

Sl.No.	BOQ_ANNEXURE_1: STANDARD & PROJECT SPECIFIC TECHNICAL NOTES & SCOPE
1	<p>Bidder Supplied Material - For approved make of supply items, please visit "POWERGRID COMPENDIUM OF VENDORS" at following website address. <b>www.powergrid.in</b></p> <p>Bidder to offer items from powergrid approved make only (as applicable). Bidder to supply material of proven design and make, which have already been extensively used and tested. Bidder to obtain approval from BHEL Engineer incharge / Customer prior to supply. Quantity of supply items are provisional and shall be finalised during contract stage. Qty of supply item may vary upto any extent and and even may get deleted. However overall contract value may vary +/- 30%. Variation will be valid up-to contract stage.</p>
2	<p>All <b>consumables</b> required for sucessful erection testing &amp; commissioning of present scope of work is in bidders scope, such as (not limited to) Welding Electrodes, Low hydrogen content welding electrode, Ferruls, Cable Lug, cable ties, , Paint, bitumen compound, Zinc riched enamel paint, red oxide and zinc chromate etc. complete in all respect.</p>
3	<p>All pre-commissioning activities for substation equipment shall be carried out in accordance "<b>Pre- Commissioning procedures for Switchyard Equipments (Doc. No. D-2-01-03-01-03)</b>"</p>
4	<p>The storage instructions of the equipment manufacturer/ Employer shall be strictly adhered to. POWERGRID Field Quality Plan shall be followed alongwith the provision of Technical Specification for storage.</p>
5	<p><b>ETC of Power / Control / Instrument Cable:</b> Scope includes Cable Laying tagging , dressing, ferruling, lugging, installation of cable gland ,soldering, tapping, jointing, crimping, termination, and drilling/ cutting holes in cable gland plates- laying can be either on trays, hanger, supports, underground, buried in ground or through GI/PVC pipe over/under ground, through wall etc. All erection materials viz. Cable Lug, ferrules, cable ties / straps, Al. tags, route markers, GI / PVC wall sleeves with rubber / nylon bushes etc shall be supplied by bidder. excluding supply of Cable Gland which are covered separately (as a separate BOQ item / free supply by BHEL). Machine ferruling shall be adopted.</p>
6	<p><b>ETC of Directly Buried Cable (including sand bed &amp; brick cover)</b> - Scope includes laying of cables, directly in buried cable trench. All civil &amp; erection activities such as excavation, supply and placement of sand, bricks, backfilling, compaction, tagging , dressing, ferruling, lugging, installation of cable gland ,soldering, tapping, jointing, crimping, termination, and drilling/ cutting holes in cable gland plates etc shall be in contractor's scope. All erection materials viz. Sand, Bricks, Cable Lug, ferrules, cable ties / straps, Al. tags, route markers, GI / PVC wall sleeves with rubber / nylon bushes etc shall be supplied by bidder. excluding supply of Cable Gland which are covered separately (as a separate BOQ item / free supply by BHEL). Machine ferruling shall be adopted.</p>
7	<p>For Directly Buried Cable (as mentioned above) bidder to supply &amp; install cable route marker. Location of cables laid directly underground shall be clearly indicated with <b>cable route marker</b> made of galvanised iron plate. The cable route marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road and drain crossings as per relevant standard.</p>

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8	<p><b>CABLE LUG:</b> Supply of cable lug is in bidders scope. cable lugs shall be tinned copper solderless crimping type conforming to IS-8309 &amp; 8394 for all control Cables and cables with copper wire.</p> <p>For Aluminium Bimetallic lugs for power cables as required shall be used depending upon type of cables and terminations. Solderless crimping of terminals shall be done by using corrosion inhibitory compound.</p> <p>The cable lugs shall suit the type of terminals provided. The bidder shall cover the exposed part of all cable lugs whether supplied by him or not with insulating tape, sleeve or paint.</p> <p>Bidder to supply cable lug from manufacturer's authorised representative / dealer. Make of cable lug is to be approved by Powergrid site i.e. DOWELLS /COMET/ JAIN ELECTRONICS/ JAICO ELECTRIC/ SI METAL WORKS / powergrid approved make etc. Please refer "powergrid compendium of vendors of the equipment" for details.</p>
9	<p><b>Cable TAGS &amp; Markers</b> - Bidder to supply and install cable tag &amp; markers. The tag shall be of aluminium with the number punched on it and securely attached to the cable conduit by not less than two turns of 20 SWG GI wire conforming to IS:280. Cable tags shall be of rectangular shape for power cables and of circular shape for control cables.</p>
10	<p><b>Cable Gland:</b> Tin/ Nickel, Nickel/chromium - Plated (coating thickness not less than 10 microns) Powergrid approved / Sunil &amp; Co. / Arup/ Comet / QPIE make brass cable glands, double compression heavy-duty type complete with necessary armour clamp &amp; tapered washer etc. Bidder to offer the gland from authorised representative of manufacturer. Cable gland shall be subject to customer approval prior to dispatch. Cable glands shall match with the sizes of different HT/LT/Control cables.</p>
11	<p>Power and control cables shall be securely fixed to the trays/supports with self locking type nylon ties with de-interlocking facility at every 5 metre interval for horizontal run. Vertical and inclined cable runs shall be secured with 25 mm wide and 2 mm thick aluminium strip clamps at every 2m.</p>
12	<p>Vertical run of cables on equipment support structure shall be supported on perforated cable trays of suitable width which shall be suitably bolted/clamped with the equipment support structure. Tray shall be supplied by BHEL.</p>
13	<p><b>Insulating Rubber Mats</b> - The scope covers supply and laying of insulating mats of class-A conforming to IS: 15652-2006. These insulating mats shall be laid in front of all floor mounted ACDB, CRP, SAS (As applicable under present scope) in control room building. The insulating mats shall be made of elastomer material free from any insertions leading to deterioration of insulating properties. It shall be resistant to acid, oil and low temperature. Upper surface of the insulating mats shall have small aberration (rough surface without edges) to avoid slippery effects while the lower surface shall be plain or could be finished slip resistant without affecting adversely the dielectric property of the mat. The Insulating mat shall be of pastable type, to be fixed permanently on the front of the panels except for the chequered plate area which shall not be pasted as per requirement. The insulating mats shall generally be fixed and joints shall be welded as per recommendations in Annexure-A of IS:15652. Width of insulating mats shall generally be of 1.5 meters or as per site requirements. Length shall be supplied as per site requirements.</p>

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14	Cable ends shall be kept sealed to prevent damage. In cable vault, fire resistant seal shall be provided underneath the panels. Wherever cable pass through floor or through wall openings or other partitions, GI/PVC wall sleeves with bushes having a smooth curved internal surface so as not to damage the cable, shall be supplied, installed and properly sealed by the Contractor at no extra charges.
15	All arc welding with shall be done with <b>low hydrogen content electrodes</b> for all earthing works i.e. MS Rod, GI Flat & MS Flat
16	The welds on 40MM MS Rod, 100X12 mm MS Flat(existing), should be treated with red oxide primer and afterwards coated with two layers bitumen compound to prevent corrosion.
17	50mm x 6mm MS flat shall run on the top tier and all along the cable trenches and the same shall be welded to each of the racks. Further this flat shall be earthed at both ends and at an interval of 30 mtrs. The M.S. flat shall be finally painted with two coats of <b>Red oxide primer and two coats of Zinc riched enamel paint.</b>
18	Connection between equipment earthing lead and main earthing conductors and between main earthing conductors shall be welded type. For rust protections, the welds should be treated with red oxide primer and afterwards coated with two layers <b>bitumen compound</b> to prevent corrosion.
19	All welding done at site for equipment and structures, shall be painted with zinc rich paint immediately to avoid corrosion.
20	Cable racks and supports shall be painted after installation with two coats of metal primer (comprising of <b>red oxide and zinc chromate</b> in a synthetic medium) followed by two finishing coats of aluminium paint. The red oxide and zinc chromate shall conform to IS:2074.
21	Supervision of testing and commissioning of Relay / Protection / SAS / Automation / Bus Bar Panels (as applicable) is in the scope of BHEL/ panel supplier. Necessary manpower support, tools, tackles and testing equipment to be in scope of ETC contractor
22	Minor Civil works such as modification of civil foundations, making holes in the trenches/control room building for PVC/GI pipe entries etc. are in the scope of ETC contractor.
23	Removal of gravel, if gravelling is already done, for connection of Equipment earthing strip to the existing mat (wherever earthing mat is already laid), and <u>after completion of earthing , contractor should place the gravel to bring it in original shape.</u>
24	Compleete ETC package is under the scope of bidder. All T&P required to complete the job including oil filterating machine, cranes etc. required to complete the job shall be provided by bidder only.
25	Any other item i.e. Portable Flood Light Panel etc if handling is in the scope of bidder. For Fire Fighting Equipment: RECEIPT OF MATERIAL, UNLOADING, PROPER STORAGE, MATERIAL RECONCILIATION, SAFE KEEPING, Erection at Designated Place in Substation, PROPER RECORD KEEPING ETC TO COMPLETE. PLEASE REFER ANNEXURE_FIRE-PROTECTION.
26	<b>MANDATORY SPARES: Please refer Annexure "ANNEXURE-MANDATORY SPARES-NEEMUCH" for details. Scope includes Unloading, storage , material handling and Handing over.</b>

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26	Detailed scope of work of ETC of Transformer & reactor is given at Annexure-A: SCOPE OF ERECTION TESTING & COMMISSIONING WORKS OF TRANSFORMER/REACTOR. This is indicative document, if any other activity required to be carried for successful commissioning if transformer/reactor the same is inclusive in scope of work.
26	PMU related items shall be mounted in the cut-out provided in CRP panel. Necessary manpower support, tools, tackles and testing equipment to be in scope of ETC contractor
26	Welding of Aluminium tubes (supply of welding sleeve excluded) as per 'Annexure-C: PROCEDURE FOR WELDING OF ALUMINIUM BUSES' is in ETC contractor's scope and joints shall be tested as per SECTION-SWITCHYARD ERECTION. Welding and Bending machines and any other equipment will be in ETC Contractor scope.
26	Trench Material 50x50x6 mm MS Angle To be of grade - A as per IS:2062
26	<b>Testing instruments</b> (dully calibrated) have to be arranged by ETC Contractor at it's own cost ( List is only provided for information , if any other instrument not mentioned below but required for sucessful completion of ETC work shall be in ETC contractor's scope) , (However OMICRON or equivalent kit for Numerical relay testing shall be arranged by BHEL.). Bidder to submit valid calibration certificate during commencement of testing / commissioning works.
26.01	DCRM (OPERATIONAL ANALYZER )
26.02	Contact Resistance Measurement kit (CRM)
26.03	Capacitance and Tan delta measurement Kit
26.04	Dew Point Measurement kit
26.05	5kV/1kV Insulation tester
26.06	Primary current Injection Kit
26.07	Single phase variac
26.08	Secondary current/Voltgae Injection kit
26.09	1Ph Variac
26.10	Multimeters

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26.11	Clamp on meter
26.12	Relay test kit

**BOQ\_ANNEXURE\_2**  
**PROJECT SPECIFIC DRAWING & DOCUMENT LIST**

Sl. No.	DRAWING / DOCUMENT NUMBER	DRAWING / DOCUMENT TITLE	APPLICABLE FOR STATION
1	TB-1-418-316-001A TB-1-418-316-001B	NEEMUCH S/S-400/220 kV SWICTHYARD ELECTRICAL LAYOUT PLAN & SECTION	neemuch
2	TB-1-418-316-002	NEEMUCHS/S-400/220 kV SWICTHYARD ERECTION KEY DIAGRAM LAYOUT PLAN & SECTION	neemuch
3	TB-1-418-316-005	NEEMUCH S/S-400/220kV SWICTHYARD STRUCTURAL LAYOUT PLAN & SECTION	neemuch
4	TB-1-418-316-007	NEEMUCH S/S-400/220 kV SWICTHYARD CABLE TRENCH LAYOUT	neemuch
5	TB-1-418-316-008	NEEMUCHS/S-400/220 kV SWICTHYARD DSLP LAYOUT	neemuch
6	ANNEXURE-MANDATORY SPARES-NEEMUCH	ANNEXURE-MANDATORY SPARES-NEEMUCH	neemuch
7	Annexure-A	SCOPE OF ERECTION TESTING & COMMISIONING WORKS OF TRANSFORMER/REACTOR	neemuch
8	Annexure-C	PROCEDURE FOR WELDING OF ALUMINIUM BUSES	neemuch

**BOQ\_ANNEXURE\_3**  
**STANDARD DRAWING & DOCUMENT LIST**

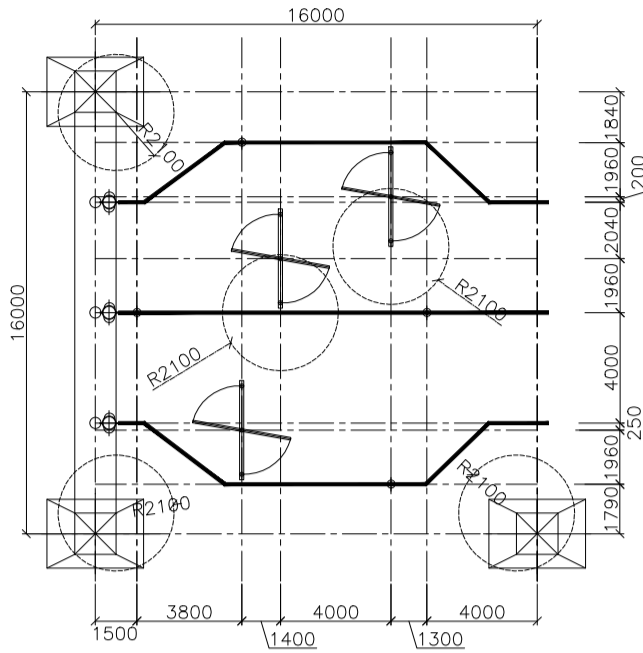
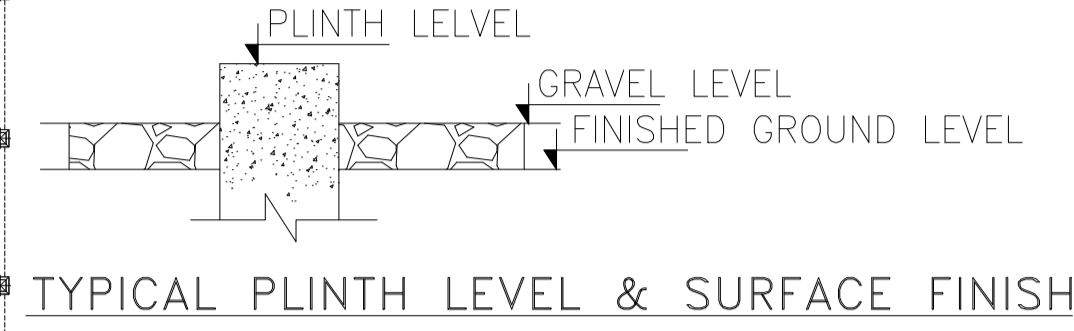
SI.No	DRAWING / DOCUMENT NUMBER	DRAWING / DOCUMENT TITLE
1	PG-SECTION-PROJECT--REV.00	SECTION-PROJECT. (REV.00)
2	C/ENGG/SPEC/GTR (Rev.15)	SECTION-GENERAL TECHNICAL REQUIREMENTS (REV.15)
3	PG-C-ENGG-SPEC-SE-REV.10	SECTION-SWITCHYARD ERECTION (REV.10)
4	PG-C-ENGG-STD-EARTHING-09	STANDARD EARTHING DETAILS (EQUIPMENT EARTHING DRAWING)
5	PG-C-ENGG-SPEC-LS-REV.07	SECTION-LIGHTING SYSTEM (REV.07)
6	PG-C-ENGG-SPEC-SWGR-CB-REV.11	SECTION- SWITCHGEAR- CB (REV 11)
7	PG-C-ENGG-SPEC-SWGR-ISO-REV.R11B	SECTION- SWITCHGEAR- ISO (REV 11B)
8	PG-C-ENGG-SPEC-SWGR-INT-REV.R11	SECTION- SWITCHGEAR-INST (INSTRUMENT TRANSFORMER) (REV 11)
9	C/ENGG/SPEC/SWGR/SA/R12	SECTION- SWITCHGEAR- SURGE ARRESTER (REV 12)
10	PG-C-ENGG-SPEC-CAB-REV.06	SECTION-POWER AND CONTROL CABLES (REV.06)
11	C/ENGG/MODEL-SPEC/TRF Rev. 13	Technical Specification: Section -Transformer (Upto 400kV Class)
12	C/ENGG/MODEL-SPEC/RT Rev. 11	Technical Specification, Upto 400kV Shunt Reactor
13	D-2-01-03-01-04	PRE COMMISSIONING PROCEDURE & FORMAT FOR SWITCHYARD ERECTION
14	ANNEXURE_INSULATING_MAT	TECHNICAL SPECIFICATION FOR INSULATING MAT
15	TB-XXX-618-002a	TECHNICAL SPECIFICATION FOR HARDWARE

FIRST ANGLE PROJECTION ( ALL DIMENSIONS ARE IN MM. )

DRAWING NO. TB-1-418-316-001A

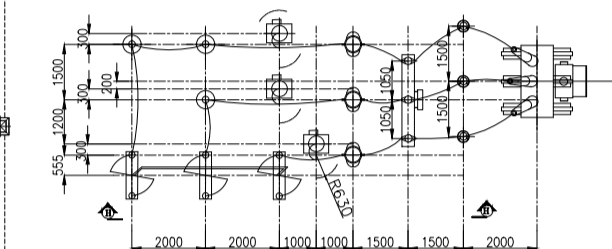
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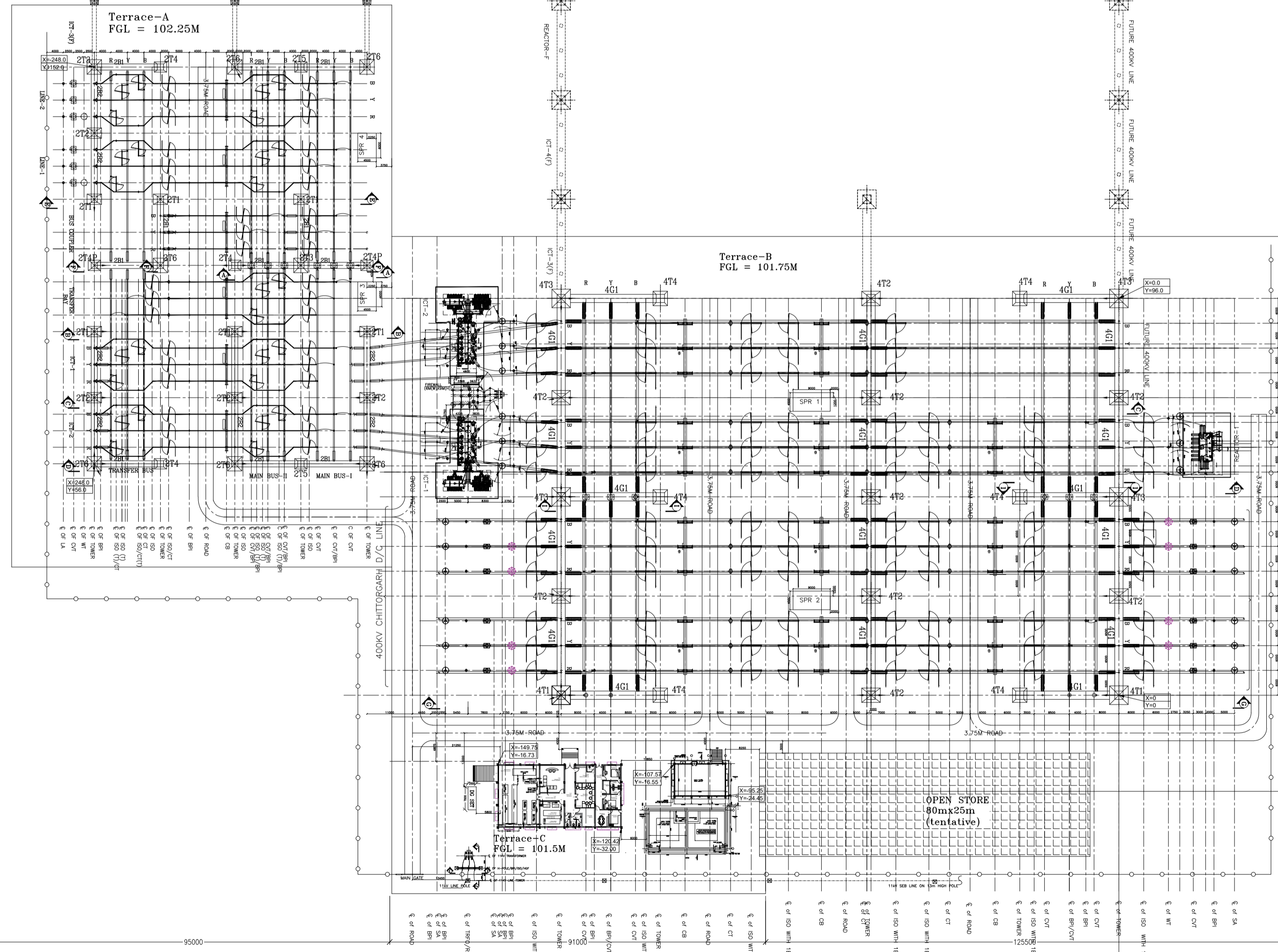


MINIMUM CLEARANCE TABLE	400kV	220kV	72.5kV
PHASE TO PHASE (PP) (mm)	4000	2100	750
PHASE TO EARTH (PE) (mm)	3500	2100	630
SECTION CLEARANCE (SC) (mm)	6500	5000	3100
HEIGHT OF TUBE CENTRE LINE OF FIRST LEVEL (MIN.) MM. (FROM PLINTH LEVEL)	8000	5900	3800
GROUND CLEARANCE TO NEAREST PART NOT AT EARTH POTENTIAL OF AN INSULATOR SUPPORTING LIVE CONDUCTOR	2550	2550	2550

- NOTE:
1. THE ROAD SHOWN FOR BREAKER MAINTENANCE IN 400KV YARD SHALL BE UTILIZED DURING DE-ENERGISED POSITION ONLY.
  2. THE TERRACE SLOPE IS 1:1



△ CLEARANCE DIAGRAM FOR TANDEM ISOLATOR



S.NO.	KV	DESCRIPTION	QUANTITY AS PER BPS(No.)	QUANTITY AS PER LAYOUT(No.)
1	400	500 MVA AUTO TRANSFORMER, 3-Ph, 400/220/33kV	2	2
2		125 MVAR SHUNT REACTOR	1	1
3		3150A,63KA FOR 1 SEC. 3 PHASE SF6 CIRCUIT BREAKER WITHOUT CLOSING RESISTOR (* 2 NOS CIRCUIT BREAKERS WITH CSD)	11	11
4		3150A,63KA FOR 1 SEC. 3 PHASE ELECTRICALLY GANGED ISOLATOR WITH ONE EARTH SWITCH	27	27
5		3150A,63KA FOR 1 SEC. 3 PHASE ELECTRICALLY GANGED ISOLATOR WITH TWO EARTH SWITCHES	2	2
6		SURGE ARRESTER (336kV)	21	21
7		WAVE TRAP 3150A, 0.5mH, 63KA FOR 1 SEC.	8	8
8		CURRENT TRANSFORMER 3000A, 63KA FOR 1 SEC.	33	33
9		CAPACITIVE VOLTAGE TRANSFORMER 4400pF	18	18
10		BUS POST INSULATOR	35	35
11		CIRCUIT BREAKER 3150A, 50KA FOR 1 SEC. 3 PHASE, SF6, CIRCUIT BREAKER (BUS COUPLER)	1	1
12	CIRCUIT BREAKER 1600A, 50KA FOR 1 SEC. 3 PHASE, SF6, CIRCUIT BREAKER (CT & TRANSFER BUS)	5	5	
13	1600A, 50KA FOR 1 SEC. 3 PHASE MECHANICALLY GANGED ISOLATOR WITH ONE EARTH SWITCH	5	5	
14	3150A, 50KA FOR 1 SEC. 3 PHASE MECHANICALLY GANGED ISOLATOR WITH TWO EARTH SWITCHES	2	2	
15	1600A, 50KA FOR 1 SEC. 3 PHASE MECHANICALLY GANGED ISOLATOR WITH TWO EARTH SWITCHES	5	5	
16	1600A, 50KA FOR 1 SEC. 3 PHASE MECHANICALLY GANGED ISOLATOR WITHOUT EARTH SWITCH (TANDEM)	9	9	
17	WAVE TRAP(1600A,0.5mH) 50KA FOR 1 SEC.	2	2	
18	CURRENT TRANSFORMER 2500A Ih=120% 50KA FOR 1 SEC.	3	3	
19	CURRENT TRANSFORMER 1600A Ih=120% 50KA FOR 1 SEC.	15	15	
20	CAPACITIVE VOLTAGE TRANSFORMER 4400pF	12	12	
21	SURGE ARRESTER (216kV)	12	12	
22	BUS POST INSULATOR	60	60	
23	72.5kV DOUBLE BREAK ISOLATOR 25KA FOR 1 SEC. 3 PHASE MECHANICALLY GANGED	1	1	
24	72.5kV 1250A,25KA,3PH CIRCUIT BREAKER	1	1	
25	72.5kV CT	3	3	
26	72.5kV PT	3	3	
27	BUS POST INSULATOR	6	6	
28	30 KV LA	3	3	
29	630kVA, 11kV/0.433kV LT TRANSFORMER	2	1	
30	33KV BUS POST INSULATOR	3	3	
31	33KV DOUBLE BREAK ISOLATOR (3-PHASE)	1	1	
32	33KV HORN GAP FUSE (3-PHASE)	1	1	
33	630kVA, 11kV/0.433kV LT TRANSFORMER	0	1	

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COMPUTER DRG. PATH NAME :

REF. DRG. No.

SIGN & DATE

INVENTORY No.

REV.	DATE	ALTERED	SY	REV.	DATE	ALTERED	SY	REV.	DATE	ALTERED	SY
03	05.04.23	CHECKED	SS	02	17.01.23	CHECKED	SS	01	21.10.22	CHECKED	SS
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REV.	DATE	ALTERED	SY	REV.	DATE	ALTERED	SY	REV.	DATE	ALTERED	SY
01	21.10.22	CHECKED	SS								
		APPROVED	SKS								

DRG. NO.	DATE	DESIGN	CHECKED	APPROVED
01	21.10.22	SKS	SKS	SKS

NAME OF CUSTOMER/PROJECT	POWER GRID CORPORATION OF INDIA LIMITED
NEEMUCH 400/220KV SUBSTATION	

CA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022
	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-II/06 dtd. 23/09/2022

ADDITIONAL INFORMATION	W.O.No.

