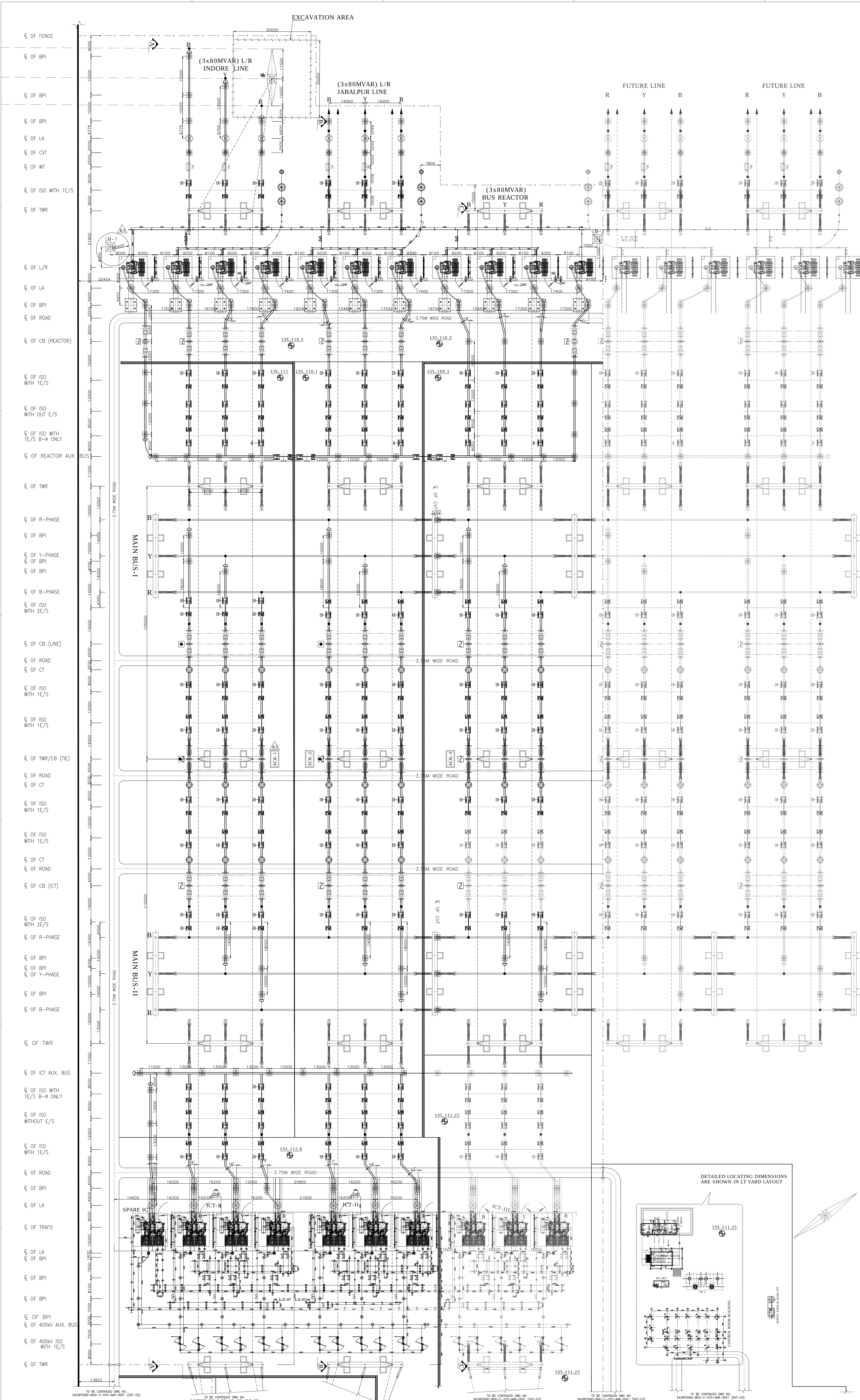


Appendix - A



SYSTEM PARAMETERS (TABLE-1)				
Sl.No.	DESCRIPTION	765kV SYSTEM	132kV SYSTEM	33kV SYSTEM
1	SYSTEM OPERATING VOLTAGE	765kV	132kV	33kV
2	MAX. OPERATING VOLTAGE OF THE SYSTEM (rms)	800kV	145kV	36kV
3	RATED FREQUENCY	50Hz	50Hz	50Hz
4	NO. OF PHASES	3	3	3
RATED INSULATION LEVELS				
i) FULL WAVE LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2/50microsec.)				
5	ii) SWITCHING IMPULSE WITHSTAND VOLTAGE (250/2500microsec.) DRY & WET	1500kV	—	—
iii) ONE MINUTE POWER FREQUENCY DRY & WET WITH STAND VOLTAGE (rms)				
6	MIN. CREEPAGE DISTANCE	20000mm	3625mm	1813mm
7	CORONA EXTINCTION VOLTAGE	508kV	—	—
8	MAX. RADIO INTERFERENCE VOLTAGE LEVEL AT CORONA EXTINCTION VOLTAGE (rms)	2500 micro volts	—	—
9	RATED 3-PH. SYMMETRICAL SHORT CIRCUIT CURRENT WITHSTAND CAPACITY	40kA/1sec.	40kA/1sec.	25kA/1sec.
10	SYSTEM NEUTRAL EARTHING	EFFECT. EARTHED	EFFECT. EARTHED	UN-EARTHED

BILL OF QUANTITY OF 765kV EQUIPMENTS (TABLE-2)				
Sl.No.	SYMBOL	DESCRIPTION	MAKE	QTY AS PER CONTRACT
1		765kV/3150A/40kA/1sec/3P/3P CIRCUIT BREAKER WITH CONTROL SWITCHING ONLY	ALSTOM	04
2		765kV/3150A/40kA/1sec/3P/3P CIRCUIT BREAKER WITH CLOSING RESISTOR & CONTROL SWITCHING	ALSTOM	02
3		765kV/3150A/40kA/1sec/3P/3P CIRCUIT BREAKER WITH CLOSING RESISTOR ONLY	ALSTOM	02
4		765kV/3150A/40kA/1sec/3P/3P CIRCUIT BREAKER WITH CONTROL SWITCHING ONLY (SUITABLE FOR 1 PHASE REACTOR SWITCHING)	ALSTOM	02
5		765kV/3150A/40kA/1sec/3P/3P CIRCUIT BREAKER WITH CONTROL SWITCHING ONLY (SUITABLE FOR 1 PHASE REACTOR SWITCHING)	ALSTOM	02
6		ISOLATOR WITH 1 EARTH SWITCH, VERTICAL, KNEE TYPE, 765kV, 3P, 3150A, 40kA FOR 1 sec. ELECTRICALLY GANGED	ALSTOM	17
7		ISOLATOR WITH 2 EARTH SWITCH, VERTICAL, KNEE TYPE, 765kV, 3P, 3150A, 40kA FOR 1 sec. ELECTRICALLY GANGED	ALSTOM	02
8		ISOLATOR WITH 1 EARTH SWITCH, VERTICAL, KNEE TYPE, 765kV, 1P, 2000A, 40kA FOR 1 sec. ELECTRICALLY GANGED (ALL MASTER)	ALSTOM	15
9		ISOLATOR WITHOUT EARTH SWITCH, VERTICAL, KNEE TYPE, 765kV, 1P, 2000A, 40kA FOR 1 sec. ELECTRICALLY GANGED WITH SPECIAL OPERATING MECHANISM ACTING AS "MASTER" ABLE TO COMBINE THE SIGNALS COMING FROM THE TWO SEPARATE AND INDEPENDENT OPERATING MECHANISMS	ALSTOM	04
10		ISOLATOR WITHOUT EARTH SWITCH, VERTICAL, KNEE TYPE, 765kV, 1P, 2000A, 40kA FOR 1 sec. ELECTRICALLY GANGED WITH SPECIAL OPERATING MECHANISM ACTING AS "SLAVE" ABLE TO COMBINE THE SIGNALS COMING FROM THE TWO SEPARATE AND INDEPENDENT OPERATING MECHANISMS	ALSTOM	04
11		ISOLATOR WITHOUT EARTH SWITCH, VERTICAL, KNEE TYPE, 765kV, 1P, 2000A, 40kA FOR 1 sec. ELECTRICALLY GANGED WITH SPECIAL OPERATING MECHANISM ACTING AS "MASTER" ABLE TO COMBINE THE SIGNALS COMING FROM THE TWO SEPARATE AND INDEPENDENT OPERATING MECHANISMS	ALSTOM	13
12		ISOLATOR WITHOUT EARTH SWITCH, VERTICAL, KNEE TYPE, 765kV, 1P, 2000A, 40kA FOR 1 sec. ELECTRICALLY GANGED WITH SPECIAL OPERATING MECHANISM ACTING AS "SLAVE" ABLE TO COMBINE THE SIGNALS COMING FROM THE TWO SEPARATE AND INDEPENDENT OPERATING MECHANISMS	ALSTOM	13
13		CURRENT TRANSFORMER, 765kV, 6 CORE, 3000A 40kA for 1sec. 120S EXTENDED CURRENT RATING	ALSTOM	12
14		CURRENT TRANSFORMER, 765kV FEEDERS, 5 CORE, 3000A, 1-PH, 40kA for 1sec. 120S EXTENDED CURRENT RATING	ALSTOM	12
15		765kV, 1-PH CVT (440kV), 4 CORE, 3P/3P/0.2/0.2	ALSTOM	06
16		765kV, 1-PH CVT (440kV), 3 CORE, 3P/3P/0.2	ALSTOM	06
17		62kV, LIGHTNING ARRESTER (1-4) DISCHARGE CURRENT 20kA	COL	24
18		765kV BUS POST INSULATOR	W3	77

BILL OF QUANTITY OF 145kV EQUIPMENTS (TABLE-3)			
Sl.No.	SYMBOL	DESCRIPTION	MAKE QTY.
1		145kV HCB 1P ISOLATOR WITHOUT E/S	--- 14

BILL OF QUANTITY OF 33kV EQUIPMENTS (INSULATION LEVEL OF 72.5kV CLASS) (TABLE-4)			
Sl.No.	SYMBOL	DESCRIPTION	MAKE QTY.
1		72.5kV HCB 2P/400A, ISOLATOR WITHOUT E/S MOTOR OPERATED	--- 12

BILL OF QUANTITY OF 33kV EQUIPMENTS (TABLE-5)			
Sl.No.	SYMBOL	DESCRIPTION	MAKE QTY.
1		33kV HCB 1P, 400A ISOLATOR W/O E/S MOTOR OPERATED	--- 02
2		33kV HCB 1P, 400A ISOLATOR W/O E/S MANUAL OPERATED	--- 06
3		33kV NEUTRAL CT 400/1A	--- 02

EQUIPMENT TO BE SUPPLIED BY CUSTOMER (NOT IN ALSTOM SCOPE) (TABLE-6)			
Sl.No.	SYMBOL	DESCRIPTION	MAKE QTY.
1		INTERCONNECTING TRANSFORMER, 500MVA (SINGLE PHASE) 765/400kV	--- 6+1 (SPARE)
2		LINE SHUNT REACTOR, 80MVAR (SINGLE PHASE) 765kV	--- 6+1 (SPARE)
3		BUS SHUNT REACTOR, 80MVAR (SINGLE PHASE) 765kV	--- 3+1 (SPARE)
4		NEUTRAL GROUNDING REACTOR 145kV, 1200 KVAR (WITH BCT)	--- 02
5		120kV LIGHTNING ARRESTER (WITH BCT) DISCHARGE CURRENT 10kA	--- 02
6		120MVAR BUS REACTOR (400kV)	--- 01

MINIMUM AIR CLEARANCE (TABLE-7)			
Sl.No.	DESCRIPTION	765kV SYSTEM	132kV SYSTEM
1	PHASE TO PHASE CONDUCTOR TO CONDUCTOR ROD TO STRUCTURE	7600 9400	1100 480
2	PHASE TO GROUND CONDUCTOR TO STRUCTURE ROD TO STRUCTURE	4900 6400	1100 480
3	SECTIONAL CLEARANCE	10300	3700 3100

CONDUCTOR DETAIL OF SWITCHYARD (TABLE-8)	
VOLTAGE LEVEL-765kV	
MAIN BUS-1 & MAIN BUS-II	QUAD BULL AAC CONDUCTOR
JACK BUS/STRINGING CONNECTION	QUAD BULL AAC CONDUCTOR
DROPPERS/JUMPERS	QUAD BULL AAC CONDUCTOR
EQUIPMENT INTERCONNECTION	5" IPS AL TUBE
SHIELD WIRE	7/3.66mm GI WIRE (10.98mm DIA)

AS-BUILT

NOTES:-
1. ALL DIMENSIONS ARE IN MM.
2. * DEAD END TOWER, STRINGING & CONDUCTOR NOT IN ALSTOM SCOPE.

