises (MSME) are exempted from furnishing bid guarantee/EMD, cost of

tender documents provided that such small scale units are registered under single point registration scheme of NSIC / MSME and are valid on the scheduled date of tender opening and the product range mentioned in the certificate is the same or similar to the tender requirement. The NSIC / MSME certificate duly attested by any Notary Public with seal and date shall only be accepted.

(ii) The bidders claiming to be MSME and/or MSME-SC/ST and/or Start Ups and/or Domestically Manufactured Producer under Make in India initiatives etc., the relaxations and concessions as per Government of India notifications/ instructions/guidelines issued from time to time and as adopted/allowed by RECPDCL are allowed to same subject to submission and production of requisite documents/proofs etc.

(iii) In addition, RECPDCL reserves the right to verify/confirm all original documentary evidence including references and clients as submitted by bidders in support of above mentioned clauses of eligibility criteria.

(iv) Bidders claiming exemptions should enclose UAN and submit the same on tender portal and adhere to all Guidelines as issued and amended from time to time by Government of India.

2.8 EMD shall be forfeited without prejudice to the Bidder being liable for any further consequential loss or damage incurred to RECPDCL under following circumstances:

a. Hundred percent (100%) of EMD amount, if a Bidder withdraws/revokes or cancels or unilaterally varies his bid in any manner during the period of bid validity specified in the tender document.
b. Hundred percent (100%) of EMD amount, if the Successful Bidder fails to unconditionally accept Letter of Intent/Purchase Order issued by RECPDCL within 3 days from the date of issuance of such Letter of Intent/Purchase Order.
c. Hundred percent (100%) of EMD amount, if the Successful Bidder fails to furnish PBG as specified in the tender document.

3. PERFORMANCE BANK GUARANTEE (PBG): The bidder need to submit unconditional & irrevocable Performance Bank Guarantee (PBG) from a scheduled bank as per Annexure-VIII amounting to 10% of total contract value with a validity till completion of warranty period of 18 months plus 6 months' claim period. PBG shall be submitted within 10 days from the date of issuance of Letter of Intent/ Purchase Order. The PBG shall be forfeited as follows without prejudice to the Bidder being liable for any further consequential loss or damage incurred to RECPDCL:

a. If the Supplier is not able to supply materials to the satisfaction of RECPDCL within sanctioned period, PBG amount submitted shall be forfeited.
b. If the supplier does not fulfill its obligations as mentioned in the scope of work, PBG amount shall be forfeited.

PBG shall be returned to the bidder on successful completion of warranty period and fulfillment of all responsibilities by the Bidder as furnished in the tender.

4. DELIVERY: The materials must be delivered timely as per conditions specified in this NIT to sub-divisional headquarters of APDA in the State of Arunachal Pradesh so as to complete the work within sanctioned period. Delivery locations shall tentatively be Bhalukpong, Naharlagun, Ziro, Pasighat, Roing, Tezu and Deomali.

5. **PERMIT:** The Bidder will arrange for all necessary Permits to supply material as per Tender specified locations.
6. **QUANTITY:** Quantities of items as mentioned in the financial bid are indicative for evaluation purpose only and are not exhaustive. Quantities of items may vary up to +/- 20% of total quantity at same rate, term & conditions. In case of requirement & based on sole discretion of RECPDCL, repeat order up to 100% quantity of each/ any item can be placed on successful bidder(s) on same rate, terms & conditions within 6 months from the date of Letter of Intent/ Purchase Order (whichever is earlier). In such case, it will be binding on successful bidder(s) to honour the condition of additional quantity/ repeat order.

7. **TAX EXEMPTIONS:** Bidder shall claim any kind of tax exemption on its own.

8. **LIQUIDATED DAMAGES:** For the delay in supply of materials, the Liquidated Damages (LD) @ 1% of the contract value per week or part thereof subject to the maximum of 10% of the contract value shall be deducted from bill of the successful bidder(s).

9. **SPLIT OF WORKS:** In view of targeted capacity and limited time available for completion of the task, RECPDCL reserves the right to increase / decrease / split of the work at the sole discretion of the RECPDCL. Suitable amendment / communication shall be issued in the event of variations in quantities.

10. **PAYMENT TERMS:** All Payments shall be made in Indian Rupees only on pro-rata basis towards quantities of items dispatched/ delivered at designated location. Any payment shall be released only after completion of all contractual formalities.

Milestone No.	Milestone	Details of milestone	% payment
1	**Advance Payment** (On request of supplier, interest bearing adjustable initial advance of 10% shall be released to successful bidder. The annual interest rate shall be calculated based on SBI Base Rate as applicable from time to time.)	Requisites: 1. Submission of unconditional acceptance of LOA 2. Unconditional & irrevocable Advance Bank Guarantee as per Annexure-VII with a validity up to sanctioned delivery period plus 3 months' claim period in favor of RECPDCL amounting to 110% of total advance amount 3. Unconditional & irrevocable Performance Bank Guarantee (PBG) as per Annexure-VIII for ten percent (10%) of the total Contract price towards Contract Performance with a validity till completion of warranty period of 60 months plus 6 months' claim period.	10% of the total value of the supply portion (i.e. exclusive of Freight & Insurance and GST) within 5 working days from receipt of eligible invoice along with necessary documents.
2	**Dispatch of material from manufacturer's premises after receiving dispatch clearance from RECPDCL**	Requisites: 1. Submission of documents except for Advance Bank Guarantee as indicated in milestone-1. 2. Tax invoice 3. Material Dispatch Clearance Certificate 4. Evidence of dispatch (GR/LR copy) 5. Packing list identifying contents of each	30% of value of materials dispatched including cost of supply plus GST but excluding freight & Insurance within 5 working days from receipt of eligible

		shipment 6. Copy of insurance 7. Warranty Certificate If supplier has opted for advance, the same shall be adjusted proportionately while making payments of this installment. Also, up-to-date accrued interest shall also be recovered.	invoice along with necessary documents.
3	**Receipt and acceptance of Materials at store of APDA**	Requisites: 1. Tax invoice 2. Material Receipt Note (MRN)/ Material handing over certificate duly signed by authorized representative of supplier, RECPDCL and respective DISCOM/ Power Department.	60% of value of materials supplied including cost of supply plus GST and 100% freight & Insurance charges and GST within 5 working days from receipt of eligible invoice along with necessary documents.
4	**After completion of 6 months from the date of delivery of Materials at store of APDA**	Requisites: 1. Tax invoice 2. No adverse remark from APDA for the supplied materials	10% of value of materials supplied including cost of supply plus GST within 5 working days from receipt of eligible invoice along with necessary documents.
			100%

Note: Successful bidder shall raise fortnightly invoice for the completed milestone to RECPDCL.

11. **FORCE MAJEURE:** Force majeure shall mean any cause, existing or future, which is beyond the reasonable control of Bidder or RECPDCL including, but not limited to, acts of God, storm, fire, floods, explosion, epidemics, quarantine, earthquake, strike, riot, lock out, embargo, interference by civil or military authorities, acts, regulations or orders of any governmental authority in their sovereign capacity, acts of war (declared or undeclared) including any acts of terrorism, and all other such acts of similar or analogous nature (where all such acts to be collectively referred to as "Force Majeure"). RECPDCL and Bidder shall not be liable for the failure to perform any obligation in terms of this Proposal if and to such extent such failure is caused by a Force Majeure, provided that none of such acts of Force Majeure will relieve the Customer from meeting its payment obligations.