STATUS OF DRAWING	DISTRIBUTION OF PRINTS

DEPT.	SCALE	CARD CODE
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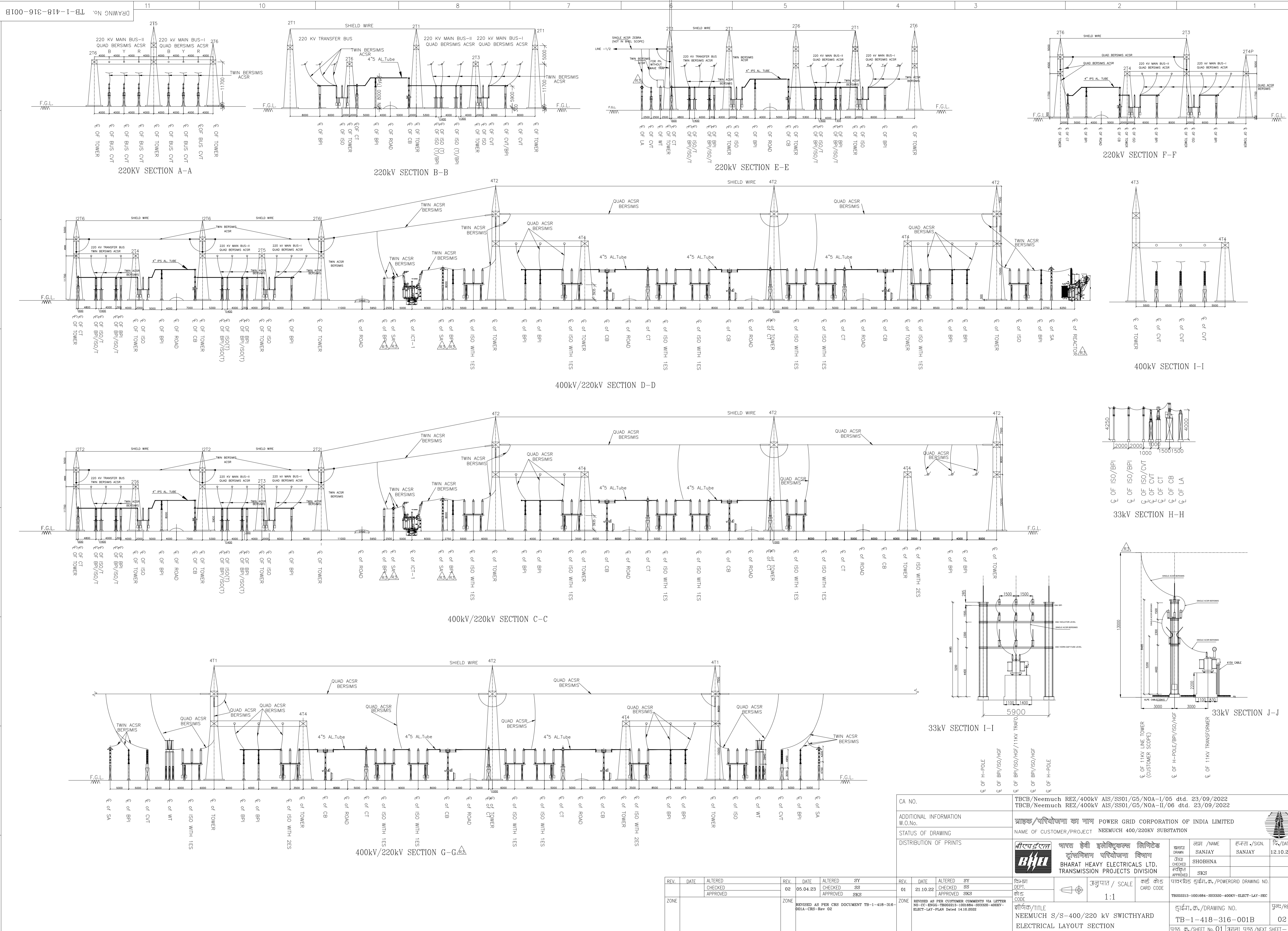
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ADDITIONAL INFORMATION W.O.No.	आहूतक/परियोजना का नाम POWER GRID CORPORATION OF INDIA LIMITED																
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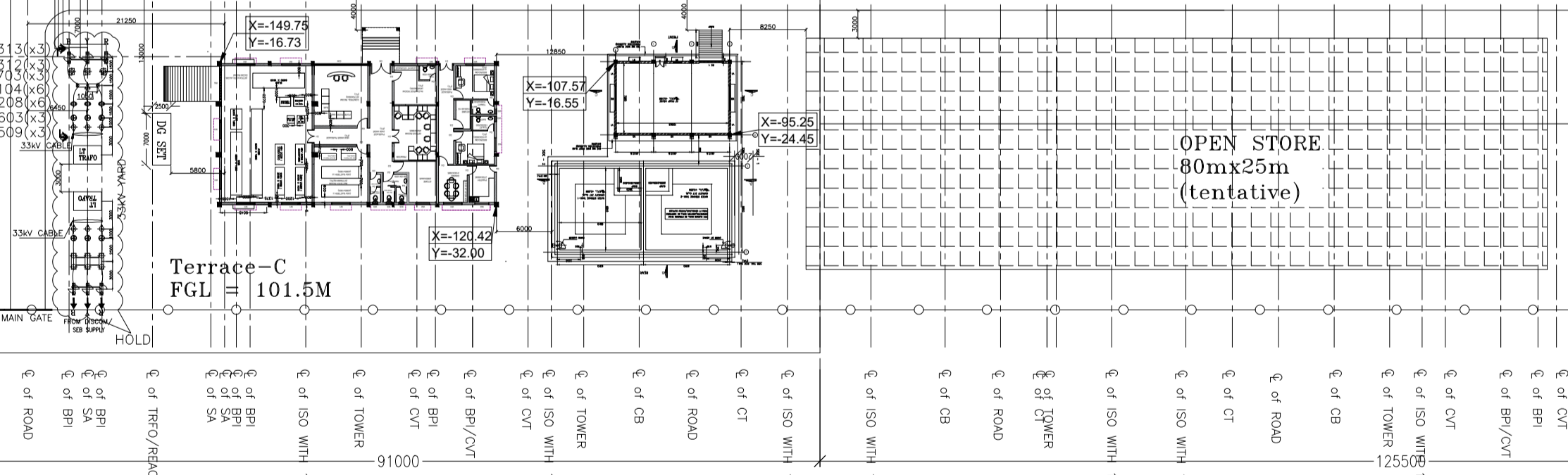
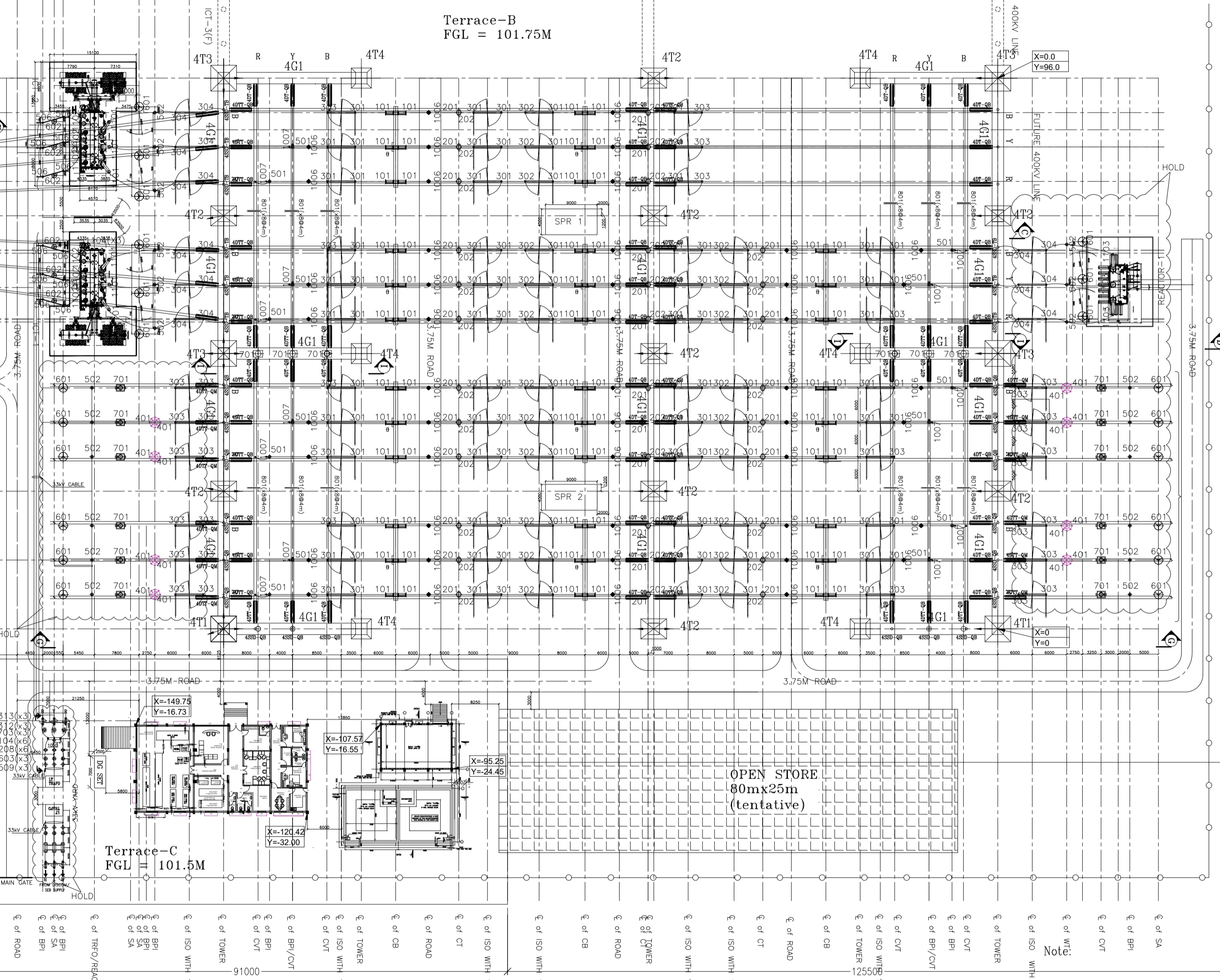
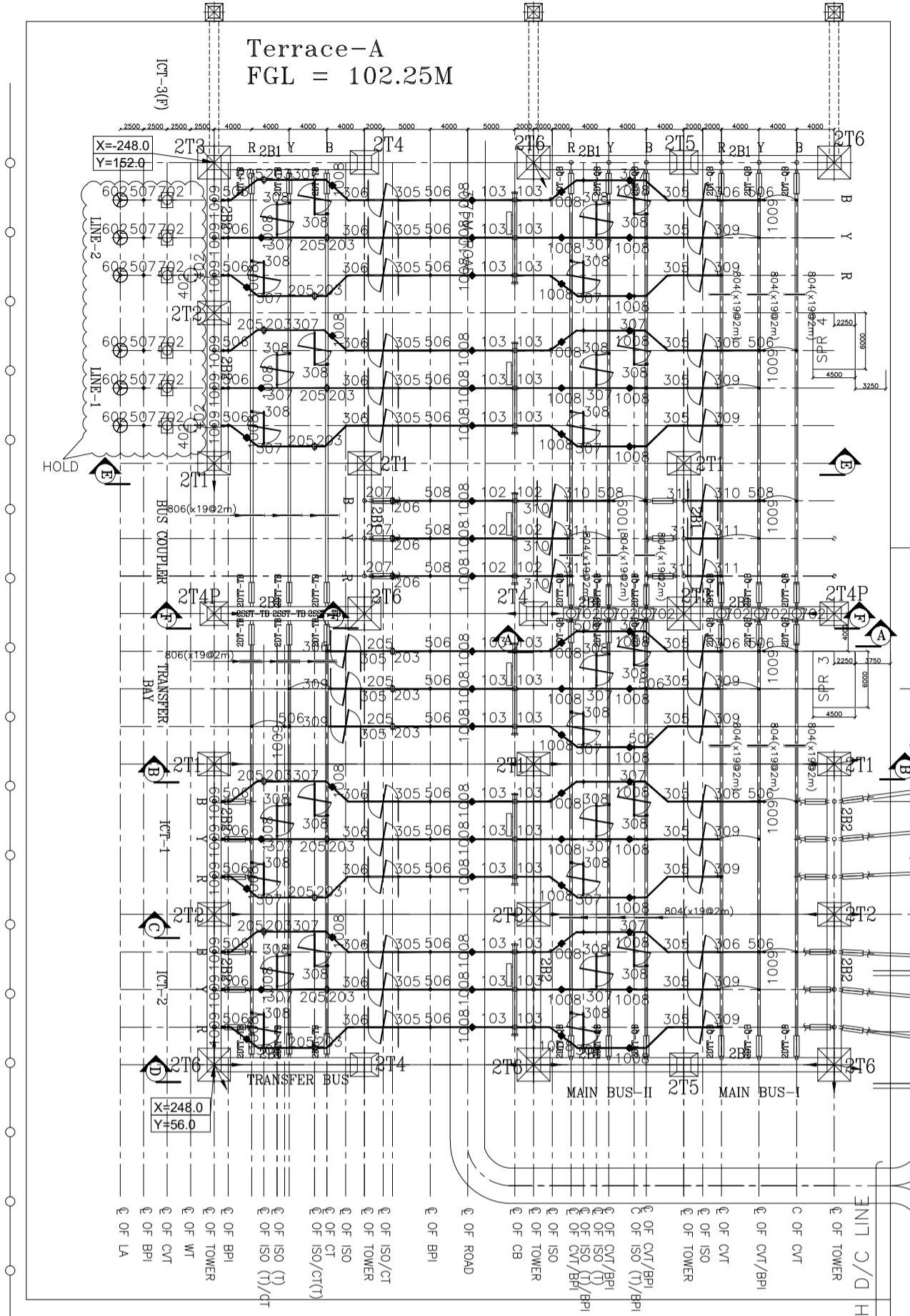
DRAWING NO. TB-1-418-316-002

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COMPUTER DRG. PATH NAME :

SIGN. & DATE REF. DRG. No.

INVENTORY No.



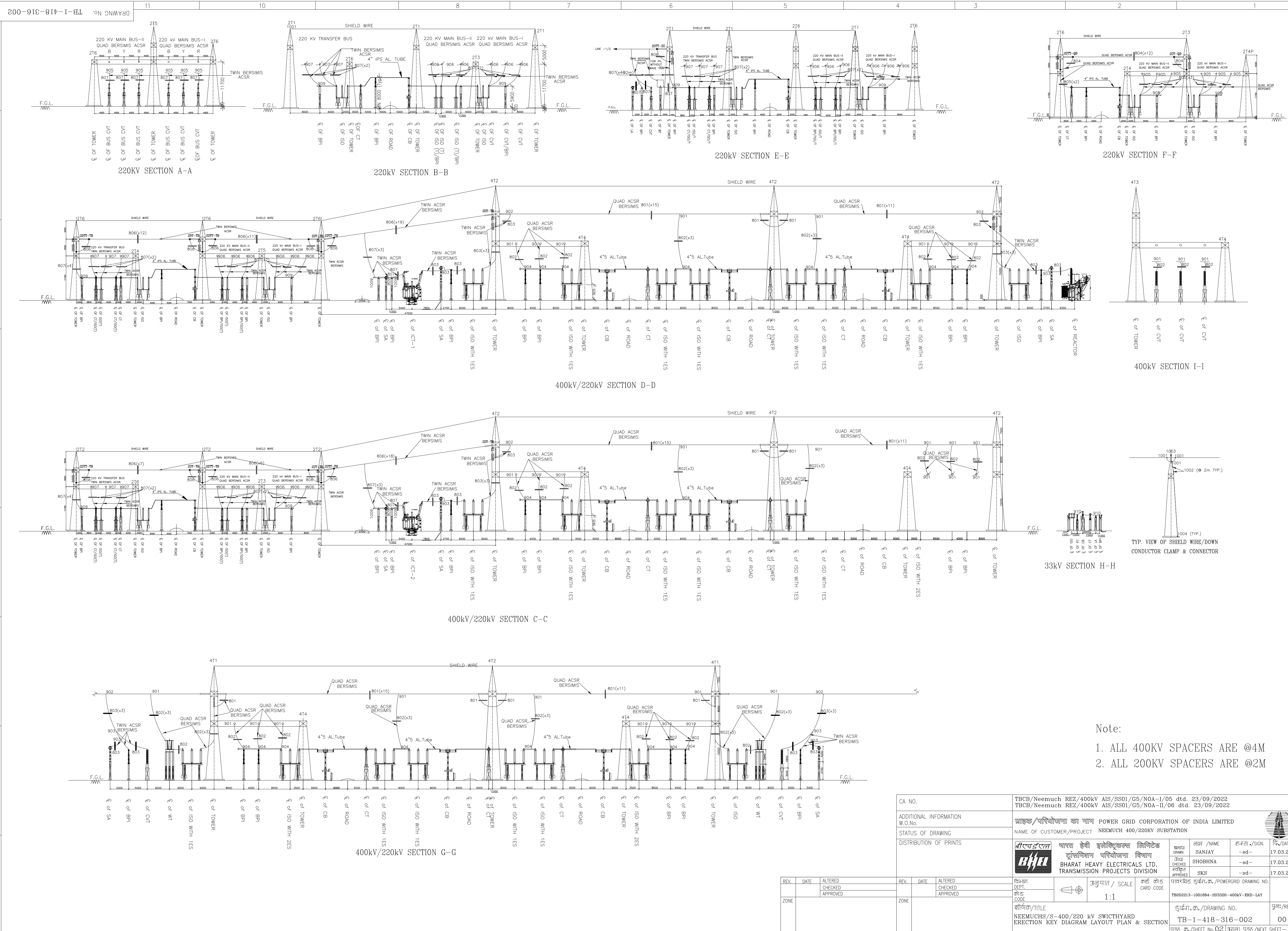
OPEN STORE  
80m x 25m  
(tentative)



THIS DRAWING SHOULD BE REFERED ONLY FOR EKD CLAMP NO. REFERENCE.

CA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-1/05 dtd. 23/09/2022 TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-11/06 dtd. 23/09/2022																
ADDITIONAL INFORMATION W.O.No.	आह्वय/परियोजना का नाम POWER GRID CORPORATION OF INDIA LIMITED																
STATUS OF DRAWING	NAME OF CUSTOMER/PROJECT NEEMUCH 400/220KV SUBSTATION																
DISTRIBUTION OF PRINTS	<table border="1"> <tr> <th>DRW/NO.</th> <th>DRW/NAME</th> <th>DRW/SIGN.</th> <th>DRW/DATE</th> </tr> <tr> <td>DRW/1</td> <td>SHOBHNA</td> <td>-sd-</td> <td>17.03.23</td> </tr> <tr> <td>DRW/2</td> <td>SHOBHNA</td> <td>-sd-</td> <td>17.03.23</td> </tr> <tr> <td>DRW/3</td> <td>SKS</td> <td>-sd-</td> <td>17.03.23</td> </tr> </table>	DRW/NO.	DRW/NAME	DRW/SIGN.	DRW/DATE	DRW/1	SHOBHNA	-sd-	17.03.23	DRW/2	SHOBHNA	-sd-	17.03.23	DRW/3	SKS	-sd-	17.03.23
DRW/NO.	DRW/NAME	DRW/SIGN.	DRW/DATE														
DRW/1	SHOBHNA	-sd-	17.03.23														
DRW/2	SHOBHNA	-sd-	17.03.23														
DRW/3	SKS	-sd-	17.03.23														
REV.	<table border="1"> <tr> <th>REV.</th> <th>DATE</th> <th>ALTERED</th> <th>CHECKED</th> <th>APPROVED</th> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>	REV.	DATE	ALTERED	CHECKED	APPROVED											
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ZONE	<table border="1"> <tr> <th>ZONE</th> <th>DATE</th> <th>ALTERED</th> <th>CHECKED</th> <th>APPROVED</th> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>	ZONE	DATE	ALTERED	CHECKED	APPROVED											
ZONE	DATE	ALTERED	CHECKED	APPROVED													
DEPT.	उत्तुपार / SCALE																
CODE	NTS																
TITLE	NEEMUCH/S-400/220 kV SWITCHYARD ERECTION KEY DIAGRAM LAYOUT PLAN & SECTION																
DRAWING NO.	पुस्तक नं./DRAWING NO. TB-1-418-316-002																
SHEET NO.	पृष्ठ नं./SHEET No. 01																
REV.	पुस्तक नं./NEXT SHEET 02																

FIRST ANGLE PROJECTION ( ALL DIMENSIONS ARE IN MM. )



Note:  
 1. ALL 400KV SPACERS ARE @4M  
 2. ALL 200KV SPACERS ARE @2M

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 COMPUTER DRG. PATH NAME :  
 REF. DRG. No.  
 SIGN & DATE  
 INVENTORY No.

CA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-1/05 dtd. 23/09/2022 TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-II/06 dtd. 23/09/2022																								
ADDITIONAL INFORMATION W.O.No.	ग्राहक/परियोजना का नाम POWER GRID CORPORATION OF INDIA LIMITED																								
STATUS OF DRAWING	NAME OF CUSTOMER/PROJECT NEEMUCH 400/220KV SUBSTATION																								
DISTRIBUTION OF PRINTS	<table border="1"> <tr> <th>क्रमांक DRAWN</th> <th>गण /NAME</th> <th>रिस्त/ /SIGN.</th> <th>दि./DATE</th> </tr> <tr> <td>1</td> <td>SANJAY</td> <td>-sd-</td> <td>17.03.23</td> </tr> <tr> <th>क्रमांक CHECKED</th> <th>गण /NAME</th> <th>रिस्त/ /SIGN.</th> <th>दि./DATE</th> </tr> <tr> <td>2</td> <td>SHOBHNA</td> <td>-sd-</td> <td>17.03.23</td> </tr> <tr> <th>क्रमांक APPROVED</th> <th>गण /NAME</th> <th>रिस्त/ /SIGN.</th> <th>दि./DATE</th> </tr> <tr> <td>3</td> <td>SKS</td> <td>-sd-</td> <td>17.03.23</td> </tr> </table>	क्रमांक DRAWN	गण /NAME	रिस्त/ /SIGN.	दि./DATE	1	SANJAY	-sd-	17.03.23	क्रमांक CHECKED	गण /NAME	रिस्त/ /SIGN.	दि./DATE	2	SHOBHNA	-sd-	17.03.23	क्रमांक APPROVED	गण /NAME	रिस्त/ /SIGN.	दि./DATE	3	SKS	-sd-	17.03.23
क्रमांक DRAWN	गण /NAME	रिस्त/ /SIGN.	दि./DATE																						
1	SANJAY	-sd-	17.03.23																						
क्रमांक CHECKED	गण /NAME	रिस्त/ /SIGN.	दि./DATE																						
2	SHOBHNA	-sd-	17.03.23																						
क्रमांक APPROVED	गण /NAME	रिस्त/ /SIGN.	दि./DATE																						
3	SKS	-sd-	17.03.23																						
REV.	<table border="1"> <tr> <th>REV.</th> <th>DATE</th> <th>ALTERED</th> <th>DEPT.</th> <th>उत्तुपार / SCALE</th> <th>कार्ड कोड CARD CODE</th> </tr> <tr> <td> </td> <td> </td> <td>CHECKED</td> <td> </td> <td>1:1</td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td>APPROVED</td> <td> </td> <td> </td> <td> </td> </tr> </table>	REV.	DATE	ALTERED	DEPT.	उत्तुपार / SCALE	कार्ड कोड CARD CODE			CHECKED		1:1				APPROVED									
REV.	DATE	ALTERED	DEPT.	उत्तुपार / SCALE	कार्ड कोड CARD CODE																				
		CHECKED		1:1																					
		APPROVED																							
ZONE	पाठक/सं./DRAWING NO. TB-1-418-316-002 पृष्ठ नं./SHEET No.02																								

CUSTOMER	POWERGRID NEEMUCH TRANSMISSION SYSTEM LIMITED																			
PROJECT	Substation Package SS01 for (i) 400/220kV AIS Neemuch New S/S including 400kV class Transformer & Bus Reactor, (ii) Extension of 400kV Chittorgarh S/S and (iii) Extension of 400kV Mandsaur S/S associated with Transmission system for evacuation of power from Neemuch REZ																			
NOA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 &																			
STATION	NEEMUCH																			
CUSTOMER DOC ID	TB202213-1001684-SS3320-400kV-EKD-BOQ																			
BHEL DOC ID	TB-1-418-316-002-BOQ-REV 00																			
DOC TITLE	NEEMUCHS/S-400/220 kV SWICHTHYARD ERECTION KEY DIAGRAM BOQ																			
BILL OF QUANTITIES FOR CLAMPS AND CONNECTORS-NEEMUCH-400KV																				
S.NO.	ITEM DESCRIPTION	CLAMP NO.	UNIT	BAY WISE QUANTITY															TOTAL QUANTITY	
				Mandsaur-1	tie	Chittorgarh-1	Mandsaur-2	tie	Chittorgarh-2	REACTOR	tie	ICT-1	ICT-2	tie	MAIN BUS-1	MAIN BUS-II	TRANSFER BUS	COMMON		
1	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 3150A, CB CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, EXPANSION TYPE	101	Nos	6	6	6	6	6	6	6	6	6	6	6	0	0	0	0	66	
2	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 3150A, CT CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, RIGID TYPE	201	Nos	3	3	3	3	3	3	3	3	3	3	3	0	0	0	0	33	
3	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 3150A, CT CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, EXPANSION TYPE	202	Nos	3	3	3	3	3	3	3	3	3	3	3	0	0	0	0	33	
4	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 3150A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, RIGID TYPE	301	Nos	8	9	11	8	9	11	8	9	11	11	6	0	0	0	0	101	
5	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 3150A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, EXPANSION TYPE	302	Nos	3	3	0	3	3	0	3	3	0	0	3	0	0	0	0	21	
6	SUPPLY- CLAMPS & CONNECTORS : 400KV, 63KA FOR 1S, 3150A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR QUAD BERSIMIS	303	Nos	7	0	1	7	0	1	1	0	1	1	3	0	0	0	0	22	
7	SUPPLY- CLAMPS & CONNECTORS : 400KV, 63KA FOR 1S, 2000A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR TWIN BERSIMIS	304	Nos	0	0	0	0	0	0	6	0	6	6	0	0	0	0	0	18	
8	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 3150A, WAVE TRAP CONNECTOR SUITABLE FOR QUAD BERSIMIS	401*	Nos	4	0	4	4	0	4	0	0	0	0	0	0	0	0	0	16	
9	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 3150A, BPI CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, SLIDING THROUGH TYPE	501	Nos	2	0	2	2	0	2	2	0	2	2	0	0	0	0	0	14	
10	SUPPLY- CLAMPS & CONNECTORS : 400KV, 63KA FOR 1S, 2000A, BPI CONNECTOR SUITABLE FOR TWIN BERSIMIS	502	Nos	3	0	3	3	0	3	3	0	3	3	0	0	0	0	0	21	
11	SUPPLY- CLAMPS & CONNECTORS : 390KV, 63KA FOR 1S, LIGHTNING ARRESTER CONNECTOR SUITABLE FOR TWIN BERSIMIS	601*	Nos	3	0	3	3	0	3	3	0	3	3	0	0	0	0	0	21	
12	SUPPLY- CLAMPS & CONNECTORS : 400KV, 63KA FOR 1S, 2000A, CVT CONNECTOR SUITABLE FOR TWIN BERSIMIS	701	Nos	3	0	3	3	0	3	0	0	0	0	0	3	3	0	0	18	
13	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 2000A, ICT BUSHING CONNECTOR SUITABLE FOR TWIN BERSIMIS	1101	Nos	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	6	
14	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 2000A, REACTOR BUSHING CONNECTOR SUITABLE FOR TWIN BERSIMIS	1103	Nos	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3	
15	CONNECTORS SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 4000A, FLEXIBLE SPACER SUITABLE FOR QUAD BERSIMIS	801	Nos	90			90			84			84			48	48	48	0	492
16	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 4000A, RIGID SPACER SUITABLE FOR QUAD BERSIMIS	802	Nos	66			66			24			24			3	3	0	0	186
17	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 2000A, RIGID SPACER SUITABLE FOR TWIN BERSIMIS	803	Nos	30			30			36			18			0	0	0	0	114
18	SUPPLY- CLAMPS & CONNECTORS : 400KV, 63KA FOR 1S, 4000A, TEE CONNECTOR SUITABLE FOR QUAD BERSIMIS TO QUAD BERSIMIS	901	Nos	21			21			12			12			3	3	0	0	72
19	SUPPLY- CLAMPS & CONNECTORS : 400KV, 63KA FOR 1S, 4000A, TEE CONNECTOR SUITABLE FOR QUAD BERSIMIS TO TWIN BERSIMIS	902	Nos	6			6			6			3			0	0	0	0	21