LEGEND	
	PRESENT SCOPE
	FUTURE
	BOUNDARY LINE
	LEVEL INDICATING

5429PS060-BHO-C-SYD-AAR-1000 COMBINED ELECTRICAL LAYOUT PLAN FOR 765/400kV BHOPAL
5429PS060-BHO-C-SYD-SLD-0401 SINGLE LINE DIAGRAM FOR 765/400kV BHOPAL SUBSTATION

REFR. DRG. NO. DESCRIPTION

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.	
CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011	
TITLE: 765kV ELECTRICAL LAYOUT PLAN FOR BHOPAL SUBSTATION	
SCALE: 1:550	
DRAWING NO.: 5429PS060-BHO-C-SYD-AAR-0001	
SHEET NO. 001/002	

CUSTOMER: BHOVAL DHULE TRANSMISSION COMPANY LTD	
OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.	
PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.	
CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011	
TITLE: 765kV ELECTRICAL LAYOUT PLAN FOR BHOPAL SUBSTATION	
SCALE: 1:550	
DRAWING NO.: 5429PS060-BHO-C-SYD-AAR-0001	
SHEET NO. 001/002	

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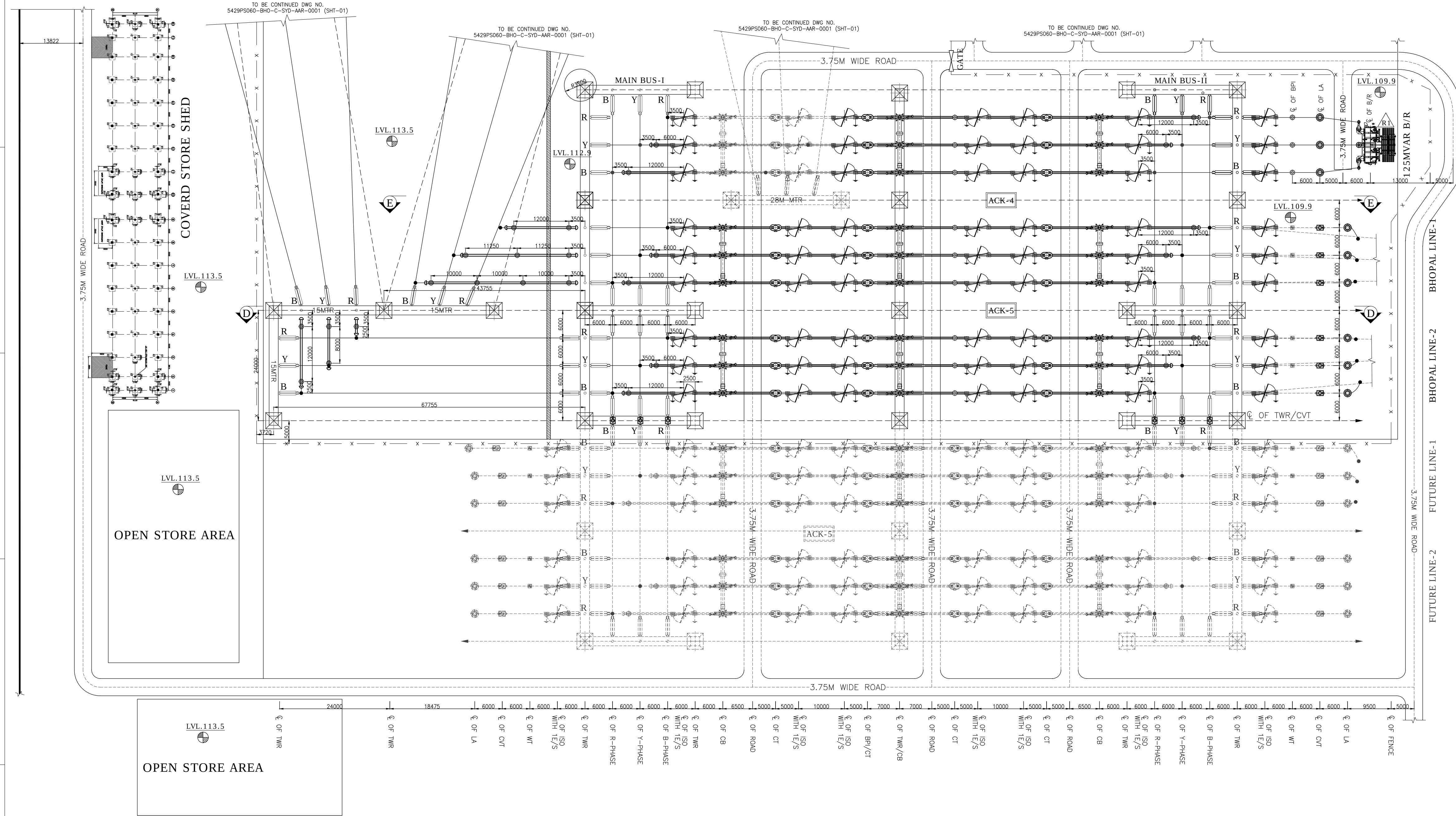
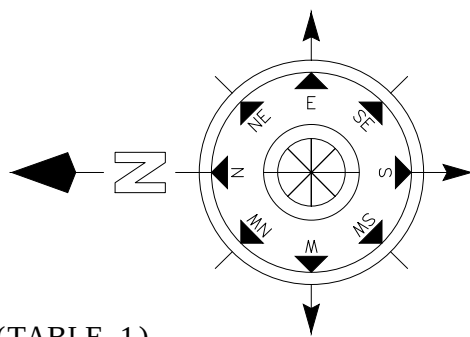
5

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7

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DRAWING NO.: 5429PS060-BHO-C-SYD-AAR-0001



SYSTEM PARAMETERS (TABLE-1)

Sl.No.	DESCRIPTION	400kV SYSTEM
1	SYSTEM OPERATING VOLTAGE	400kV
2	MAX. OPERATING VOLTAGE OF THE SYSTEM (rms)	420kV
3	RATED FREQUENCY	50Hz
4	NO. OF PHASES	3
RATED INSULATION LEVELS		
i)	FULL WAVE LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2/50microsec.)	1425kVp
ii)	SWITCHING IMPULSE WITHSTAND VOLTAGE (250/2500microsec.) DRY & WET	1050kV
iii)	ONE MINUTE POWER FREQUENCY DRY & WET WITH STAND VOLTAGE (rms)	630kV
6	MIN. CREEPAGE DISTANCE	10500mm
7	CORONA EXTINCTION VOLTAGE	320kV
8	MAX. RADIO INTERFERENCE VOLTAGE LEVEL AT CORONA EXTINCTION VOLTAGE (rms), micro volts	1000
9	RATED 3-PH. SYMMETRICAL SHORT CIRCUIT CURRENT WITHSTAND CAPACITY	50kA/1sec.
10	SYSTEM NEUTRAL EARTHING	EFFECT, EARTHED

BILL OF QUANTITY OF 400kV EQUIPMENTS (TABLE-2)

Sl.No.	SYMBOL	DESCRIPTION	MAKE	QTY AS PER CONTRACT
1		CIRCUIT BREAKER, 400kV, 3150A, 50kA for 1 sec. SFE, 3P, WITH CONTROLLED SWITCHING	ALSTOM	02
2		CIRCUIT BREAKER, 400kV, 3150A, 50kA for 1 sec. SFE, 3P, WITHOUT CONTROLLED SWITCHING	ALSTOM	06
3		400kV, 3150A, 50kA, 1sec. 3-PHASE HDB TYPE ISOLATOR WITH ONE EARTH SWITCH (WITH MASTER SLAVE OPERATION)	ALSTOM	18
4		400kV, 3150A, 50kA, 1sec. 3-PHASE HDB TYPE ISOLATOR WITH TWO EARTH SWITCH (WITH MASTER SLAVE OPERATION)	ALSTOM	02
5		ISOLATOR WITH 1 EARTH SWITCH, HDB TYPE, 400kV, 1P, 3150A, 50kA FOR 1 sec. ELECTRICALLY GANGED (ALL MASTERS)	ALSTOM	07
6		ISOLATOR WITHOUT EARTH SWITCH, HDB TYPE, 400kV, 1P, 3150A, 50kA FOR 1 sec. ELECTRICALLY GANGED (ALL MASTERS)	ALSTOM	05
7		CURRENT TRANSFORMER(1-#) 400kV, 6CORE, 3000A 50kA for 1sec 120X EXTENDED CURRENT RATING	ALSTOM	12
8		CURRENT TRANSFORMER(1-#) 400kV, 5 CORE, 3000A 50kA for 1sec 120X EXTENDED CURRENT RATING	ALSTOM	12
9		400kV, 50kA, 1 Sec 1-PH CVT (4400pF) 400E 3P/3P/0.2	ALSTOM	06
10		400kV, 50kA, 1 Sec 1-PH CVT (4400pF) 300E 3P/3P/0.2	ALSTOM	06
11		336kV LIGHTNING ARRESTER (1-#) DISCHARGE CURRENT 20kA	---	16
12		400kV HIGH BUS POST INSULATOR 13MTR HEIGHT	ADITYA BRLA	13
13		400kV LOW BUS POST INSULATOR 8MTR HEIGHT	ADITYA BRLA	62

CONDUCTOR DETAIL OF SWITCHYARD (TABLE-3)

VOLTAGE LEVEL-400kV	
MAIN BUS-I & BUS-II	QUAD MOOSE ACSR CONDUCTOR
JACK BUS/STRINGING CONNECTION	QUAD MOOSE ACSR CONDUCTOR
DROPPERS/JUMPERS	TWIN MOOSE ACSR CONDUCTOR (FOR LA,CVT) QUAD MOOSE ACSR CONDUCTOR FOR OTHERS
EQUIPMENT INTERCONNECTION	5" IPS AL. TUBE
SHIELD WIRE	7/3.66mm GI WIRE (10.98mm DIA)
ICT TERTIARY FORMATION	3" IPS AL. TUBE

MINIMUM AIR CLEARANCE (TABLE-4)

Sl.No.	DESCRIPTION	400kV SYSTEM
1	PHASE TO PHASE CONDUCTOR TO CONDUCTOR ROD TO STRUCTURE	4000 4200
2	PHASE TO GROUND CONDUCTOR TO STRUCTURE ROD TO STRUCTURE	3500
3	SECTIONAL CLEARANCE	6400

AS-BUILT

REV.	DESCRIPTION	DRAWN	ELECT.	PM	CHECKED	APPROVED	STATUS
R3	INTERNAL UPDATION	Name: KSV DPK Date: 07.05.13 Sign: PTK 07.05.13					FOR APPROVAL
R2	REVISED AS PER CUSTOMER COMMENTS	Name: KSV DPK Date: 20.03.13 Sign: PTK 20.03.13					FOR APPROVAL
R1	REVISED AS PER CUSTOMER COMMENTS	Name: KSV DPK Date: 07.02.13 Sign: PTK 07.02.13					FOR APPROVAL
R0	FIRST ISSUE	Name: KSV DPK Date: 28.01.13 Sign: PTK 28.01.13					FOR APPROVAL

CUSTOMER: BHOVAL DHULE TRANSMISSION COMPANY LTD			
OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.			
PROJECT:	SYSTEM STRENGTHENING SCHEME OF WR.		
CONTRACT:	LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011		
TITLE:	400kV ELECTRICAL LAYOUT PLAN FOR BHOVAL SUBSTATION		
SCALE: A1 1:475	ALSTOM T&D INDIA LTD. (Formerly AREVA T&D INDIA LTD.) AL-7, SECTOR-65 NOIDA - 201301 UTTAR PRADESH (INDIA).	DRAWING NO.:	SHEET NO.
		5429PS060-BHO-C-SYD-AAR-0001	002/002

5429PS060-BHO-C-SYD-AAR-1000
5429PS060-BHO-E-SYD-SLD-0401

COMBINED ELECTRICAL LAYOUT PLAN FOR 765/400kV BHOVAL SINGLE LINE DIAGRAM FOR 765/400kV BHOVAL SUBSTATION

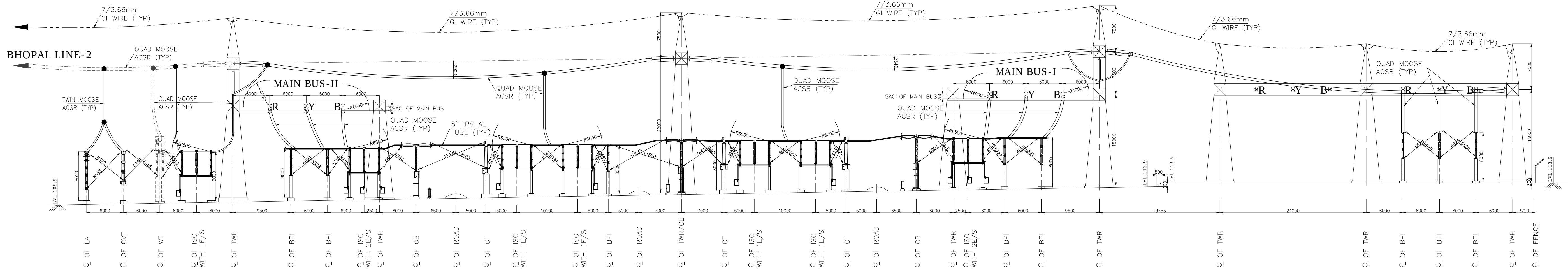
LEGEND:-
PRESENT SCOPE
FUTURE
BOUNDARY LINE
LEVEL INDICATIONS

NOTES:-
1. ALL DIMENSION ARE IN MM
2. DEAD END TOWER STRINGING & CONDUCTOR NOT IN ALSTOM SCOPE.