12. **SUCCESSORS & ASSIGNS:** In case RECPDCL or successful bidder may undergo any merger or amalgamation or a scheme of arrangement or similar re-organization & this contract is assigned to any entity (ies) partly or wholly, the contract shall be binding mutatis mutandis upon the successor entities & shall continue to remain valid with respect to obligation of the successor entities.

13. **INDEMNITY CLAUSE:**

(i) The bidder shall indemnify and hold harmless the RECPDCL and its employees and officers from and against any and all losses, liabilities, and costs (including losses, liabilities, and costs incurred

in defending a claim alleging such a liability), that the RECPDCL or its employees or officers may suffer as a result of any infringement or alleged infringement of any Intellectual Property Rights patent, trademark/copyright or industrial design rights arising from the use of the supplied goods/ materials etc. and related services or any part thereof.

(ii) Such indemnity shall not cover:

a) any use of supplied materials, other than for the purpose indicated by or to be reasonably inferred from the Contract,
b) any infringement resulting from the use of goods, products of the material produced thereby in association or combination with any other goods or services not supplied by the bidder, where the infringement arises because of such association or combination and not because of use of the system in its own right.

(iii) If any proceedings are brought or any claim is made against the RECPDCL arising out of the matters referred to in Clause (i), the RECPDCL shall promptly give the bidders notice of such proceedings or claims, the bidder shall have sole control on the conduct of such proceedings or claim and any negotiations for the settlement of any such proceedings or claim and the RECPDCL shall provide the bidder with the assistance, information, and authority reasonably necessary to perform the above.

(iv) If the Goods/ Materials is held or is believed by the bidder to infringe, the bidder shall have the option, at its expense, to

a) modify the goods, including the Materials or the Bidder Property to be non-infringing,
b) obtain for the RECPDCL a license to continue using the goods/ Material, or
c) terminate the license for the infringing part and refund a pro rata portion of the fees paid for that portion. This provides for the bidder's entire liability and the RECPDCL's exclusive remedy for claims of infringement of intellectual property rights related to the goods/ materials and the bidder Properties.

14. NO SUSPENSION OF WORK & RISK PURCHASE:

NO SUSPENSION OF WORK

The obligations of the RECPDCL and the bidder shall not be altered by reasons of conciliation/ arbitration being conducted during the progress of works. Neither party shall be entitled to suspend the work on account of conciliation/arbitration nor shall payments to the bidder continue to be made in terms of the contract. Subject to the above including the sub-clauses that is pending conciliation or arbitration on any issue between the RECPDCL and the bidder, it shall be agreed that the RECPDCL shall be entitled to claim any amount as reimbursement as per the claim in writing for any works done by the RECPDCL from the outside agency for the default of the bidder in respect of any item for which such conciliation or arbitration as stated above is pending and the bidder shall jointly and severally be liable to pay such amount or amounts immediately on receipt of such demand from the RECPDCL without demur, and in case of the award in such arbitration is given by the arbitrators in favour of the bidder, then the amount/s under the award shall be refunded to the bidder , as the case may be by the RECPDCL, immediately on receipt of such award, if not challenged in a court of law.

If the selected bidder is not able to fulfil its obligations under the contract, which includes non-completion of the work, the RECPDCL reserves the right to accomplish the work through another bidder and EMD / Security Deposit of bidder will be forfeited. Also any costs, damages etc. resulting

out of the same shall have to be borne by the selected bidder. However, the bidder will continue to offer transition services.

RISK PURCHASE

Notwithstanding what is stated above, it is agreed upon that the bidder will be responsible to RECPDCL for implementation of the contract. In case of non-performance of contract by the bidder or the bidder fails to take proper corrective action to perform the contract satisfactorily within a reasonable period as given by RECPDCL, RECPDCL in addition to levy of liquidated damages, may terminate the contract and award the same to any other party at the risk and cost of the bidder for carrying out the balance work after giving due notice to the bidder. This clause may be invoked during the period of project implementation as well as warranty period with effect from the date of acceptance of Letter of Intent or Letter of Award by the Bidder. The limitation of liability of bidder in case of risk purchase will be to the extent of immediate next higher financial quote (total bid value as per price schedule). The percentage of liability of Risk Purchase will be quantified while placing the letter of award.

15. TERMINATION OF CONTRACT:

a. In case of award of work to successful bidder, the contract shall remain in force as per the timeline of award of work or till satisfactory completion of awarded work, whichever is earlier.
b. However, in case, in the opinion of RECPDCL if the successful bidder is not likely to make up for the delay or test checks by RECPDCL are indicating poor quality work or the Supplier is acting in anyway prejudicial to the completion of project or on adoption of unethical practices, the contract may be terminated partly or fully by giving 7 days' notice and the balance supply shall get executed at the risk & cost of the successful bidder.
c. In case of default in services or denial of services, RECPDCL, at its sole discretion, will be free to avail services of other service providers at the "Risk & Cost" of the defaulter.

16. DISPUTE:

- Disputes under the agreement shall be settled by mutual discussion.
- However, in the event amicable resolution or settlement is not reached between the parties, the differences of disputes shall be referred to and settled by the Sole Arbitrator to be appointed by Chairman, RECPDCL.
- The arbitration proceedings shall be in accordance with the prevailing Arbitration and Conciliation Act, 1996 and Laws of India as amended or enacted from time to time.
- The venue of the arbitration shall be New Delhi, India.
- The fee & other charges of Arbitrator shall be shared equally between the parties.
- The Arbitrator will give the speaking & reasoned award. The party will not be entitled to any Pendent late interest during arbitration proceedings.

SECTION-VII

BID EVALUATION METHODOLOGY & ALLOCATION OF QUANTITY

1. OPENING AND EVALUATION OF TECHNICAL BID:

Opening of technical bids will be through online mode only.

a. Bidders have to submit documents as per Section-III, Clause-C (Submission of Bid Documents).

b. Bids duly submitted, will be opened on the date and time indicated in this document in the presence of bidders or their authorized representatives who desire to present. The bidders' representatives present there, shall sign a register evidencing their attendance.

c. If due date of receipt / opening of bids happens to be a closed holiday, the bids would be received and opened on the next working day.

d. REC PDCL reserves the right to postpone and/or extend the date of receipt/opening of Bids or to withdraw the Tender notice, without assigning any reason thereof. In any such cases, the bidders shall not be entitled to any form of compensation from the Company.

e. RECPDCL will scrutinize the technical bid documents submitted by the bidders and shortlist the bidders who qualify based on eligibility criteria, terms and conditions, technical specifications of this tender document. RECPDCL reserves right to seek clarifications from the Bidders towards any non-conformity/ shortfall in the bid submitted by them which shall be replied by the Bidder within the given timeline as per discretion of RECPDCL.

f. RECPDCL reserves right to assess the capacity & capability of all or any bidder(s) during evaluation process before award of work.

g. After completion of technical evaluation process, RECPDCL will determine whether each bid is complete, and is substantially responsive to the Bidding Documents. For the 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, exceptions, objections, conditionality or reservations etc.

h. If a bid is not substantially responsive, it will be rejected by the RECPDCL and may not subsequently be made responsive by the Bidder by correction of the non-conformity later on. The RECPDCL's determination of bid responsiveness will be based only on the contents of the bid submitted.

