1290938/2023/TBG-TB_ENG_SR

TQR Ref: TBEM/FFS/TQR

TECHNICAL PRE QUALIFICATION REQUIREMENT

Name of 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 through TBCB route**
Name of Customer	**POWERGRID NEEMUCH TRANSMISSION LTD.**
Name of Package	**FIRE FIGHTING SYSTEM**

TECHNICAL PRE QUALIFICATION REQUIREMENT

The Bidder is required to meet the pre-qualification requirement for Fire Fighting system as per criteria stipulated below:

The bidder should have designed, co-ordinated the manufacture, supplied, erected, tested & commissioned at least one number firefighting system of each type described in (i), (ii) & (iii) below in installations such as power plants, sub-stations, refineries, fertilizer plants or other industrial or commercial installations. Such systems must have been designed to the recommendations of Tariff Advisory Committee of India or any other internationally reputed authority like FOC, London or NFPA, USA etc. executed **during the last ten (10) years as on the date of techno-commercial bid opening of this tender.**

i. Hydrant type fire protection system comprising fire pumps, pressurising arrangement, outdoor & indoor pipe work, hydrant valves, hoses with branch pipes, nozzles, hose boxes and other accessories including instrumentation & control.

ii. Automatic high velocity water spray (HVWS/ MVWS/ Sprinkler System) type fire protection system for electrical equipment such as Transformers, reactors or oil storage installation or LPG storage. Each system shall comprise of fire pumps, pressurising arrangement, outdoor/ indoor pipe work, sprinkler/ nozzle array, heat detector network and all other accessories including instrumentation & control.

iii. Fire Extinguishers & Smoke detection and alarm System.

In support of the same the bidder should submit copy of Purchase order/work order along with completion certificate from buyer/ customer. Above Fire Fighting Systems could have been executed under single or multiple purchase orders /projects.

SUPPORTING DOCUMENTS TO BE ATTACHED AGAINST EACH CREDENTIAL

Sr	Required Criteria	Supporting Documents to be submitted by bidder along with technical bid
1	Design	Approved drawings/GTP etc.
2	Supply	Copy of PO/Work order/Material receipt certificate at site, etc.
3	Commissioning/ETC/ Execution	Pre commissioning report / commissioning report and final work completion or handing over report/certificate for complete fire-fighting system.

Notes (General points):

1. Consideration of offer shall be subject to customer's approval of bidder as approved vendor for this package.

2. Bidder to submit all supporting documents in Hindi/English. If documents submitted by bidder are in language other than Hindi/English, a self- attested English translated document should also be submitted.

3. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.

4. After satisfactory fulfilment of all the above criteria / requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

1290936/2023/TBG-TB_ENG_SR

भारत हैवी ईलैक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LIMITED
पारेषण व्यापार अभियांत्रिकी प्रबंधन
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

प्रलेख संख्या/ DOC. No	TB-418-552-001	परिशोधन संख्या/ Rev. No.	0		बनाया/ Prepared	जांचा/ Checked	स्वीकृती/ Approved
TYPE/ प्रकार OF DOC.	TECHNICAL SPECIFICATION			हस्ता. / SIGN			
TITLE/ शीर्षक	FIRE FIGHTING SYSTEM			नाम / NAME	AJ	AR	VK
				दिनांक/ DATE	03.02.23	03.02.23	03.02.23
				समूह/GROUP	TBEM	W.O. No	88009

ग्राहक/ CUSTOMER	**POWERGRID NEEMUCH TRANSMISSION LTD.**
परियोजना/ 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 through TBCB route**
NOA 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**
STATION	**400/220kV AIS Neemuch New S/S, Madhya Pradesh Extension of 400kV Chittorgarh S/S, Rajasthan Extension of 400kV Mandsaur S/S, Madhya Pradesh**

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

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SECTION 1
INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA AND SCOPE

1.0.0 INTENT OF SPECIFICATION

This specification is intended to specify the requirements for design, engineering, manufacture, assembly, stage testing, inspection, testing before supply, packing, forwarding, transportation at site, unloading & storage ***(unloading and storage are only for Neemuch Site***), complete erection of all equipment and accessories, testing of the system, trial run, commissioning of the system ***(ETC scope is for Neemuch and Chittorgarh Stations),*** final painting and carrying out acceptance test of Fire Fighting System along with its accessories and auxiliary equipments / instruments etc. as mentioned in this section and in various other sections of this specification **for 400/220 kV AIS Sub-station at NEEMUCH & Extension of 400kV Chittorgarh S/S and 400kV Mandsaur Extn. of PNTL (POWERGRID NEEMUCH TRANSMISSION LTD.)**

1.1.0 The system shall be designed, erected & commissioned in accordance with **TAC/ NFPA** guidelines.

1.2.0 Requirements pertaining to type, make, quality, testing & inspection of equipments as laid down in various clauses of CUSTOMER Specification, enclosed in Section 2, shall be full & final. In the event of any contradiction w.r.t. other sections of this specification, technical requirements of Section 1 & 2 shall prevail.