CUSTOMER	POWERGRID NEEMUCH TRANSMISSION SYSTEM LIMITED																			
PROJECT	Substation Package SS01 for (i) 400/220kV AIS Neemuch New S/S including 400kV class Transformer & Bus Reactor, (ii) Extension of 400kV Chittorgarh S/S and (iii) Extension of 400kV Mandasaur S/S associated with Transmission system for evacuation of power from Neemuch REZ																			
NOA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 &																			
STATION	NEEMUCH																			
CUSTOMER DOC ID	TB202213-1001684-SS3320-400kV-EKD-BOQ																			
BHEL DOC ID	TB-1-418-316-002-BOQ-REV 00																			
DOC TITLE	NEEMUCHS/S-400/220 kV SWICHTHYARD ERECTION KEY DIAGRAM BOQ																			
<b>BILL OF QUANTITIES FOR CLAMPS AND CONNECTORS-NEEMUCH-400KV</b>																				
S.NO.	ITEM DESCRIPTION	CLAMP NO.	UNIT	BAY WISE QUANTITY															TOTAL QUANTITY	
				Mandasaur-1	tie	Chittorgarh-1	Mandasaur-2	tie	Chittorgarh-2	REACTOR	tie	ICT-1	ICT-2	tie	MAIN BUS-1	MAIN BUS-II	TRANSFER BUS	COMMON		
20	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 2000A, TEE CONNECTOR SUITABLE FOR TWIN BERSIMIS TO TWIN BERSIMIS	903	Nos	0			0			6			3			0	0	0	0	9
21	CONNECTORS SUPPLY- CLAMPS & CONNECTORS : 400KV, 63KA FOR 1S, 4000A, TEE CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS TO QUAD CONDUCTOR	904	Nos	12			12			12			6			0	0	0	0	42
22	CLAMPS & CONNECTORS PG CLAMP FOR SHIELD WIRES OF DIA 10.98MM	1001	Nos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	35	
23	CLAMPS & CONNECTORS CLAMP FOR 10.98MM DIA SHIELD WIRE ON LATTICE / PIPE STRUCTURE	1002	Nos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	225	225	
24	SUPPLY- CLAMPS & CONNECTORS : STRAIN CLAMP FOR SHIELD WIRE 10.98MM DIA	1003	Nos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	15	
25	CLAMPS & CONNECTORS PAD CONNECTOR TO SUIT 10.98MM DIA GS WIRE AND 75X12 MM GS FLAT	1004	Nos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	15	
26	CLAMPS & CONNECTORS CLAMPS FOR 75X12MM EARTHING STRIP ON LATTICE/PIPE STRUCTURE	1005	Nos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2740	2740	
27	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 3150A, WELDING SLEEVE SUITABLE FOR 4.5 INCH IPS AL TUBE	1006	Nos	13			13			13			8			0	0	0	0	47
28	SUPPLY- CLAMPS & CONNECTORS : 420KV, 63KA FOR 1S, 3150A, CORONA BELL SUITABLE FOR 4.5 INCH IPS AL TUBE	1007	Nos	2	0	2	2	0	2	2	0	2	2	0	0	0	0	0	0	14

## 1401640/2023/TBG-TB\_HVDC

CUSTOMER	POWERGRID NEEMUCH TRANSMISSION SYSTEM LIMITED
PROJECT	Substation Package SS01 for (i) 400/220kV AIS Neemuch New S/S including 400kV class Transformer & Bus Reactor, (ii) Extension of 400kV Chittorgarh S/S and (iii) Extension of 400kV Mandsaur S/S associated with Transmission system for evacuation of power from Neemuch REZ
NOA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 &
STATION	NEEMUCH
CUSTOMER DOC ID	TB202213-1001684-SS3320-400kV-EKD-BOQ
BHEL DOC ID	TB-1-418-316-002-BOQ-REV 00
DOC TITLE	NEEMUCHS/S-400/220 kV SWICTHYARD ERECTION KEY DIAGRAM BOQ

## BILL OF QUANTITIES FOR CLAMPS AND CONNECTORS-NEEMUCH-220KV

S.NO.	ITEM DESCRIPTION	CLAMP NO.	UNIT	BAY WISE QUANTITY										TOTAL QUANTITY	
				ICT-1	ICT-2	BUS COUPLER	TRANSFER BAY	LINE-1	LINE-2	220KV MAIN BUS 1	220KV MAIN BUS 2	220KV TRANSFER BUS	COMMON		
1	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 2500A, CB CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, EXPANSION TYPE	102	Nos	0	0	6	0	0	0	0	0	0	0	0	6
2	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 1600A, CB CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, EXPANSION TYPE	103	Nos	6	6	0	6	6	6	0	0	0	0	0	30
3	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 1600A, CT CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, RIGID TYPE	203	Nos	3	3	0	3	3	3	0	0	0	0	0	15
4	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 1600A, CT CONNECTOR SUITABLE FOR TWIN BERSIMIS	204	Nos	3	3	0	0	3	3	0	0	0	0	0	12
5	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 1600A, CT CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, EXPANSION TYPE	205	Nos	3	3	0	3	3	3	0	0	0	0	0	15
6	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 2500A, CT CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, RIGID TYPE	206	Nos	0	0	3	0	0	0	0	0	0	0	0	3
7	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 2500A, CT CONNECTOR SUITABLE FOR TWIN BERSIMIS	207	Nos	0	0	3	0	0	0	0	0	0	0	0	3
8	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 1600A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, RIGID TYPE	305	Nos	6	6	0	6	6	6	0	0	0	0	0	30
9	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 1600A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, EXPANSION TYPE	306	Nos	4	4	0	2	4	4	0	0	0	0	0	18
10	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 1600A, ISOLATOR (TANDEM) CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS	307	Nos	6	6	0	3	6	6	0	0	0	0	0	27
11	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 1600A, ISOLATOR (TANDEM) CONNECTOR SUITABLE FOR TWIN BERSIMIS	308	Nos	6	6	0	3	6	6	0	0	0	0	0	27
12	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 1600A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR TWIN BERSIMIS	309	Nos	2	2	0	4	2	2	0	0	0	0	0	12
13	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 3150A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, RIGID TYPE	310	Nos	0	0	5	0	0	0	0	0	0	0	0	5

## 1401640/2023/TBG-TB\_HVDC

CUSTOMER	POWERGRID NEEMUCH TRANSMISSION SYSTEM LIMITED
PROJECT	Substation Package SS01 for (i) 400/220kV AIS Neemuch New S/S including 400kV class Transformer & Bus Reactor, (ii) Extension of 400kV Chittorgarh S/S and (iii) Extension of 400kV Mandsaur S/S associated with Transmission system for evacuation of power from Neemuch REZ
NOA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 &
STATION	NEEMUCH
CUSTOMER DOC ID	TB202213-1001684-SS3320-400kV-EKD-BOQ
BHEL DOC ID	TB-1-418-316-002-BOQ-REV 00
DOC TITLE	NEEMUCHS/S-400/220 kV SWICTHYARD ERECTION KEY DIAGRAM BOQ

## BILL OF QUANTITIES FOR CLAMPS AND CONNECTORS-NEEMUCH-220KV

S.NO.	ITEM DESCRIPTION	CLAMP NO.	UNIT	BAY WISE QUANTITY										TOTAL QUANTITY	
				ICT-1	ICT-2	BUS COUPLER	TRANSFER BAY	LINE-1	LINE-2	220KV MAIN BUS 1	220KV MAIN BUS 2	220KV TRANSFER BUS	COMMON		
14	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 3150A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR QUAD BERSIMIS	311	Nos	0	0	7	0	0	0	0	0	0	0	0	7
	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 1600A, WAVE TRAP CONNECTOR SUITABLE FOR TWIN BERSIMIS	402*	Nos	0	0	0	0	2	2	0	0	0	0	0	4
15	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 1600A, BPI CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, RIGID/SLIDING THROUGH TYPE	506	Nos	13	13	0	8	7	7	0	0	0	0	0	48
16	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 2000A, BPI CONNECTOR SUITABLE FOR TWIN BERSIMIS	507	Nos	0	0	0	0	3	3	0	0	0	0	0	6
17	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 3150A, BPI CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, RIGID/SLIDING THROUGH TYPE	508	Nos	0	0	5	0	0	0	0	0	0	0	0	5
	SUPPLY- CLAMPS & CONNECTORS : 216KV, 50KA FOR 1S, LIGHTNING ARRESTER CONNECTOR SUITABLE FOR TWIN BERSIMIS	602*	Nos	3	3	0	0	3	3	0	0	0	0	0	12
18	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 2000A, CVT CONNECTOR SUITABLE FOR TWIN BERSIMIS	702	Nos	0	0	0	0	3	3	3	3	0	0	0	12
35	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 2000A, ICT BUSHING CONNECTOR SUITABLE FOR TWIN BERSIMIS	1102	Nos	3	3	0	0	0	0	0	0	0	0	0	6
19	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 4000A, FLEXIBLE SPACER SUITABLE FOR QUAD BERSIMIS	804	Nos	0	0	42	0	0	0	114	114	0	0	0	270
20	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 4000A, RIGID SPACER SUITABLE FOR QUAD BERSIMIS	805	Nos	0	0	24	0	0	0	0	0	0	0	0	24
21	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 2000A, FLEXIBLE SPACER SUITABLE FOR TWIN BERSIMIS	806	Nos	141	141	0	0	0	0	0	0	114	0	0	396
22	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 2000A, RIGID SPACER SUITABLE FOR TWIN BERSIMIS	807	Nos	45	45	0	18	54	54	3	3	0	0	0	222
23	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 4000A, TEE CONNECTOR SUITABLE FOR QUAD BERSIMIS TO QUAD BERSIMIS	905	Nos	0	0	6	0	0	0	3	3	0	0	0	12
24	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 4000A, TEE CONNECTOR SUITABLE FOR QUAD BERSIMIS TO TWIN BERSIMIS	906	Nos	6	6	0	6	6	6	0	0	0	0	0	30

## 1401640/2023/TBG-TB\_HVDC

CUSTOMER	POWERGRID NEEMUCH TRANSMISSION SYSTEM LIMITED													
PROJECT	Substation Package SS01 for (i) 400/220kV AIS Neemuch New S/S including 400kV class Transformer & Bus Reactor, (ii) Extension of 400kV Chittorgarh S/S and (iii) Extension of 400kV Mandsaur S/S associated with Transmission system for evacuation of power from Neemuch REZ													
NOA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 &													
STATION	NEEMUCH													
CUSTOMER DOC ID	TB202213-1001684-SS3320-400kV-EKD-BOQ													
BHEL DOC ID	TB-1-418-316-002-BOQ-REV 00													
DOC TITLE	NEEMUCHS/S-400/220 kV SWICTHYARD ERECTION KEY DIAGRAM BOQ													
<b>BILL OF QUANTITIES FOR CLAMPS AND CONNECTORS-NEEMUCH-220KV</b>														
S.NO.	ITEM DESCRIPTION	CLAMP NO.	UNIT	BAY WISE QUANTITY										TOTAL QUANTITY
				ICT-1	ICT-2	BUS COUPLER	TRANSFER BAY	LINE-1	LINE-2	220KV MAIN BUS 1	220KV MAIN BUS 2	220KV TRANSFER BUS	COMMON	
25	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 2000A, TEE CONNECTOR SUITABLE FOR TWIN BERSIMIS TO TWIN BERSIMIS	907	Nos	3	3	0	3	3	3	0	0	0	0	15
26	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 4000A, TEE CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS TO QUAD CONDUCTOR	908	Nos	0	0	2	0	0	0	0	0	0	0	2
27	SUPPLY- CLAMPS & CONNECTORS : 220KV, 50KA FOR 1S, 2000A, TEE CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS TO TWIN CONDUCTOR	909	Nos	7	7	0	2	4	4	0	0	0	0	24
28	CLAMPS & CONNECTORS PG CLAMP FOR SHIELD WIRES OF DIA 10.98MM	1001	Nos	0	0	0	0	0	0	0	0	0	48	48
29	CLAMPS & CONNECTORS CLAMP FOR 10.98MM DIA SHIELD WIRE ON LATTICE / PIPE STRUCTURE	1002	Nos	0	0	0	0	0	0	0	0	0	216	216
30	SUPPLY- CLAMPS & CONNECTORS : STRAIN CLAMP FOR SHIELD WIRE 10.98MM DIA	1003	Nos	0	0	0	0	0	0	0	0	0	30	30
31	CLAMPS & CONNECTORS PAD CONNECTOR TO SUIT 10.98MM DIA GS WIRE AND 75X12 MM GS FLAT	1004	Nos	0	0	0	0	0	0	0	0	0	25	25
32	CLAMPS & CONNECTORS CLAMPS FOR 75X12MM EARTHING STRIP ON LATTICE/PIPE STRUCTURE	1005	Nos	0	0	0	0	0	0	0	0	0	1260	1260
33	SUPPLY- CLAMPS & CONNECTORS : 220KV, WELDING SLEEVE SUITABLE FOR 4.5 INCH IPS AL TUBE	1008	Nos	12	12	3	9	12	12	0	0	0	0	60
34	SUPPLY- CLAMPS & CONNECTORS : 220KV, CORONA BELL SUITABLE FOR 4.5 INCH IPS AL TUBE	1009	Nos	10	10	2	2	4	4	0	0	0	0	32

<b>CUSTOMER</b>	<b>POWERGRID NEEMUCH TRANSMISSION SYSTEM LIMITED</b>			
<b>PROJECT</b>	Substation Package SS01 for (i) 400/220kV AIS Neemuch New S/S including 400kV class Transformer & Bus Reactor, (ii) Extension of 400kV Chittorgarh S/S and (iii) Extension of 400kV Mandsaur S/S associated with Transmission system for evacuation of power from Neemuch REZ			
<b>NOA NO.</b>	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 &			
<b>STATION</b>	NEEMUCH			
<b>CUSTOMER DOC ID</b>	TB202213-1001684-SS3320-400kV-EKD-BOQ			
<b>BHEL DOC</b>	TB-1-418-316-002-BOQ-REV 00			
<b>DOC TITLE</b>	NEEMUCHS/S-400/220 kV SWICTHYARD ERECTION KEY DIAGRAM BOQ			
<b>BILL OF QUANTITIES FOR CLAMPS AND CONNECTORS-NEEMUCH-72.5 KV</b>				
<b>S.NO.</b>	<b>ITEM DESCRIPTION</b>	<b>CLAMP NO.</b>	<b>UNIT</b>	<b>QUANTITY</b>
1	SUPPLY- CLAMPS & CONNECTORS : 72.5KV, 25KA FOR 1S, 1250A, CB CONNECTOR SUITABLE FOR SINGLE BERSIMIS	104	NO.	6
2	SUPPLY- CLAMPS & CONNECTORS : 72.5KV, 25KA FOR 1S, 800A, CT CONNECTOR SUITABLE FOR SINGLE BERSIMIS	208	NO.	6
3	SUPPLY- CLAMPS & CONNECTORS : 72.5KV, 25KA FOR 1S, 1250A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR SINGLE BERSIMIS	312	NO.	3
4	SUPPLY- CLAMPS & CONNECTORS : 66KV, 25KA FOR 1S, PT CONNECTOR SUITABLE FOR SINGLE BERSIMIS	703	NO.	3
5	SUPPLY- CLAMPS & CONNECTORS : 72.5KV, 25KA FOR 1S, 1250A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR FIXING 33KV CABLE TERMINATION KIT	313	NO.	3
6	SUPPLY- CLAMPS & CONNECTORS : 72.5KV, 25KA FOR 1S, 1250A, BPI CONNECTOR SUITABLE FOR FIXING 33KV CABLE TERMINATION KIT	509	NO.	3
7	SUPPLY- CLAMPS & CONNECTORS : 30KV, 25KA FOR 1S, LIGHTNING ARRESTER CONNECTOR SUITABLE FOR SINGLE BERSIMIS	603*	NO.	3
8	SUPPLY- CLAMPS & CONNECTORS : 72.5KV, 25KA FOR 1S, 1250A, TEE CONNECTOR/PG CONNECTOR SUITABLE FOR SINGLE BERSIMIS TO SINGLE BERSIMIS	910#	NO.	6
9	SUPPLY- CLAMPS & CONNECTORS : 66KV, 25KA FOR 1S, 3150A, BUSHING CONNECTOR SUITABLE FOR CABLE TERMINATION	1104	NO.	3

## Note:

- 1 Clamp marked with \* will be supplied by equipment supplier.
- 2 Clamp marked with # will be supplied by ETC contractor.

## 1401640/2023/TBG-TB\_HVDC

CUSTOMER	POWERGRID NEEMUCH TRANSMISSION SYSTEM LIMITED												
PROJECT	Substation Package SS01 for (i) 400/220kV AIS Neemuch New S/S including 400kV class Transformer & Bus Reactor, (ii) Extension of 400kV Chittorgarh S/S and (iii) Extension of 400kV Mandsaur S/S associated with Transmission system for evacuation of power from Neemuch REZ												
NOA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 &												
STATION	NEEMUCH												
CUSTOMER DOC ID	TB202213-1001684-SS3320-400kV-EKD-BOQ												
BHEL DOC ID	TB-1-418-316-002-BOQ-REV 00												
DOC TITLE	NEEMUCHS/S-400/220 kV SWICHTYARD ERECTION KEY DIAGRAM BOQ												
<b>Bill of Quantity - String Insulators Hardware - Neemuch Station (400kV)</b>													
S.No	Engineering Description	Nomenclature	Sl. No. as per BPS	Description as per BPS	LINE-TIE-LINE	LINE-TIE-LINE	REACTOR-TIE-ICT-1	FUTURE-TIE-ICT2	400KV MAIN BUS 1	400KV MAIN BUS 2	Engineered Quantity Total (Nos)	Quantity as per BPS (Nos)	REMARKS
<b>Tension Hardware</b>													
1	400 kV Double Tension Hardware with Turnbuckle suitable for Quad ACSR Bersimis Conductor	4DTT-QB	35	400KV TENSION INSULATOR STRING AND ASSOCIATED HARDWARE FITTINGSWITH TURN BUCKLE SUITABLE FOR QUAD CONDUCTOR	6	6	6	6	6	6	36	48	--
2	400 kV Double Tension Hardware with Turnbuckle suitable for Quad AL59 Moose Conductor - Line Side	4DTT-QM			6	6	--	--	--	--	12		--
3	400 kV Double Tension Hardware without Turnbuckle suitable for Quad ACSR Bersimis Conductor	4DT-QB	36	400KV TENSION INSULATOR STRING AND ASSOCIATED HARDWARE FITTINGSWITHOUT TURN BUCKLE SUITABLE FOR QUAD CONDUCTOR	6	6	6	6	6	6	36	36	--
<b>Suspension Hardware</b>													
1	400 kV Single Suspension Hardware with <b>Drop</b> Clamp suitable for Quad ACSR Bersimis Conductor	4SSD-QB	38	400KV SUSPENSION INSULATOR STRING AND ASSOCIATED HARDWARE FITTINGSWITH DROP CLAMP SUITABLE FOR QUAD CONDUCTOR	6	6	--	--	--	--	12	12	--
2	400 kV Single Suspension Hardware with <b>Drop</b> Clamp suitable for Twin ACSR Bersimis Conductor	4SSD-TB	--	Item Not Covered in BPS	--	--	6	3	--	--	9	not available	New Type Requires Customer Contract Amendment
<b>COMPOSITE LONG ROD POLYMER INSULATOR-400KV</b>													
1	400KV COMPOSITE LONG ROD POLYMER INSULATOR - 31mm/kV, 120kN - For Tension Insulators		--	--	--	--	--	--	--	--	168	--	Included in Hardware
2	400KV COMPOSITE LONG ROD POLYMER INSULATOR - 31mm/kV, 120kN - For suspension Insulators		--	--	--	--	--	--	--	--	21	--	Included in Hardware

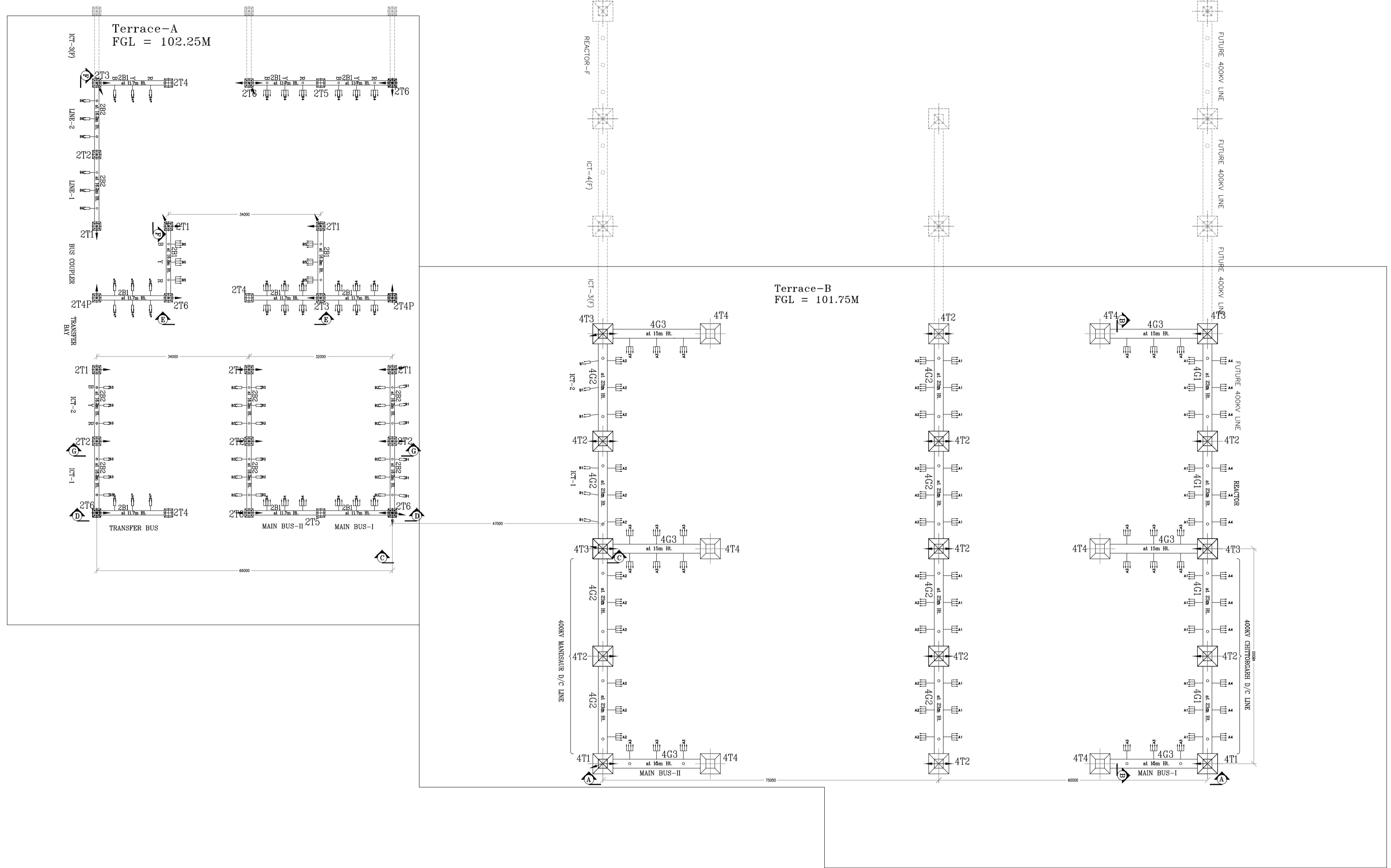
CUSTOMER	POWERGRID NEEMUCH TRANSMISSION SYSTEM LIMITED														
PROJECT	Substation Package SS01 for (i) 400/220kV AIS Neemuch New S/S including 400kV class Transformer & Bus Reactor, (ii) Extension of 400kV Chittorgarh S/S and (iii) Extension of 400kV Mandsaur S/S associated with Transmission system for evacuation of power from Neemuch REZ														
NOA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 &														
STATION	NEEMUCH														
CUSTOMER DOC ID	TB202213-1001684-SS3320-400KV-EKD-BOQ														
BHEL DOC ID	TB-1-418-316-002-BOQ-REV 00														
DOC TITLE	NEEMUCHS/S-400/220 KV SWICHTHYARD ERECTION KEY DIAGRAM BOQ														
<b>Bill of Quantity - String Insulators Hardware - Neemuch Station (220kV)</b>															
S.No	Engineering Description	Nomenclature	Sl. No. as per BPS	Description as per BPS	220KV ICT 1	220KV ICT 2	220KV LINE 1	220KV LINE 1	220KV BUS COUPLER	220KV MAIN BUS 1	220KV MAIN BUS 2	220KV TRANSFER BUS	Engineered Quantity Total (Nos)	Quantity as per BPS (Nos)	REMARKS
<b>Tension Hardware</b>															
1	220 kV Double Tension Hardware without Turnbuckle suitable for Quad ACSR Bersimis Conductor	2DT-QB	44	220KV TENSION INSULATOR STRING AND ASSOCIATED HARDWARE FITTINGS WITHOUT TURN BUCKLE SUITABLE FOR QUAD CONDUCTOR	--	--	--	--	3	6	6	--	15	18	--
2	220 kV Double Tension Hardware without Turnbuckle suitable for Twin ACSR Bersimis Conductor	2DT-TB	45	220KV TENSION INSULATOR STRING AND ASSOCIATED HARDWARE FITTINGS WITHOUT TURN BUCKLE SUITABLE FOR TWIN CONDUCTOR	9	9	--	--	--	--	--	6	24	21	Amendment Required for additional 3 No.
3	220 kV Double Tension Hardware with Turnbuckle suitable for Twin ACSR Bersimis Conductor	2DTT-TB	46	220KV TENSION INSULATOR STRING AND ASSOCIATED HARDWARE FITTINGS WITH TURN BUCKLE SUITABLE FOR TWIN CONDUCTOR	9	9	--	--	--	--	--	6	24	27	--
4	220 kV Double Tension Hardware with Turnbuckle suitable for Quad ACSR Bersimis Conductor	2DTT-QB	47	220KV TENSION INSULATOR STRING AND ASSOCIATED HARDWARE FITTINGS WITH TURN BUCKLE SUITABLE FOR QUAD CONDUCTOR	--	--	--	--	3	6	6	--	15	18	--
5	220 kV Double Tension Hardware with Turnbuckle suitable for Single Zebra Conductor - Line Side	2DTT-SZ	--	Item Not Covered in BPS	--	--	3	3	--	--	--	--	6	not available	New Type Requires Customer Contract Amendment
<b>Suspension Hardware</b>															
1	220 kV Single Suspension Hardware with <b>Through</b> Clamp suitable for Twin ACSR Bersimis Conductor	2SST-TB	48	220KV SUSPENSION INSULATOR STRING AND ASSOCIATED HARDWARE FITTINGS WITH THROUGH CLAMP SUITABLE FOR TWIN CONDUCTOR	6	6	--	--	--	--	--	3	15	6	Amendment Required for additional 9 No.
2	220 kV Single Suspension Hardware with <b>Drop</b> Clamp suitable for Twin ACSR Bersimis Conductor	2SSD-TB	49	220KV SUSPENSION INSULATOR STRING AND ASSOCIATED HARDWARE FITTINGS WITH DROP CLAMP SUITABLE FOR TWIN CONDUCTOR	6	6	3	3	--	--	--	--	12	6	Amendment Required for additional 6 No.
3	220 kV Single Suspension Hardware with <b>Drop</b> Clamp suitable for Quad ACSR Bersimis Conductor	2SSD-QB	--	Item Not Covered in BPS	--	--	--	--	6	--	--	--	6	not available	New Type Requires Customer Contract Amendment
<b>COMPOSITE LONG ROD POLYMER INSULATOR-220KV</b>															
1	220KV COMPOSITE LONG ROD POLYMER INSULATOR - 31mm/kV, 120kN - For Tension Insulators	--	--	--	--	--	--	--	--	--	--	--	168	--	Included in Hardware
2	220KV COMPOSITE LONG ROD POLYMER INSULATOR - 31mm/kV, 120kN - For suspension Insulators	--	--	--	--	--	--	--	--	--	--	--	33	--	Included in Hardware