2. OPENING AND EVALUATION OF FINANCIAL BID:

Opening of financial bids will be through online mode only.

a. Financial Bids of technically qualified bidders will be opened on the date and time indicated in this document in the presence of bidders or their authorized representatives who desire to be present.

b. Price Bids (Financial Bids) of Bidders whose EMDs received in original (DD or BG) within due date/time will only be opened. Rest of the Financial bids without submission of requisite EMDs in original (DD or BG) within due date/time will not be opened.

c. If due date of receipt of Financial Bids/ opening of Financial Bids happens to be a closed holiday, the bids would be received and opened on the next working day.

d. REC PDCL reserves the right to postpone and/or extend the date of receipt/opening of Financial Bids or to withdraw the Financial Bid notice, without assigning any reason thereof. In any such cases, the bidders shall not be entitled to any form of compensation from the Company.

e. Financial Bids shall be evaluated on the basis of total price inclusive of Freight & Insurance and all taxes & duties quoted as per Annexure-XV.

f. RECPDCL may or may not conduct reverse auction.

3. ALLOCATION OF QUANTITY:

a. Based on total price quoted by the bidders, RECPDCL shall arrange the bids in the ascending order i.e. L1, L2, L3, _ _ _Ln (L1 being the lowest quote).
b. Approx. 50% of the tentative quantity will be allocated to the L1 successful bidder.
c. For further allocation, (after allocating the quantity to the L1 bidder) based on total price quoted by the bidders, RECPDCL shall arrange the bids in the ascending order i.e. L2, L3, L4 _ _ _ _ and so on (L2 being the second lowest quote and so on) and allocate approx. 30% of the tentative quantity to L2 bidder & approx. 20% of the tentative quantity to L3 bidder subject to matching the L1 rate. In case, L2 bidder and/or L3 bidder do not match the L1 price in such case RECPDCL reserves right to call next lowest bidder(s) for allocation of remaining 30% / 20% quantities at L1 price.
d. However, RECPDCL reserves right to select no. of successful bidders at its sole discretion as per requirement of the project.
e. In case, certain quantity remains unallocated, it will mandatory to L1 bidder to supply such unallocated quantities at the rate quoted in financial bid.
f. Quantities for each delivery location shall be proportionately distributed among all successful bidders as per allocation percentage.
g. If the successful bidder(s), to whom Letter of Intent/Purchase Order has been issued does not fulfil any of the conditions specified in bid document or demonstrating unsatisfactory progress/work, the RECPDCL reserves the right to annul/cancel the award of work to such successful bidder and allocate such quantity to other performing bidders in orderly/proportionate manner.

SECTION-VIII

GENERAL CONDITIONS OF BID

1. Each bidder should submit **ONLY SINGLE** bid.
2. The bidder shall ensure that deputed personnel are trained and experienced for jobs as defined in scope of work for ensuring the high quality and correctness of jobs and to be carried out in a highly professional, safe, and sound managerial manner.
3. RECPDCL reserves the right to accept or reject any or all Bid requests without assigning any reason.
4. RECPDCL reserves the right to waive off any shortfalls; accept the whole, accept part of or reject any or all responses to this tender.
5. RECPDCL reserves the right to cancel the bids at any stage and call for fresh tender.
6. RECPDCL reserves the right to modify, expand, restrict, scrap, re-float the tender without assigning any reason for the same.
7. The responder shall bear all costs associated with the preparation and submission of its Bid and RECPDCL will in no case be responsible or liable for these costs, regardless of the conduct or the outcome of the tender process.
8. The Bidder shall be well capable of supplying desired quantum of materials as mentioned in the tender within permissible timeline. RECPDCL reserves right to conduct capacity & capability assessment of participating bidders at the time of technical evaluation process.
9. RECPDCL reserves the right to withdraw the work & get it completed at the risk & cost of the agency, if performance of the agency is unsatisfactory, to whom work has been awarded. Further, the said agency may be black-listed for a period of one year or more for participating in any of the bids invited by RECPDCL. Also, RECPDCL would be free to intimate such black-listing to various state/central utilities/ Ministry of Power/ State Governments/ Other agencies not to consider the said agency for any assignment including of the same on websites.
10. RECPDCL reserves the right to conduct reverse auction.
11. Bidder has to submit test certificates/reports as specified in technical specifications from IECQ / NABL accredited laboratory for relevant IEC/ Equivalent BIS Standard as applicable.
12. **All items/ materials supplied under the Contract of this NIT shall be marked with name of the Scheme i.e. DDUGJY/ SAUBHAGYA.**
13. In case of supply of any defect material or substandard material, the materials will be rejected & it will be the responsibility of the bidder for taking back & replacing the rejected materials at their own cost.
14. The supplied materials should be strictly as per specifications mentioned in this tender, otherwise the material would be liable for rejection.
15. Validity of Bid shall be 180 days from the last date of bid submission.
16. No price escalation is applicable on account of any statutory payments increase or fresh imposition of custom duty, excise duty, sales tax or duty leviable in respect of the major components in the said acceptance of the tender.
17. EMDs received late due to any reason including postal delay will not be considered.
18. Bidder's quoted rates should be firm and fixed. No price variation and escalation will be allowed.
19. Bids must be submitted in English language only.
20. Incomplete, telegraphic or conditional tenders are not accepted.
21. Canvassing in any manner is strictly prohibited. The same will lead to rejection of the submitted bid.

22. The last date of receipt of bids from bidders is 06.08.2018 at 16:30 Hrs. Original, Sealed EMD will only be accepted during office hours on working days through deposit in the tender box kept for the purpose at REC Power Distribution Corporation Ltd. (RECPDCL), 4th Floor, KRIBHCO Bhawan, A10, Sector-1, Noida (U.P.)-201301.
23. EMDs received after due date & time will not be accepted.
24. If due to any reason, the due date is declared as a holiday, the tender will be opened on next working day at the same time.
25. The technical bid shall be opened on 06.08.2018 at 17:00 Hrs in RECPDCL office, Noida in the presence of such Bidders /their representatives, who desire to be present at the time of opening.
26. The Bid with validity of less than 180 days from the last date of bid submission shall not be considered. The validity can be further extended with mutual consent.
27. Any or all Bids may be rejected or accepted partially or fully without assigning any reason thereof by Chief Executive Officer, RECPDCL.
28. Bidders are requested to watch out RECPDCL website for change of events/additional information from time to time.
29. Bidders should take cognizance of geography, terrain, all site conditions, factors etc. at their discretion/will, if they desire so before quoting the rate. However, in any case, it will be assumed that bidder has understood all site conditions, factors etc. for this work before submission of bid.
30. It will be imperative on each bidder to fully acquaint itself of all the local conditions and factors which would have effect on the performance of the work and its cost. And it will be deemed that while quoting all such factors have been taken into account.

LETTER FOR SUBMISSION OF BID

(To be submitted on Company's letterhead duly signed)

To,

Addl. Chief Executive Officer
REC Power Distribution Company Ltd.
4th Floor, KRIBHCO Bhawan,
A10, Sector-1, Noida (U.P.)-201301

Sub.: Engagement of Agency for Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme

Dear Sir,

We wish to submit bid against RECPDCL's NIT No: RECPDCL/TECH/ARP/18-19/1692 dated: 20.07.2018 for "Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme" as per the requirements of RECPDCL.