1.3.0 The Bidder shall be deemed to have understood completely all the tender drawings and documents and quoted accordingly.

1.4.0 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respect to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to Purchaser / Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his/their judgment is not in full accordance with the specifications.

1.5.0 The Bidder to note carefully that parameters, estimated capacities of equipment indicated and the tender drawings in the specification are only for the guidance of the Bidder. The system shall be designed as per relevant standards/ codes and exact capacities and quantities are to be estimated by the Bidder. All such estimations and design calculations shall be submitted for Purchaser's approval.

1.6.0 The Contract shall be on unit rate basis for the quantities furnished by BHEL. During contract stage, quantities of various items of BOQ may vary to any extent and same rates will be applicable so far the resultant variation in total contract value is within % Variations defined in the NIT.

1.7.0 The term 'Customer' appearing in this specification shall refer to **PNTL (POWERGRID NEEMUCH TRANSMISSION LTD.)**, the term **'Purchaser'** shall refer to **BHEL** and the term **'Contractor'** shall refer to the **successful Bidder**.

1.8.0 There shall preferably be no deviation on technical specification. The bidder shall sign and stamp the "Certificate for No Deviation" enclosed in Schedule-3, Section-5 towards confirmation.

Deviations in any other form including clarifications / assumptions / observations, input data in the GTP etc will not be considered and it will be construed that the bid conforms strictly to the specification.

2.0.0 TYPE OF FIRE PROTECTION REQUIRED

NEEMUCH S/s

i) Hydrant system for all the buildings in the substation viz. control building, Transformers (2 nos.), Reactors (1 no.), LT transformer area (2 nos. auxiliary transformers), firefighting pump house, DG Set and store.

Location of above areas in switchyard are as per attached layout.

ii) HVW spray system for:

Rating of Bus Reactors without NGR & Nos.: 125 MVAR, 420kV, 3phase Bus Reactor- 1 No.

OGA of 125MVAR reactor (BHEL make) is enclosed for reference and estimation purpose only.

Rating of Auto-Transformers/ s : 500MVA, 400KV/220/33 kV, 3-phase Autotransformer
No. of Auto Transformers : 02 Nos.
(OGA of 500MVA Transformer (BHEL make) is enclosed to this spec. for reference and estimation purpose.)

iii) Conventional fire detection & alarm system for 4 Nos. Switchyard Panel Rooms (under present scope) and Control Room Building. (Locations of switchyard panel rooms and CRB are shown in the plot plan layout attached to this spec.)

iv) Capacity and qty. of fire extinguishers are given in scope of supply Cl. No. 4.1.0. These extinguishers shall be installed in Switchyard Panel Rooms, Control Room Building, Fire Fighting pump house, LT transformers & DG set areas. Distribution of these shall be finalized during detailed engineering.

CHITTORGARH S/s

i) Conventional fire detection & alarm system for 1 No. Switchyard Panel Rooms (under present scope). (Locations of switchyard Panel rooms is shown in the plot plan layout attached to this spec.)

ii) One no. 4.5 kg CO2 type potable fire extinguisher are given in scope of supply. This extinguisher shall be installed in Switchyard Panel Room.

MANDSAUR S/s

i) Fire buckets -6 Nos.

ii) 22.5 kg CO2 type wheel/trolley mounted Fire extinguisher-2 Nos.

iii) 50 Litre Foam Type trolley/Wheel mounted Fire Extinguisher-2 Nos.

iv) Dry Chemical type 75Kg Trolley mounted fire extinguisher-1 No.

3.0.0 DESIGN CRITERIA

3.0.1 The equipment offered shall comply with the relevant Indian Standards. The equipment conforming to any other approved international standards shall meet the requirement called for in the latest revision of relevant Indian Standard or shall be superior. The Deluge valves, HVW

spray nozzles & quartzoid bulb detectors shall have the approval of any of the following agencies;

a. UL of USA.
b. F M of USA
c. LPCB of UK or
d. VDs of Germany,

3.0.2 Light Hazard occupancy shall be considered for hydrant protection.

3.0.3 All the requirements regarding supplies, provisions of control, interlocks, indications, annunciations, alarms etc, stipulated in various clauses of POWERGRID specification (Section 2) shall be satisfied by the contractor in totality.

3.0.4 It is contractor's responsibility to prepare the standard HVW spray drawing of Reactors & Transformers of each rating/type/make and get approval on the same from Powergrid as a part of standardization which is a normal practice in any sub-station project. BHEL shall extend help in this approval process.