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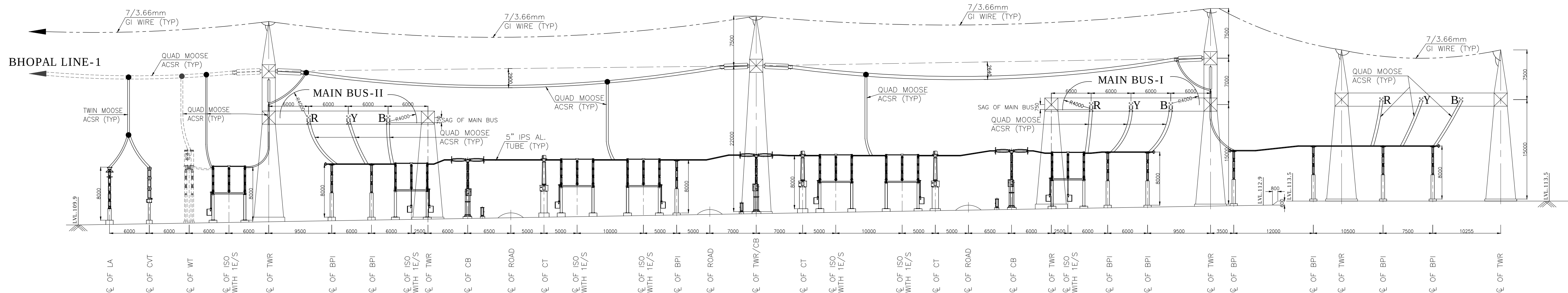
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DRAWING NO.: 5429PS060-BHO-C-SYD-AAR-0002



SECTION D-D

400kV (BHOPAL LINE-2-TIE-ICT#1)



SECTION E-E

400kV (BHOPAL LINE-1-TIE-ICT#2)

AS-BUILT

ALL DIMENSIONS ARE IN MM

CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.

CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

TITLE: 400kV ELECTRICAL LAYOUT SECTION FOR BHOPAL SUBSTATION

ALSTOM T&D INDIA LTD
(Formerly AREVA T&D INDIA LTD)
A-7, SECTOR-65,
NOIDA - 201301
UTTAR PRADESH (INDIA).

DRAWING NO.:

5429PS060-BHO-C-SYD-AAR-0002

SHEET NO

002 002

5429PS060-BHO-C-SYD-AAR-0001 (Sh-03) 400kV ELECTRICAL LAYOUT PLAN FOR BHOPAL SUBSTATION

REFR. DRG. NO.

DESCRIPTION

DESCRIPTION

DRAWN

ELECT.

PM

CHECKED

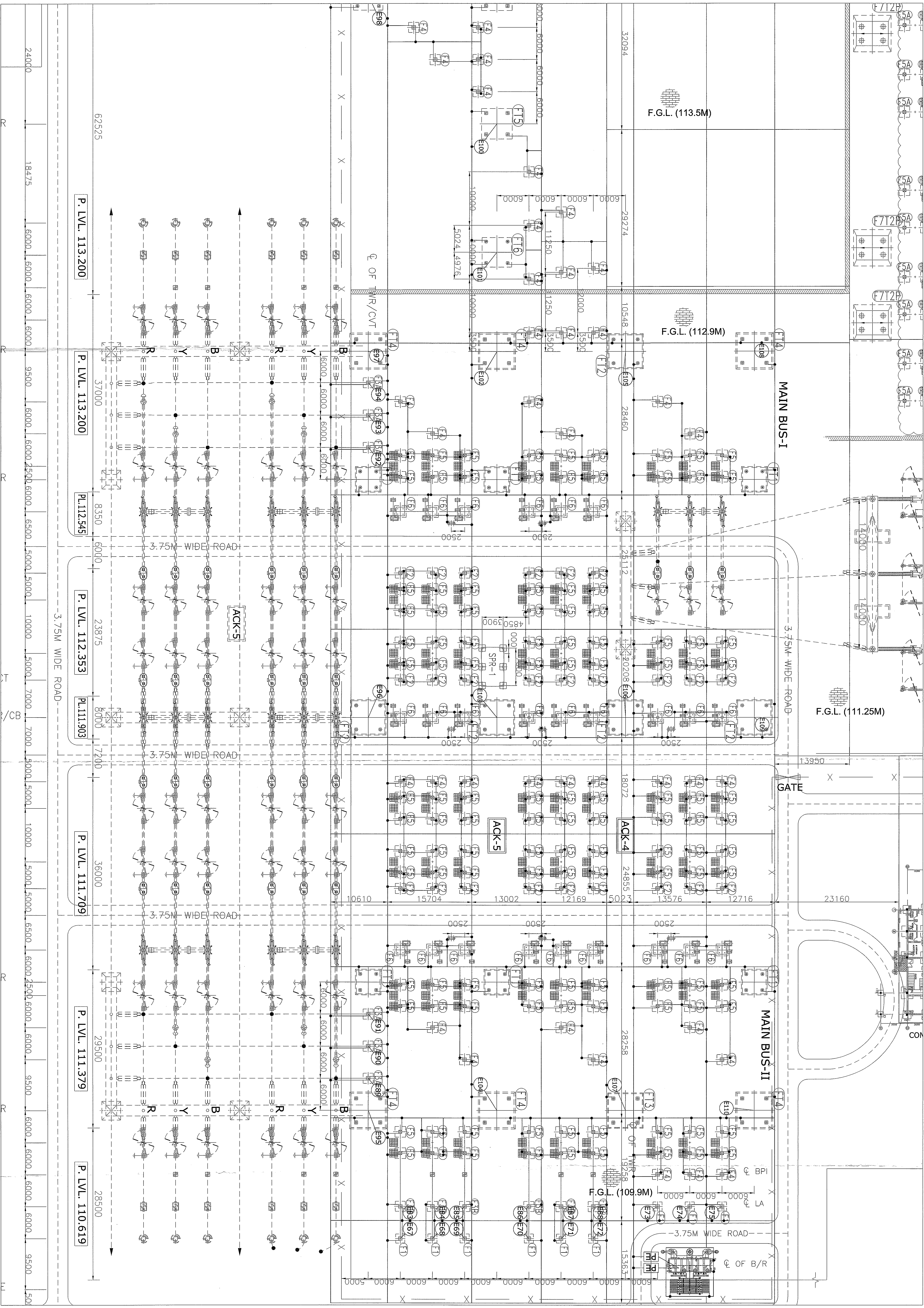
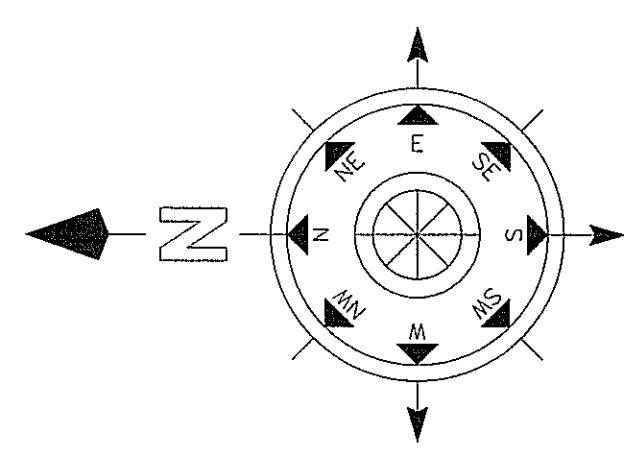
APPROVED

STATUS

SCALE

A1

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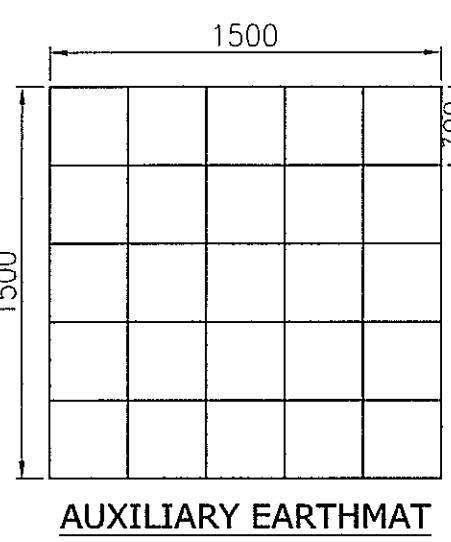


400KV LEGEND & BOQ OF EARTHMAT (TABLE NO-1)

S.NO.	DESCRIPTION	UOM	TOTAL QTY
1.	32MM DIA MS ROD FOR MAIN EARTHMAT	MTR	2098
2.	100MM DIA MS ROD FOR MAIN EARTHMAT	MTR	44
3.	100MM DIA MS ROD FOR MAIN EARTHMAT	MTR	02

ROD ELECTRODE (TABLE NO-2)

S.NO.	DESCRIPTION	UOM	TOTAL QTY
1.	(LA) E97 TO E98	NOS.	16
2.	(CVT) E93 TO E94	NOS.	12
3.	(PEAK TOWER) E95 TO E110	NOS.	16



NOTES

- THE EARTHMAT SHALL BE MADE WITH 32MM DIA MS ROD.
- EARTHMAT CONDUCTORS SHALL BE BURIED 300MM BELOW FSL, UNLESS OTHERWISE SPECIFIED.
- WHEREVER EARTHMAT CONDUCTOR CROSS UNDER GROUND SERVICES DUCTS, PIPES, TUNNELS, RAILWAY TRACKS ETC. IT SHALL BE LAID AT LEAST 300MM BELOW THEM AND SHALL BE PROTECTED IN CASE OF FORCE WITH EQUIPMENT/STRUCTURE FOUNDATION.
- EARTHMAT CONDUCTORS CROSSING THE ROAD SHALL BE LAID AT 1m DEPTH FROM FSL.
- ALL GROUND CONDUCTORS SHALL BE MADE BY ELECTRIC AND WELDING. ALL WELDED JOINTS SHALL BE ALLOWED TO COOL DOWN SUFFICIENTLY TO AMBIENT TEMPERATURE BEFORE PUTTING ANY LOAD ON IT. VERTICAL COUPLING SHALL NOT BE ALLOWED.
- ALL EQUIPMENT & STRUCTURES SHALL BE GROUNDED AS PER EQUIPMENT EARTHING PRESCRIPTION IN 1000 MS BARBERS-BHO-C-SYD-EAR-0002.
- THE LOCATION OF EARTHMAT CONDUCTOR, EARTHMAT AND GROUND RODS ARE INDICATED AND MAY BE MODIFIED TO SUIT SITE CONDITION.
- EARTHMAT CONDUCTOR SHALL BE BURIED 300MM OUTSIDE THE SWITCHYARD FENCE AND ALL THE GATES EXCEPT ALTERNATE FIRST OF FENCE SHALL BE CONNECTED TO MAIN EARTHMAT GRID.
- PIPE FISHING PIPE LINE AND ANY OTHER PIPING SYSTEM RUNNING THROUGH THE 3.75M YARD SHALL BE GROUNDED WITH TREATY YARD EARTHMAT.
- EARTHMAT LAYOUT FOR SWITCHYARD BUILDINGS SHALL BE SUBMITTED SEPARATELY.
- AUXILIARY EARTHMAT SHALL BE 1500X1500 SQUARE OF 30MM.
- MINIMUM SPACE BETWEEN TWO EARTHMAT ELECTRODES SHALL BE 30MM.
- 15.80% TOLERANCE "L" AND DETAIL EARTHMAT LAYOUT TO BE SUBMITTED SEPARATELY.
- THE EARTHMAT SHALL BE LAID TO SUIT THE GROUND SURFACE.
- THE EARTHMAT SHALL BE LAID TO SUIT THE GROUND SURFACE.