Further, I hereby certify that:

1. I have read the provisions of all clauses and confirm that notwithstanding anything stated elsewhere to the contrary, the stipulation of all clauses of Bid are acceptable to me and I have not taken any deviation to any clause.

2. I further confirm that any deviation to any clause of Tender found anywhere in my Bid, shall stand unconditionally withdrawn, without any cost implication whatsoever to the RECPDCL.

3. Our bid shall remain valid for period of 180 days from the last date of bid submission.

Date: **Signature:**
Place: **Full Name:**

Designation:
Address:

Note: In absence of above declaration/certification, the Bid is liable to be rejected and shall not be taken into account for evaluation.

BIDDER'S GENERAL DETAILS

(To be submitted on Company's letterhead duly signed)

NIT No: RECPDCL/TECH/ARP/18-19/1692 dated: 20.07.2018

Name of Work: Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme

GENERAL DETAILS

1. **Name of Company: _____**
2. **Year of Incorporation: _____**
3. **Name of Authorized Person: _____**
4. **Regd. Address:**
   - **a) Address of Office: _____**
     _____
   - **b) Contact Person's**
     - i. Name & Designation: _____
     - ii. Address: _____
       _____
     - iii. Tel. No. (Landline& Mobile): _____
     - iv. Email ID : _____
5. **Type of Firm (Please tick):** Private Ltd./ Public Ltd./ LLP/ Joint Venture Company
6. **Permanent Account Number: _____**
7. **GSTIN:_____**
8. **EMD Details:** **Rs. _____**
   DD/BG No. _____
   Name & Address of Bank: _____
   _____

Signature……

Full Name……..

Designation……..

Address……..

LETTER OF TRANSMITTAL

To,

Addl. Chief Executive Officer
REC Power Distribution Company Ltd.
4th Floor, KRIBHCO Bhawan,
A10, Sector-1, Noida (U.P.)-201301

Dear Sir,

I/We, the undersigned, have examined the details given in your Tender No. RECPDCL/TECH/ARP/18-19/1692 dated: 20.07.2018 for Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme. We accept all the terms & conditions of the bid document without any deviation and submit the Bid. We hereby certify that M/s _____ or its group companies have not been awarded any work for & shall not be a competitor to REC during contract period in case the contract is awarded.

Also, M/s _____ or its group companies is not executing or providing any type of consultancy services either directly or as a sub-contractor for the particular work for which Bid is submitted.

It is confirmed that M/s. _____ is not banned or blacklisted by any Govt./Pvt. Institutions in India.

Authorized Signature [In full and initials]:

Name and Title of Signatory:

Name of Firm:

Address:

FINANCIAL ELIGIBILITY CRITERIA AS PER SECTION-IV

To,

Addl. Chief Executive Officer
REC Power Distribution Company Ltd.
4th Floor, KRIBHCO Bhawan,
A10, Sector-1, Noida (U.P.)-201301

Dear Sir,

We wish to submit bid against RECPDCL's NIT No: RECPDCL/TECH/ARP/18-19/1692 dated: 20.07.2018 for "Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme" for which details of our financial parameters as per eligibility criteria requirements mentioned in Section-IV are as follows:

Name of Bidding Company:

Financial Particulars	Financial Year	Value as per Audited Annual Accounts
Annual Turnover	FY 2015-16	
	FY 2016-17	
	FY 2017-18	
Net Worth	FY 2015-16	
	FY 2016-17	
	FY 2017-18	

(Signature & seal of Authorized Signatory)

Name:

Designation:

Date:

Place:

(Signature & seal of Chartered Accountant)

Name:

Date:

Place:

Membership No.

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 Bidder) _____ who have submitted their bid to REC Power Distribution Company Limited, Noida against NIT No. …… for Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme, 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:

S. No.	Type of Facility	Sanctioned Limit as on Date	Utilization 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

BID BANK GUARANTEE (EARNEST MONEY DEPOSIT) FORMAT

This deed of Guarantee made this ……. day of …… 2018 by ……
…… **(Name of the Bank)** having one its branch at ……..
…….. acting through its Manager (hereinafter called the "Bank") which expression shall wherever the context so requires includes its successors and permitted assigns in favour of REC Power Distribution Company Ltd., registered under the Companies Act, 1956, having its office at 4th Floor, KRIBHCO Bhawan, A10, Sector-1, Noida (U.P.)-201301 (hereinafter called "RECPDCL") which expression shall include its successors and assigns.

WHEREAS RECPDCL has invited tender vide their Tender Notice No: ……
…….. Dated …… to be opened on ……
AND WHEREAS M/s ……
……
…… (**Name of Tenderer)** having its office at ……
…… (hereinafter called the "Tenderer"), has/have in response to aforesaid tender notice offered to supply/ do the job of Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme as contained in the tender.

AND WHEREAS the Tender is required to furnish to RECPDCL a Bank Guarantee for a sum of ₹ …… /- (Rupees..... only) as Earnest Money for participation in the Tender aforesaid.

AND WHEREAS, we ……
…… **(Name of Bank)** have at the request of the tender agree to give RECPDCL this as hereinafter contained.

NOW, THEREFORE, in consideration of the promises we, the undersigned, hereby covenant that, the aforesaid Tender shall remain open for acceptance by RECPDCL during the period of validity as mentioned in the Tender or any extension thereof as RECPDCL and the Tender may subsequently agree and if the Tender for any reason back out, whether expressly or impliedly, from his said Tender during the period of its validity or any extension thereof as aforesaid or fail to furnish Bank Guarantee for performance as per terms of the aforesaid Tender, we hereby undertake to pay RECPDCL, New Delhi on demand without demur to the extent of ₹ …… /-(Rupees ..... only).

We further agree as follows:

1. That RECPDCL may without affecting this guarantee extend the period of validity of the said Tender or grant other indulgence to or negotiate further with the Tender in regard to the conditions contained in the said tender or thereby modify these conditions or add thereto any further conditions as may be mutually agreed to in between RECPDCL and the Tender AND the said Bank shall not be released from its liability under these presents by an exercise by RECPDCL of its liberty with reference to the matters

aforesaid or by reason of time being given to the Tender or any other forbearance, act or omission on the part of the RECPDCL or any indulgence by RECPDCL to the said Tender or any other matter or thing whatsoever.

2. The Bank hereby waive all rights at any time in consistent with the terms of this Guarantee and the obligations of the Bank in terms thereof shall not be otherwise affected or suspended by reason of any dispute or dispute having been raised by the Tender (whether or not pending before any arbitrator, tribunal or court) or any denial of liability by the Tender stopping or preventing or purporting to stop or prevent any payment by the Bank to RECPDCL in terms thereof.

3. We the said Bank, lastly undertake not to revoke this Guarantee during its currency except with the previous consent of RECPDCL in writhing and agree that any charges in the constitution, winding up, dissolution or insolvency of the Tender, the said Bank shall not be discharged from their liability.