3.0.5 Interfacing Requirement (Neemuch New S/s)

Provision of sufficient potential free contacts in FAP to repeat all the firefighting system alarms in ***SAS (Substation automation system)*** as specified in various clause of customer specification attached in section-2.

Also, Annunciations windows, zone cards and suitable nos. of terminal blocks (with complete internal wiring etc.) shall be provided for future switchyard panel rooms (5 Nos.) & future transformer/reactors (9 Nos.) in the Annunciation panels and FAP under present scope.

Future scope shall be clearly demarcated and shown in the drawing of annunciation panel of pump house and control room building.

3.0.6 Interfacing Requirement (Chittorgarh Extn. S/s)

Suitable no. of terminal block and space will be provided by customer in the existing Annunciation cum fire alarm panel in the control room to annunciate fire signals in SPR. However 2 zone cards (working +standby) shall be supplied and installed by contractor in the existing FAP (Agni make) for above purpose.

All detection devices including detectors, MCP and hooters in switchyard panel room shall be hooked up with existing Fire alarm cum annunciation panel by contractor.

However cable laying and termination scope to wire fire signals from equipment to Junction box in SPR and further from SPR junction box to fire alarm cum annunciation panel in CRB shall be done by the contractor.

4.0.0 SCOPE OF SUPPLIES & SERVICES

The requirements mentioned under this clause are ***indicative and minimum*** for the system. Any other item/ service required to complete the work for safe and sound operation of system (as under customer technical specification enclosed under section-2) shall be provided and installed by the bidder at no extra cost to the BHEL.

4.1.0 SCOPE OF SUPPLY

Complete supply for <u>NEEMUCH New S/s</u> consists of following scope broadly:

Sr. No.	System	Areas Covered
1	Hydrant System	a) Control room Building b) LT transformer area c) Fire Fighting pump House d) Store e) Auto Transformers f) Reactors
2	Conventional Fire Detection and alarm System (As per customer spec. Cl. No-2.03.00 attached to Section-2)	a) Switchyard Control Room Building b) Switchyard panel rooms- 4 nos. (Present scope) and 5 nos. (Future scope)
3	HVW Spray System	a) 2 Nos. Autotransformer b) 1 No. of 125 MVAR reactor
4	Pumping arrangement for HVW system & hydrant system, complete with all piping, valves, fittings, puddle flange, nozzles, level switch, pressure switches and indicator etc. inside pump house and water tank as per POWERGRID technical specification attached to section-2.	For supply of water to hydrant and HVW system
5	Fire Extinguishers as per Powergrid technical specification attached to section-2.	i) 9 Lt Water type ii) 4.5 Kg CO_2 type iii) 5 Kg DCP type iv) 50 Lt. Mechanical foam type
6	Civil	RCC Pedestals for above ground piping Deluge valve housings Pylon supports for HVW spray system
7	Electricals (All type of panels as defined including all annunciation for present and future scope of SPR and Transformers/reactors & Junction boxes of suitable sizes/capacity TB's for cable laying between the equipment to panel and panel to panel)	As per Cl. No. 2.06 of POWERGRID Specification attached under section-2.

8	Mandatory Spares: a. Smoke detectors b. Pressure gauge c. Pressure switch	 4 nos. 1 no. 1 no.
9	Erection, Testing & commissioning	For complete fire fighting system as per specification.

Complete supply for <u>CHITTORGARH EXTENSION S/s</u> consists of following scope broadly:

Sr. No.	System	Areas Covered
1	Conventional Fire Detection and alarm System (As per customer spec. Cl. No-2.03.00 attached to Section-2)	a) Switchyard panel rooms (2 nos.)
2	Fire Extinguishers as per Powergrid technical specification attached to Section-2.	a) 4.5 Kg CO_2 type
3	Electricals (supply of zone cards and installation in existing fire alarm cum annunciation panel in CRB and hooking FDA devices of SPR with the same including cable laying and supply of junction box etc.)	As per Cl. No. 2.06 of POWERGRID Specification attached under section-2.
4	Mandatory Spares: Smoke detectors	 4 nos.
5	Erection, Testing & commissioning	For complete firefighting system as per specification.