B.T.C.L. CAT-2 APPROVED
Signed: 14.5.17
This approval does not absolve the contractor/engineer of his contractual responsibility to engineer an efficient design and successful performance of the Project/Equipment.

CONTROLLED COPY
APPROVAL: [] AS BUILT
[] PENDING
[] CONSTRUCTION
[] PLANNING
[] REFERENCE
[] MANUFACTURING
[] INVENT
[] RECORD
[] EXISTENCE
ALSTOM
16/3/17

ALL DIMENSIONS ARE IN MM

CUSTOMER: BHOVAL DHULE TRANSMISSION COMPANY LTD
OWNERS ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.
CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

TITLE: 400KV EARTHMAT LAYOUT OF BHOVAL SUBSTATION

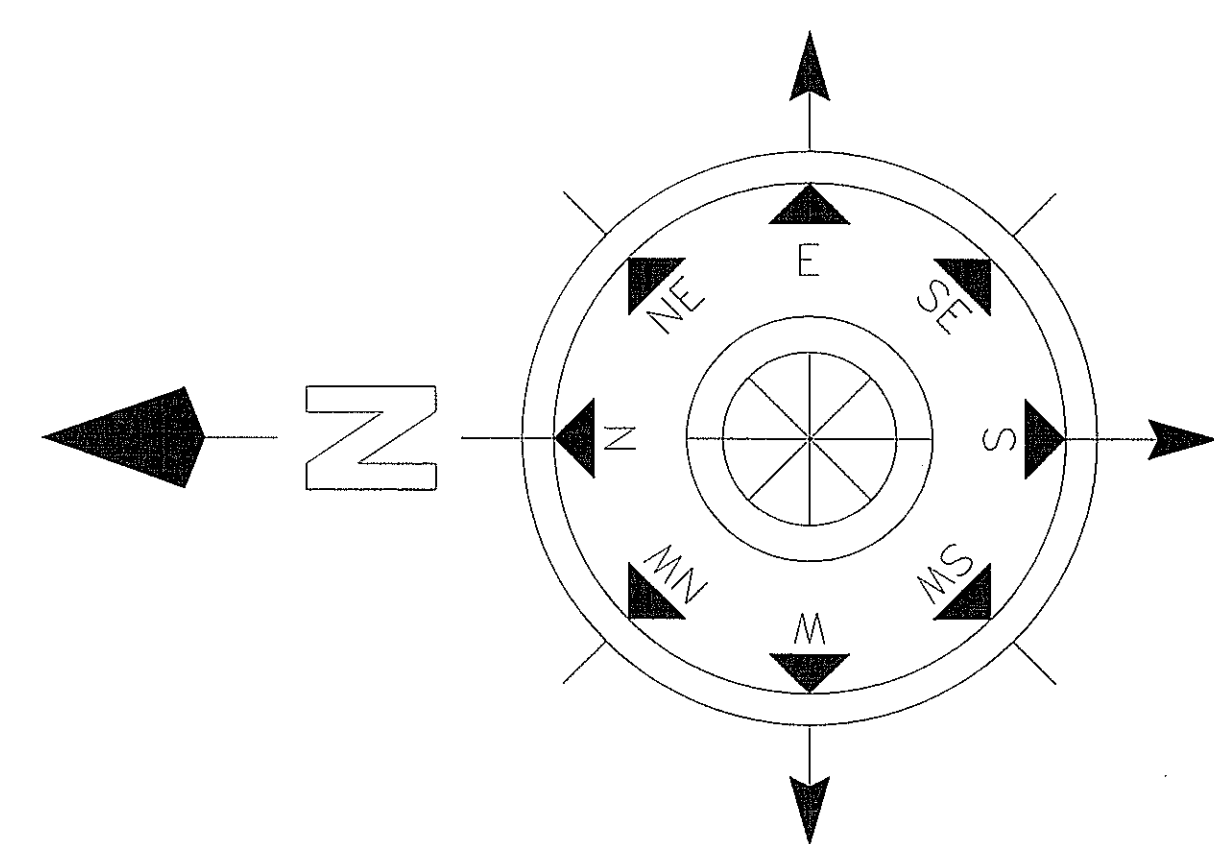
SCALE: 1:275
SHEET NO: 002/002

ALSTOM
5429PS060-BHO-C-SYD-EAR-0202

5429PS060-BHO-C-SYD-EAR-1053 400KV FOUNDATION LAYOUT FOR BHOVAL SUBSTATION
5429PS060-BHO-C-SYD-EAR-1001 COMBINED ELECTRICAL LAYOUT PLAN FOR 765/400KV BHOVAL SUBSTATION
5429PS060-BHO-C-SYD-EAR-0001 765/400KV LAYOUT PLAN & SECTION FOR BHOVAL SUBSTATION
5429PS060-BHO-C-SYD-EAR-1051 400KV STRUCTURAL LAYOUT FOR BHOVAL SUBSTATION

REFR. DRG. NO. DESCRIPTION

REV.	DESCRIPTION	DATE	BY	CHECKED	APPROVED	STATUS
R1	REVISED AS PER CUSTOMER COMMENTS	14.03.17	KS	DPK	DPK	FOR APPROVAL
R0	FIRST ISSUE	22.02.13	KS	DPK	DPK	FOR APPROVAL

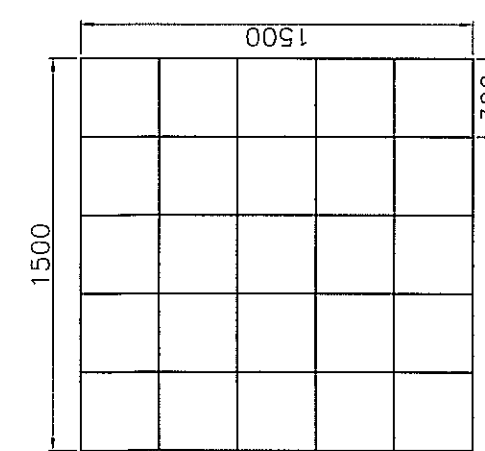


765KV LEGEND & BOQ OF EARTHMAT (TABLE NO-1)

S.NO.	DESCRIPTION	UOM	TOTAL QTY
1.	32MM DIA MS ROD FOR MAIN EARTHMAT	mtr	11179
2.	3m LONG ROD ELECTRODE OF 32MM DIA WITH UNTREATED EARTH PIT	NOS.	68
3.	3m LONG PIPE ELECTRODE OF 32MM DIA WITH TREATED EARTH PIT	NOS.	10

ROD ELECTRODE (TABLE NO-2)

S.NO.	DESCRIPTION	UOM	TOTAL QTY
1.	(LA) E1 TO E24	NOS.	24
2.	(CVT) E25 TO E36	NOS.	12
3.	(PEAK TOWER) E37 TO E64	NOS.	28
4.	(LM) E65 TO E66	NOS.	02



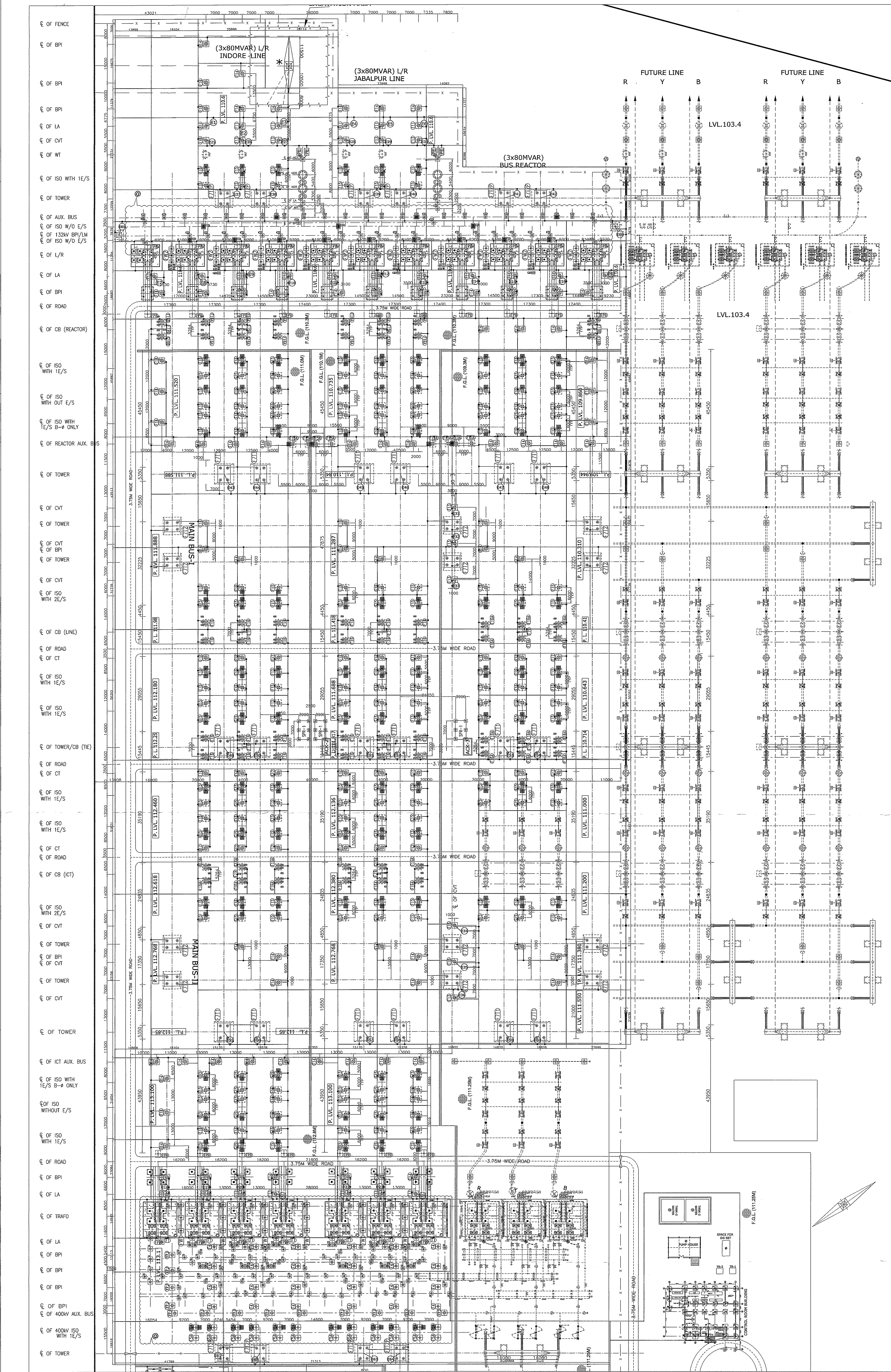
NOTES

1. THE EARTHMAT SHALL BE MADE WITH 32mm DIA MS ROD.
2. EARTHING CONDUCTORS SHALL BE BURIED 600mm BELOW FOL UNLESS OTHERWISE SPECIFIED.
3. WHEREVER EARTHING CONDUCTOR CROSS CABLE TRENCH UNDER GROUND SERVICES DUCTS, PIPES, TUNNELS, RAILWAY TRACKS ETC. IT SHALL BE LAID AT LEAST 300mm BELOW THEM AND SHALL BE REDROUTED IN CASE IT FOLDS WITH EQUIPMENT/STRUCTURE FOUNDATION.
4. EARTHING CONDUCTORS CROSSING THE ROAD SHALL BE LAID AT 1m DEPTH FROM FOL.
5. ALL GROUND CONNECTIONS SHALL BE MADE BY ELECTRIC ARC WELDING. ALL WELDED JOINTS SHALL BE ALLOWED TO COOL DOWN GRADUALLY TO ATMOSPHERIC TEMPERATURE BEFORE PUTTING ANY LOAD ON IT. ARTIFICIAL COOLING SHALL NOT BE ALLOWED.
6. ALL EQUIPMENT & STRUCTURES SHALL BE GROUNDED AS PER EQUIPMENT EARTHING PHILOSOPHY as : 500-KV-5429PS060-BHO-C-SYD-EAR-0003
7. THE LOCATION OF EARTHING CONDUCTOR, EARTHPIES AND GROUND RODS ARE INDICATIVE AND MAY BE MODIFIED TO SUIT SITE CONDITION.
8. EARTHING CONDUCTOR SHALL BE BURIED 200mm OUTSIDE THE SWITCHYARD FENCE, AND ALL THE GATES EVERY ALTERNATE POST OF FENCING SHALL BE CONNECTED TO MAIN EARTHING GRID.
9. FIRE FIGHTING PIPE LINE AND ANY OTHER PIPING SYSTEM RUNNING THROUGH THE 765KV YARD SHALL BE GROUNDED WITH 765KV YARD EARTHMAT.
10. EARTHING LAYOUT FOR SWITCHYARD BUILDINGS SHALL BE SUBMITTED SEPARATELY.
11. AUXILIARY EARTH MAT SHALL BE 1000X1000 SPACING OF 300MM.
12. MINIMUM SPACE BETWEEN TWO EARTH ELECTRODES SHALL BE 6MTRS
13. REACTION NEUTRAL AND ICT TERTIARY, LT YARD DETAILED EARTHING LAYOUT TO BE SUBMITTED SEPARATELY.
14. THE PIT NUMBERS SHALL BE WRITTEN BOLDLY ON THE EARTH PIT AS PER THE LAYOUT AND TABLE NO-2

BDTCL
CAT. APPROVED
Signed: *[Signature]*
Date: 16.02.2015
This approval does not absolve the contractor/Supplier of his contractual responsibility to engineer as/vis-à-vis design and successful performance of the Project/Equipment.