NOTWITHSTADING anything contained above, the liability of the Bank in respect of this Guarantee is restricted to the said sum of ₹ …… /-(Rupees ..... only).and this Guarantee shall remain in force till …….. unless a claim under this guarantee is filed with the bank within 30 (thirty) days from this date or the extended date, as the case may be i.e. up to …….. all rights under Guarantee shall lapse and the Bank be discharged from all liabilities hereunder.

In witness whereof the Bank has subscribed and set its name and seal here under.

Note: The date shall be thirty (30) days after the last date for which the bid is valid.

ADVANCE BANK GUARANTEE (ABG) FORMAT

M/s REC Power Distribution Company Ltd.,
Core-4, Scope Complex, Lodhi Road,
New Delhi — 110003 (INDIA)
(With due stamp duty if applicable)

OUR LETTER OF GUARANTEE NO.: _____

In consideration of REC Power Distribution Company Ltd., having its office at _____ _____ (hereinafter referred to as "RECPDCL" which expression shall unless repugnant to the content or meaning thereof include all its successors, administrators and executors) and having issued Work Order No. _____dated _____with/on M/s _____ (hereinafter referred to as "The Agency" which expression unless repugnant to the content or meaning thereof, shall include all the successors, administrators, and executors).

WHEREAS the Agency having unequivocally accepted to perform the services as per terms and conditions given in the Letter of Intent/ Purchase Order No._____ dated _____ and RECPDCL having agreed that the Agency shall furnish to RECPDCL an Advance Bank Guarantee for the advance taken (to the extent of 10% of contract amount), of the value of ₹_____.

We, _____ ("The Bank") which shall include OUR successors, administrators and executors herewith establish an irrevocable Letter of Guarantee No. _____ in your favor for account of _____ _____ (The Agency) in cover of performance guarantee in accordance with the terms and conditions of the Work Order/ Sanction Order.

Hereby, we undertake to pay up to but not exceeding _____ (say _____ _____ only) upon receipt by us of your first written demand accompanied by your declaration stating that the amount claimed is due by reason of the Agency having failed to perform the Work Order/ Sanction Order and despite any contestation on the part of above named-agency.

This letter of Guarantee will expire on _____ including 90 days of claim period and any claims made hereunder must be received by us on or before expiry date after which date this Letter of Guarantee will become of no effect whatsoever whether returned to us or not.

_____
Authorized signature
Chief Manager/ Manager
Seal of Bank

Note: ABG shall be valid till completion of sanctioned delivery period plus 3 months' claim period.

PERFORMANCE BANK GUARANTEE (PBG) FORMAT

M/s REC Power Distribution Company Ltd.,
Core-4, Scope Complex, Lodhi Road,
New Delhi — 110003 (INDIA)
(With due stamp duty if applicable)

OUR LETTER OF GUARANTEE NO.: _____

In consideration of REC Power Distribution Company Ltd., having its office at _____ _____ (hereinafter referred to as "RECPDCL" which expression shall unless repugnant to the content or meaning thereof include all its successors, administrators and executors) and having issued Work Order No. _____dated _____with/on M/s _____ (hereinafter referred to as "The Agency" which expression unless repugnant to the content or meaning thereof, shall include all the successors, administrators, and executors).

WHEREAS the Agency having unequivocally accepted to perform the services as per terms and conditions given in the Letter of Intent/ Purchase Order No._____ dated _____ and RECPDCL having agreed that the Agency shall furnish to RECPDCL a Performance Guarantee for the faithful performance during the entire contract, of the value of ₹_____.

We, _____ ("The Bank") which shall include OUR successors, administrators and executors herewith establish an irrevocable Letter of Guarantee No. _____ in your favor for account of _____ _____ (The Agency) in cover of performance guarantee in accordance with the terms and conditions of the Work Order/ Sanction Order.

Hereby, we undertake to pay up to but not exceeding _____ (say _____ _____ only) upon receipt by us of your first written demand accompanied by your declaration stating that the amount claimed is due by reason of the Agency having failed to perform the Work Order/ Sanction Order and despite any contestation on the part of above named-agency.

This letter of Guarantee will expire on _____ including 180 days of claim period and any claims made hereunder must be received by us on or before expiry date after which date this Letter of Guarantee will become of no effect whatsoever whether returned to us or not.

_____
Authorized signature
Chief Manager/ Manager
Seal of Bank

Note: PBG shall be valid till completion of warranty period of 18 months plus 6 months' claim period.

POWER OF ATTTORNEY

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution.)

(a) Power of Attorney to be provided by the Bidding Company in favour of its representative as evidence of authorized signatory's authority.

Know all men by these presents, We …… (name and address of the registered office of the Bidding Company as applicable) do hereby constitute, appoint and authorize Mr./Ms. …….. (name & residential address) who is presently employed with us and holding the position of …… as our true and lawful attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to submission of our Bid for Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme in response to the NIT No. …… dated …… issued by REC Power Distribution Company Ltd. (RECPDCL), Noida including signing and submission of the Bid and all other documents related to the Bid, including but not limited to undertakings, letters, certificates, acceptances, clarifications, guarantees or any other document which RECPDCL may require us to submit. The aforesaid Attorney is further authorized for making representations to REC Power Distribution Company Ltd., Noida and providing information/responses to RECPDCL representing us in all matters before RECPDCL and generally dealing with RECPDCL in all matters in connection with Bid till the completion of the bidding process as per the terms of the above mentioned NIT.

We hereby agree to ratify all acts, deeds and things done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall be binding on us and shall always be deemed to have been done by us.

All the terms used herein but not defined shall have the meaning ascribed to such terms under the NIT.

Signed by the within named
…….. (Insert the name of the executant company)
through the hand of
Mr. ……
duly authorized by the Board to issue such Power of Attorney
Dated this …… day of ……

Accepted
……..
Signature of Attorney
(Name, designation and address of the Attorney)

Attested

……

(Signature of the executant)
(Name, designation and address of the executant)

……
Signature and stamp of Notary of the place of execution

Common seal of …… has been affixed in my/our presence pursuant to Board of Director's Resolution dated……

WITNESS
1. ……..

(Signature)

Name……

Designation ……

2. ……..

(Signature)

Name……

Designation …….

Notes:
The mode of execution of the power of attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and the same should be under common seal of the executant affixed in accordance with the applicable procedure. Further, the person whose signatures are to be provided on the power of attorney shall be duly authorized by the executant(s) in this regard.

The person authorized under this Power of Attorney, in the case of the Bidding Company / Lead Member being a public company, or a private company which is a subsidiary of a public company, in terms of the Companies Act, 1956, with a paid up share capital of more than Rupees Five crores, should be the Managing Director / whole time director/manager appointed under section 269 of the Companies Act, 1956. In all other cases the person authorized should be a director duly authorized by a board resolution duly passed by the Company.

Also, wherever required, the executant(s) should submit for verification the extract of the chartered documents and documents such as a Board resolution / power of attorney, in favour of the person executing this power of attorney for delegation of power hereunder on behalf of the executant(s).

UNDERTAKING TOWARDS NOT BEING BLACK-LISTED

I, _____ Authorized Signatory of M/s _____ hereby give undertaking that we, as a company are not black-listed by any Central/ State Government/ Semi-Government Organization/ Public Sector Undertaking/ Private Institution in India.

Further, if information furnished above stands false at any stage, we shall be completely liable for actions taken by RECPDCL as per terms & conditions of the tender including disqualification and exclusion from future contracts/assignments.