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DRAWING NO. TB-1-418-316-005

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**LOADING DETAILS:-**

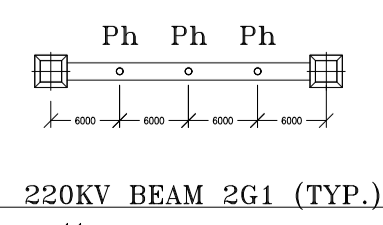
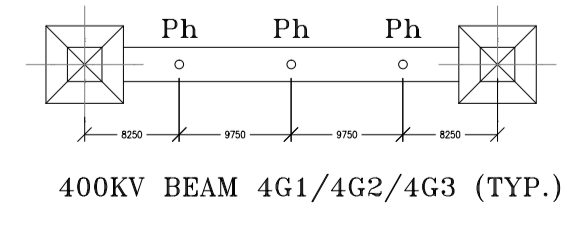
NOTATION	VOLTAGE (KV)	NO. & TYPE OF COND. AND SPAN PER PHASE	NORMAL TENSION PER PHASE(KG)	SPACER SPAN (m)	S/C TENSION PER PHASE (KG)	DEVIATION (Degree)
A1-E	400	QUAD ACSR BERSIMIS 60000 MM	5000	4.0	6869.44	±0°
A2-E	400	QUAD ACSR BERSIMIS 75000 MM	5000	4.0	7703.18	±10°
A3-E	400	QUAD ACSR BERSIMIS 48000 MM	5000	4.0	6665.13	±0°
A4-E	400	QUAD CONDUCTOR (TO BE CONFIRMED BY POWERGRID) 200000 MM(SLACK SPAN)	5000	4.0	NA	±30°
B1-C	220	TWIN ACSR BERSIMIS 47000 MM	2000	2.0	3544.66	±30°
B2-C	220	TWIN ACSR BERSIMIS 32000 MM	2000	2.0	3328.28	±0°
B3-C	220	TWIN ACSR BERSIMIS 34000 MM	2000	2.0	3359.30	±0°
B4-E	220	QUAD ACSR BERSIMIS 48000 MM	4000	2.0	4815.66	±0°
△B4*-C	220	△TWIN ACSR BERSIMIS 48000 MM	△ 2000	2.0	△ 4815.66	±0°
B5-E	220	QUAD ACSR BERSIMIS 34000 MM	4000	2.0	4549.22	±0°
B6-C	220	TWIN CONDUCTOR (TO BE CONFIRMED BY POWERGRID) 200000 MM(SLACK SPAN)	2000	2.0	NA	±30°
S →	NA	SHIELD WIRE	800	NA	NA	NA

**TOWER DETAIL :-**

TOWERS DESIGNATION	STR. HEIGHT DETAIL ABOVE PLINTH (m)	TYPE	QUANTITY (NOS.)
4T1	15+8+7.5M(P)=30.5M	END	02
4T2	23+7.5M(P)=30.5M	MIDDLE	09
4T3	15+8+7.5M(P)=30.5M	MIDDLE	04
4T4	15M	END	06
2T1	16.2+5M(P)=21.2M	END	06
2T2	16.2+5M(P)=21.2M	MIDDLE	04
2T3	11.7+4.5+5M(P)=21.2M	MIDDLE	02
△ 2T4P	11.7+5M(P)=16.7M	END	02
△ 2T4	11.7M	END	03
△ 2T5	11.7M	MIDDLE	02
△ 2T6	11.7+4.5+5M(P)=21.2M	CORNER	06
NO. OF TOWERS			46

**BEAM DETAIL :-**

BEAM TYPE	HEIGHT ABOVE PLINTH (M)	BEAM LENGTH (M)	QUANTITY (NOS.)	BEAM TYPE	HEIGHT ABOVE PLINTH (M)	BEAM LENGTH (M)	QUANTITY (NOS.)
4G1	23	24	04	2B1	16.2/11.7	16	△ 02/09
4G2	23	24	08	2B2	16.2	16	08
4G3	15	24	06	NO. OF BEAMS			19
NO. OF BEAMS			18				



REV.	DATE	ALTERED BY	SY
02	25.01.23	CHECKED	SS
		APPROVED	SKS

ZONE REVISOR AS PER LAYOUT PLAN-REV 02

REV.	DATE	ALTERED BY	SY
01	03.11.22	CHECKED	SS
		APPROVED	SKS

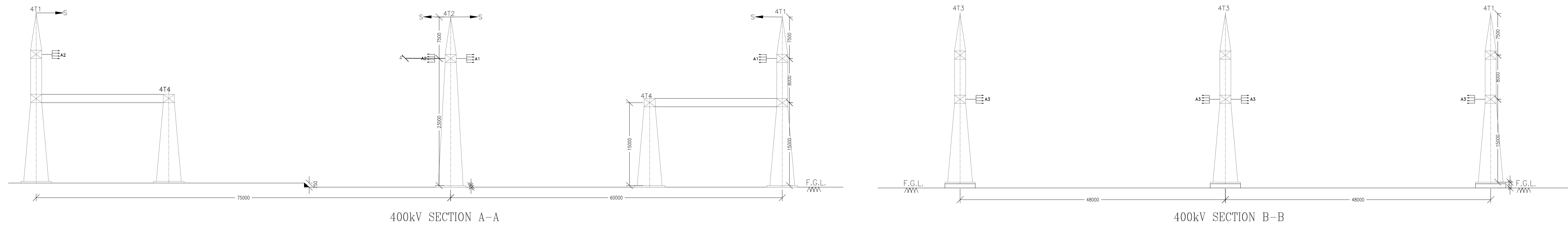
ZONE REVISOR AS PER CUSTOMER COMMENTS VIA LETTER NO-CC-ENG-TR02213-1001684-383320-400KV-STR-LAY Dated: 02.11.2022

CA NO.	TBCB/Neemuch REZ/400kv AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 TBCB/Neemuch REZ/400kv AIS/SS01/G5/NOA-II/06 dtd. 23/09/2022		
ADDITIONAL INFORMATION W.O.No.	ग्राहक/परियोजना का नाम POWER GRID CORPORATION OF INDIA LIMITED		
STATUS OF DRAWING	NAME OF CUSTOMER/PROJECT NEEMUCH 400/220KV SUBSTATION		
DISTRIBUTION OF PRINTS	भारत हेवी इलेक्ट्रिकल्स लिमिटेड भारतीय भारती परियोजना विभाग BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION	ड्राफ्ट / NAME SANJAY	हस्ता /SIGN. SANJAY
	ड्राफ्ट / CHECKED SHOBHNA	ड्राफ्ट / APPROVED SKS	दि. / DATE 18.10.22
	ड्राफ्ट / TITLE NEEMUCH S/S-400/220 kV SWITCHYARD STRUCTURAL LAYOUT PLAN & SECTION	ड्राफ्ट / ड्राफ्ट नं. /DRAWING NO. TB-1-418-316-005	पृष्ठ नं. /REV. 02

COMPUTER DRG. PATH NAME :  
SIGN. & DATE  
INVENTORY No.

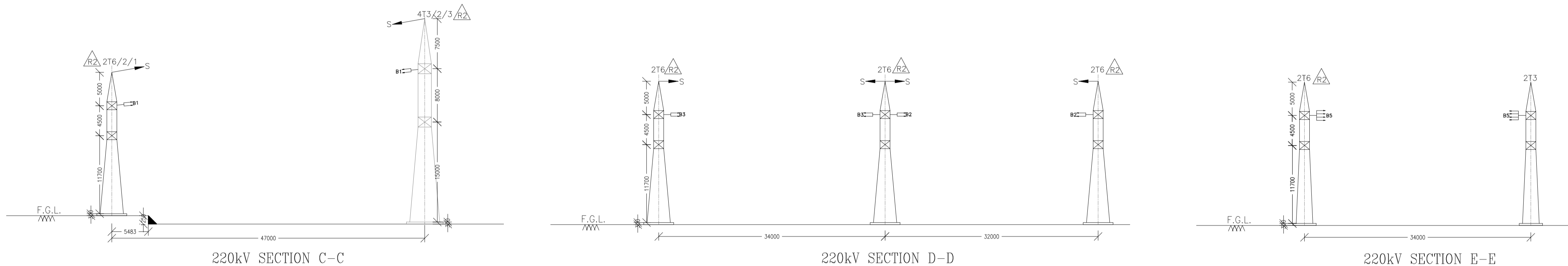
DRAWING NO. TB-1-418-316-005

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400kV SECTION A-A

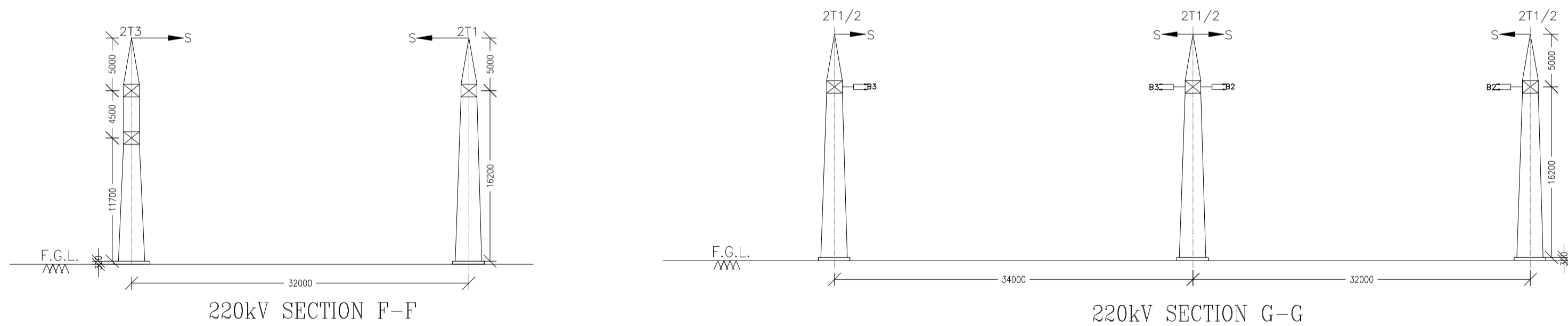
400kV SECTION B-B



220kV SECTION C-C

220kV SECTION D-D

220kV SECTION E-E



220kV SECTION F-F

220kV SECTION G-G

COMPUTER DRG. PATH NAME :  
SIGN. & DATE REF. DRG. No.  
INVENTORY No.

CA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-II/06 dtd. 23/09/2022																
ADDITIONAL INFORMATION W.O.No.	आह्वक/परियोजना का नाम POWER GRID CORPORATION OF INDIA LIMITED																
STATUS OF DRAWING	NAME OF CUSTOMER/PROJECT NEEMUCH 400/220KV SUBSTATION																
DISTRIBUTION OF PRINTS	<table border="1"> <tr> <td>ड्रॉइंग DRAWN</td> <td>भारत हेवी इलेक्ट्रिकल्स लिमिटेड भारतीय भारी परियोजना विभाग</td> <td>नाम /NAME</td> <td>हस्ता /SIGN.</td> <td>दि./DATE</td> </tr> <tr> <td>ड्रॉइंग CHECKED</td> <td>BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION</td> <td>SHOBHNA</td> <td>SANJAY</td> <td>18.10.22</td> </tr> <tr> <td>ड्रॉइंग APPROVED</td> <td></td> <td>SKS</td> <td></td> <td></td> </tr> </table>	ड्रॉइंग DRAWN	भारत हेवी इलेक्ट्रिकल्स लिमिटेड भारतीय भारी परियोजना विभाग	नाम /NAME	हस्ता /SIGN.	दि./DATE	ड्रॉइंग CHECKED	BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION	SHOBHNA	SANJAY	18.10.22	ड्रॉइंग APPROVED		SKS			
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REV.	DATE	ALTERED BY	डिप्ट. DEPT.	अनुपात / SCALE	कार्ड कोड CARD CODE	पावरग्रीड ड्राईंग.क./POWERGRID DRAWING NO.											
02	25.01.23	CHECKED/SS APPROVED/SS	03.11.22	1:1	TB020213-1001684-SS3320-400KV-STR-LAY												
ZONE	REVISED AS PER LAYOUT PLAN-REV 02		ZONE	REVISED AS PER CUSTOMER COMMENTS VIA LETTER NO-CC-8400-TB020213-1001684-SS3320-400KV-STR-LAY Dated 02.11.2022													
शीर्षक/TITLE NEEMUCH S/S-400/220 kV SWITCHYARD STRUCTURAL LAYOUT PLAN & SECTION			ड्राईंग.क./DRAWING NO. TB-1-418-316-005		पृष्ठ/REV. 02												
			पृष्ठ क./SHEET No.02		अगला पृष्ठ/NEXT SHEET --												

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FIRST ANGLE PROJECTION ( ALL DIMENSIONS ARE IN MM. )

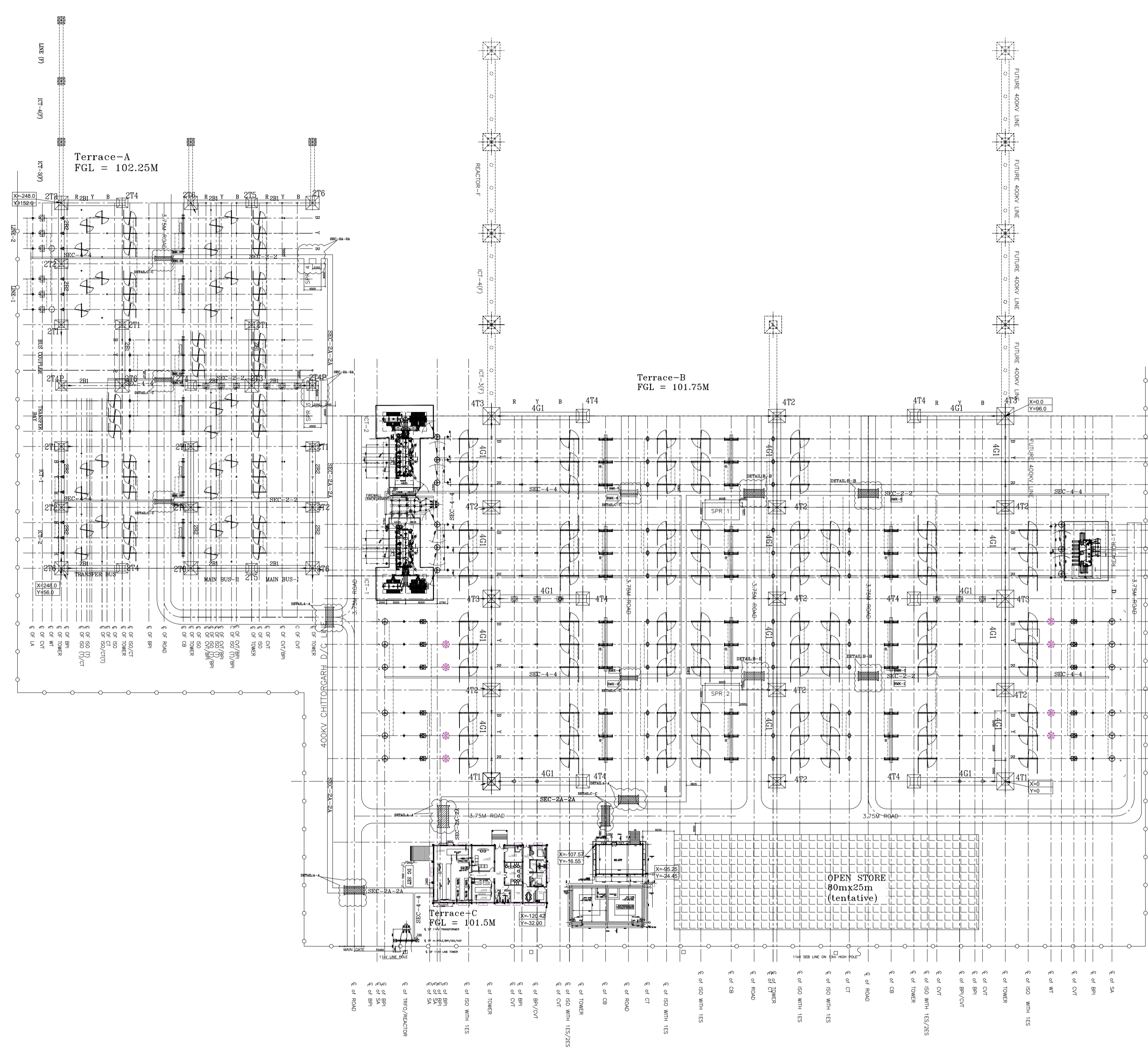
DRAWING NO. TB-1-418-316-001A

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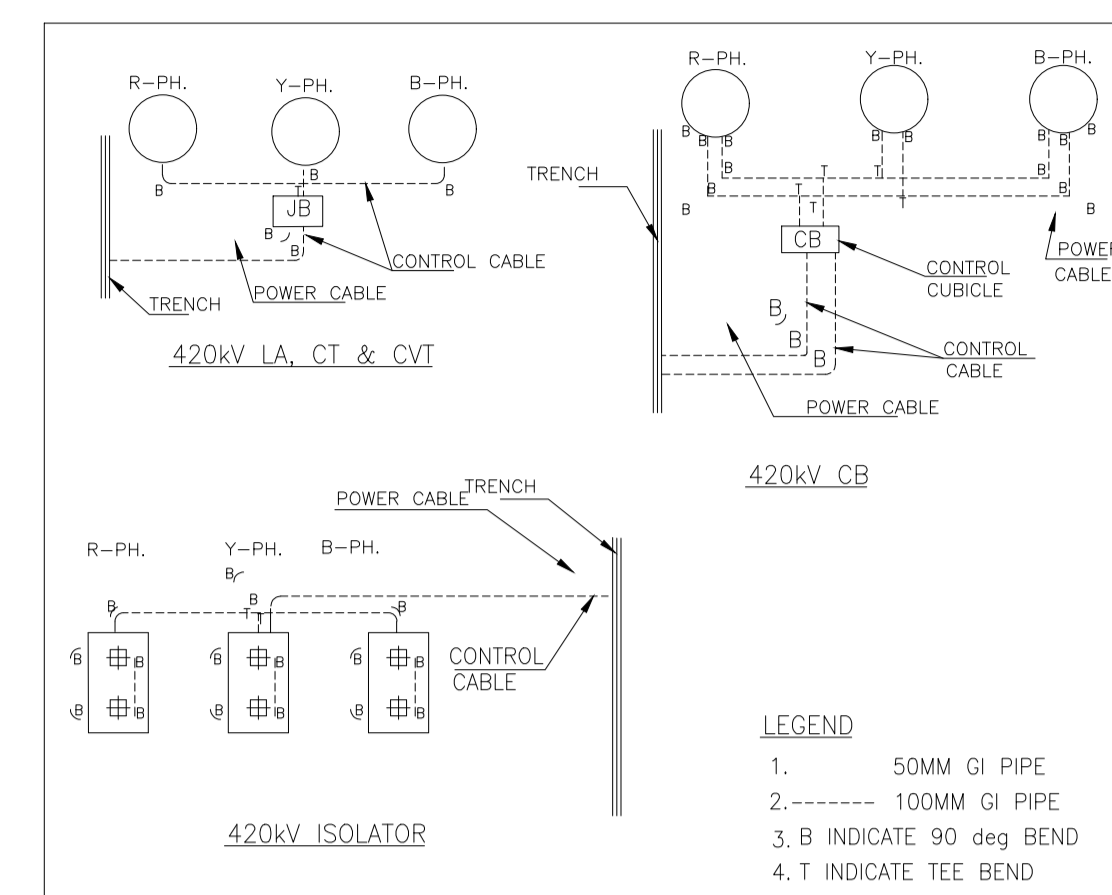
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SIGN & DATE REF. DRG. No.

INVENTORY No.