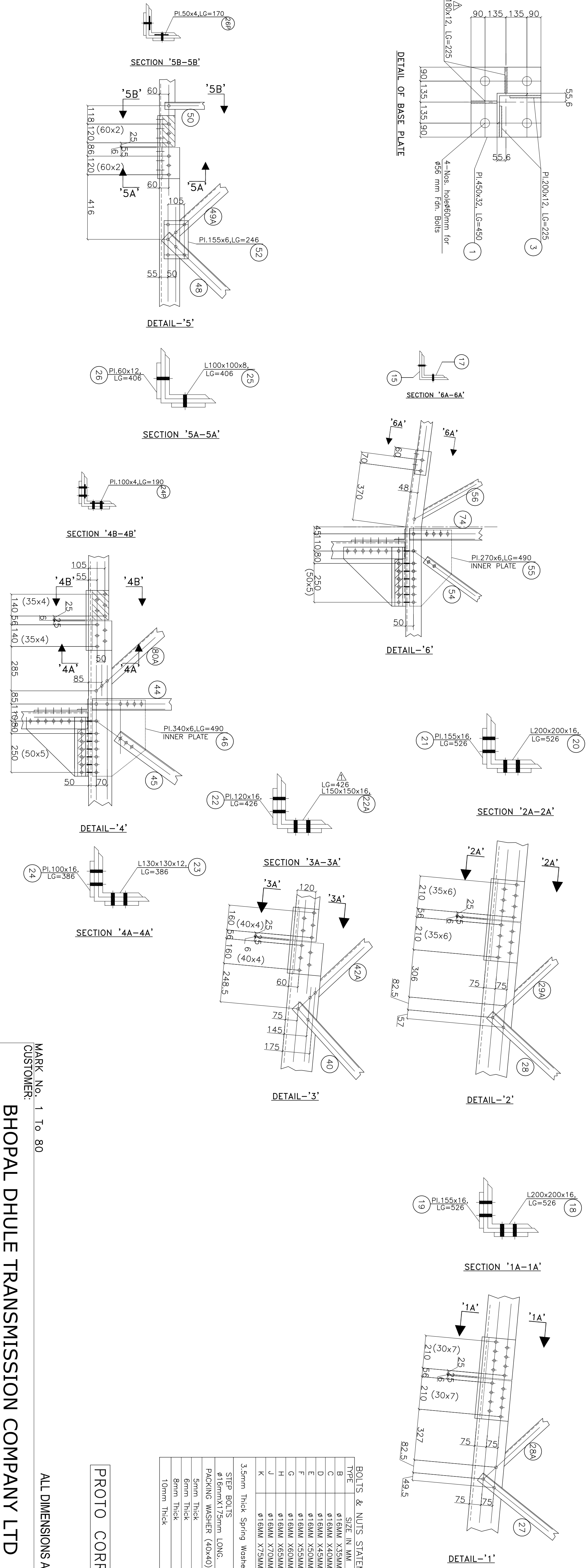
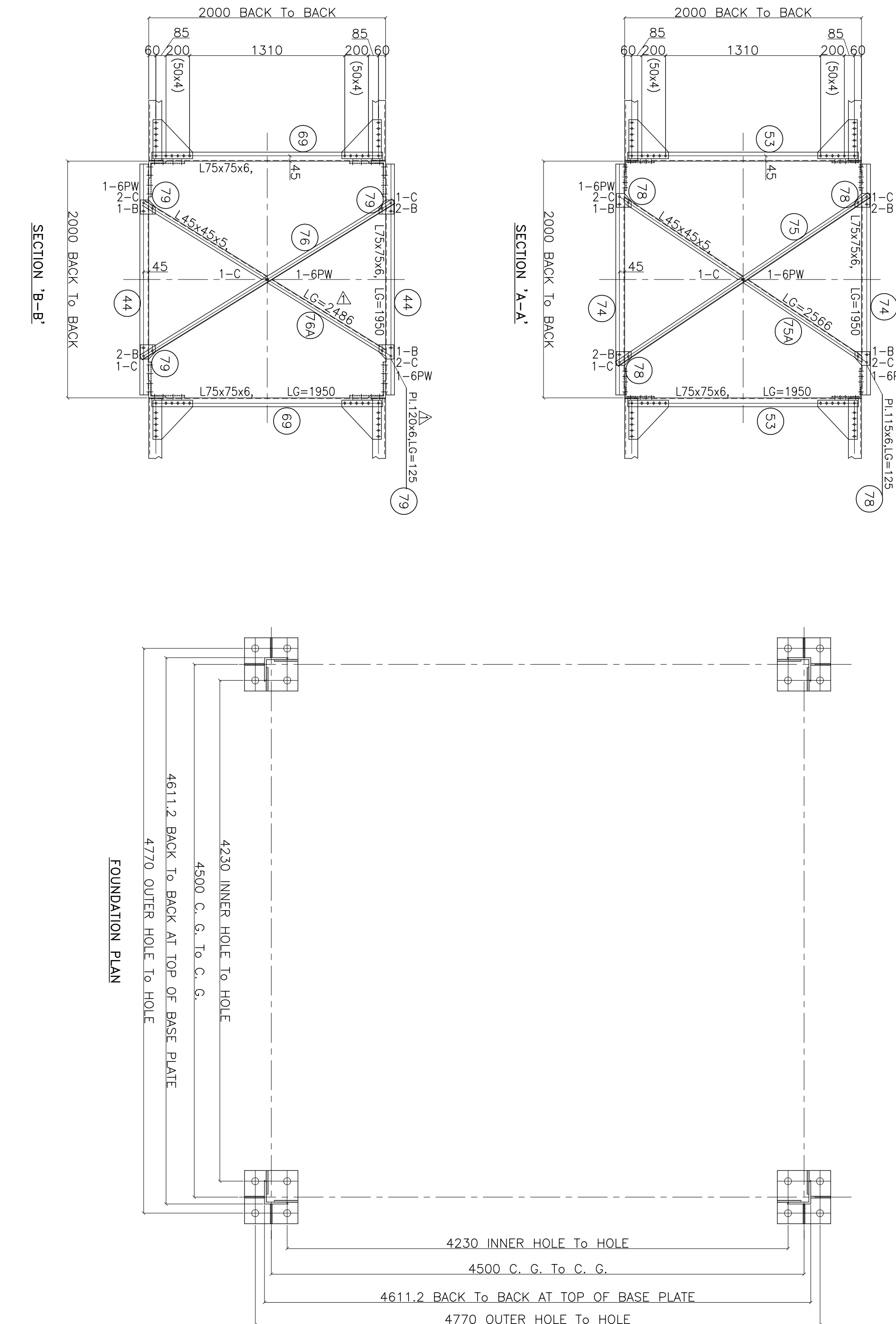
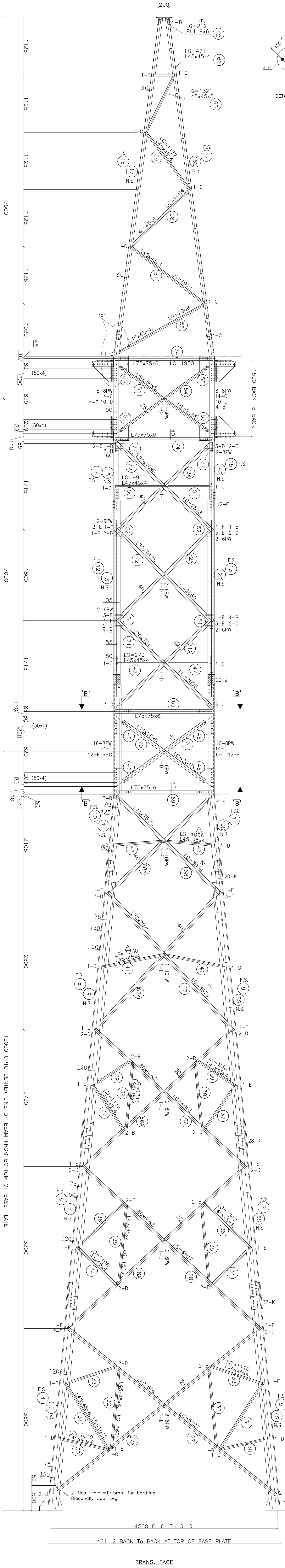
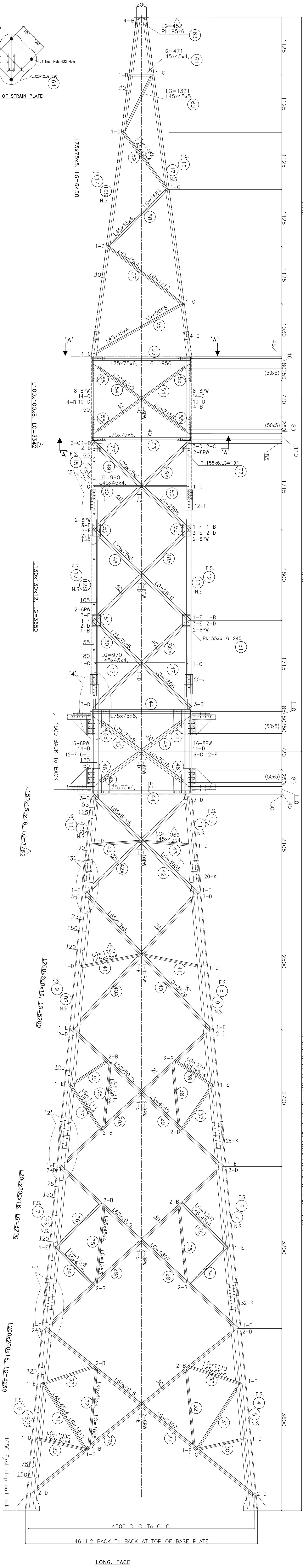
CONTROLLED COPY
☒ APPROVAL ☐ AS BUILT
☐ PHOTO ☐ CONSTRUCTION
☐ PLANNING ☐ REFERENCE
☐ MANUFACTURING ☐ INVENTORY
☐ RECORD ☐ EXECUTION
04/03/15 STOP

CUSTOMER:		BHOHAL DHULE TRANSMISSION COMPANY LTD	
OWNER'S ENGINEER:		KNR ENGINEERS (INDIA) PVT. LTD.	
PROJECT:	SYSTEM STRENGTHENING SCHEME OF WR.		
CONTRACT:	LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011		
TITLE:	765KV EARTHMAT LAYOUT OF BHOHAL SUBSTATION		
SCALE:	1:475	ALSTOM	DRAWING NO. : 5429PS060-BHO-C-SYD-EAR-0202
SHEET NO.	001	001	



REFR. DRG. NO.	DESCRIPTION
5429PS060-BHO-C-SYD-AR-1053	765KV FOUNDATION LAYOUT FOR BHOHAL SUBSTATION
5429PS060-BHO-C-SYD-AR-1000	COMBINED ELECTRICAL LAYOUT PLAN FOR 765/400KV BHOHAL SUBSTATION
5429PS060-BHO-C-SYD-AR-0001	765/400KV LAYOUT PLAN & SECTION FOR BHOHAL SUBSTATION
5429PS060-BHO-C-SYD-AR-1051	400KV STRUCTURAL LAYOUT FOR BHOHAL SUBSTATION

15000 UPTO CENTER LINE OF BEAM FROM BOTTOM OF BASE PLATE



BOLTS & NUTS STATEMENTS	
TYPE	SIZE IN MM
A	Ø 16mm X 50mm
B	Ø 16mm X 50mm
C	Ø 16mm X 50mm
D	Ø 16mm X 50mm
E	Ø 16mm X 50mm
F	Ø 16mm X 50mm
G	Ø 16mm X 50mm
H	Ø 16mm X 50mm
I	Ø 16mm X 50mm
J	Ø 16mm X 50mm
K	Ø 16mm X 50mm
L	Ø 16mm X 50mm
M	Ø 16mm X 50mm
N	Ø 16mm X 50mm
O	Ø 16mm X 50mm
P	Ø 16mm X 50mm
Q	Ø 16mm X 50mm
R	Ø 16mm X 50mm
S	Ø 16mm X 50mm
T	Ø 16mm X 50mm
U	Ø 16mm X 50mm
V	Ø 16mm X 50mm
W	Ø 16mm X 50mm
X	Ø 16mm X 50mm
Y	Ø 16mm X 50mm
Z	Ø 16mm X 50mm

PROTO CORRECTED

ALL DIMENSIONS ARE IN MM

MARK NO. 1 To 80
CUSTOMER
BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER
KNR ENGINEERS (INDIA) PVT. LTD.