(Signature of Authorized Signatory)

Name*:

Designation*:

Seal:

* Please provide the name and designation of each signatory.

ACCEPTANCE FORM FOR PARTICIPATION IN REVERSE AUCTION EVENT

(To be signed and stamped by the bidder on letterhead)

In a bid to make our entire procurement process more fair and transparent, RECPDCL intends to use the reverse auctions in case to case at sole discretion of RECPDCL when financial bids are invited later on. Techno-Commercially acceptable bidders up to the level of L6 or lower as the case may be shall be allowed to participate in the Reverse Auctioning at sole discretion of RECPDCL.

The following terms and conditions are accepted by the bidder on participation in the bid event:

1. RECPDCL shall provide the user id and password to the authorized representative of the bidder. (Authorization Letter in lieu of the same shall be submitted along with the signed and stamped Acceptance Form).
2. RECPDCL decision to award the work would be final and binding on the supplier.
3. The bidder agrees to non-disclosure of trade information regarding the purchase, identity of RECPDCL, bid process, bid technology, bid documentation and bid details to any other party.
4. The bidder is advised to fully make aware itself of auto bid process and ensure its participation in the event of reverse auction and failing to which RECPDCL will not be liable in any way.
5. In case of bidding through Internet medium, bidders are further advised to ensure availability of the infrastructure as required at their end to participate in the auction event. Inability to bid due to telephone line glitch, internet response issues, software or hardware hangs, power failure or any other reason shall not be the responsibility of RECPDCL.
6. In case of intranet medium, RECPDCL shall provide the infrastructure to bidders. Further, RECPDCL has sole discretion to extend or restart the auction event in case of any glitches in infrastructure observed which has restricted the bidders to submit the bids to ensure fair & transparent competitive bidding. In case an auction event is restarted, the best bid as already available in the system shall become the basis for determining start price of the new auction.
7. In case the bidder fails to participate in the auction event due any reason whatsoever, it shall be presumed that the bidder has no further discounts to offer and the initial bid as submitted by the bidder as a part of the tender shall be considered as the bidder's final no regret offer. Any offline price bids received from a bidder in lieu of non-participation in the auction event shall be out rightly rejected by RECPDCL.
8. The bidder shall be prepared with competitive price quotes on the day of the bidding event.
9. The prices as quoted by the bidder during the auction event shall be inclusive of all the applicable taxes, duties and levies and shall be FOR at site.
10. The prices submitted by a bidder during the auction event shall be binding on the bidder.
11. No requests for time extension of the auction event shall be considered by RECPDCL.
12. The original price bids of the bidders shall be reduced on pro-rata basis against each line item based on the final all inclusive prices offered during conclusion of the auction event for arriving at Contract amount.

Signature & Seal of the Bidder
(Authorized Signatory)

INTEGRITY PACT

Between

REC Power Distribution Company Limited
having its Registered Office at Core-4 Scope complex, New Delhi

hereinafter referred to as

"RECPDCL",

and

_____

[Insert the name of the Bidder)

having its Registered Office at _____

(Insert full Address)

_____

Hereinafter referred to as

"The Bidder"

Preamble

RECPDCL intends to engage, under laid-down organisational procedures, agencies for Supply of Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme**.**

(Signature) _____ (Signature) _____
(For & On behalf of RECPDCL) (For & On behalf of Bidder)

Supply of materials for sub-transmission and distribution network in Arunachal Pradesh relevant laws and regulations, and the principles of economical use of resources, and of fairness and transparency in its relations with its Bidders.

In order to achieve these goals, RECPDCL and the above named Bidder enter into this agreement called '**Integrity Pact'** which will form a part of the bid.

It is hereby agreed by and between the parties as under:

Section I - Commitments of RECPDCL

(1) RECPDCL commits itself to take all measures necessary to prevent corruption and to observe the following principles :

a) No employee of RECPDCL, personally or through family members, will in connection with the tender, or the execution of the contract, demand, take a promise for or accept, for him/herself or third person, any material or other benefit which he/she is not legally entitled to.

b) RECPDCL will, during the tender process treat all Bidder(s) with equity and fairness. RECPDCL will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

(c) RECPDCL will exclude from evaluation of Bids its such employee(s) who has any personnel interest in the Companies/Agencies participating in the Bidding/Tendering process

(2) If Chairman RECPDCL obtains information on the conduct of any Employee of RECPDCL which is a criminal offence under the relevant Anti-Corruption Laws of India, or if there be a substantive suspicion in this regard, he will inform its Chief Vigilance Officer and in addition can initiate disciplinary actions under its Rules.

Section II - Commitments of the Bidder

(1) The Bidder commits himself to take all measures necessary to prevent corruption. He Commits himself to observe the following principles

(Signature) _____ (Signature) _____
(For & On behalf of RECPDCL) (For & On behalf of Bidder)

during his participation in the tender process and during the contract execution:

a) The Bidder will not, directly or through any other person or firm, offer, promise or give to RECPDCL, or to any of RECPDCL's employees involved in the tender process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange an advantage during the tender process or the execution of the contract.

b) The Bidder will not enter into any illegal agreement or understanding, whether formal or informal with other Bidders. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or actions to restrict competitiveness or to introduce cartelization in the bidding process.

c) The Bidder will not commit any criminal offence under the relevant Anti-corruption Laws of India; further, the Bidder will not use for illegitimate purposes or for purposes of restrictive competition or personal gain, or pass on to others, any information provided by RECPDCL as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

d) The Bidder of foreign origin shall disclose the name and address of the Agents/representatives in India, if any, involved directly or indirectly in the Bidding. Similarly, the Bidder of Indian Nationality shall furnish the name and address of the foreign principals, if any, involved directly or indirectly in the Bidding.

e) The Bidder will, when presenting his bid, disclose any and all payments he has made, or committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and/or with the execution of the contract.

f) The Bidder will not misrepresent facts or furnish false/forged documents/ information in order to influence the bidding process or the execution of the contract to the detriment of RECPDCL.

(2) The Bidder will not instigate third persons to commit offences outlined above or be an accessory to such offences.

(Signature) _____ (Signature) _____
(For & On behalf of RECPDCL) (For & On behalf of Bidder)

Section III- Disqualification from tender process and exclusion from future Contracts

(1) If the Bidder, before contract award, has committed a serious transgression through a violation of Section II or in any other form such as to put his reliability or credibility as Bidder into question, RECPDCL may disqualify the Bidder from the tender process or terminate the contract, if already signed, for such reason.

(2) If the Bidder has committed a serious transgression through a violation of Section II such as to put his reliability or credibility into question, RECPDCL may after following due procedures also exclude the Bidder from future contract award processes. The imposition and duration of the exclusion will be determined by the severity of the transgression. The severity will be determined by the circumstances of the case, in particular the number of transgressions, the position of the transgressors within the company hierarchy of the Bidder and the amount of the damage. The exclusion will be imposed for a minimum of 12 months and maximum of 3 years.

(3) If the Bidder can prove that he has restored/recouped the damage caused by him and has installed a suitable corruption prevention system, RECPDCL may revoke the exclusion prematurely.

Section IV - Liability for violation of Integrity Pact

(1) If RECPDCL has disqualified the Bidder from the tender process prior to the award under Section III, RECPDCL may forfeit the Bid Guarantee under the Bid.