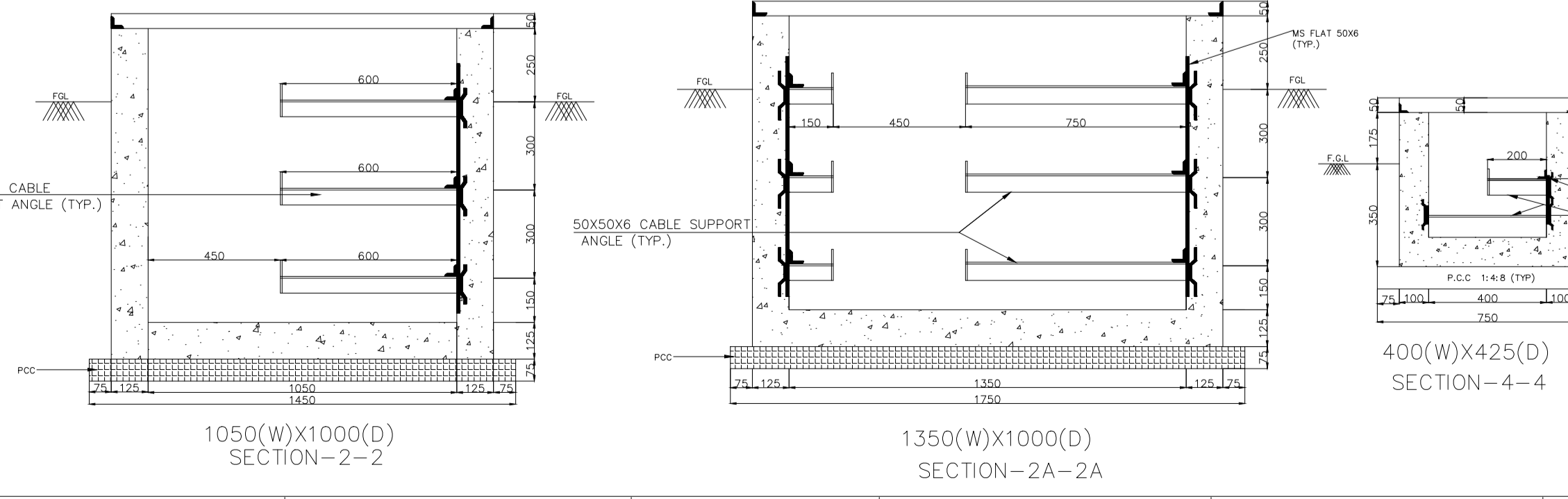
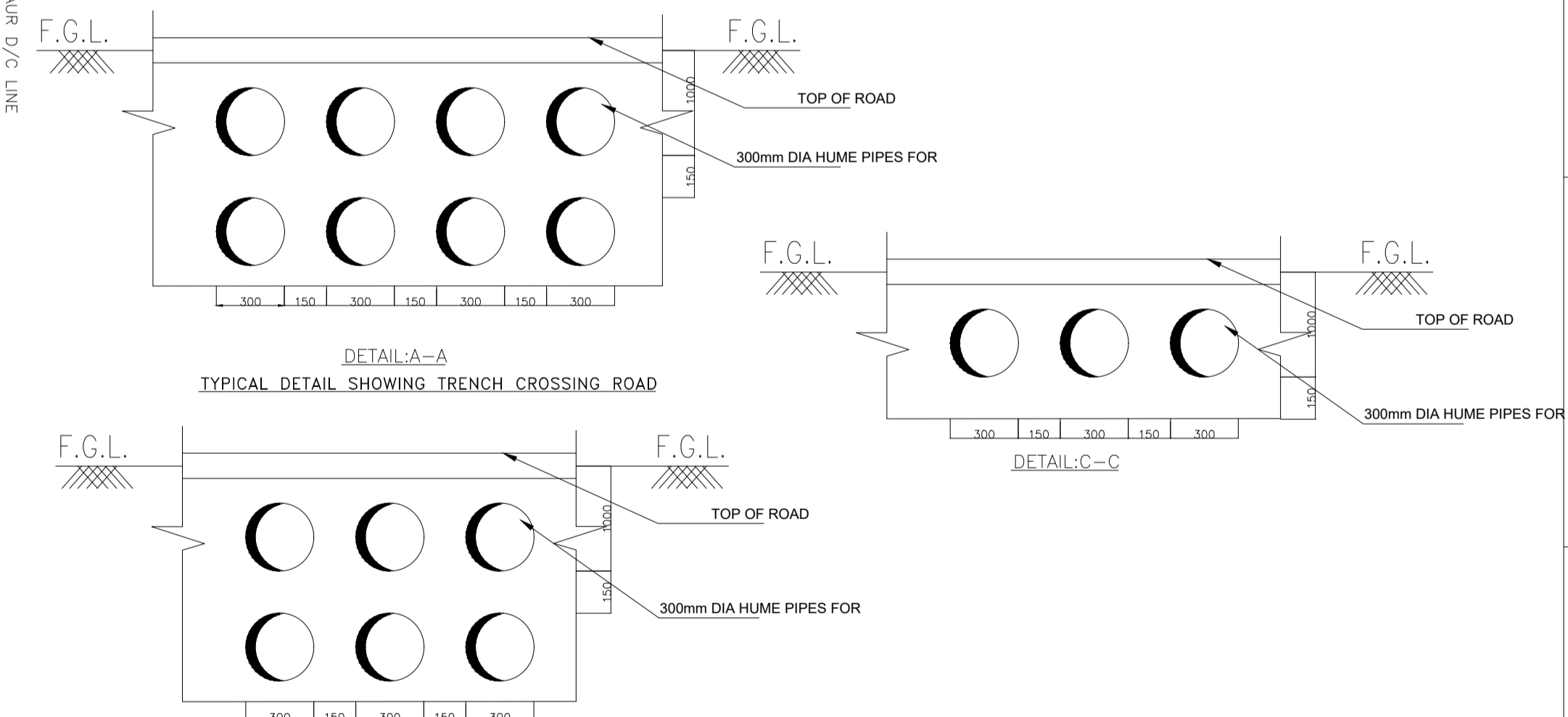


PVC PIPE DETAILS OF 420/220 kV EQUIPMENTS



NOTE--

- ALL DIMENSIONS ARE IN MM.
- THE LOCATION OF CABLE TRENCHES MARKED IN THIS DWG MAY BE SLIGHTLY MODIFIED TO SUIT SITE CONDITIONS.
- OPENINGS FOR TAKING OUT PVC PIPES TO EQUIPMENTS SHALL BE PROVIDED AT APPROPRIATE LOCATION IN CABLE TRENCHES. SIZE OF OPENING SHALL BE SUITABLE TO DIA. 50/110 PIPE SHALL BE PROVIDED BELOW TOP CABLE SUPPORT.
- CABLES SHALL BE LAID IN MULTILAYER ON CABLE SUPPORT (ANGLES).
- CABLE SUPPORT SHALL BE PROVIDED AT EVERY 0.75m INTERVAL.
- INSERTS MUST BE EMBEDDED AT EVERY 750mm INTERVAL, FOR FIXING CABLE SUPPORT.
- AUXILIARY POWER CABLES SHALL BE LAID IN TOP TIERS AND CONTROL CABLES IN BOTTOM TIERS, AS PER TECHNICAL SPECIFICATION.
- BURIED CABLES FOR LIGHTING PURPOSE SHALL BE AS PER LIGHTING LAYOUT.
- EARTH CONDUCTOR 50x6 MS FLAT SHALL BE RUN ALONG THE TOP TIER AND TO BE WELDED ON THE CABLE SUPPORT BEFORE INSTALLATION OF CABLES.
- DETAILS OF CABLE TRENCHES AND ITS ROAD CROSSING SHALL BE AS PER POWERGRID STANDARD DRAWINGS.
- FOR POWER & CONTROL SEPARATE PIPES SHALL BE USED CONSIDERING 60% VOID FOR EACH PIPE I.E., 40% FILLING CRITERIA. ACCORDINGLY, ADDITIONAL PIPES (IF REQUIRED) WILL BE PROVIDED AS PER SITE CONDITION.
- PVC PIPES SHALL BE SECURELY FIXED AT BOTH ENDS, EITHER EMBEDDED IN CONCRETE OR PROPERLY CLAMPED.
- AFTER LAYING THE CABLES THE ENDS OF PIPES SHALL BE FULLY SEALED TO PREVENT INGRESS OF WATER INSIDE THE PIPE.
- CABLE RACK AND SUPPORTS SHALL BE PAINTED AFTER INSTALLATION WITH 2 COATS OF METAL PRIMER (COMPRISING OF RED OXIDE & ZINC CHROMATE IN A SYNTHETIC MEDIUM) FOLLOWED BY TWO FINISHING COAT OF ALUMINIUM PAINT.
- SUITABLE PULL OUT BOX SHALL BE PROVIDED (IF REQUIRED), WHERE CABLE SHALL BE LAID IN PVC PIPE.
- LONGITUDINAL SLOPE IN CABLE TRENCH SHALL BE AS PER CIVIL DRG.
- FOR ALL CIVIL WORKS EXECUTION POWERGRID APPROVED/RELEASED DRGS SHALL BE FOLLOWED.
- PROVISION FOR CONNECTING EARTH FLAT TO EXTERNAL EARTH GRID AT AN INTERVAL OF 30 METRE SHALL BE PROVIDED.
- ALL CABLE FROM BAY CABLE TRENCH TO EQUIPMENT AND ALL INTERPOLE CABLES (BOTH POWER & CONTROL) FOR ALL EQUIPMENT SHALL BE LAID IN PVC PIPE.
- FIBRE OPTIC CABLES SHALL RUN THROUGH G.I. PIPES IN BOTTOM TIER OF TRENCH/ANGLE SIZE 150mm (AS APPLICABLE).
- THE PURPOSE OF TRENCH LAYOUT DRAWING IS FOR USE AS FOLLOWS: -- TO BE USED AS CIVIL INPUT FOR CABLE TRENCHES, FOR ERECTION OF CABLE RACKS AT SITE. -- FOR CABLE LAYING AND ROUTING AT SITE.
- ALL OTHER DETAILS PERTAINING TO CIVIL WORKS SHALL BE REFLECTED IN THE RESPECTIVE CIVIL DRAWINGS.
- LOCATION OF LINE SIDE EQUIPMENTS WT, CVT, BPI & LA ARE INDICATIVE. FINAL LOCATION SHALL BE AFTER DEAD END TOWER LOCATION IS FINALISED (IF REQUIRED).
- INDICATES CABLES LAID IN PVC PIPES OF 50/110mm OUTER DIA AT DEPTH OF 300mm (MAX.) CABLE FROM EQUIPMENT TO CABLE TRENCH SHALL RUN IN PVC PIPES.
- INDICATE CABLE TRENCH.
- INDICATE PIPE CULVERT.
- 400KV BAY MK MARKED BMK-1 TO BMK-7
- 220KV BAY MK MARKED BMK-01 TO BMK-06
- TRENCH CROSSING DETAIL ARE INDICATIVE OF THE REQUIREMENT OF NO. OF PIPES. CONSTRUCTION DETAILS SHALL BE ACCORDING TO CIVIL DRAWING.



CA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-1/05 dtd. 23/09/2022 TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-II/06 dtd. 23/09/2022																
ADDITIONAL INFORMATION W.O.No.	आवक/परियोजना का नाम POWER GRID CORPORATION OF INDIA LIMITED																
STATUS OF DRAWING	NAME OF CUSTOMER/PROJECT NEEMUCH 400/220KV SUBSTATION																
DISTRIBUTION OF PRINTS	<table border="1"> <tr> <th>क्रमांक</th> <th>भाग / NAME</th> <th>रिक्तता / SIGN.</th> <th>दि./DATE</th> </tr> <tr> <td>1</td> <td>SANJAY</td> <td>-sd-</td> <td>20.02.23</td> </tr> <tr> <td>2</td> <td>SHOBHNA</td> <td>-sd-</td> <td>20.02.23</td> </tr> <tr> <td>3</td> <td>SKS</td> <td>-sd-</td> <td>20.02.23</td> </tr> </table>	क्रमांक	भाग / NAME	रिक्तता / SIGN.	दि./DATE	1	SANJAY	-sd-	20.02.23	2	SHOBHNA	-sd-	20.02.23	3	SKS	-sd-	20.02.23
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NTS	NTS	79800213-1001084-SS330-400KV-CAPTR-LAY															
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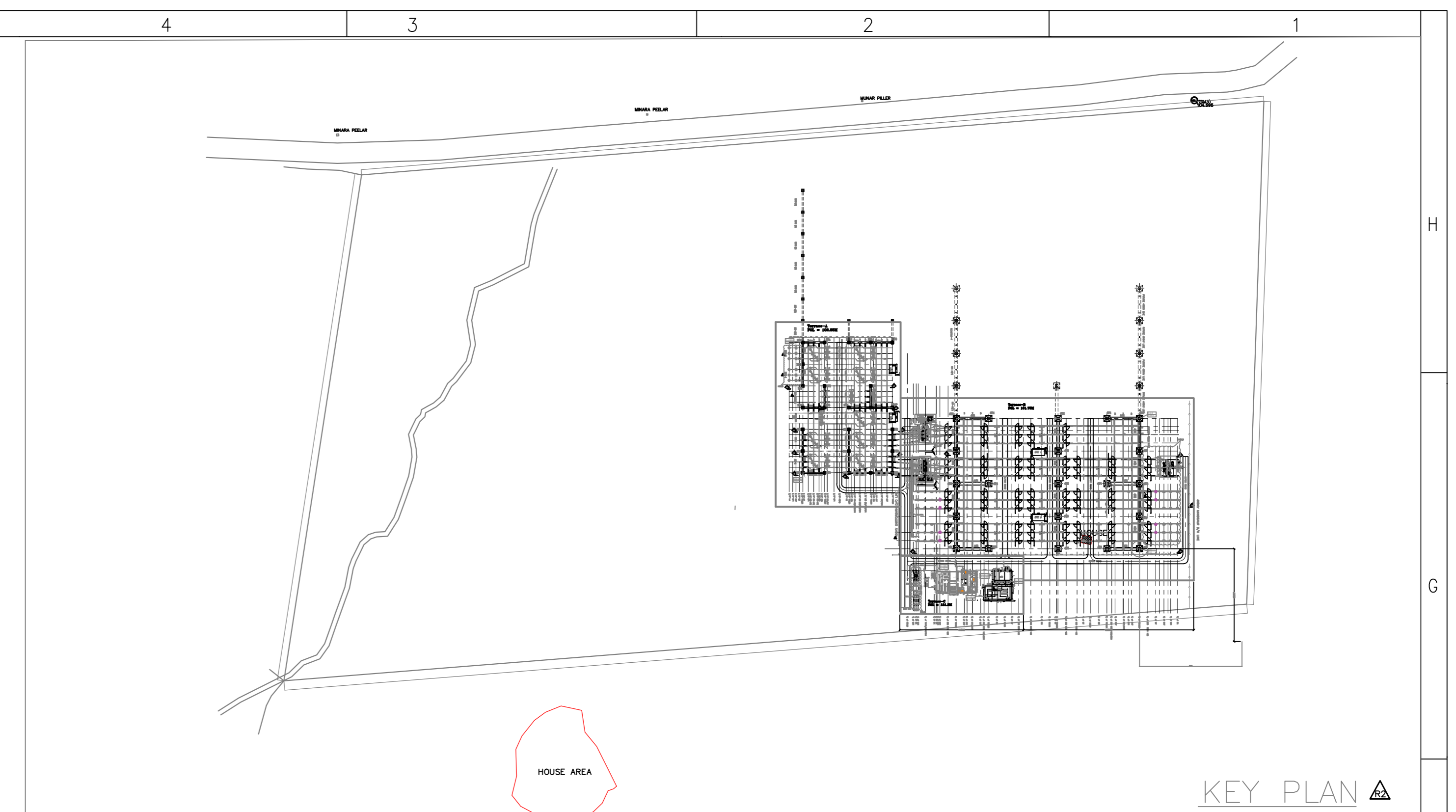
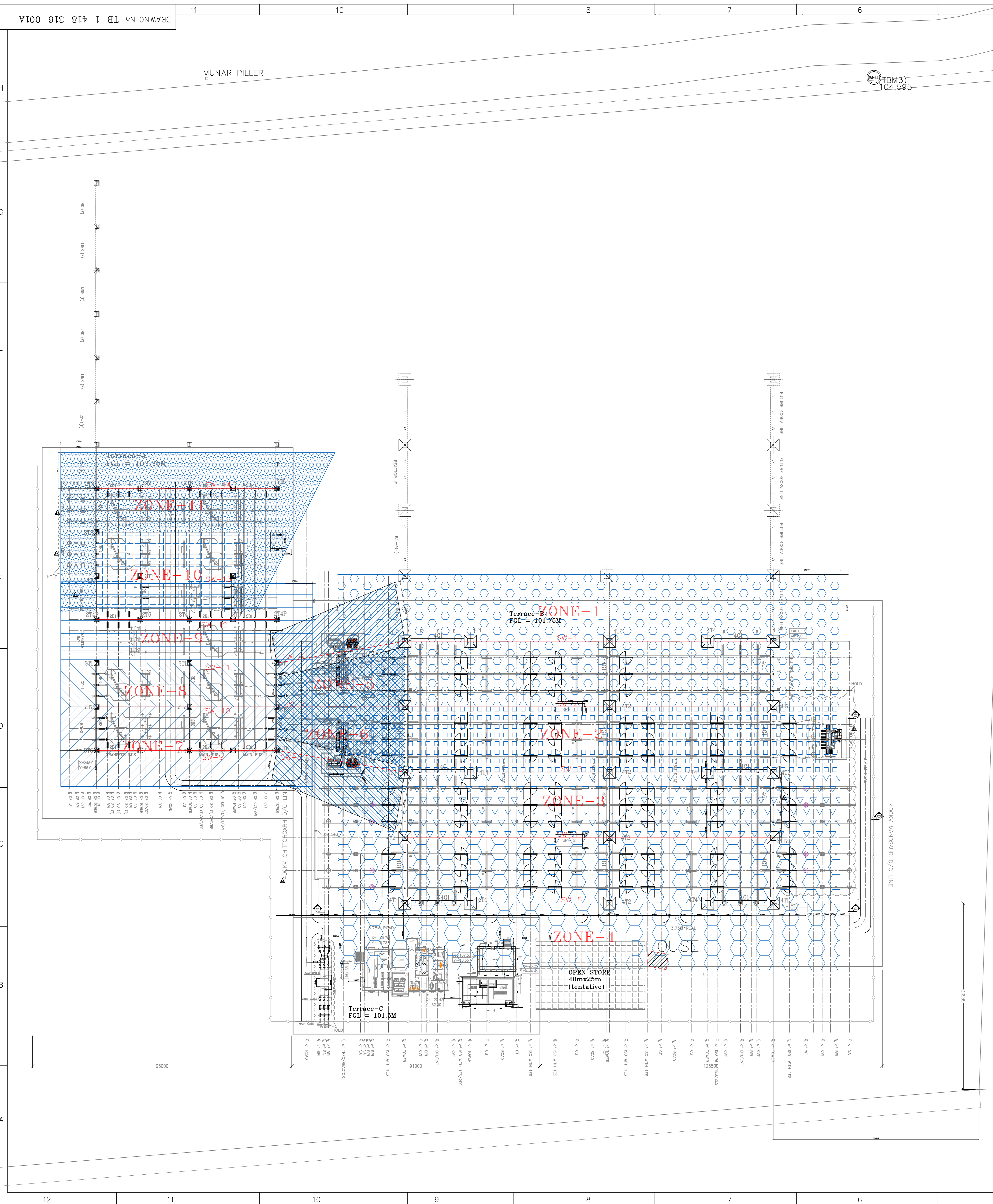
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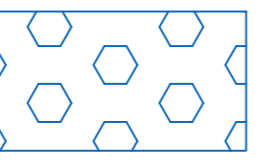
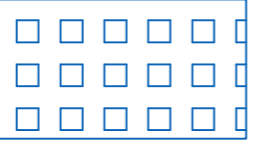
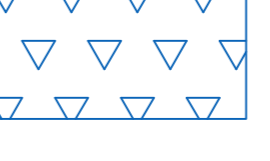








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COMPUTER DRG. PATH NAME :


SIGN. & DATE REF. DRG. No.

INVENTORY No.



-  ZONE-1
-  ZONE-2
-  ZONE-3
-  ZONE-4
-  ZONE-5
-  ZONE-6
-  ZONE-7
-  ZONE-8
-  ZONE-9
-  ZONE-10
-  ZONE-11

REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED
		APPROVED			APPROVED

CA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-II/06 dtd. 23/09/2022				
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DISTRIBUTION OF PRINTS		आवरल हेवी इलेक्ट्रिकल्स लिमिटेड भारत भारी इलेक्ट्रिकल्स लिमिटेड	जाम /NAME SANJAY	हस्ता./SIGN. -sd-	दि./DATE 15.02.23
		भारत भारी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION	चेक/checked SHOBHNA	-sd-	15.02.23
			स्वीकृत/Approved SKS	-sd-	15.02.23
			अनुपात / SCALE NTS	कार्ड कोड CARD CODE	पावर ग्रीड ड्राइंग नं./POWERGRID DRAWING NO. TB202213-1001084-SS3320-400kV-DSLP-LAY
			शीर्षक/TITLE NEEMUCH/S-400/220 kV SWICHYARD DSLP LAYOUT	ड्राइंग नं./DRAWING NO. TB-1-418-316-008	पृष्ठ/REV. 00
				पृष्ठ नं./SHEET No. 01	अगला पृष्ठ/NEXT SHEET --

## 1401640/2023/TBG-TB\_HVDC ANNEXURE-MANDATORY SPARES-NEEMUCH

S.No	Description	Unit	400/ 220 kV Neemuch
<b>1</b>	<b>400/220/33kV, 500MVA, AUTO TRANSFORMER</b>		
a)	Bushing (of each voltage rating) with Metal part & gaskets.	Set	1
b)	Oil cooler pumps with motor	Set	1
c)	Cooler Fan with motor	Set	1
d)	Buchholz relay, complete with floats & contacts for main tank	Set	1
e)	Local Winding temperature indicator with sensing device & contact	Set	1
f)	Magnetic oil level gauge	No.	1
g)	Set of starters, contactors, relays and switches for electrical control panel (one set of each type)	Set	1
h)	Oil flow indicator with flow switch	Set	1
i)	Spare Insulating Oil	KL	5
j)	Local Oil temperature indicator with sensing device & contact	Set	1
<b>2</b>	<b>400kV Class Bus Reactor</b>		
a)	Bushing (of each voltage rating) with Metal part & gaskets.	Set	1
b)	Buchholz relay, complete with floats & contacts for main tank	Set	1
c)	Local Winding temperature indicator with sensing device & contact	Set	1
d)	Magnetic oil level gauge	No.	1
e)	Set of starters, contactors, relays and switches for electrical control panel (one set of each type)	Set	1
f)	Spare Insulating Oil	KL	5
g)	Local Oil temperature indicator with sensing device & contact	No.	1
<b>3</b>	<b>420kV Circuit Breaker</b>		
a)	Complete Pole (Phase) of circuit Breaker including closing resistor (if applicable), grading capacitor (if applicable), Pole column, interrupter, operating mechanism, marshaling box, corona ring (if applicable) but without support structure <b>(420kV, 3150A, 63kA)</b>	Pole (No.)	1
b)	Grading Capacitor (if applicable)	Nos.	2
c)	Rubber Gasket "O Ring" and seals	Set	1
d)	Trip coils with resistor (as applicable)	Set	2
e)	Closing coils with resistor (as applicable)	Set	2
f)	Terminal Pads (One No of each type)	Set	2
g)	Molecular filter	Nos.	2
h)	Corona Rings (if applicable)	Nos.	1

## 1401640/2023/TBG-TB\_HVDC ANNEXURE-MANDATORY SPARES-NEEMUCH

i)	Relay, Power contactors, switch fuse units, limit switches fuse units, limit switches, push buttons, timers & MCB etc	Set	1
j)	Pressure Switch of each type	Set	1
k)	Auxiliary Switch assembly	Set	1
l)	Operation Counter	No.	1
m)	Complete Drive Mechanism	Set	1
n)	SF6 Gas	-	Equivalent to 2 Poles
<b>4</b>	<b>245kV Circuit Breaker</b>		
a)	Complete Pole (Phase) of circuit Breaker including closing resistor (if applicable), grading capacitor (if applicable), Pole column, interrupter, operating mechanism, marshaling box, corona ring (if applicable) but without support structure <b>(245kV, 3150A, 50kA)</b>	Pole (No)	1
b)	Grading Capacitor (if applicable)	No	2
c)	Rubber Gasket " O Ring" and seals	Set	1
d)	Trip coils with resistor (as applicable)	Set	2
e)	Closing coils with resistor (as applicable)	Set	2
f)	Terminal Pads (One No of each type )	Set	2
g)	Molecular filter	No	2
h)	Corona Rings (if applicable)	No	1
i)	Relay, Power contactors, switch fuse units, limit switches fuse units, limit switches, push buttons, timers & MCB etc	Set	1
j)	Pressure Switch of each type	Set	1
k)	Auxiliary Switch assembly	Set	1
l)	Operation Counter	No	1
m)	Complete Drive Mechanism	Set	1
n)	SF6 Gas	-	Equivalent to 2 Poles
<b>5</b>	<b>420kV Isolator</b>		
a)	One Complete Pole including support insulator, earth switch, Motor operating mechanism (MOM) but excluding support structure <b>(420kV, 3150A, 63kA with two E/S)</b>	Pole (No.)	1
b)	Copper contact fingers for male & female contact	Set	2
c)	Open/Close contactor assembly, timers, key interlock push button switch & Auxiliary switches	Set	1
d)	Limit Switch	Set	2
e)	Terminal Pads	Nos.	3
f)	Corona Shield rings (if applicable)	Nos.	3
<b>6</b>	<b>245kV Isolator</b>		

## 1401640/2023/TBG-TB\_HVDC ANNEXURE-MANDATORY SPARES-NEEMUCH

a)	One Complete Pole including support insulator, earth switch, Motor operating mechanism (MOM) but excluding support structure <b>(245kV, 3150A, 50kA with two E/S)</b>	Pole (No.)	1
b)	Copper contact fingers for male & female contact	Set	2
c)	Open/Close contactor assembly, timers, key interlock push button switch & Auxiliary switches	Set	1
d)	Limit Switch	Set	2
e)	Terminal Pads	Nos.	3
f)	Corona Shield rings (if applicable)	Nos.	3
<b>7</b>	<b>420kV Current Transformer</b>		
a)	420kV, 3000A, 63kA Current Transformer with 120% extended current rating	Nos.	1
<b>8</b>	<b>245kV Current Transformer</b>		
a)	245kV, 2500A, 50kA Current Transformer with 120% extended current rating	Nos	1
<b>9</b>	<b>420kV Capacitive Voltage Transformer</b>		
a)	420kV, 4400pF CVT	Nos.	1
<b>10</b>	<b>245kV Capacitive Voltage Transformer</b>		
a)	245kV, 4400pF CVT	Nos	1
<b>11</b>	<b>336kV Surge Arrester</b>		
a)	Complete LA with insulating base, surge counter/monitor	Nos.	2
b)	Surge Counter/Monitor	Nos.	2
<b>12</b>	<b>216kV Surge Arrester</b>		
a)	Complete LA with insulating base, surge counter/monitor	No	3
b)	Surge Counter/Monitor	No	2
<b>13</b>	<b>Relay &amp; Protection Panels</b>		
a)	Control Switching Device (each type)	Set	1
b)	Numerical distance relay (Main-I) with in-built DR and fault locator, OV protection, software	Set	1
	Numerical distance relay (Main-II) with in-built DR and fault locator, OV protection, software	Set	1
c)	Line Current Differential Relay	Set	1
d)	Transformer Differential Protection Relay	Set	1
e)	REF relay with non-linear resistor for Transformer Protection	Set	1
f)	Reactor Differential Protection relay	Set	1

## 1401640/2023/TBG-TB\_HVDC ANNEXURE-MANDATORY SPARES-NEEMUCH

g)	REF relay with non-linear resistor for Reactor Protection	Set	1
h)	Reactor back-up Impedance protection relay	Set	1
i)	Power Supply module for Bus Bar protection	No.	1
j)	Bus bar bay unit module	Set	1
k)	LBB Relay (If standalone)	No.	1
l)	Auxiliary & Trip relays (installed CRP Panel)	No.	2 (each type)
<b>14</b>	<b>Substation Automation System(SCADA)</b>		
	Bay control unit (IED) BCU configuration shall be as below: Power Supply card -1 No., Processor card – 1 No., Analog Card for Voltage and Current input – 1 No. (6V & 4I), Milli-ampere (4-20mA) input Card : 1 No. (minimum 8 inputs) and BI/BO cards sufficient for following number of Binary Inputs and Outputs :		
a)	i)AIS Substations : Binary Inputs- 72 Nos. & Binary Outputs -40 Nos The spare BCU shall be 19” Rack Mounted and shall have same Firmware Version, Software version, port configuration etc. as that supplied for main item. It shall be suitable for One to One replacement of the BCUs supplied under the project and shall be configurable at site itself without special assistance of OEM.	No.	1
b)	Ethernet switch 19” Rack Mount, Ethernet Switch Ports: 24 LC FO Multimode	No.	1
c)	Ethernet switch 19” Rack Mount, Ethernet Switch Ports:	No.	1
<b>15</b>	<b>PLCC Equipment</b>		
a)	Set of Prints for carrier terminal (Speech & Protection)	Set	1
b)	Set of Prints for analogue protection coupler	Set	1
c)	Digital Tele-protection coupler	Set	1
<b>16</b>	<b>420kV Bus Post Insulator</b>		
a)	Bus Post Insulator	Sets	2
<b>17</b>	<b>245kV Bus Post Insulator</b>		
a)	Bus Post Insulator	Set	2
<b>18</b>	<b>Comm. Equipment</b>		
a)	SDH EQUIPMENT (STM-16 MADM UPTO 5 MSP PROTECTED DIRECTIONS)-COMMONCARDS, CROSS-CONNECT/CONTROL CARDS, OPTICAL BASE CARD, POWER SUPPLYCARDS, POWER CABLING, OTHER HARDWARE & ACCESSORIES (EACH).	SET	1

## 1401640/2023/TBG-TB\_HVDC ANNEXURE-MANDATORY SPARES-NEEMUCH

b)	Optical Line Interface card (to support minimum 150 kms)	No.	1
	TRIBUTARY INTERFACE- E1 INTERFACE (MINIMUM 16 NOS.)	SET	1
c)	ETHERNET INTERFACE 10/100 BASE T WITH LAYER-2 SWITCHING (MIN 8INTERFACES PER CARD)	No.	1
d)	TRIBUTARY INTERFACE-GIGABIT ETHERNET INTERFACES 10/100 MBPS WITH LAYER-2 SWITCHING (MINIMUM 2 NOS.)	SET	1
e)	VOIP TELEPHONE INSTRUMENT WITH ONE COMMON SWITCH (MIN. 8 PORT)	No.	1
f)	24F (DWSM) APPROACH FIBRE OPTIC CABLE INCLUDING ALL INSTALLATIONHARDWARE SET	KM	1
g)	S16.1 SFP	No.	1
h)	SFP S4.1	No.	1
i)	L16.2 SFP	No.	1

## SCOPE OF ERECTION TESTING & COMMISSIONING WORKS OF TRANSFORMER/REACTOR

### 4.1 RECEIPT, UNLOADING, VERIFICATION, STORAGE, UP-KEEP AND HANDLING OF ACCESSORIES:

This activity will involve the following work:

- 4.1.1 Upon receipt of Transformer / Reactor – Main tank at site, checking of N<sub>2</sub> pressure, measurement of dew point by vaisala kit or similar type and core insulation isolation test (CC-CL, CC-T & CL-T) has to be carried out at site on trailer before unloading of Transformer. Contractor has to arrange calibrated equipment's for above check immediately after arrival of main tank at site. Delay in providing above facilities shall be considered as delay in completion of work and shall be dealt as per contract clause -7.3. After placement of ICT Main Tank over the final location – impact recorder needs to be brought back to BHEL Bhopal by E&C agencies representatives at site.
- 4.1.2 The main tank shall be checked for it proper placement on the plinth matching with center lines as per BHEL/ Customer drawing and ensure the tightness of roller bolts. Minor adjustment may be required.
- 4.1.3 Receipt, unloading and storage of all accessories including online gas monitoring system, other monitoring/control devices, oil and spares supplied against this Contract in the store at site.
- 4.1.4 Checking of N<sub>2</sub> pressure in main tank and maintaining it at 0.25-0.35 Kg/cm<sup>2</sup> with dry Nitrogen gas of dryness not less than (-) 60 °C dew point before start of erection. The log books of N<sub>2</sub> pressure and dew point nitrogen filled Main tank till erection is commenced.
- 4.1.5 The contractor shall be fully responsible for all joint material verification to be carried out along with BHEL & customer representative, for checking and recording of material/ accessories received at site and to be stored under his control. The contractor will have to ensure inspection of all materials, accessories for any damage/ shortage (if any). **Records will have to be maintained for all the material received with date of receipt, material taken out for erection etc in registers and report to BHEL periodically.** The contractor will have to submit actual photographs of stored items for verification.
- 4.1.6 Dew point measurement of nitrogen filled Main tank prior to start of its erection by vaisala kit or similar type. Internal inspection of the Main tank to find out and rectify transportation damages (if any).
- 4.1.7 During internal inspection dummy insulation block provided inside Transformer needs to be removed / taken out for DP test (degree of polymerization) & moisture content test. This insulation should be preserved in Jar filled with transformer oil till the DP test & moisture content test are performed in NABL lab. All the work stated above is included in contractor's scope of work.
- 4.1.8 Shifting of all accessories conservators, radiators, coolers, pipe works, bushings etc to erection site for pre-erection test and E&C work.