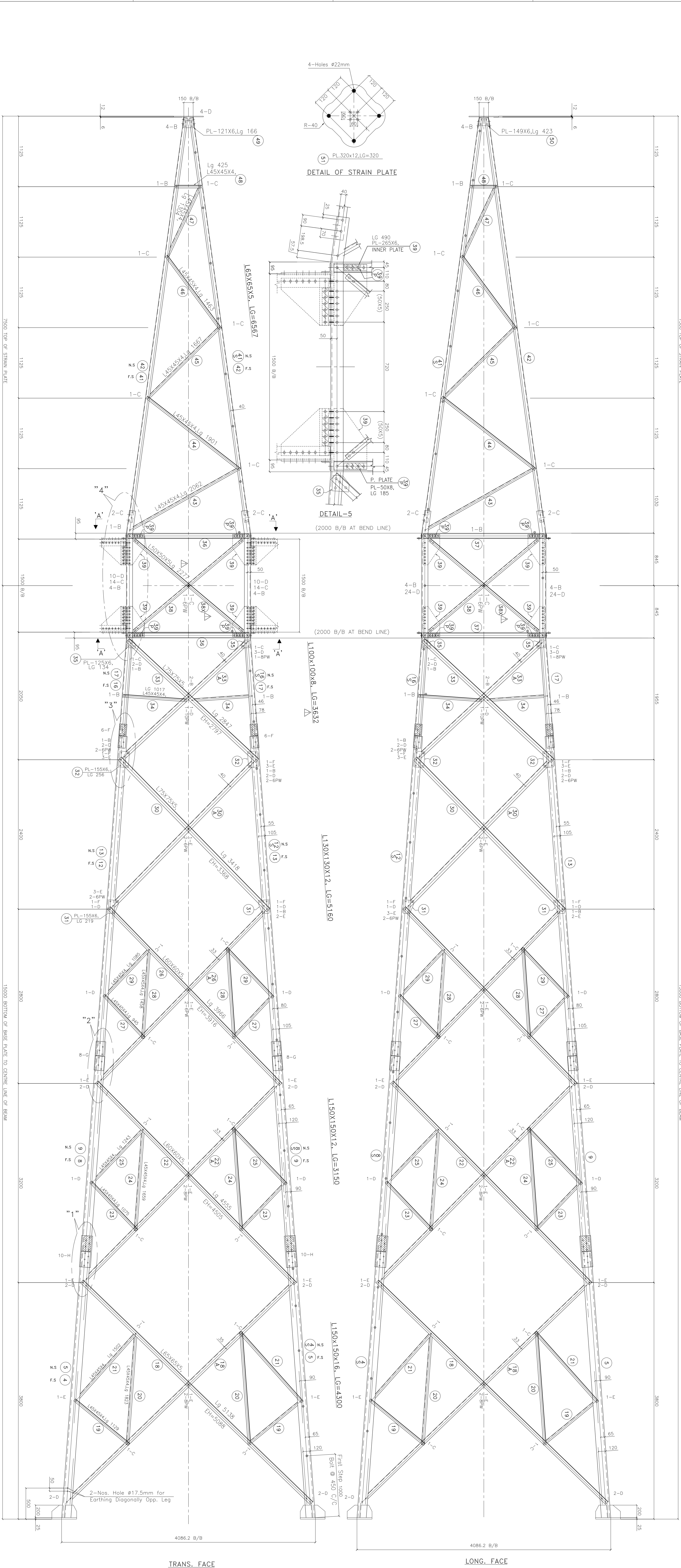
PROJECT:
SYSTEM STRENGTHENING SCHEME OF WR.

CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

TITLE:
400KV TOWER TYPE "T4"
DHULE SUBSTATION

DRAWING NO.:
5429PS060-DHU-C-SYD-FAB-1555

REVISION	
NO.	DESCRIPTION
1	1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED. 2. ALL HOLES SHALL BE 1.25mm FOR 16mm BOLTS UNLESS OTHERWISE SPECIFIED. 3. ALL SECTION MARKS ARE TO BE PROVIDED WITH 14, 12, 3 etc. 4. 1500mm FROM ROUNDED EDGE 5. ALL WEBS ARE 16mm PLATE CORRUGATED WELD UNLESS OTHER WISE SPECIFIED 6. L45x45 & L45x45, WITH 23mm BACK MARK 7. ALL BOLTS NUTS & LOCK WASHERS SHALL CONFORM TO IS:3597 (Grade) 8. ALL STEEL SECTIONS SHALL BE GALVANIZED MINIMUM WT. OF ZINC COATING SHALL BE 60g/m ² 9. ALL STRUCTURAL STEEL MEMBERS ARE OF MILD STEEL (GRADE E250 QUALITY X2) 10. FABRICATION SHALL CONFORM TO IS802 PART-(1972)
2	1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED. 2. ALL HOLES SHALL BE 1.25mm FOR 16mm BOLTS UNLESS OTHERWISE SPECIFIED. 3. ALL SECTION MARKS ARE TO BE PROVIDED WITH 14, 12, 3 etc. 4. 1500mm FROM ROUNDED EDGE 5. ALL WEBS ARE 16mm PLATE CORRUGATED WELD UNLESS OTHER WISE SPECIFIED 6. L45x45 & L45x45, WITH 23mm BACK MARK 7. ALL BOLTS NUTS & LOCK WASHERS SHALL CONFORM TO IS:3597 (Grade) 8. ALL STEEL SECTIONS SHALL BE GALVANIZED MINIMUM WT. OF ZINC COATING SHALL BE 60g/m ² 9. ALL STRUCTURAL STEEL MEMBERS ARE OF MILD STEEL (GRADE E250 QUALITY X2) 10. FABRICATION SHALL CONFORM TO IS802 PART-(1972)
3	1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED. 2. ALL HOLES SHALL BE 1.25mm FOR 16mm BOLTS UNLESS OTHERWISE SPECIFIED. 3. ALL SECTION MARKS ARE TO BE PROVIDED WITH 14, 12, 3 etc. 4. 1500mm FROM ROUNDED EDGE 5. ALL WEBS ARE 16mm PLATE CORRUGATED WELD UNLESS OTHER WISE SPECIFIED 6. L45x45 & L45x45, WITH 23mm BACK MARK 7. ALL BOLTS NUTS & LOCK WASHERS SHALL CONFORM TO IS:3597 (Grade) 8. ALL STEEL SECTIONS SHALL BE GALVANIZED MINIMUM WT. OF ZINC COATING SHALL BE 60g/m ² 9. ALL STRUCTURAL STEEL MEMBERS ARE OF MILD STEEL (GRADE E250 QUALITY X2) 10. FABRICATION SHALL CONFORM TO IS802 PART-(1972)
4	1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED. 2. ALL HOLES SHALL BE 1.25mm FOR 16mm BOLTS UNLESS OTHERWISE SPECIFIED. 3. ALL SECTION MARKS ARE TO BE PROVIDED WITH 14, 12, 3 etc. 4. 1500mm FROM ROUNDED EDGE 5. ALL WEBS ARE 16mm PLATE CORRUGATED WELD UNLESS OTHER WISE SPECIFIED 6. L45x45 & L45x45, WITH 23mm BACK MARK 7. ALL BOLTS NUTS & LOCK WASHERS SHALL CONFORM TO IS:3597 (Grade) 8. ALL STEEL SECTIONS SHALL BE GALVANIZED MINIMUM WT. OF ZINC COATING SHALL BE 60g/m ² 9. ALL STRUCTURAL STEEL MEMBERS ARE OF MILD STEEL (GRADE E250 QUALITY X2) 10. FABRICATION SHALL CONFORM TO IS802 PART-(1972)
5	1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED. 2. ALL HOLES SHALL BE 1.25mm FOR 16mm BOLTS UNLESS OTHERWISE SPECIFIED. 3. ALL SECTION MARKS ARE TO BE PROVIDED WITH 14, 12, 3 etc. 4. 1500mm FROM ROUNDED EDGE 5. ALL WEBS ARE 16mm PLATE CORRUGATED WELD UNLESS OTHER WISE SPECIFIED 6. L45x45 & L45x45, WITH 23mm BACK MARK 7. ALL BOLTS NUTS & LOCK WASHERS SHALL CONFORM TO IS:3597 (Grade) 8. ALL STEEL SECTIONS SHALL BE GALVANIZED MINIMUM WT. OF ZINC COATING SHALL BE 60g/m ² 9. ALL STRUCTURAL STEEL MEMBERS ARE OF MILD STEEL (GRADE E250 QUALITY X2) 10. FABRICATION SHALL CONFORM TO IS802 PART-(1972)
6	1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED. 2. ALL HOLES SHALL BE 1.25mm FOR 16mm BOLTS UNLESS OTHERWISE SPECIFIED. 3. ALL SECTION MARKS ARE TO BE PROVIDED WITH 14, 12, 3 etc. 4. 1500mm FROM ROUNDED EDGE 5. ALL WEBS ARE 16mm PLATE CORRUGATED WELD UNLESS OTHER WISE SPECIFIED 6. L45x45 & L45x45, WITH 23mm BACK MARK 7. ALL BOLTS NUTS & LOCK WASHERS SHALL CONFORM TO IS:3597 (Grade) 8. ALL STEEL SECTIONS SHALL BE GALVANIZED MINIMUM WT. OF ZINC COATING SHALL BE 60g/m ² 9. ALL STRUCTURAL STEEL MEMBERS ARE OF MILD STEEL (GRADE E250 QUALITY X2) 10. FABRICATION SHALL CONFORM TO IS802 PART-(1972)
7	1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED. 2. ALL HOLES SHALL BE 1.25mm FOR 16mm BOLTS UNLESS OTHERWISE SPECIFIED. 3. ALL SECTION MARKS ARE TO BE PROVIDED WITH 14, 12, 3 etc. 4. 1500mm FROM ROUNDED EDGE 5. ALL WEBS ARE 16mm PLATE CORRUGATED WELD UNLESS OTHER WISE SPECIFIED 6. L45x45 & L45x45, WITH 23mm BACK MARK 7. ALL BOLTS NUTS & LOCK WASHERS SHALL CONFORM TO IS:3597 (Grade) 8. ALL STEEL SECTIONS SHALL BE GALVANIZED MINIMUM WT. OF ZINC COATING SHALL BE 60g/m ² 9. ALL STRUCTURAL STEEL MEMBERS ARE OF MILD STEEL (GRADE E250 QUALITY X2) 10. FABRICATION SHALL CONFORM TO IS802 PART-(1972)
8	1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED. 2. ALL HOLES SHALL BE 1.25mm FOR 16mm BOLTS UNLESS OTHERWISE SPECIFIED. 3. ALL SECTION MARKS ARE TO BE PROVIDED WITH 14, 12, 3 etc. 4. 1500mm FROM ROUNDED EDGE 5. ALL WEBS ARE 16mm PLATE CORRUGATED WELD UNLESS OTHER WISE SPECIFIED 6. L45x45 & L45x45, WITH 23mm BACK MARK 7. ALL BOLTS NUTS & LOCK WASHERS SHALL CONFORM TO IS:3597 (Grade) 8. ALL STEEL SECTIONS SHALL BE GALVANIZED MINIMUM WT. OF ZINC COATING SHALL BE 60g/m ² 9. ALL STRUCTURAL STEEL MEMBERS ARE OF MILD STEEL (GRADE E250 QUALITY X2) 10. FABRICATION SHALL CONFORM TO IS802 PART-(1972)