(2) If RECPDCL has terminated the contract under Section III, RECPDCL may forfeit the Contract Performance Guarantee of this contract besides resorting to other remedies under the contract.

Section V- Previous Transgression

(1) The Bidder shall declare in his Bid that no previous transgressions occurred in the last 3 years with any other Public Sector Undertaking or Government Department that could justify his exclusion from the tender process.

(Signature) _____ (Signature) _____
(For & On behalf of RECPDCL) (For & On behalf of Bidder)

(2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section VI - Equal treatment to all Bidders

(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 who does not sign this Pact or violate its provisions.

Section VII - Punitive Action against violating Bidders / Contractors

If RECPDCL obtains knowledge of conduct of a Bidder or a Contractor or his subcontractor or of an employee or a representative or an associate of a Bidder or Contractor or his Subcontractor which constitutes corruption, or if RECPDCL has substantive suspicion in this regard, RECPDCL will inform the Chief Vigilance Officer (CVO)/Competent authority.

Section VIII - Pact Duration

This Pact begins when both parties have legally signed it. It expires for the Contractor after the closure of the contract and for all other Bidder's six month after the contract has been awarded.

Section IX - 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 Integrity Pact.

(2) Changes and supplements as well as termination notices need to be made in writing.

(3) Views expressed or suggestions/submissions made by the parties and the recommendations of the competent authority/CVO in respect of the violation of this agreement, shall not be relied on or introduced as evidence in the arbitral or judicial proceedings (arising out of the arbitral proceedings) by the parties in connection with the disputes/differences arising out of the subject contract.

(4) Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

(Signature) _____ (Signature) _____
(**For & On behalf of RECPDCL**) (**For & On behalf of Bidder)**

(Office Seal) (Office Seal)

Name:_____ Name:_____

Designation:_____ Designation:_____

Witness 1 :_____Witness 1 :_____

(Name & Address) _____(Name & Address) _____

_____

_____

Witness 2 :_____ Witness 2 :_____

(Name & Address) _____(Name & Address) _____

_____ _____

MANUFACTURER'S AUTHORIZATION FORM

(On Respective Manufacturer's Letterhead)

To: [Insert: name of Employer]

Dear Sir/ Madam,

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 NIT *[insert**: title and reference number of NIT**]* 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.*

PERT CHART

(To be signed and stamped by the bidder on letterhead)

PERT Chart for Supply of Distribution Transformers in Arunachal Pradesh					
S. No.	**Activity**	**TIME IN DAYS**	**START DATE**	**END DATE**	**CUMULATIVE TIME SCHEDULE (from Zero date of project)**
1	**Design**				
a	Submission of GTP, drawings, BOM				
b	Approval of GTP, drawings, BOM				
2	**Manufacturing/PDI**				
a	Manufacturing of 1st lot i.e. 40% of ordered quantity				
b	PDI - 1st lot				
c	Manufacturing of 2nd lot i.e. next 40% of ordered quantity				
d	PDI - 2nd lot				
e	Manufacturing of 3rd lot i.e. last 20% of ordered quantity				
f	PDI - 3rd lot				
3	**Shipment of cleared lot**				
a	**Start of shipment**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
b	**Receipt of shipment at Stores**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
4	**Handing over to APDA**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				

PERT Chart for Supply of ACSR Conductor in Arunachal Pradesh					
S. No.	**Activity**	**TIME IN DAYS**	**START DATE**	**END DATE**	**CUMULATIVE TIME SCHEDULE (from Zero date of project)**
1	**Design**				
a	Submission of GTP, drawings, BOM				
b	Approval of GTP, drawings, BOM				
2	**Manufacturing/PDI**				
a	Manufacturing of 1st lot i.e. 40% of ordered quantity				
b	PDI - 1st lot				
c	Manufacturing of 2nd lot i.e. next 40% of ordered quantity				
d	PDI - 2nd lot				
e	Manufacturing of 3rd lot i.e. last 20% of ordered quantity				
f	PDI - 3rd lot				
3	**Shipment of cleared lot**				
a	**Start of shipment**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
b	**Receipt of shipment at Stores**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
4	**Handing over to APDA**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				

PERT Chart for Supply of LT XLPE Cables in Arunachal Pradesh					
S. No.	**Activity**	**TIME IN DAYS**	**START DATE**	**END DATE**	**CUMULATIVE TIME SCHEDULE (from Zero date of project)**
1	**Design**				
a	Submission of GTP, drawings, BOM				
b	Approval of GTP, drawings, BOM				
2	**Manufacturing/PDI**				
a	Manufacturing of 1st lot i.e. 40% of ordered quantity				
b	PDI - 1st lot				
c	Manufacturing of 2nd lot i.e. next 40% of ordered quantity				
d	PDI - 2nd lot				
e	Manufacturing of 3rd lot i.e. last 20% of ordered quantity				
f	PDI - 3rd lot				
3	**Shipment of cleared lot**				
a	**Start of shipment**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
b	**Receipt of shipment at Stores**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
4	**Handing over to APDA**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				

PERT Chart for Supply of LTDB for Transformers & Service Connection in Arunachal Pradesh					
S. No.	**Activity**	**TIME IN DAYS**	**START DATE**	**END DATE**	**CUMULATIVE TIME SCHEDULE (from Zero date of project)**
1	**Design**				
a	Submission of GTP, drawings, BOM				
b	Approval of GTP, drawings, BOM				
2	**Manufacturing/PDI**				
a	Manufacturing of 1st lot i.e. 40% of ordered quantity				
b	PDI - 1st lot				
c	Manufacturing of 2nd lot i.e. next 40% of ordered quantity				
d	PDI - 2nd lot				
e	Manufacturing of 3rd lot i.e. last 20% of ordered quantity				
f	PDI - 3rd lot				
3	**Shipment of cleared lot**				
a	**Start of shipment**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
b	**Receipt of shipment at Stores**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
4	**Handing over to APDA**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				

PERT Chart for Supply of Insulators & Transformer Substation Equipments in Arunachal Pradesh					
S. No.	**Activity**	**TIME IN DAYS**	**START DATE**	**END DATE**	**CUMULATIVE TIME SCHEDULE (from Zero date of project)**
1	**Design**				
a	Submission of GTP, drawings, BOM				
b	Approval of GTP, drawings, BOM				
2	**Manufacturing/PDI**				
a	Manufacturing of 1st lot i.e. 40% of ordered quantity				
b	PDI - 1st lot				
c	Manufacturing of 2nd lot i.e. next 40% of ordered quantity				
d	PDI - 2nd lot				
e	Manufacturing of 3rd lot i.e. last 20% of ordered quantity				
f	PDI - 3rd lot				
3	**Shipment of cleared lot**				
a	**Start of shipment**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
b	**Receipt of shipment at Stores**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
4	**Handing over to APDA**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				