### 4.2 PRE-ERECTION TESTS – (ALL CTs & CORE ISOLATION)

This activity will involve the following work:

- 4.2.1 Cleaning of accessories including, turrets & main tank shall be carried out at erection site before pre-erection testing is started.
- 4.2.2 Before start of erection, testing of turret mounted CT's, neutral CT's and internal CT's of Main tank etc shall be carried out to ascertain their healthiness. The tests to be carried out are as follows:
  - i) Isolation test of CC, CL of transformer at 500V.
  - ii) Continuity, Insulation Resistance, Ratio, Winding resistance and determination of knee point of all protection CTs.
  - iii) Continuity, Insulation Resistance, Ratio, Winding resistance of all metering CTs & WTI.

**4.3 PRE-ERECTION TEST - (C & TAN D TEST OF BUSHINGS)**

This activity will involve the following work:

- 4.3.1 Cleaning of bushings including its all petticoats shall be carried out at erection site before pre-erection testing is started.
- 4.3.2 OIP/ RIP bushings shall require to be in vertical position for minimum 4-6 hrs before testing is started.
- 4.3.3 Before start of erection, capacitance and tan delta test at variable frequency of all bushings as per BHEL norms shall be conducted. During the testing, the bushing shall be hang in vertical position isolating from earth part.

**4.4 PHYSICAL INSPECTION/ PRESSURE TEST ON RADIATOR BANK**

After unloading of the Radiator bank at site each individual radiator shall be physically inspected at site before erection. After physical inspection every Radiator shall be pressure tested as per BHEL standards and results shall be recorded. Any observation in physical inspection/ pressure test shall be informed to concerned BHEL Engineer at site and necessary action shall be taken to rectify the defect of weld joint noticed at site. Major rectification work shall be taken in consultation with BHEL.

**4.5 RADIATOR / CLEANING / FLUSHING OF RADIATOR /COOLER BANK**

The E&C contractor shall ensure to deploy the Filter M/c and Storage Tank at the start of E&C activities at site. The cleaning/ Flushing of Radiator/ Cooler Bank and associated pipe works shall be carried out well in advance before the start of Erection of Cooler Banks at site. The Cleaning / Flushing of cooler Bank shall be executed in 2 stages followed by its pressure testing at site.

**Stage –I**

In this stage all the Radiator/ Cooler banks and associated pipe work, after unloading shall be shifted to Erection location. At Erection location the thoroughly cleaned by compressed air at site.

**Stage –II**

After thorough cleaning of each individual Radiator of Radiator / Cooler Bank and pipe work shall be flushed with the Transformer oil through Filter M/c. The E&C contractor shall arrange the filter M/c well in advance to carry out cleaning of Radiator bank in advance.

**4.6 ERECTION OF MAIN TANK ACCESSORIES, COOLER BANK & CABLING WORK**

This activity will involve the following work:

- 4.6.1 Before erection is started, cleaning/testing of all accessories including, conservators, radiators, coolers, pipe works, turrets, bushings etc., bidder needs to arrange vacuum cleaner of proper capacity, ladder, torch and necessary arrangement for flushing of Transformer accessories from Transformer oil.
- 4.6.2 Erection of 400 kV Bushings shall be done by using mobile crane only. The mobile crane must be operated on outriggers for greater stability while lifting 400 kV Bushings for erection. Erection work through Hydra-tyre mounted shall not be allowed for HV Bushing Erection at site. In the event of crane is not used by contractor for bushing erection, the recovery as per rate in optional activities will be made.
- 4.6.3 Assembly of transformer accessories, cooling pipework, pumps, fans, radiators/coolers, Buchholz's pipe work, marshalling box, PRVs, OTI, WTI, RTD sensors, online DGA equipment and thermosyphon etc. Any adjustment, repair work i.e. oil leakage, alignment etc. will have to attend by contractor.
- 4.6.4 Dry air from portable unit or pressurized cylinder shall be pumped in Transformer tank throughout erection/ exposure during erection period. Contractor will have to ensure that their workmen take utmost care during erection to safeguard and avoid ingress of dust, dirt or any foreign material in the Transformer. Contractor will also have to make arrangement for the dry air unit / pressurized cylinders of dry air at site for the purpose.
- 4.6.5 During erection it is mandatory to use water resistance tarpaulin or protective covering so as to negate chances of any ingress of moisture, dust, dirt or any foreign material in the Transformer.

- 4.6.6 Installation of on-line gas monitoring system, digital RTCC panel and other instruments and laying of cable between Unit and RTCC panel (if included in supplies) shall also be included in contractor's scope of work.
- 4.6.7 Carrying out pressure testing on completely assembled Transformer by filling N<sub>2</sub> up to pressure of 0.25 -0.35 Kg/cm<sup>2</sup> and arresting leakages (if any) to ensure leakage free assembly.
- 4.6.8 Carry out touch up painting on Transformer and cooling system. Arranging of polyurethane paint of specified shade & quality shall also be in the scope of Contractor. Application of zinc rich paint over weld joints of galvanized surfaces, if any.
- 4.6.9 All cabling, cable termination and tagging, FO cable laying in conduit and its splicing, connection of Transformer neutral with Neutral bus, NCT & earthing of various equipment / accessories with earth-grid.
- 4.6.10 Locking of Transformer / Reactor Main tank by welding on embedded plates of foundation shall be done by contractor as per BHEL drawing. The welding machine & welding electrode / brazing arrangement along with qualified welder is to be arranged by contractor.
- 4.6.11 For cooler bank foundation / equipment foundation - drilling, cleaning of each hole & fixing of anchor fastener with adhesive/filler for all foundation bolts etc. shall be done by contractor as per BHEL drawing. The drilling machine & gun for adhesive/filler along with skilled manpower is to be arranged by contractor. Anchor fastener & adhesive/filler materials shall be supplied by BHEL.

➤ **STAGE-III: DRYOUT & OIL CIRCULATION**

**4.7 N2 DRYOUT CYCLES**

This activity will involve the following work:

- 4.7.1 After Erection of all accessories, successful leakage testing & completion of SFRA test – ratio and resistance shall be done as per clause 4.14 & 4.16, the job shall be subjected to dry out cycles (minimum 2 Nos) or till achieving the Dry out values and needs to maintain Rh of 0.5% or less and dew point of -36 °C or better as per customer requirement.
- 4.7.2 In 1<sup>st</sup> dryout cycle, vacuum pulling and maintaining a vacuum of less than 1.0 Torr for a minimum period of 72 Hrs. After completion of vacuum cycle of 72 hrs, the vacuum break is to be achieved by using Nitrogen gas purging till the pressure of 0.25 -0.35 Kg/cm<sup>2</sup> is achieved and maintaining minimum period of 24hrs. After completion of 24 hrs with nitrogen gas pressure, the dew point of gas filled in the tank is measured and noted for record.
- 4.7.3 In 2<sup>nd</sup> dryout cycle, the vacuum for 48 hrs and nitrogen gas purging for 24 hrs shall be carried out. As per 4.8.1 till desired dew point of main tank is achieved in subsequent dry out cycle process to be carried out in similar manner at no extra charges is under the scope of Dry out work.

In the above dryout cycles, nitrogen gas of UHP grade (- 60°C dew point or better, purity 99.999% or better) shall be required.

**4.8 OIL PREPARATION, OIL FILLING, HOT OIL CIRCULATION:**

This activity will involve the following work:

- 4.8.1 Sample testing of oil from drums (randomly selected of oil drums from the supplied lot as per customer sampling plan / IS:2500-part-1) shall be required to be carried out for BDV, PPM, IFT, Resistivity & Tan delta before pouring into storage tank at site.
- 4.8.2 The Contractor has to arrange total quantity of oil storage tank as per capacity of main tank to ensure oil filling in the main tank in one go without interruption. Oil filling in the main tank shall not be permitted without preparation and testing of complete oil. In the event of single storage tank of the required capacity is not available then complete oil should preferably be contained in storage Tanks of capacity not lesser than 20 KL. The contractor needs to arranged the storage Tank as per Main Tank capacity and kept the filtered oil ready & tested as per BHEL/ Powergrid standard, so that oil filling will be executed in one go at site. Oil filling in multiple go is not allowed, execution of activity in this way shall not be considered as the completion of work.

- 4.8.3 After filling of oil in the storage tank and completion of oil filtration, oil testing for BDV, moisture content, tan delta & IFT shall be required to be carried out before filling in main tank as per Clause 4.10.
- 4.8.4 Filling of Transformer / Rector main tank, its cooler bank and complete assembly with prepared and tested oil under vacuum up to desired level. The required oil tanks, filter machine of capacity not lesser than 10KL (Ultra High Vacuum type oil treatment plant preferably 10 KL per hour or more) and other accessories shall be arranged contractor.
- 4.8.5 Hot Oil Circulation- Drying out of Transformer with high vacuum filter machine and maintaining minimum temperature in tank up to 57°C of oil inside the Tank (i.e Inlet oil to be maintained) for not less than 72 hrs to till desired insulation parameters of oil and PI values of winding were achieved. IR values has to be recorded regularly at an interval of 4 hrs during the complete Hot oil circulation process. In the format provided by BHEL. The process shall be continued till clearance from BHEL is provided to end the process.

#### 4.9 OIL TESTING - OF STORAGE TANKS

- 4.9.1 After filling of oil in the storage tank and completion of oil filtration, oil testing for BDV, moisture content, tan delta and IFT shall be required to be carried out before filling in main tank at a reputed NABL accredited lab acceptable to BHEL/customer.

#### 4.10 OIL TESTING – BDV, MOISTURE CONTENT, IFT, TAN DELTA & RESISTIVITY OF MAIN TANK & OLTC – BDV & MOISTURE CONTENT

- 4.10.1 After completion of hot oil circulation, the testing of oil samples for BDV, Moisture Content, Tan-delta & Resistivity at 90°C and IFT of processed oil Main Tank & OLTC of each phase for BDV & Moisture Content before final charging of equipment shall be under scope of contractor. Testing shall be carried out from NABL accredited lab acceptable to BHEL/customer. **Acceptance norms for BDV of equipment is 70 KV or above and moisture content of less than 05 PPM.**

#### 4.11 FINE FILTRATION & PARTICLE COUNTING

- 4.11.1 After HOC, E&C contractor has to maintain the filtration level of oil in Transformer, so as to achieve the desired value of particle count as per Table-I. If required E&C contractor may use the additional ultra-fine filtration machine to achieve the particle count as per BHEL standards. E&C contractor also required to arrange the equipment to measure the particle count of oil of Transformer after filtration from configurable kit which gives ISO counts alongwith cumulative and differential particle count in printable report immediately after measurement. The measuring equipment must have a valid calibration certificate at the time of measurement.

Table I Particle Count

If measured with particle counter which works on ISO 11171 and ISO 4406:1999 ( cumulative count)	≥ 4 micron cumulative count should have a ISO count of 10
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#### 4.12 OIL TESTING – DGA BEFORE CHARGING

- 4.12.1 After obtaining desired parameters of oil testing as per Clause 4.11 & 4.12, Oil sample DGA of Main Tank before charging needs to be carried out from NABL accredited / customer lab acceptable to customer / BHEL.

##### ➤ STAGE – IV: TESTING & COMMISSIONING

#### 4.13 PRE-COMMISSIONING TESTS – LOW VOLTAGE TESTS

This activity will involve the following work:

- 4.13.1 After desired oil parameters are achieved and completion of settling time, the pre-commissioning tests shall be conducted on Transformer. The list of tests to be carried out are as under:

- i) Isolation test for CC, CL and tank
- ii) Measurement of Magnetization Current,
- iii) Measurement of Magnetic balance
- iv) Measurement of vector Group, Polarity

- v) *Contact Resistance measurement of joints of HV/IV/LV/Neutral etc.*
- vi) *Measurement of Turn Ratio at all tap positions before & after oil filling in ICT.*
- vii) *Measurement of Winding Resistance at all tap positions before and after oil filling in ICT.*
- viii) *Measurement of Insulation Resistance and determination of PI (10/1 min value)*
- ix) *Measurement of particle count by particle count meter and carry out filtration for attaining the values as per BHEL standards.*
- x) *Functional tests of all Accessories/ Marshalling box operation test of OLTC.*

The list of test and above scope of work is indicative and it may vary marginally as per BHEL norms/ customer requirements. All the tests shall be carried out by using calibrated instruments. Arranging all the test instruments shall also be in the Contractor's scope. However, any other jobs not mentioned above but required for successful completion of work is to be done by contractor at their cost. Contractor needs to arrange all required tools /special tools/ Insulation tester, Dew point meter, Multimeter etc and other consumables such as CRC, Cloth, Teflon tapes etc and expert Manpower for complete execution of work at site.

#### **4.14 PRE-COMMISSIONING TEST - CAPACITANCE & TAN DELTA TEST OF BUSHING AND/OR WINDING**

4.14.1 Following test shall be carried out under the scope of work:

- i) *Measurement of Capacitance and Tan delta of Bushings*
- ii) *Measurement of Capacitance and Tan delta of Windings*

#### **4.15 PRE-COMMISSIONING TEST – SFRA TEST**

4.15.1 Sweep Frequency Response Analysis (SFRA) as per factory test combinations for all windings shall be carried out for Transformer. The signature of the test shall be submitted in hard copy as well as program file of the software which easily downloadable and readable in PC/laptop. This report shall contain phase wise and three phase comparison of the plots.

a) Without oil filled condition:

Before start of stage III activity, SFRA test shall also be carried out without oil-filled condition after completion of erection work.

b) Oil filled condition:

After oil filling & HOC, SFRA test shall be conducted during pre-commissioning testing.

#### **4.16 FINAL COMMISSIONING & HANDING OVER:**

This activity will involve the following work:

4.16.1 Final connection with system providing assistance of Electrician / Manpower for pre charging checks and thorough checking of compatibility and functionality of Transformer protection with customer protection system, readiness for charging of the Transformer, commissioning and handing over. Oil test / electrical testing whichever is required during different stages of E&C work lies in scope of contractor. DGA after 24 hrs charging of Transformer needs to be carried out by contractor from NABL accredited / customer lab acceptable to customer / BHEL.

4.16.2 Handing over of all spares and accessories including oil to customer and obtaining completion certificate for different activities.

#### **4.17 PREPARATION AND SUBMISSION OF CHECK LIST/ TEST RESULTS AFTER COMPLETION OF WORK AT EACH STAGE**

4.17.1 Submission of all the low voltage electrical test results in BHEL format signed by Contractor & BHEL/customer representative and submission of oil test report of NABL laboratory immediately after completion of test.

4.17.2 Submission of all records of various stages of pre-erection, erection in the prescribed BHEL format signed by Contractor and BHEL/Customer representative in the form of bound booklet & scanned copy. (Erection

**Annexure-A**

checklist shall be provided at time of award of contract). After completion of final commissioning and handing over equipment has and closure of all punch point, then contractor can take their porta cabin.

## Annexure-C

### PROCEDURE FOR WELDING OF ALUMINIUM BUSES

#### A. Recommended welding procedures to insure a sound weld are as follows:

Pure aluminum melts at 660 Deg. C while aluminum alloy melts in the range of 519 Deg. C depending on the alloy content of the particular metal involved. When aluminum alloy are heated there is no change in color. This makes it difficult, if not impossible; to tell metal is near the welding temperature.

The ever present surface oxide films on aluminum have a melting point of 1982 Deg. C. The parent aluminum or aluminum alloy can therefore be melted without fusing the surface oxides. Unless this film is removed, cleanliness of the molten filler metal and the parent metal cannot be completed and both strength and conductivity may be sacrificed. Therefore, it is of prime importance that aluminum oxides be removed from the aluminum alloys before welding is started. In the shielded arc welding method the shielding gas has a tendency to clean the material as welding progresses.

#### B. CLEANING OF BUSES & FITTINGS:

It is very important to remove all greases and oxides from the surfaces to be welded. This can be accomplished by using a mild alkaline solution or standard degreasing solution. The preferred method is to use a stainless steel wire brush and vigorously scrub the surfaces to be welded. The stainless steel brushes are specified because the stainless steel has fewer tendencies to pick up particles of aluminum.

#### C. WELDING METHODS

The following types of welding methods for welding aluminum fittings and buses are recommended.

##### 1. TUNGSTEN-ARC WELDING (TIG)

The inert-gas shielded tungsten arc process is widely used for welding aluminum bus fittings. In this process the arc is established between a non-consumable tungsten electrode and the section to be welded. Inert gas envelopes the arc to prevent oxidation during welding.

Hence no flux is required. A bare filler rod supplies filler metal to the weld area. To initiate the arc the tungsten electrode is placed in contact with the component and then withdrawn to establish an arc length of approximately 3/16". The arc is given a circular motion until the base metal liquefies and the weld puddle is established. Filler metal is added by hand as required. In this process, if more than one pass is required for a sufficient weld, the weld should be wire brushed between passes, to remove any surface dirt or oxides which have accumulated from the previous pass. Since no flux is used the finished weld does not require cleaning. In this process the heat of the tungsten arc is concentrated in a smaller area and is much faster than the conventional type of welding and distortion of the weld is negligible since the heat is concentrated in a small area. In this process, if thickness is greater than 0.5" arc to be welded, pre-heating of parts will increase the arc speed.

##### 2. METALLIC ARC INERT GAS SHIELDED WELDING

MIG welding process combines the advantages of tungsten arc welding with the increased welding speed. Welding can be done from any position and the process can be either manual or automatic, Manual welding techniques are somewhat different from other methods. However, a welder can be trained to use the MIG process with only a few days concentrated training. In the MIG process the bare filler rod is supplied as a coil of bare wire. In the commercially available equipment this wire is added to the weld at predetermined rate by a motor driven feed that can be adjusted to the magnitude of the welding current. In this process as well as the tungsten arc process, gas forms a shield around the arc to prevent oxidation during welding.

## Annexure-C

Either helium, argon or a mixture of helium and argon are suitable shielding gases. Pure argon is most widely used on the gas arc usually mixed to combine the hotter arc argon. If exceptionally hot arc characteristics are required pure helium can be substituted for the gas mixture. Precaution should be exercised if this substitution is made in that it is very easy to burn through the items that are to be welded with a pure helium atmosphere.

As it is readily apparent, the basic difference between the two types of welding apparatus is the automatic feeding mechanism for the filler wire. In both types of apparatuses the electrode holder and the welding gun can or cannot be cooled by water. If welding currents of more than 125 Amps are required, both methods will have to have water cooling apparatuses to the electrode holder and the welding gun.

### D.WELDERS QUALIFICATIONS

No welding should be done until the operator has had experience with welding aluminum alloys by the methods described above, Men with previous experience with in metal welding should be selected for training in welding aluminum for a period of training of not less than one week after which time the man can be considered to be proficient in the use of the equipment and in the welding of aluminum joints. After this period there should be no difficulty experienced in welding aluminum alloys. It is suggested, if practical, that welders should practice on actual fittings or buses before proceeding with the welding of the required job.

The following is the recommended specification for the current fittings wire feeds, gas flows etc. These specifications are of a general nature to the extent that many factors have to be considered such as:

1. Type of equipment used, whether water cooled or not.
2. The size and mass of the piece to be welded.
3. The position of the weld.
4. And most important of all, the operator's skill
5. All persons in the welding area would wear the proper shields. The arc is approximately twice as strong as the standard AC welding arc. Extreme caution should be exercised for the protection of eyes.

### ACCEPTANCE STANDARDS FOR NON-DESTRUCTIVE TESTING LIQUID PENETRANT EXAMINATION OF WELDED JOINTS

- a) Evaluation of indications:
  - Relevant indications are those which result from mechanical discontinuities.
  - Linear indications are those indications in which the length is more than three times with width.
  - Rounded indications or indication, which are circular or elliptical with the length less than three times, the width.
  - Any questionable or doubtful indications shall be re-tested to verify whether or not actual defects are present.
  - Localised surface imperfections, such as may occur from machining marks, surface conditions, may produce similar indications, which are not relevant to detection of unacceptable discontinuities.
- b) **Acceptance standards:**
  - Linear indications
  - Four or more rounded defects with any dimensions more than 1.6 mm in a line separated by 1/16 inch (1.6 mm) or less (edge to edge)
- c) **Defect removal and repair:**

Unacceptable imperfections shall be removed and reexamination made to assure the complete removal. Whenever a defect is removed and subsequent repair by welding is not required, the excavated area shall be blended into the surrounding surface so as to avoid sharp notches, crevices or corners. Where welding is required after removal of a defect, the area shall be cleaned and welding performed in accordance with a qualified welding

**Annexure-C**

procedure, Completed repairs shall be re-examined by the method originally used for detection of the deflection.

**d) Treatment of imperfections believed non-relevant.**

Any indication of an imperfection, which is believed to be non-relevant, shall be regarded as defect unless, on re-evaluation, it is shown by re-examination by the same method or by the use of other non-destructive methods and/ or by surface conditioning that no unacceptable defect is present.

**e) Examination of areas form which defects have been removed:**

After a defect is thought to have been removed and prior to making weld repairs, the area shall be examined by suitable methods to ensure the defect has been eliminated.

**f) Re-examination of repaired areas:**

After repairs are made, the repaired areas shall be blended.

**ACCEPTANCE STANDARDS FOR NON-DESTRUCTIVE TESTING**  
**RADIOGRAPHIC EXAMINATION OF WELDED JOINTS**

Radiographic examination shall cover minimum 10% of weld seam and acceptance standard for visual examination and Radiography shall be as follows:

Any of the following imperfections shall not be acceptable.

1. Cracks
2. Zone of incomplete fusion or penetration, which exceed 10% of the weld length of the joint in longitudinal or transverse butt weld, where full penetration is intended by the weld procedure, some lack of penetration acceptable. The total length of weld with lack of penetration shall not exceed 10% of the overall weld length. At no place, shall weld penetration be less than 90% of the thickness of the material. Continuous occurrence of lack of penetration is permitted, but shall not exceed 50 mm in any 500 mm length of weld.
3. Inadequate weld dimensions, root cavity (shrinkage) and incompletely filled groove greater than 10% effective throat thickness.
4. Excess penetration shall be permitted provided it does not exceed 25% of the wall thickness or 4 mm whichever is smaller.
5. Weld reinforcement: Build up in excess of 25% of the effective throat thickness shall be dressed. Any reinforcement shall be substantially symmetrical about the center line of the weld and shall be of smooth contour blending smoothly at the toes with the parent material.
6. Undercutting and overlapping, greater than 10% effective throat thickness.
7. Elongated cavities and/or worm holes exceeding 3 mm dia or equivalent area in length provided the limitations on porosity are met with.
8. Copper, tungsten or oxide inclusions greater than t/1 or 3 mm whichever is smaller.
9. Crater pipes exceeding 25% effective throat thickness or 3 mm whichever is smaller.
10. Porosity: Scattered porosity not exceeding 0.5% by volume is acceptable. In general, the size of the pores shall not exceed 0.8 mm dia, but occasional 1.6 mm dia pores may be acceptable, provided the following limits are not exceeded.
  - a) Where pore size is 0.4 mm or less, up to 150 t pores may be permitted in 1000 mm sq. area of radiograph.

**Annexure-C**

- b) Where pore size is 0.8 mm or less, up to 19 t pores may be permitted in 1000 mm. sq. area of radiograph.
- c) Where pore sizes are generally 0.8 mm dia or less, but occasional 1.6 mm dia/pores are present, up to 9t pores of 0.8 mm dia may be permitted in 1000 sq. mm area of radiograph, provided the number of pores up to 1.6 mm in dia does not exceed it.
- d) However, visible surface porosity > 1mm dia is not acceptable.