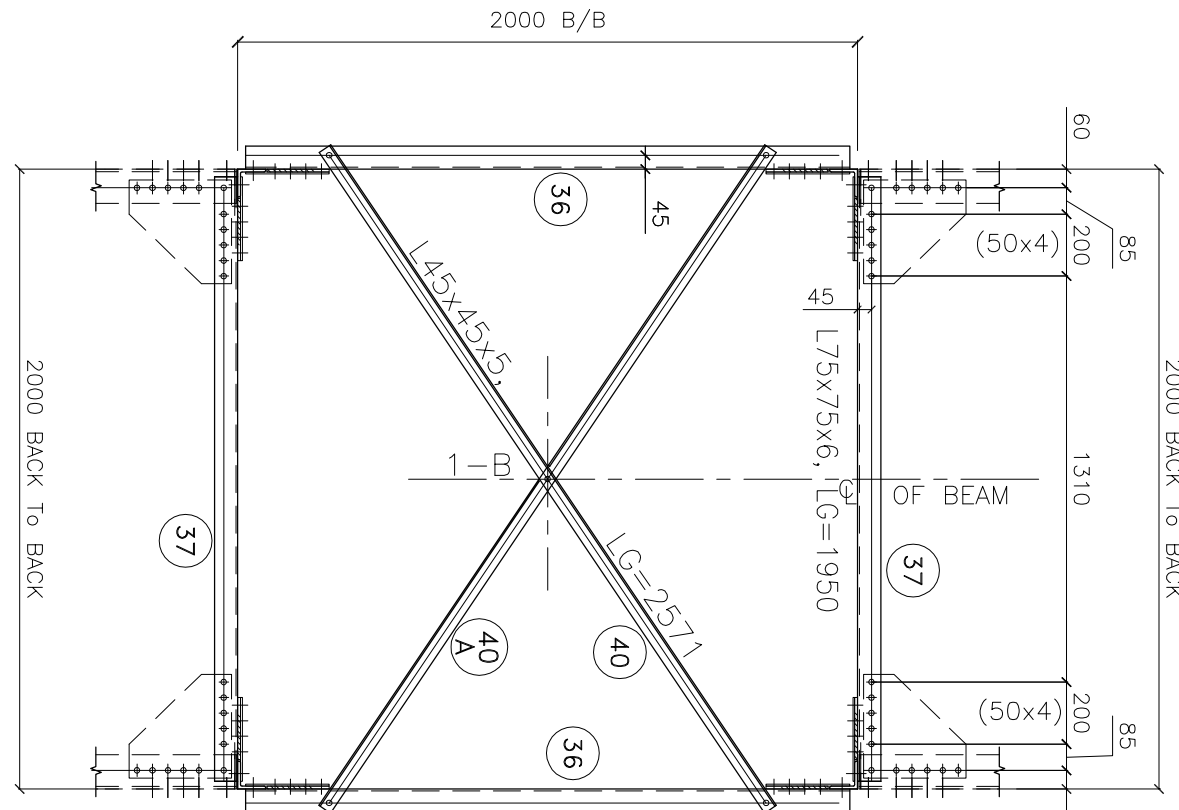


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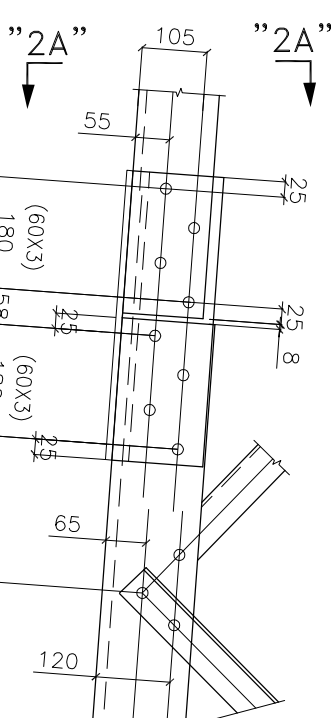
BOLTS & NUTS STATEMENTS

TYPE	SIZE IN MM	QTY.
B	ø16MM X35MM	108
C	ø16MM X40MM	168
D	ø16MM X45MM	264
E	ø16MM X50MM	84
F	ø16MM X55MM	68
G	ø16MM X60MM	66
H	ø16MM X65MM	82
J	ø16MM X70MM	—
K	ø16MM X75MM	—
L	ø16MM X80MM	—
PACKING WASHER (40x40)	835	—
3.5mm Thick Spring Washer	835	—
5mm Thick	50	—
6mm Thick	24	—
10mm Thick	08	—
ø16X75MM LONG STEP BOLT	48	—

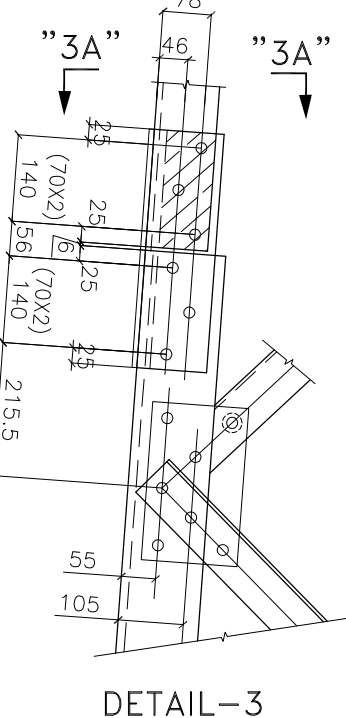
SECTION 'A-A'



SECTION '2A-2A'

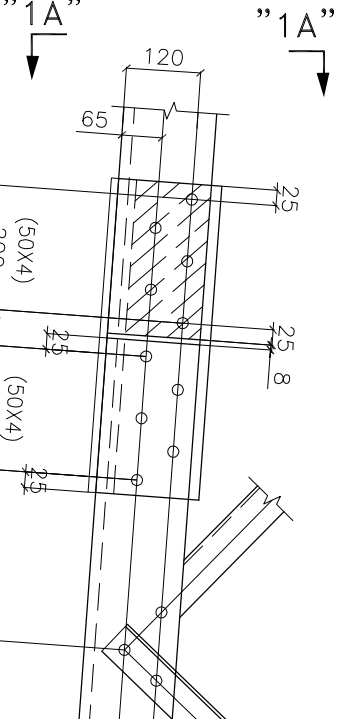


SECTION '3A-3A'



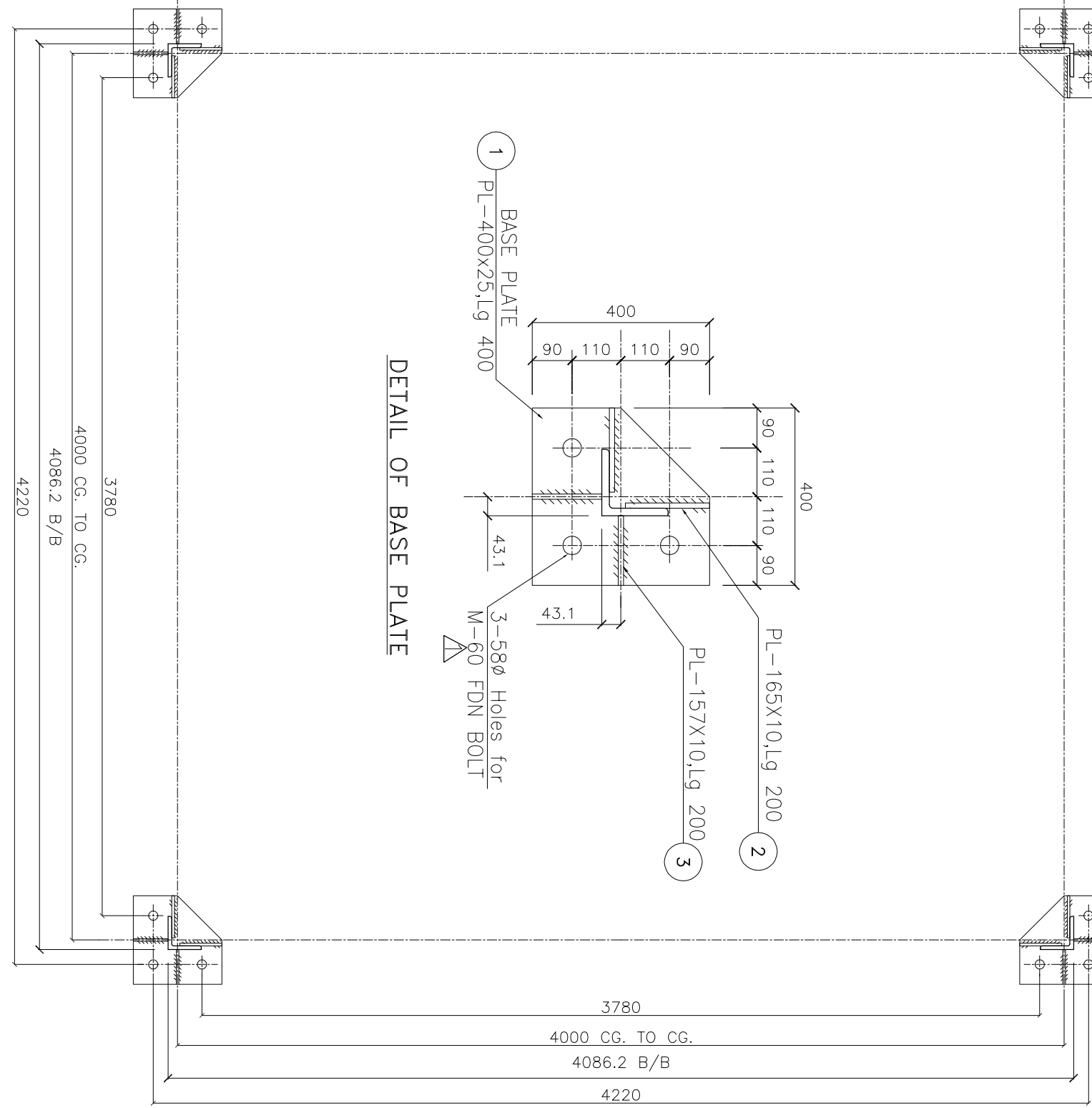
DETAIL-3

SECTION '1A-1A'



DETAIL-1

DETAIL OF BASE PLATE



FOUNDATION PLAN

MARK No. 1 To 51
CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD
OWNERS ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.
PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.
CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011
TITLE: 400KV TOWER TYPE " T5 " DHULE SUBSTATION
DRAWING NO.: 5429PS060-DHU-C-SYD-FAB-1557
SCALE: 1:20
SHEET NO: 001/001