PERT Chart for Supply of Stay Sets, GI Wire and Spike Rod in Arunachal Pradesh					
S. No.	**Activity**	**TIME IN DAYS**	**START DATE**	**END DATE**	**CUMULATIVE TIME SCHEDULE (from Zero date of project)**
1	**Design**				
a	Submission of GTP, drawings, BOM				
b	Approval of GTP, drawings, BOM				
2	**Manufacturing/PDI**				
a	Manufacturing of 1st lot i.e. 40% of ordered quantity				
b	PDI - 1st lot				
c	Manufacturing of 2nd lot i.e. next 40% of ordered quantity				
d	PDI - 2nd lot				
e	Manufacturing of 3rd lot i.e. last 20% of ordered quantity				
f	PDI - 3rd lot				
3	**Shipment of cleared lot**				
a	**Start of shipment**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
b	**Receipt of shipment at Stores**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				
4	**Handing over to APDA**				
i	1st lot i.e. 40% of ordered quantity				
ii	2nd lot i.e. next 40% of ordered quantity				
iii	3rd lot i.e. last 20% of ordered quantity				

FINANCIAL BID

(To be submitted through Online)

NIT No: RECPDCL/TECH/ARP/18-19/1692 dated: 20.07.2018

Name of Work: Supply of materials for sub-transmission and distribution network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY Scheme

Supply of Materials for Sub-transmission & Distribution Network in Arunachal Pradesh for electrification works under SAUBHAGYA/DDUGJY										
Name of the Company										
S. No.	**Item Description**	**Unit**	**Quantity**	**Per Unit Rate (in Rs.)**	**Total Amount without GST (in Rs.)**	**GST Percentage**	**GST Amount (in Rs.)**	**Total Amount including GST (in Rs.)**	**Freight & Insurance (including taxes) (in Rs.)**	**Total Amount (including GST, Freight & Insurance) (in Rs.)**
A	B	C	D	E	F = D x E	G	H = F x G	I = F + H	J	K = I + J
1	Supply of Single Phase 5 KVA, 11kV/240V Distribution Transformer, Aluminium wound as per scope of work	Nos.	97							
2	Supply of Single Phase 10KVA, 11kV/240V Distribution Transformer, Aluminium wound as per scope of work	Nos.	319							
3	Supply of Single Phase 16KVA, 11kV/240V Distribution Transformer, Aluminium wound as per scope of work	Nos.	31							
4	Supply of Three Phase 16KVA, 11kV/433V-250V Distribution Transformer, Copper wound as per scope of work	Nos.	416							

5	Supply of Three Phase 25KVA, 11kV/433V-250V Distribution Transformer, Aluminium/ Copper wound as per scope of work	Nos.	326							
6	Supply of Three Phase 63KVA, 11kV/433V-250V Distribution Transformer, Aluminium/ Copper wound as per scope of work	Nos.	133							
7	Supply of Three Phase 100KVA, 11kV/433V-250V Distribution Transformer, Aluminium/ Copper wound as per scope of work	Nos.	14							
8	Supply of Three Phase 200KVA, 11kV/433V-250V Distribution Transformer, Aluminium/ Copper wound as per scope of work	Nos.	2							
9	Supply of weasel ACSR conductor as per scope of work	KM	3896							
10	Supply of squirrel ACSR conductor as per scope of work	KM	8220							
11	Supply of Single Core LT XLPE armoured Cable (1X16 sq. mm) as per scope of work	Meter	12945							

12	Supply of Single Core LT XLPE armoured Cable (1X35 sq. mm) as per scope of work	Meter	4890							
13	Supply of Single Core LT XLPE armoured Cable (1X50 sq. mm) as per scope of work	Meter	1995							
14	Supply of Single Core LT XLPE armoured Cable (1X70 sq. mm) as per scope of work	Meter	240							
15	Supply of 11 KV Polymer Pin Insulator (3 Nos.) with GI Pin as per scope of work	Set	30398							
16	Supply of 11 KV Polymer Disc Insulator T&C type (3 Nos.) with hardware fittings as per scope of work	Set	34966							
17	Supply of LT Pin Insulator with GI Pin as per scope of work	Nos.	201514							
18	Supply of Shackle Insulator as per scope of work	Nos.	72760							
19	Supply of 9KV Station Class Surge Arrestor as per scope of work	Nos.	3050							
20	Supply of 11 KV Three Pole Drop Out Fuse Unit as per scope of work	Set	1371							

21	Supply of Gang Operated Three Pole Air Break Switch unit as per scope of work	Nos.	1371							
22	Supply of LT Stay Set (16 mm) as per scope of work	Set	18478							
23	Supply of HT Stay Set (20 mm) as per scope of work	Set	21492							
24	Supply of 8 SWG GI Wire as per scope of work	MT	94.86							
25	Supply of Spike Rod (20x2500)mm for earthing as per scope of work	Nos.	19106							
26	Supply of LT Distribution Boxes for 5 KVA, 11KV/240V Single Phase Distribution Transformer as per scope of work	Nos.	97							
27	Supply of LT Distribution Boxes for 10KVA, 11KV/240V Single Phase Distribution Transformer as per scope of work	Nos.	319							
28	Supply of LT Distribution Boxes for 16KVA, 11KV/240V Single Phase Distribution Transformer as per scope of work	Nos.	31							
29	Supply of LT Distribution Boxes for 16KVA, 11KV/433V-250V Three Phase Distribution Transformer as per scope of work	Nos.	416							

30	Supply of LT Distribution Boxes for 25KVA, 11KV/433V-250V Three Phase Distribution Transformer as per scope of work	Nos.	326								
31	Supply of LT Distribution Boxes for 63KVA, 11KV/433V-250V Three Phase Distribution Transformer as per scope of work	Nos.	133								
32	Supply of LT Distribution Boxes for 100KVA, 11KV/433V-250V Three Phase Distribution Transformer as per scope of work	Nos.	14								
33	Supply of LT Distribution Boxes for 200 KVA, 11KV/433V-250V Three Phase Distribution Transformer as per scope of work	Nos.	2								
34	Supply of Single Phase LT Distribution Boxes (4-Way) for Service Connections as per scope of work	Nos.	1338								
Sub-Total (in Rs.)											
Grand Total in figure(in Rs.)											
Grand Total in words (in Rs.)											

Note:

1. Price should be quoted as per format of Annexure-XV which must be inclusive of all costs involved in the supply contract i.e. complete design, engineering, manufacture, testing and supply of materials as per scope of work including transportation & insurance up to sub-divisional headquarters of APDA in

the State of Arunachal Pradesh and all applicable taxes and duties of Central & State Governments etc.

2. If it is found that the tax quoted is higher than the applicable tax, in that case actual applicable taxes will only be paid by RECPDCL and if the tax quoted is lower than the applicable tax, in that case only the quoted taxes will be paid by the RECPDCL.
3. It shall be assumed that taxes other than GST, if any, are already included in the ex-works price of materials.
4. Bidder shall ensure timely payment of all taxes as per Income Tax & GST rules of Central & State Governments.
5. TDS will be deducted from the payment of the Bidder as per the prevalent laws and rules of Central & State Governments as the case may be.
6. Price quoted by the bidder shall remain firm & fixed and shall be binding on the Successful Bidder till completion of warranty period irrespective of actual cost of supply. No escalation/price variation will be granted on any reason whatsoever. The bidder shall not be entitled to claim any additional charges, even though it may be necessary to extend the completion period for any reasons whatsoever.
7. The offer must be kept valid for a period of 180 days from the last date of bid submission. No escalation clause would be accepted. The validity can be further extended with mutual consent.
8. Bids with non-conformity to above will be considered as non-responsive.

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