## Note:

- i. In all cases, t+ thickness of the thinnest section of the weld under examination.
- ii. Unacceptable weld defects shall be repaired in accordance with the original welding procedure. All repairs shall be 100% inspected in accordance with original testing procedure.

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## 1.0 GENERAL

1.1 Power Grid Corporation of India Ltd. (POWERGRID), a Govt. of India Enterprise is responsible for bulk Power transmission of electrical energy from various Central Govt. Power Projects to various utilities/beneficiaries and interconnecting regional grids, operating and maintaining the National electrical grid of India. It is established with mandate of "We will become a Global Transmission Company with Dominant Leadership in Emerging Power Markets with World Class Capabilities by:

- World Class: Setting superior standards in capital project management and operations for the industry and ourselves.
- Global: Leveraging capabilities to consistently generate maximum value for all stakeholders in India and in emerging and growing economies.
- Inspiring, nurturing and empowering the next generation of professionals.
- Achieving continuous improvements through innovation and state of the art technology
- Committing to highest standards in health, safety, security and environment." as its mission.

Govt. of India (MoP) has identified the execution of "**Transmission system for evacuation of power from Neemuch REZ**" through Tariff Based Competitive Bidding (TBCB) route. POWERGRID is intending to arrange for pre-bid tie-up for the scope envisaged.

- 1.2
1. Establishment of 2x500 MVA, 400/220kV Pooling Station (AIS) at Neemuch with 1x125 MVAr Bus Reactor
  2. 2 nos. of 400 kV line bays at Chhittorgarh (PG) 400 kV S/S
  3. 2 no. of 400 kV line bays at Mandsaur 400 kV S/s

1.3 It is the intent of this specification to describe primary features, materials, and design & performance requirements and to establish minimum standards for the work. The specification is not intended to specify the complete details of various practices of manufactures/ bidders, but to specify the requirements with regard to performance, durability and satisfactory operation under the specified site conditions.

1.4 The work to be done under this specification shall include all labour, plant, equipment, material and performance of all work necessary for the complete installation and commissioning of switchyard. All apparatus, appliances, material and labour etc. not specifically mentioned or included, but are necessary to complete the entire work or any portion of the work in compliance with the requirements implied in this specification is deemed to be included in the scope of contractor

1.5 Before proceeding with the construction work the Contractor shall fully familiarize himself with the site conditions and General arrangements & scheme etc. Though the Employer shall endeavor to provide the information, it shall not be binding for the Employer to provide the same. The bidders are advised to visit the substation sites and acquaint themselves with the topography, infrastructure and also the design philosophy. The bidder shall be fully responsible for providing all equipment, materials, system and services specified or otherwise which are required to complete the construction and successful commissioning, operation & maintenance of the substation in all respects. All materials required for the Civil and construction/installation work including cement and steel shall be supplied by the Contractor. Complete design (unless specified otherwise in specification elsewhere) and detailed engineering shall be done by the Contractor

## 2.0 SCOPE

The broad scope of this specification covers Establishment/Extension of following substations for elements detailed below :

I	Name of Substation : Establishment of 400/220kV Neemuch (New)
❖	400 kV Switchyard

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- **Switching Scheme : One and a Half Breaker Scheme**
- Fault Level: 63 kA for 1 sec
- Line Bays: 4
- ICT Bays: 2
- Bus Reactor Bay: 1
- Tie Bays: 4
- Future Line with Switchable Reactor bay: 6
- Future ICT Bay: 2
- Future Bus Reactor Bay: 1
- Future Tie Bays : 4

❖ **220 kV Switchyard**

- **Switching Scheme : Double Main & Transfer Scheme**
- Fault Level: 50 kA for 1 sec
- Line bays: 2
- ICT Bays: 2
- Transfer Bus Coupler Bay: 1
- Bus Coupler Bay: 1
- Future Line bay: 5
- Future ICT Bay: 2

- 2 number units of 400/220/33kV, 500 MVA, 3-Phase Autotransformers along with all fittings & accessories
- 1 number units of 125MVAR, 420kV, 3-Phase Bus Reactor along with all fittings & accessories

**The detailed scope of work of the substation is brought out in subsequent clauses of this section. Rating of various equipments shall be as per BPS.**

**A) ELECTRICAL EQUIPMENTS, ELECTRICAL & MECHANICAL AUXILIARIES, COMMUNICATION EQUIPMENT, SWITCHYARD ERECTION EQUIPMENTS & ACCESSORIES :**

Design, engineering, manufacture, testing at manufacture's work, supply including transportation & insurance, unloading, storage, erection, testing and commissioning of following equipment and items complete in all respect:

**(a) POWER TRANSFORMERS**

- 400/220/33kV, 500 MVA, 3-Phase Autotransformers along with all fittings & accessories
- Digital RTCC panel with 2 no. of relays for 400/220kV Transformers

**(b) REACTORS**

- 125MVAR, 420kV, 3-Phase Bus Reactor along with all fittings & accessories

**(c) LT TRANSFORMERS**

- LT Transformer for Tertiary Loading of 1 No of 400/220/33kV Auto Transformer
- LT Transformer for DISCOM/SEB supply

**(d) AIR INSULATED SWITCHGEAR**

**400kV / 220kV / 72.5kV / 33kV CLASS EQUIPMENTS (As per BPS) :**

- CIRCUIT BREAKERS, ISOLATOS, CURRENT TRANSFORMERS,CAPACITIVE VOLTAGE TRANSFORMERS, WAVE TRAP, BUS POST INSULATORS & SURGE ARRESTER

**(e) CONTROL AND PROTECTION SYSTEM**

- Control Switching Device (As Per BPS)
- Complete Control, Relay and Protection system for bays under present scope as per Section–Control and Relay Panels **including control, monitoring and protection of LT Transformer connected to tertiary of Autotransformer**

**(f) SUBSTATION AUTOMATION SYSTEM**

- Complete Substation Automation System based on IEC-61850 as per Section Substation Automation (including hardware and software) alongwith associated equipment. Further the contractor shall also supply necessary BCUs for control and monitoring of substation auxiliary system

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- The necessary interface equipment (Router, Firewall, Ethernet Switches etc.) and integration work for transferring data to RLDC (RSCC)/NLDC/National Transmission Asset Management Centre (NTAMC) at Manesar through optical fiber based SDH communication link is also under present scope. However, no work is envisaged at remote end (RLDC/NLDC/NTAMC/RTAMC etc) in the present scope
- Integration of Digital RTCC relays for 400/220kV Transformers [**being supplied under scope of this package**] with substation automation system is also included under present scope
- (g) **FIRE PROTECTION SYSTEM**
- Pumping arrangement inside the Pump House, Hydrant system outside Pump House, complete piping, fittings & accessories, etc. as per Technical Specification.
- HVWS & Hydrant system for Autotransformers and Reactors (including Employer supplied Transformer & Reactors specified above for the subject station)
- Conventional type Smoke detection, Fire alarm & Annunciation System and Fire Extinguishers for Switchyard panel Rooms and Control Room Building.
- (h) **AIR CONDITIONING SYSTEM**
- For Control Room Building
- For Switchyard Panel Room
- (i) **DG SET alongwith AMF Panel**
- (j) **LT SWITCHGEAR**
- AC/DC system shall be provided as per the specified present scope of work, including future provisions, and in line with the LT SLD enclosed at Annexure-I.
- Further, following shall also be noted:
- (i) Minimum current rating of bus bar, incomer and bus coupler ACB of Main Switch board shall be 1000A. Associated relays, meters etc. shall be co-ordinated accordingly.
- (ii) Minimum current ratings of bus bar, incomer and bus coupler MCCB of MLDB shall be 400A. Associated relays, meters etc. shall be co-ordinated accordingly.
- (iii) Minimum current ratings of DG set incomer (ACB), MSB incomers (MCCB) and bus coupler (MCCB) of ACDB shall be 400A. Associated relays, meters etc. shall be coordinated accordingly.
- LT Switchgear shall comprise of following panels:
- 415V Main Switchboard : 1 Set
  - 415V AC Distribution Board (ACDB) : 1 Set
  - • 415V MLDB (along with 2 nos. 100 kVA Lighting transformer) : 1 Set
  - 415V Emergency LDB(along with 1 no. 25kVA lighting transformer) : 1 Set
  - 220V DCDB : 2 Sets
  - 48V DCDB : 2 Sets
- (k) **BATTERY AND CHARGER**
- The capacity of Battery & Battery charger shall be worked out by contractor for complete substation scope including future bays and shall be submitted for Employer's approval. However, capacity of battery & Battery charges should not be less than that as specified below
- 220V VRLA BATTERY : 700 AH
  - 48V VRLA BATTERY : 750 AH
  - 220 V BATTREY CHARGER: 120 A
  - 48V BATTERY CHARGER 120 A
- If the capacity of battery & battery charger size increases to cater the actual load requirement, same shall be supplied by the contractor without any additional cost.
- (l) **CABLES**
- 1.1kV grade Power & Control cables (and special cables, if any) along with complete accessories including cabling works for Employer supplied equipment specified above for subject station. Methodology for supply, installation & sizing of 1.1kV Power & Control cables shall be as per **Annexure-IV**
- (m) **VISUAL MONITORING SYSTEM AS PER BPS**

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- (n) **ILLUMINATION SYSTEM :**  
 > LED based Indoor and Outdoor Illumination & Outdoor Receptacle (As per BPS)
- (o) **ERECTION HARDWARE**  
 Conductor(s), Al tube, bus-bar materials, cable trays & covers, Bay MB, spacers, clamps & connectors, junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels, Insulating mats, cable sealing arrangement, insulator guy arrangement, all accessories etc. as required
- (p) **INSULATOR STRINGS AND ASSOCIATED HARDWARE**  
 > Insulator strings and associated hardware fittings under present scope shall be provided by the contractor as per Bid Price Schedule (BPS).
- (q) **Main Earthmat : As per BPS**  
 > Main Earthmat shall be provided under present scope of work. All the equipment, LT station, FFPH, DG Set, Control room area, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main
- (r) **LIGHTNING PROTECTION (DSLPL)**  
 > The lightning protection (DSLPL) for complete switchyard is to be provided by the contractor. The contractor shall design the lightning protection by utilizing the structures being provided under present scope. In case, additional structures (Lightning Masts) are required to meet the lightning protection, the contractor shall provide the same without any additional cost to POWERGRID. The cost for provision of lightning masts, including associated earthing materials, hardware etc. shall be deemed to be included under the respective switchyard bay structures. The civil works shall be payable as per relevant item of BPS.
- (s) **COMMUNICATION EQUIPMENT**  
 PLCC equipment including Analog protection coupler, Digital Protection Coupler (suitable for interfacing with E1 port of SDH equipment), FODP on gantry, signal converters (if required), communication cables, associated power cables etc. for both ends of following transmission lines  
 • 1. Neemuch - Chittorgarh 400kV D/C Line      2. Neemuch - Mandsaur 400kV D/C Line
- Tele-Communication Equipment:**
- (ii) The broad Scope of the procurement of FO based Communication Equipment shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing, training and demonstration for acceptance, commissioning and documentation for following  
 • SDH Equipment along with suitable interfaces and line cards.  
 • All cabling, wiring, Digital Distribution frame patch facilities and interconnection to the supplied equipment at the defined interfaces,  
 • System integration of all supplied subsystem  
 • Integration with the existing communication system based on SDH and PDH of employer  
 • Integration of supplied subsystem with SCADA system, PLCC equipment, PABX of RLDC/SLDC, VOIP (SIP compliant) for voice.  
 • Fibre Optic Approach Cable (FOAC) along with duct and Fibre Optic Distribution Panel (FODP)  
 • Integration of new Communication equipment in the existing regional NMS. All required support to existing NMS vendor for integration of new Communication equipment.
- Phasor Measuring Unit**  
 The broad scope of the procurement of PMU shall include Planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing and demonstration for acceptance, commissioning and documentation for PMU as per BPS and these PMU shall support IEEE C 37.118 protocols. These PMUs shall be integrated with Phasor data Concentrator (PDC) at RLDC/SLDC for the subject project
- (iii)

**B) MANDATORY SPARES :**

- > Design , engineering, manufacture, testing and supply including transportation & insurance, storage of mandatory spares at site as per BPS. The Break-up of Mandatory Spares shall be as per **Annexure-III.**

**C) CIVIL WORKS & SUPPORT STRUCTURE****C.1) CIVIL WORKS : BASED ON POWERGRID SUPPLIED DRAWINGS**

- (a) Construction of **boundary wall** as per tender drawing.

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- (b) Construction of **main entrance gate** as per tender drawing.
- (c) **Construction of Security hut as per tender drawings:** The architectural drawings pertaining to Security hut is attached as a part of tender drawings. The corresponding structural drawings shall be issued during detailed engineering to the contractor.
- (d) **Road :**Road shall be constructed as per tender drawing. However, Road layout shall be prepared by contractor and submitted to POWERGRID for approval.

Approach road, if any required for connecting the S/S to the main road shall be considered included under the scope of work & BPS item for Road works shall be applicable.

- (e) **Cable Trenches :** Cable trenches including cable trenches in Reactor/Transformer area along with covers including road/rail crossing, sump pits, culverts etc. shall be constructed as per tender drawings. However, Cable trench layout including invert levels shall be prepared by contractor for approval of POWERGRID based on the cable trench sections available in Tender drawings.

Mode of measurement of this item is in RM as per BOQ. All works such as Excavation, PCC, RCC, Reinforcement, Misc. Structural steel, cable trench crossings (using RCC Hume Pipe (NP-3)), sumps etc. required as per technical specification and drawings for successful completion of the works are deemed to be included in quoted rates.

- (f) **Drains :** Storm water Drain layout including peripheral drains if any shall be prepared by contractor based on the drain sections available in Tender drawings and to be submitted for approval of POWERGRID.

Diversion of existing Nallah/ Surface runoff, if required, the design & drawing of drains shall be prepared by contractor along with the drain layout and same shall be submitted to POWERGRID for approval. Payment shall be made under respective items of BPS.

- (g) **Switchyard fencing & Gate :** Switchyard fencing & Gate as per tender drawings complete in all respect. Fencing layout drawings shall be prepared by the contractor and shall be approved by POWERGRID.

- (h) **Construction of Rain water harvesting system** as per tender drawing.

**C.2) CIVIL WORKS : BASED ON DESIGNS, ARCHITECTURAL, STRUCTURAL, FOUNDATION DRAWINGS TO BE DEVELOPED BY THE CONTRACTOR**

- (a) **Site levelling work:** The work includes Contouring of entire plot area within the substation boundary however area to be levelled shall be decided during detailed engineering. HFL data is required to be arranged by contractor for finalization of FGL (Finished Ground Level).

- (b) **Slope Protection Works & Retaining Walls:** Design & Drawings pertaining to slope protection works & retaining walls (if required) shall be finalized during detailed engineering

- (c) **Soil investigation Work-**Soil investigation needs to be conducted as per the technical specification. The necessary soil investigation layout and final soil report shall be proposed by vendor for approval of POWERGRID.

- (d) **Control room Building** The dimensions of building shall be finalized during detailed engineering based on technical requirements. Preparation of all drawings (architectural and structural) and design shall be in the scope of the contractor. The same shall be approved by POWERGRID during detail engineering. Terrace of the building shall be designed for additional load for solar panels i.e. 50 Kg/M<sup>2</sup>.

- (e) **Septic Tanks and soak pit:** Septic tank and soakpit for the Control Room and Security Hut shall be as per CPWD specs.

- (f) **Firefighting pump house & Fire Water Tank.:** The reference drawings pertaining to Firefighting pump house are attached as a part of tender drawings. These are applicable for size, plan and elevation purpose only. Preparation of all drawings (*architectural and structural*) and design shall be in the scope of the contractor. The same shall be approved by POWERGRID during detail engineering. Terrace of the building shall be designed for additional load for solar panels i.e. 50 Kg/M<sup>2</sup>

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- (g) **Transformer/ Reactor foundation including rail-cum-road, Common Oil Pit and associated fire walls. Reference drg for Rail-cum-Road is attached as tender drawing.**
- (h) Structure and foundations for Equipment supports, Gantries, LT Transformers, double pole structure, DG set etc.
- (i) **Labour Hut:** The reference drawings pertaining to Labour hut are attached as a part of tender drawings. The preparation of design and all drawings shall be in the scope of the contractor. The same shall be approved by POWERGRID during detail engineering. **Technical Specifications is attached as Annex-VII**
- (j) Stone spreading and anti-weed treatment including PCC in the switchyard. Layout for the same shall be developed by the contractor.
- (k) Internal & external water supply layout for Security Hut, Control Room Building, Firefighting Pump House Building, Fire Water Tank and Labour Hut.
- (l) Internal plumbing and external sewerage layout for Control Room Building, Security Hut and Labour Hut.
- (m) For buildings, the complete civil works including internal and external finishing, stone soling for flooring, plinth protection, drain along plinth protection etc. required to complete the building in all respect as per the drawing shall be payable in the plinth area rates.
- (n) Foundation for Lighting Poles, Bay Marshalling Boxes, Panels and Control Cubicles wherever required. The cost of these foundations shall deemed to be included in erection/installation of corresponding equipment of BPS.
- (o) Pile foundations wherever applicable  
Switchyard Panel Room: The Switchyard panel rooms can be Single or Multiple. The dimensions of these building shall be decided during detailed engineering based on the technical requirements. The reference drawings of Switchyard Panel Room is attached as a part of tender drawings. These are applicable for size, plan and elevation purpose only.
- (p)
- (q) Any other item/design/drawing required for successful completion of the scope of works.

**C.3) LATTICE AND PIPE STRUCTURES (GALVANIZED):**

Design, engineering, fabrication, proto-assembly, supply including transportation & insurance, unloading, storage, erection and commissioning of following structures complete in all respect:

- Towers, Beams, LM (if required) and all Equipment support structures except support structure for circuit breaker. The Support structure for Circuit Breaker shall be as per manufacturer's design.
- In the bid price schedule, the structures including foundation bolts and fasteners are indicated in the form of sets. In case of 400kV switchyard, the Gantry structures are required to be quoted per diameter wise. In each diameter, the bidder shall consider all required structures. In case of 220kV switchyard, the Gantry structures including foundation bolts and fastener are required to be quoted per bay wise
- Fasteners & foundation bolts are deemed to be included in respective structure items of BPS.  
For diameter/bays where transformer is to be terminated, the structure must also consider the load and deviation which is arising due to the interconnection with other side. Further, for the last diameter/bay, the end towers must be extendable type for connecting future beams. Bus work(s) may be optimized by the contractor by suitably considering the number of diameters/bays in a bus work section.
- For design of Gantry structures, the conductor tension shall be as per **Annexure-VI**. For design of gantry structure with spans, wind speed or conductor configurations other than that specified in Annexure-VI, conductor tension shall be considered based on actual requirement of present & future scope of work. Relevant design calculations for such cases shall be submitted by the contractor for employer's approval during detailed engineering.

**C.4) FACTOR OF SAFETY:**

- Factor of safety for design of tower, equipment structures shall be 1.5 under normal condition and 1.2 under short-circuit condition.
- Factor of safety for design of tower, equipment foundation shall be 1.5 in both normal and short circuit condition as per IS 456.

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- Factor of safety for stability of tower, equipment foundation like overturning shall be 2 (without wind or seismic), 1.5 (with wind or seismic) for normal and short circuit condition as per IS 1904.”

**D) Any other items not specifically mentioned in the specification but which are required for erection, testing and commissioning and satisfactory operation of the substation are deemed to be included in the scope of the specification unless specifically excluded**

**E) SPECIFIC EXCLUSION**

- Employer's site office and stores
- Supply, erection, testing & commissioning of Employersupplied Transformers/Reactors as per Clause 2.2 above
- Cable from 765kV Reactor/ Autotransformer to IMB and from IMB to CMB of 765kV Reactor/ Autotransformer
- Tarriff Meter

**F) PHYSICAL AND OTHER PARAMETERS OF THE SUBSTATION****F.1) LOCATION OF SUBSTATION**

- Name of State : Madya Pradesh
- Nearest Railway Station : Neemuch

**F.2) METOROLOGICAL DATA**

- Altitude : **Less than 1000 meter above mean sea level (MSL)**
- Snow fall : **NIL**
- Seismic Zone : **As per IS 1893**
- Wind Zone : **As per National Building Code (NBC) 2016**
- Min./Max. Ambient Temperature : **0 / 50 degree centigrade**
- Coastal Area Consideration : **NO**

The broad scope of this specification covers Extension of following substations for elements detailed below :

**II Name of Substation : Extension at Chhittorgarh (PG) 400 kV S/s****❖ 400 kV Switchyard**

- **Switching Scheme : One and a Half Breaker Scheme**
- **Fault Level: 63 kA for 1 sec**
- **Line Bays: 2**

**The detailed scope of work of the substation is brought out in subsequent clauses of this section. Rating of various equipments shall be as per BPS.**

**A) ELECTRICAL EQUIPMENTS, ELECTRICAL & MECHANICAL AUXILIARIES, COMMUNICATION EQUIPMENT, SWITCHYARD ERECTION EQUIPMENTS & ACCESSORIES :**

Design, engineering, manufacture, testing at manufacture's work, supply including transportation & insurance, unloading, storage, erection, testing and commissioning of following equipment and items complete in all respect:

**(a) AIR INSULATED SWITCHGEAR**

**400kV / 220kV / 72.5kV / 33kV CLASS EQUIPMENTS (As per BPS) :**

- CIRCUIT BREAKERS, ISOLATOS, CURRENT TRANSFORMERS,CAPACITIVE VOLTAGE TRANSFORMERS, WAVE TRAP, BUS POST INSULATORS & SURGE ARRESTER

**(b) CONTROL AND PROTECTION SYSTEM**

Complete Control, Relay and Protection system for bays under present scope as per Section–Control and Relay Panels

**➤ Details of Existing 400kV bus bar protection scheme is as below :**

- Make & Model: ALSTOM & MICOM P741
- Peripheral Bay Units for present scope: Existing
- Necessary modifications, wiring, etc. for completion of the bus bar protection scheme for bays under present scope has to be carried out by contractor. Any modification required in the existing protection scheme is included in the present scope.

**(c) SUBSTATION AUTOMATION SYSTEM**

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Augmentation of bays under present scope with existing Substation Automation System: The scope of bidder shall include but not limited to integration of IED's under present scope of augmentation with existing substation automation of Make: ALSTOM (which is based on IEC 61850) and capability enhancement of same as required including up-dating of system database, displays, development of additional displays and reports as per requirement.

- In the present scope, contractor shall also provide BCUs required for bays (bays as defined in Section: Substation Automation System) under present scope

- Any up-gradation of hardware and software for above integration shall be in the scope of contractor including license fee (if any).

The necessary interface equipment (Router, Firewall, Ethernet Switches etc.) and integration work for transferring data to RLDC (RSCC)/NLDC/National Transmission Asset Management Centre (NTAMC) at Manesar through optical fiber based SDH communication link is also under present scope. However, no work is envisaged at remote end (RLDC/NLDC/NTAMC/RTAMC etc) in the present scope

**(d) FIRE PROTECTION SYSTEM**

Conventional type Smoke detection, Fire alarm & Annunciation System and Fire Extinguishers for Switchyard panel Rooms under the present scope

For Switchyard Panel Room

**(e) CABLES**

1.1kV grade Power & Control cables (and special cables, if any) along with complete accessories including cabling works for Employer supplied equipment specified above for subject station. Methodology for supply, installation & sizing of 1.1kV Power & Control cables shall be as per [Annexure-IV](#)

**(f) VMS**

Details of VMS (being provided under separate package) shall be provided during detailed engineering. The contractor shall provide 2 nos. Color IP camera with PAN, Tilt & Zoom facility suitably located in 400kV outdoor switchyard. The scope of contractor shall include all associated items, accessories, line interface units, Fibre patch cards, Power supply units, Junction boxes, cables, Fibre optic cables, hardware and software etc. as applicable to meet functional requirements. Compatibility enhancement of VMS system, if needed, shall be done by the contractor under present scope.

**(g) ILLUMINATION SYSTEM :**

LED based Indoor and Outdoor Illumination & Outdoor Receptacle (As per BPS)

**(h) ERECTION HARDWARE**

Conductor(s), Al tube, bus-bar materials, cable trays & covers, Bay MB, spacers, clamps & connectors, junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels, Insulating mats, cable sealing arrangement, insulator guy arrangement, all accessories etc. as required

**(i) INSULATOR STRINGS AND ASSOCIATED HARDWARE**

Insulator strings and associated hardware fittings under present scope shall be provided by the contractor as per Bid Price Schedule (BPS).

**(j) MAIN EATHMAT**

Main Earthmat for area under present scope of work already exists at site. All the Gantry structures, equipment's support , structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor.

**(k) LIGHTNING PROTECTION (DSLIP)**

The lightning protection (DSLIP) for complete switchyard is to be provided by the contractor. The contractor shall design the lightning protection by utilizing the structures being provided under present scope. In case, additional structures (Lightning Masts) are required to meet the lightning protection, the contractor shall provide the same without any additional cost to POWERGRID. The cost for provision of lightning masts, including associated earthing materials, hardware etc. shall deemed to be included under the respective switchyard bay structures. The civil works shall be payable as per relevant item of BPS.

**(l) COMMUNICATION EQUIPMENT**

**1401648/2023/TBG-TB\_HVDC****Tele-Communication Equipment:**

- (i) The broad Scope of the procurement of FO based Communication Equipment shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing, training and demonstration for acceptance, commissioning and documentation for following
- SDH Equipment along with suitable interfaces and line cards.
  - All cabling, wiring, Digital Distribution frame patch facilities and interconnection to the supplied equipment at the defined interfaces,
  - System integration of all supplied subsystem
  - Integration with the existing communication system based on SDH and PDH of employer
  - Integration of supplied subsystem with SCADA system, PLCC equipment, PABX of RLDC/SLDC, VOIP (SIP compliant) for voice.
  - Fibre Optic Approach Cable (FOAC) along with duct and Fibre Optic Distribution Panel (FODP)
  - Integration of new Communication equipment in the existing regional NMS. All required support to existing NMS vendor for integration of new Communication equipment.

**Phasor Measuring Unit**

- (ii) The broad scope of the procurement of PMU shall include Planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing and demonstration for acceptance, commissioning and documentation for PMU as per BPS and these PMU shall support IEEE C 37.118 protocols. These PMUs shall be integrated with Phasor data Concentrator (PDC) at RLDC/SLDC for the subject project

**B) MANDATORY SPARES :**

- Design , engineering, manufacture, testing and supply including transportation & insurance, storage of mandatory spares at site as per BPS. The Break-up of Mandatory Spares shall be as per **Annexure-III**.