ALL DIMENSIONS ARE IN MM

PROTO CORRECTED

A

A

B

B

C

D

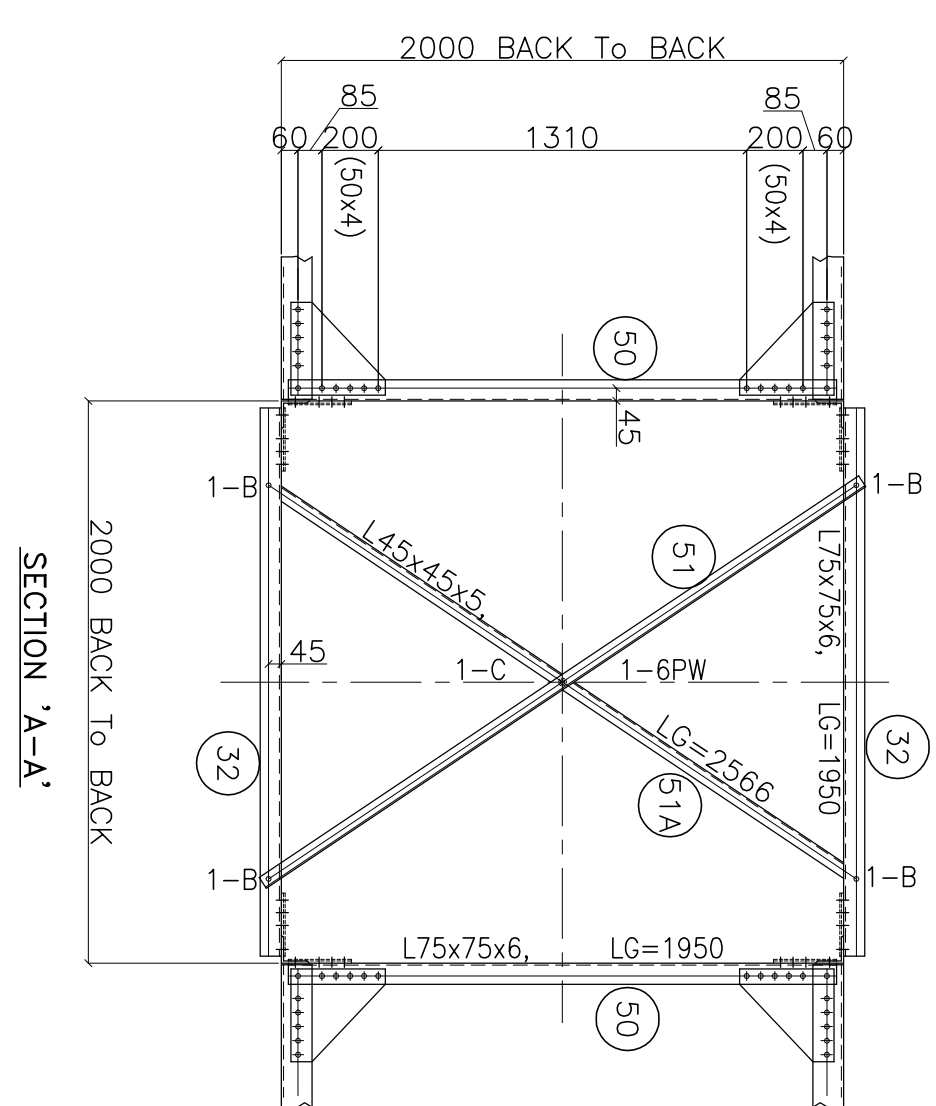
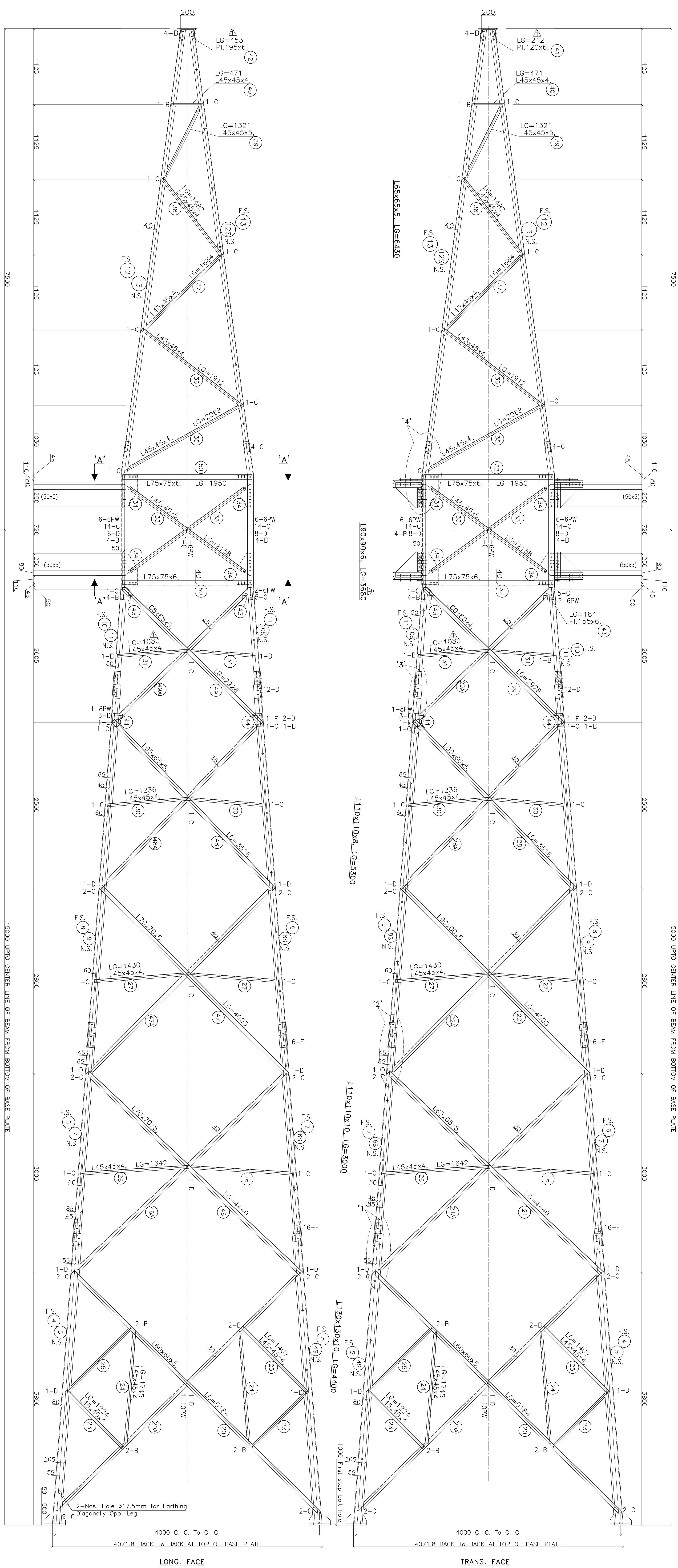
D

E

E

F

F



BOLTS & NUTS STATEMENTS		
TYPE	SIZE IN INCH	QTY./CONTR.
A	ø16MM X35MM	136
B	ø16MM X40MM	292
C	ø16MM X45MM	188
D	ø16MM X50MM	10
E	ø16MM X55MM	142
F	ø16MM X60MM	—
G	ø16MM X65MM	—
H	ø16MM X70MM	—
I	ø16MM X75MM	—
35mm Thick Spring Washer		
STEEL BOLTS		768
ø16mmX12mm LONG		—
PACKING WASHER (40x40)		45
5mm Thick		
8mm Thick		—
9mm Thick		74
10mm Thick		6

PROTO CORRECTED

ALL DIMENSIONS ARE IN MM

MARK No. 1 To 51 ALL DIMENSIONS ARE IN MM
CUSTOMER:
BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER:
KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT:	SYSTEM STRENGTHENING SCHEME OF WR.	
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TITLE:	400KV TOWER TYPE " T6 "
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DHULE SUBSTATION

SCALE	ALSIUM I&D INDIA LTD (Formerly AREVA T&D INDIA LTD)	DRAWING NO.:	SHEET NO
A1	SECTION A 7 SECTOR 6E		

1:25	 NOIDA - 201301 UTTAR PRADESH (INDIA).	5429PS060-DHU-C-SYD-FAB-1575	001 001
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REFR. DRG. NO.

DESCRIPTION

GENERAL NOTES

GENERAL NOTES

DESCRIPTION

ELECT.

STATUS

1:25

UTTAR

201301
ESH (INC

542

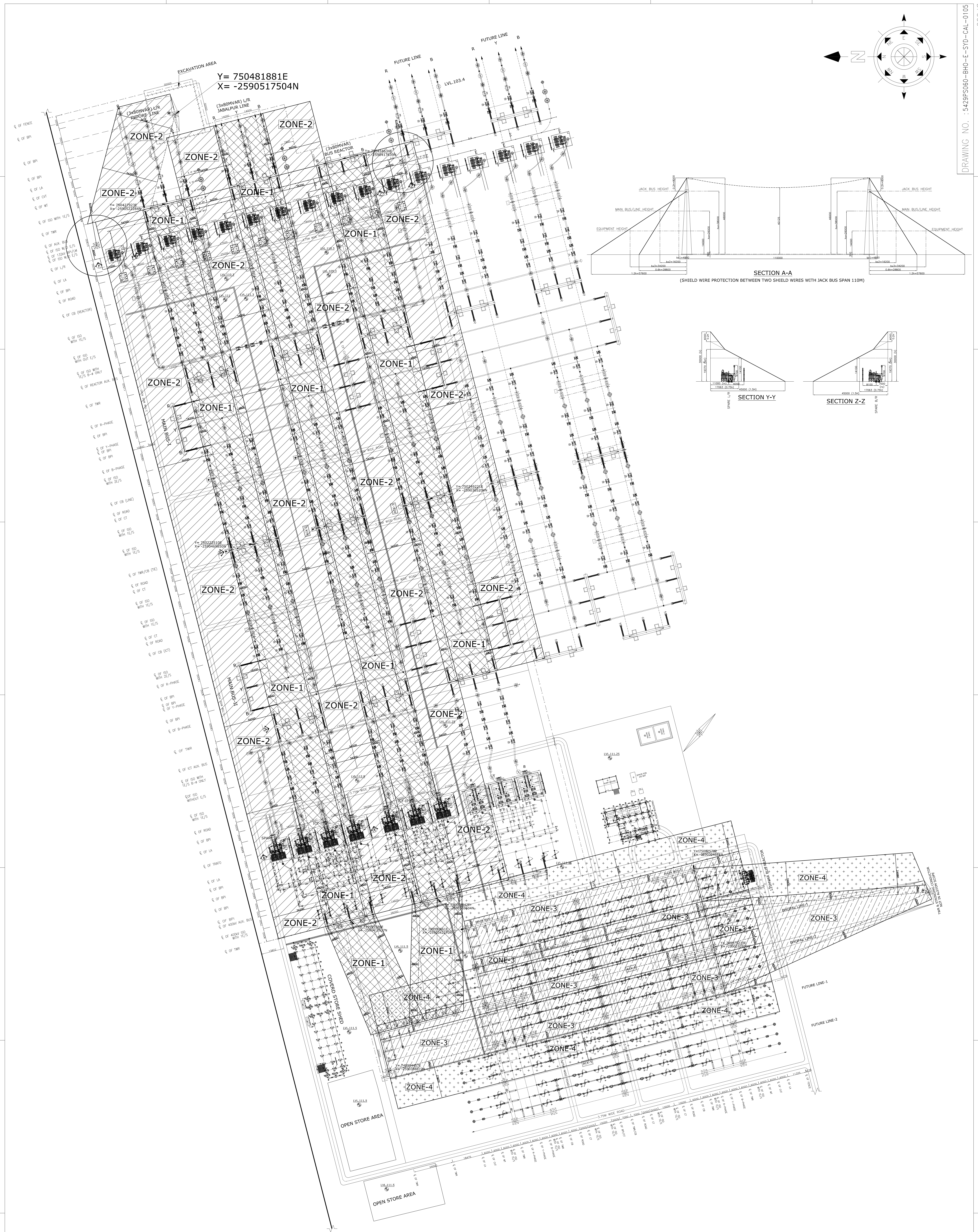
-0905-

U-C-

D-FAB

575

001



ALL DIMENSIONS ARE IN MM

OWNER'S ENGINEER: **KNR ENGINEERS (INDIA) PVT. LTD.**

PROJECT:	SYSTEM STRENGTHENING SCHEME OF WR
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CONTRACT:	LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011
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TITLE:	765/400kV DIRECT STROKE LIGHTING PROTECTION LAYOUT BHOPAL SUBSTATION
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AL	A0	SCALE 1:725	 ALSTOM T&D INDIA LTD. (Formerly ASEA T&D INDIA LTD) A-7, SECTOR-65, NOIDA - 201301 UTTAR PRADESH (INDIA)	DRAWING NO.:		SHEET NO	
				5429PS060-BHO-E-SYD-CAL-0105		001	001

ALSTOM **ALSTOM T&D INDIA LTD**
(Formerly AREVA T&D INDIA LTD)
A-7, SECTOR-65,
NOIDA - 201301
UTTAR PRADESH (INDIA)

DRAWING NO.:

SHEET NO

NOTES:-

1. ALL DIMENSION ARE IN MM.
2. LIGHTING PROTECTION FOR CONTROL ROOM TO BE SUBMITTED SEPARATELY

DSLIP LEGEND

	PROTECTION ZONE-1 FOR PROTECTION AT HEIGHTS OF 38, 26M.
	PROTECTION ZONE-2 FOR PROTECTION AT HEIGHTS OF 14M.
	PROTECTION ZONE-3 FOR PROTECTION AT HEIGHTS OF 22, 15M.
	PROTECTION ZONE-4 FOR PROTECTION AT HEIGHTS OF 8M.

--- SHIELD WIRE

5429PS060-BHO-E-SYD-CAL-0104	765/400KV DSLP CALCULATIONS FOR BHOPAL SUBSTATION
5429PS060-BHO-C-SYD-AAR-1000	COMBINED ELECTRICAL LAYOUT PLAN FOR 765/400KV BHOPAL
REFR. DRG. NO.	DESCRIPTION

R0	FIRST ISSUE	Name	KSV	Name	DPK	Name	PTK
		Date	08.02.13	Date	08.02.13	Date	08.02.13
REV.	DESCRIPTION	DRAWN	SIGNED	CHECKED	SIGNED	APPROVED	SIGNED