**C) CIVIL WORKS & SUPPORT STRUCTURE****C.1) CIVIL WORKS : BASED ON POWERGRID SUPPLIED DRAWINGS**

- Cable Trenches :** Cable trenches including cable trenches in Reactor/Transformer area along with covers including road/rail crossing, sump pits, culverts etc. shall be constructed as per tender drawings. However, Cable trench layout including invert levels shall be prepared by contractor for approval of POWERGRID based on the cable trench sections available in Tender drawings.
- (a)

Mode of measurement of this item is in RM as per BOQ. All works such as Excavation, PCC, RCC, Reinforcement, Misc. Structural steel, cable trench crossings (using RCC Hume Pipe (NP-3)), sumps etc. required as per technical specification and drawings for successful completion of the works are deemed to be included in quoted rates.

**C.2) CIVIL WORKS : BASED ON DESIGNS, ARCHITECTURAL, STRUCTURAL, FOUNDATION DRAWINGS TO BE DEVELOPED BY THE CONTRACTOR**

- (a) Structure and foundations for Equipment supports, Gantries, LT Transformers, double pole structure, DG set etc.
- Mode of measurement of this item shall be as per BOQ. The items Excavation, PCC, RCC, Reinforcement, Misc. Structural steel and all other civil works required as per technical specification and drawings for successful completion of the works are deemed to be included in quoted rates.
- (b) For buildings, the complete civil works including internal and external finishing, stone soling for flooring, plinth protection, drain along plinth protection etc. required to complete the building in all respect as per the drawing shall be payable in the plinth area rates.
- (c) Foundation for Lighting Poles, Bay Marshalling Boxes, Panels and Control Cubicles wherever required. The cost of these foundations shall deemed to be included in erection/installation of corresponding equipment of BPS.

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**Switchyard Panel Room:** The Switchyard panel rooms can be Single or Multiple. The dimensions of these building shall be decided during detailed engineering based on the technical requirements. The reference drawings of Switchyard Panel Room is attached as a part of tender drawings. These are applicable for size, plan and elevation purpose only.

- (d) Mode of measurement of this item is in SQM of plinth area as per BOQ. The calculation of plinth area shall be as per IS:3861-2002. The items Excavation, PCC, RCC, Reinforcement, Misc. Structural steel and all other civil works required as per technical specification and drawings for successful completion of the works are deemed to be included in quoted rates.

€ Any other item/design/drawing required for successful completion of the scope of works.

**C.3) LATTICE AND PIPE STRUCTURES (GALVANIZED):**

Design, engineering, fabrication, proto-assembly, supply including transportation & insurance, unloading, storage, erection and commissioning of following structures complete in all respect:

- Towers, Beams, LM (if required) and all Equipment support structures except support structure for circuit breaker. The Support structure for Circuit Breaker shall be as per manufacturer's design.

- In the bid price schedule, the structures including foundation bolts and fasteners are indicated in the form of sets. In case of 400kV switchyard, the Gantry structures are required to be quoted per diameter wise. In each diameter, the bidder shall consider all required structures. In case of 220kV switchyard, the Gantry structures including foundation bolts and fastener are required to be quoted per bay wise

- Fasteners & foundation bolts are deemed to be included in respective structure items of BPS.

- For diameter/bays where transformer is to be terminated, the structure must also consider the load and deviation which is arising due to the interconnection with other side. Further, for the last diameter/bay, the end towers must be extendable type for connecting future beams. Bus work(s) may be optimized by the contractor by suitably considering the number of diameters/bays in a bus work section.

- For design of Gantry structures, the conductor tension shall be as per **Annexure-VI**. For design of gantry structure with spans, wind speed or conductor configurations other than that specified in Annexure-VI, conductor tension shall be considered based on actual requirement of present & future scope of work. Relevant design calculations for such cases shall be submitted by the contractor for employer's approval during detailed engineering.

**C.4) FACTOR OF SAFETY:**

- Factor of safety for design of tower, equipment structures shall be 1.5 under normal condition and 1.2 under short-circuit condition.
- Factor of safety for design of tower, equipment foundation shall be 1.5 in both normal and short circuit condition as per IS 456.
- Factor of safety for stability of tower, equipment foundation like overturning shall be 2 (without wind or seismic), 1.5 (with wind or seismic) for normal and short circuit condition as per IS 1904."

**D) Any other items not specifically mentioned in the specification but which are required for erection, testing and commissioning and satisfactory operation of the substation are deemed to be included in the scope of the specification unless specifically excluded**

**E) SPECIFIC EXCLUSION**

- Employer's site office and stores
- Supply, erection, testing & commissioning of Employersupplied Transformers/Reactors as per Clause 2.2 above
- Cable from 765kV Reactor/ Autotransformer to IMB and from IMB to CMB of 765kV Reactor/ Autotransformer
- Tarriff Meter

**F) PHYSICAL AND OTHER PARAMETERS OF THE SUBSTATION****F.1) LOCATION OF SUBSTATION**

- Name of State : Rajasthan
- Nearest Railway Station : Chittaurgarh

**F.2) METOROLOGICAL DATA**

- Altitude : **Less than 1000 meter above mean sea level (MSL)**

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- Snow fall : **NIL**
- Seismic Zone : **As per IS 1893**
- Wind Zone : **As per National Building Code (NBC) 2016**
- Min./Max. Ambient Temperature : **0 / 50 degree centigrade**
- Coastal Area Consideration : **NO**

The broad scope of this specification covers /Extension of following substations for elements detailed below :

<b>III</b>	<b>Name of Substation : Extension of Mandsaur 400 kV S/s</b>
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❖	<b>400 kV Switchyard</b>
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- **Switching Scheme : Double Main & Transfer Scheme**
- Fault Level: 63 kA for 1 sec
- Line Bays: 2

**The detailed scope of work of the substation is brought out in subsequent clauses of this section. Rating of various equipments shall be as per BPS.**

<b>A)</b>	<b>ELECTRICAL EQUIPMENTS, ELECTRICAL &amp; MECHANICAL AUXILIARIES, COMMUNICATION EQUIPMENT, SWITCHYARD ERECTION EQUIPMENTS &amp; ACCESSORIES :</b>
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Design, engineering, manufacture, testing at manufacture's work, supply including transportation & insurance, unloading, storage, erection, testing and commissioning of following equipment and items complete in all respect:

<b>(a)</b>	<b>AIR INSULATED SWITCHGEAR</b>
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**400kV / 220kV / 72.5kV / 33kV CLASS EQUIPMENTS (As per BPS) :**

- CIRCUIT BREAKERS, ISOLATORS, CURRENT TRANSFORMERS, CAPACITIVE VOLTAGE TRANSFORMERS, WAVE TRAP, BUS POST INSULATORS & SURGE ARRESTER

<b>(b)</b>	<b>CONTROL AND PROTECTION SYSTEM</b>
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Complete Control, Relay and Protection system for bays under present scope as per Section–Control and Relay Panels

➤	<b>Details of Existing 400kV bus bar protection scheme is as below :</b>
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- Make & Model: GE ALSTOM & 743(AREVA)
- Peripheral Bay Units for present scope: To be supplied under present scope
- Necessary modifications, wiring, etc. for completion of the bus bar protection scheme for bays under present scope
- has to be carried out by contractor. Any modification required in the existing protection scheme is included in the present scope.

<b>(c)</b>	<b>SUBSTATION AUTOMATION SYSTEM</b>
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Augmentation of bays under present scope with existing Substation Automation System: The scope of bidder shall include but not limited to integration of IED's under present scope of augmentation with existing substation automation of Make: ALSTOM (which is based on IEC 61850) and capability enhancement of same as required including up-dating of system database, displays, development of additional displays and reports as per requirement.

- In the present scope, contractor shall also provide BCUs required for bays (bays as defined in Section: Substation Automation System) under present scope

- Any up-gradation of hardware and software for above integration shall be in the scope of contractor including license fee (if any).

The necessary interface equipment (Router, Firewall, Ethernet Switches etc.) and integration work for transferring data to RLDC (RSCC)/NLDC/National Transmission Asset Management Centre (NTAMC) at Manesar through optical fiber based SDH communication link is also under present scope. However, no work is envisaged at remote end (RLDC/NLDC/NTAMC/RTAMC etc) in the present scope

<b>(d)</b>	<b>FIRE PROTECTION SYSTEM</b>
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- Conventional type Smoke detection, Fire alarm & Annunciation System and Fire Extinguishers for Switchyard panel Rooms under the present scope

- For Switchyard Panel Room

<b>(e)</b>	<b>CABLES</b>
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- 1.1kV grade Power & Control cables (and special cables, if any) along with complete accessories including cabling works for Employer supplied equipment specified above for subject station. Methodology for supply, installation & sizing of 1.1kV Power & Control cables shall be as per **Annexure-IV**
- (f) **VMS**  
 Details of VMS (being provided under separate package) shall be provided during detailed engineering. The contractor shall provide 2 nos. Color IP camera with PAN, Tilt & Zoom facility suitably located in 400kV outdoor switchyard. The scope of contractor shall include all associated items, accessories, line interface units, Fibre patch cards, Power supply units, Junction boxes, cables, Fibre optic cables, hardware and software etc. as applicable to meet functional requirements. Compatibility enhancement of VMS system, if needed, shall be done by the contractor under present scope.
- (g) **ILLUMINATION SYSTEM :**  
 LED based Indoor and Outdoor Illumination & Outdoor Receptacle (As per BPS)
- (h) **ERECTION HARDWARE**  
 Conductor(s), Al tube, bus-bar materials, cable trays & covers, Bay MB, spacers, clamps & connectors, junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels, Insulating mats, cable sealing arrangement, insulator guy arrangement, all accessories etc. as required
- (i) **INSULATOR STRINGS AND ASSOCIATED HARDWARE**  
 Insulator strings and associated hardware fittings under present scope shall be provided by the contractor as per Bid Price Schedule (BPS).
- (j) **MAIN EARTHMAT**  
 Main Earthmat for area under present scope of work already exists at site. All the Gantry structures, equipment's support , structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor.
- (k) **LIGHTNING PROTECTION (DSLPL)**  
 The lightning protection (DSLPL) for complete switchyard is to be provided by the contractor. The contractor shall design the lightning protection by utilizing the structures being provided under present scope. In case, additional structures (Lightning Masts) are required to meet the lightning protection, the contractor shall provide the same without any additional cost to POWERGRID. The cost for provision of lightning masts, including associated earthing materials, hardware etc. shall deemed to be included under the respective switchyard bay structures. The civil works shall be payable as per relevant item of BPS.
- (l) **COMMUNICATION EQUIPMENT**  
**Tele-Communication Equipment:**
- (i) The broad Scope of the procurement of FO based Communication Equipment shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing, training and demonstration for acceptance, commissioning and documentation for following
- SDH Equipment along with suitable interfaces and line cards.
  - All cabling, wiring, Digital Distribution frame patch facilities and interconnection to the supplied equipment at the defined interfaces,
  - System integration of all supplied subsystem
  - Integration with the existing communication system based on SDH and PDH of employer
  - Integration of supplied subsystem with SCADA system, PLCC equipment, PABX of RLDC/SLDC, VOIP (SIP compliant) for voice.
  - Fibre Optic Approach Cable (FOAC) along with duct and Fibre Optic Distribution Panel (FODP)
  - Integration of new Communication equipment in the existing regional NMS. All required support to existing NMS vendor for integration of new Communication equipment.

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Phasor Measuring Unit

- (ii) The broad scope of the procurement of PMU shall include Planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing and demonstration for acceptance, commissioning and documentation for PMU as per BPS and these PMU shall support IEEE C 37.118 protocols. These PMUs shall be integrated with Phasor data Concentrator (PDC) at RLDC/SLDC for the subject project

**B) MANDATORY SPARES :**

- Design , engineering, manufacture, testing and supply including transportation & insurance, storage of mandatory spares at site as per BPS. The Break-up of Mandatory Spares shall be as per **Annexure-III.**

**C) CIVIL WORKS & SUPPORT STRUCTURE****C.1) CIVIL WORKS : BASED ON POWERGRID SUPPLIED DRAWINGS**

- (a) **Road** :Road shall be constructed as per tender drawing. However, Road layout shall be prepared by contractor and submitted to POWERGRID for approval.

Mode of measurement of this item is in SQM as per BOQ. Finished surface of concrete road is measured in sqm for payment purpose. The items earthwork (excavation, disposal etc.), compaction, rolling, watering, WBM, concreting all type, reinforcement, grating, shoulder, 100mm dia RCC hume pipe (to be provided at every 100m wherever indicated), kerb stone (if any) etc. and all other civil works required as per technical specification and drawings for successful completion of the works are deemed to be included in quoted rates.

- (b) **Cable Trenches** : Cable trenches including cable trenches in Reactor/Transformer area along with covers including road/rail crossing, sump pits, culverts etc. shall be constructed as per tender drawings. However, Cable trench layout including invert levels shall be prepared by contractor for approval of POWERGRID based on the cable trench sections available in Tender drawings.

Mode of measurement of this item is in RM as per BOQ. All works such as Excavation, PCC, RCC, Reinforcement, Misc. Structural steel, cable trench crossings (using RCC Hume Pipe (NP-3)), sumps etc. required as per technical specification and drawings for successful completion of the works are deemed to be included in quoted rates.

- (c) **Drains** : Storm water Drain layout including peripheral drains if any shall be prepared by contractor based on the drain sections available in Tender drawings and to be submitted for approval of POWERGRID.

Mode of measurement of this item is in RM as per BOQ. The items Excavation, PCC, RCC, Reinforcement, Misc. Structural steel, drain crossings (using RCC Hume Pipe (NP-3)) and all other civil works required as per technical specification and drawings for successful completion of the works are deemed to be included in quoted rates.

**C.2) CIVIL WORKS : BASED ON DESIGNS, ARCHITECTURAL, STRUCTURAL, FOUNDATION DRAWINGS TO BE DEVELOPED BY THE CONTRACTOR**

- (a) **Soil investigation Work**-Soil investigation needs to be conducted as per the technical specification. The necessary soil investigation layout and final soil report shall be proposed by vendor for approval of POWERGRID.

- (b) Soil Investigation shall be carried out for 2 bore hole locations only.

- (c) **Structure and foundations for Equipment supports, Gantries, LT Transformers, double pole structure, DG set etc.**

Mode of measurement of this item shall be as per BOQ. The items Excavation, PCC, RCC, Reinforcement, Misc. Structural steel and all other civil works required as per technical specification and drawings for successful completion of the works are deemed to be included in quoted rates.

- (d) Stone spreading and anti-weed treatment including PCC in the switchyard. Layout for the same shall be developed by the contractor.

- (e) For buildings, the complete civil works including internal and external finishing, stone soling for flooring, plinth protection, drain along plinth protection etc. required to complete the building in all respect as per the drawing shall be payable in the plinth area rates.

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Foundation for Lighting Poles, Bay Marshalling Boxes, Panels and Control Cubicles wherever required. The cost of these foundations shall be deemed to be included in erection/installation of corresponding equipment of BPS.

- (f)
- (g) Pile foundations wherever applicable
- Switchyard Panel Room:** The Switchyard panel rooms can be Single or Multiple. The dimensions of these building shall be decided during detailed engineering based on the technical requirements. The reference drawings of Switchyard Panel Room is attached as a part of tender drawings. These are applicable for size, plan and elevation purpose only.
- (h)

Mode of measurement of this item is in SQM of plinth area as per BOQ. The calculation of plinth area shall be as per IS:3861-2002. The items Excavation, PCC, RCC, Reinforcement, Misc. Structural steel and all other civil works required as per technical specification and drawings for successful completion of the works are deemed to be included in quoted rates.

- (i) Any other item/design/drawing required for successful completion of the scope of works.

**C.3) LATTICE AND PIPE STRUCTURES (GALVANIZED):**

Design, engineering, fabrication, proto-assembly, supply including transportation & insurance, unloading, storage, erection and commissioning of following structures complete in all respect:

- Towers, Beams, LM (if required) and all Equipment support structures except support structure for circuit breaker. The Support structure for Circuit Breaker shall be as per manufacturer's design.

In the bid price schedule, the structures including foundation bolts and fasteners are indicated in the form of sets. In case of 400kV switchyard, the Gantry structures are required to be quoted per diameter wise. In each diameter, the bidder shall consider all required structures. In case of 220kV switchyard, the Gantry structures including foundation bolts and fastener are required to be quoted per bay wise

- Fasteners & foundation bolts are deemed to be included in respective structure items of BPS. For diameter/bays where transformer is to be terminated, the structure must also consider the load and deviation which is arising due to the interconnection with other side. Further, for the last diameter/bay, the end towers must be extendable type for connecting future beams. Bus work(s) may be optimized by the contractor by suitably considering the number of diameters/bays in a bus work section.

- For design of Gantry structures, the conductor tension shall be as per **Annexure-VI**. For design of gantry structure with spans, wind speed or conductor configurations other than that specified in Annexure-VI, conductor tension shall be considered based on actual requirement of present & future scope of work. Relevant design calculations for such cases shall be submitted by the contractor for employer's approval during detailed engineering.

**C.4) FACTOR OF SAFETY:**

- Factor of safety for design of tower, equipment structures shall be 1.5 under normal condition and 1.2 under short-circuit condition.
- Factor of safety for design of tower, equipment foundation shall be 1.5 in both normal and short circuit condition as per IS 456.
- Factor of safety for stability of tower, equipment foundation like overturning shall be 2 (without wind or seismic), 1.5 (with wind or seismic) for normal and short circuit condition as per IS 1904."

**D) Any other items not specifically mentioned in the specification but which are required for erection, testing and commissioning and satisfactory operation of the substation are deemed to be included in the scope of the specification unless specifically excluded**

**E) SPECIFIC EXCLUSION**

- Employer's site office and stores
- Supply, erection, testing & commissioning of Employersupplied Transformers/Reactors as per Clause 2.2 above
- Cable from 765kV Reactor/ Autotransformer to IMB and from IMB to CMB of 765kV Reactor/ Autotransformer
- Tarriff Meter
- Site Levelling

**F) PHYSICAL AND OTHER PARAMETERS OF THE SUBSTATION**

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- Name of State : Madya Pradesh
- Nearest Railway Station : Neemuch

**F.2) METEOROLOGICAL DATA**

- Altitude : **Less than 1000 meter above mean sea level (MSL)**
- Snow fall : **NIL**
- Seismic Zone : **As per IS 1893**
- Wind Zone : **As per National Building Code (NBC) 2016**
- Min./Max. Ambient Temperature : **0 / 50 degree centigrade**
- Coastal Area Consideration : **NO**

**3.0 SCHEDULE OF QUANTITIES**

- The requirement of various items/equipment and civil works are indicated in Bid price Schedules.
- All equipment/items and civil works for which quantities has been given in the BPS shall be payable on unit rate basis.
- During actual execution, any variation in such quantities shall be paid based on the unit rate under each item incorporated in Letter of award.
- Wherever the quantities of items/works are indicated in Lot/Set, the bidder is required to estimate the quantity required for entire execution and completion of works and incorporate their price in respective Bid price schedules. For erection hardware items, Bidders shall estimate the total requirement of the works and indicate module-wise lump sum price bay wise and include the same in relevant Bid price schedules. Any material/works for the modules not specifically mentioned in the description in BPS, as may be required shall be deemed to be included in the module itself.

**4.0 BASIC REFERENCE DRAWINGS & OTHER DESIGN INPUTS**

- The reference drawings, which form a part of the specifications, are given at **Annexure-I**. The contractor shall maintain the phase to earth clearance, phase to phase clearance and sectional clearances, clearances between buses, bus heights but may alter the locations of equipment to obtain the statutory electrical clearances required for the substation

- It is responsibility of contractor to develop single line drawing, general arrangement drawing, layout drawings, foundation & cable trench layout, erection key diagram & all other layout drawings for present scope of work. Layout drawings shall be finalized during detailed engineering based on best engineering practices and meeting the requirements of bidding documents.

- Each circuit of a double circuit transmission line shall be terminated in different diameters.
- Transformers of same HV rating shall be placed in different diameters.
- Bus reactors of same HV rating shall be placed in different diameters.

Sl. No Description of bay 400/220kV Neemuch P/S

	400 kV	220 kV
1. Bus Bar	4000A	4000A
2. Line bay	3150A	1600A
➤ 3. ICT bay	3150A	1600A
4. Bus Reactor bay	3150A	-
5. Bus Coupler bay	-	3150A
6. Transfer Bus coupler bay	-	1600A

- Location of identified land and Plot plan for land shall be provided to successful bidder during detailed engineering
- Transmission line side conductor type & configuration of conductors for transmission lines of all voltage levels shall be provided to successful bidder during detailed engineering
- Refer **Annexure-XX** for details regarding existing substation. Other details of existing substation shall be furnished during detailed engineering. However, bidder may visit the sub-station site to get themselves familiarized with the existing facilities

**5.0 DIFFERENT SECTIONS OF TECHNICAL SPECIFICATION**

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Employer has standardized its technical specification for various equipment and works for different voltage levels. Items, which are not applicable for the scope of this package as per schedule of quantities described in BPS, the technical specification for the items should not be referred to. For the purpose of present scope of work, technical specification shall consist of following sections and they should be read in conjunction with each other.

- Section-Project Rev 0
- Section-General Technical Requirement (GTR): Rev 15
- Section-Switchgear- CB: Rev 11
- Section-Switchgear- ISO: Rev 11B
- Section-Switchgear- Instrument Autotransformer: Rev 11
- Section-Switchgear- Surge Arrester: Rev 12
- Section-Power and Control Cables: Rev 06
- Section-Lighting System: Rev 07
- Section-Fire Protection System:Rev 06
- Section-LT Transformer:Rev 05
- Section-DG Set:Rev 05
- Section-Battery & Battery Charger:Rev 06
- Section-LT Switchgear:Rev 05
- Section-Air Conditioning System: Rev 04
- Section-Switchyard Erection:Rev 10
- Section-Structures:Rev 06
- Section-Civil Works:Rev 11A
- Section-Control and Relay Panels:Rev 09
- Section-Substation Automation System:Rev 04
- Section-PLCC:Rev 05
- Section-Telecommunication Systems:Rev 02
- Section-PMU: Rev 00
- Section-Shunt Reactor upto 400kV, Neutral Grounding Reactor and Surge Arrester:Rev 11
- Section-Transformer (Up to 400kV Class): Rev 13

In case of any discrepancy between Section-PROJECT and Section-GTR and other technical specifications on scope of works, Section-PROJECT shall prevail over all other sections. In case of any discrepancy between Section-GTR and individual sections for various equipment, requirement of individual equipment section shall prevail. In case of any discrepancy between Main body of Section-Project and Annexure(s) of Section-Project, provisions specified in Main body of Section-Project shall prevail

## **6.0 MANDATORY SPARES**

The prices of mandatory spares shall be given by the Bidder in the relevant schedule of BPS and shall be considered for evaluation of bid. It shall not be binding on the Employer to procure all of these mandatory spares. The bidder is clarified that no mandatory spares shall be used during the commissioning of the equipment. Any spares required for commissioning purpose shall be arranged by the Contractor. The unutilized spares if any brought for commissioning purpose shall be taken back by the contractor.

Wherever spares in BPS/Technical Specification has been specified as “each type/each rating/each type & rating”: If the offered spare/spares are sufficient to replace the respective main equipment of all types/ratings, then such offered spare/spares shall be acceptable. It implies that common spare/spare set fulfilling the spare requirement of all types/ratings shall also be acceptable, provided it is configurable at site itself without special assistance of OEM

Mandatory Spares, wherever mentioned, are envisaged for the equipment/items being supplied under the main equipment heads under present scope meeting the requirements of Technical Specifications. The component/sub-component of an equipment/item specified in BPS under Mandatory Spare, which is not applicable as per the offered design of respective main equipment, shall not be referred to.

## **7.0 SPECIFIC REQUIREMENT**

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- 7.1 The specific requirements as mentioned at C/ENGG/SPEC/SEC-PROJECT/SPECIFIC REQUIREMENT Rev. no 06 enclosed at Annex-II and relevant/applicable clauses shall be referred for specified scope of work
- 7.2 Clause No. 24.1 of Section GTR Rev 15 is amended as **Annexure-V**
- 7.3 In case of 220kV line protection panel, Numerical Distance protection relay as Main-I and Line Current differential relay (with back up distance protection feature) as Main- II shall be provided. Remote end relays for 220kV lines are not covered under present scope.
- 7.4 The core details for 245kV, 2500A, 120% extended Current Transformer shall be as follows:
- a) Primary ratio tap: 2500-1600-800/1-1-1-1A
  - b) Class: PX, PX, 0.2S, PX, PX
  - c) Core: 5
  - d) Min. Knee point voltage  $V_k$ : 2500-1600-800 V for each core except metering
  - e) Burden: 20VA (For Metering core)
  - f) Max. CT sec. winding resistance  $R_{ct}$  (ohms): 12.5/8/4 for 2500/1600/800 tapping
  - g) Max. excitation current at  $V_k$  ( $I_{max}$  in mA): 16/25/50 for 2500/1600/800 tapping
- 7.6 All Circuit Breaker Relay Panel Shall be provided with Auto-reclose function. However, during execution stage Auto-reclose function shall be enabled/disabled based on application.
- 7.7 Sl. nos. (i), (iv) and (v) of Reference Drawings mentioned at Annexure-D of Section- Shunt Reactor upto 400kV, Neutral Grounding Reactor and Surge Arrester Rev-11 stands deleted.
- 7.8 Decentralized (Distributed) type Bus bar protection system shall be provided at Neemuch (New) substation.
- 7.9 Digital RTCC Panel under present scope shall be of front opening type.

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New clause added at Clause No. 22.0 of Section Civil Works Rev 11A as below:

a. The copyright in all drawings, documents and other materials containing data and information for such design(s) to be developed by the Contractor or through any third party under this Contract shall remain vested in the Employer for a period of 5 years from the date of Completion of the Contract. In case the Contractor intends to use these design(s) for any purpose other than for project(s) to be executed by POWERGRID prior to the period of 5 years as above, the Contractor shall obtain a written permission from POWERGRID to this effect. The permission shall be granted or otherwise by POWERGRID keeping in view the specifics of the case and POWERGRID shall be sole judge in this regard.

In case any breach of the aforesaid provisions of copyright during the copyright retention period comes to the notice, POWERGRID shall take the action as deemed fit keeping inter-alia under the provisions of the Integrity Pact.

7.10 b. The Contractor may also use previous structure designs and associated foundation designs meeting specification requirements, which have been designed by them for any other project of POWERGRID, having copyright retained thereof with POWERGRID, without any financial implication and without any written permission from POWERGRID as per para (a) above.

c. In case the Contractor uses previously designed structure and associated foundation designs meeting specification requirements, developed by the Contractor for any other utility/developer, POWERGRID shall be free to use designs and reproduce all drawings, documents and other material for the purpose of the Contract including, if required, in its any other project and for operation and maintenance, without any financial implication. The contractor shall ensure to submit only those documents for which they hold copyright.

d. Also, all the drawings indicated at (a) & (b) above shall carry the following statement and shall be displayed conspicuously on the drawing:

7.11 In Section-GTR and other technical specifications, the term 'Employer and/or 'Purchaser may be read as Employer.