Complete supply for <u>MANDSAUR EXTENSION S/s</u> consists of following scope broadly:

Sr. No.	System	Areas Covered
1	1 set consist of a) 1 no. Fire Bucket Stand with 6 nos. hooks for hanging 6 nos. fire buckets alongwith canopy b) 6 nos. fire buckets of 9kg/9 ltrs. Capacity. Fire bucket stand of suitable size made out of G.I. angle for frame, G.I. channel for Base 10SWG, G.I. steel for hood & 2 nos. hook Fire buckets 9 ltrs./9Kg Capacity made out of 26 (0.46mm) SWG MS sheet painted with white & red enamel paint inside & outside respectively. Bottom of the bucket shall be U shaped, outside of the bucket shall be written as "Fire" in English/Hindi in white enamel paint. Preferred make: KANEX or equivalent	1 Set

2	22.5 kg CO2 type trolley mounted Fire extinguisher	2 Nos.
3	50 Litre Foam Type trolley/Wheel mounted Fire Extinguisher	2 Nos.
4	Dry Chemical type 75Kg Trolley mounted fire extinguisher	1 no.
5	Erection, Testing & commissioning	Not Applicable

Besides, the Bidder shall take a note of the following while preparing his offer:

a. Water shall be provided at one point (bore well) on switchyard fencing by Purchaser/Customer. However exact location of borewell and tap-off point for connection shall be informed during detailed engineering stage. 100 NB MS pipe shall be considered to connect tap off point to water reservoir. Location of open store for providing hydrant post shall be informed during detailed engineering stage.

b. One no. gate valve with a blinding flange suitable for available pipe size shall be provided on the main incomer to water reservoir for tapping water supply to control building. Piping further from this valve to control building shall be in other's scope.

c. BIDDER IN HIS OFFER SHALL FURNISH THE REQUIREMENT OF FEEDERS i.e. NOS., TYPE & RATING FOR PUMP HOUSE & CONTROL ROOM. PURCHASER WILL LAY THE MAIN INCOMER CABLES UPTO THE EMD MAIN FIRE PUMP PANEL, JOCKEY PUMP PANEL, ACDB PANEL IN PUMP HOUSE AND DCDB PANEL IN PUMP HOUSE UNDER FIRE FIGHTING SYSTEM, HOWEVER TERMINATION OF THESE CABLES SHALL BE DONE BY CONTRACTOR. ALL CABLING FURTHER FROM THESE PANELS TO EQUIPMENT UNDER CONTRACTOR'S SCOPE OF SUPPLY AND FOR CONTROL & INTERLOCKING OF VARIOUS EQUIPMENTS SHALL BE IN CONTRACTOR'S SCOPE.

d. Power & Control cables for fire protection system (except 2CX1.5 sqmm. unarmored cable for fire Detection & alarm system) will be supplied on free issue basis to contractor. BHEL shall procure various sizes of cables ***(as per Annexure 'A' of this section)*** for the complete requirement of sub-station. Contractor shall have to choose their cables from the available sizes only and necessary modifications in their equipment for termination of these cables shall be made by contractor.

e. Since laying & termination of all power & control cables is in contractor's scope, supply of cable accessories such as **junction boxes with suitable capacity/sizes of terminals** as per cable schedule (shall be finalized during detailed engineering) of complete firefighting system, lugs, glands, cable tags & markers etc. shall be deemed to be included by the bidders in their offers. **Cables for detection and alarm system shall be as per 2.03.04 of POWERGRID specification attached under Section-2. Bidder should considered prices of cable laying between panels to equipment within pump house under different heads of BOQ suitably.**

f. **Some cable sizes are mentioned in ETC BOQ for cabling between field to pump house annunciation, DCDB to reactors/transformer DVLCP, annunciation panel in control room to annunciation panel in pump house etc. as defined in the specification. Cable schedule shall be prepared and submit by contractor during detailed engineering for approval. Further cable laying and termination shall be done by contractor as per approved cable schedule.**

g. **Cable laying between firefighting panels (annunciation panel in pump house, control room and DVLCP) to SAS panel (under purchaser scope) shall be done by BHEL. However all termination at firefighting panel's end shall be done by contractor.**

h. All other areas of control building except toilets, pantry, AC/ DC distribution room, shall be considered to be having false ceiling.

i. Necessary cable trays will be supplied on free issue basis to the contractor, however necessary hardware for fixing the same on walls or elsewhere shall be included by the bidders suitably in their offers.

j. A warning plate shall be placed near the hydrant points for the transformers and reactors substations to clearly indicate that water shall be sprayed only after ensuring that the power to the transformer/ reactor which is on fire is switched off and there are no live parts within 20metres of distance from the personnel using the hydrant. Although not specifically mentioned as BOQ item, these warning plates as per customer specification attached to section-2 shall be supplied and installed by contractor and prices against the same shall be considered suitably by bidder in their offer suitably.

k. Earthing material viz. GS flat & wire will also be supplied on free issue basis to contractor, however requirement shall be given by the bidders in their respective bids and earthing of firefighting equipment shall be done by contractor.

l. Road, Rail crossing of fire water piping shall be through RCC Hume pipes duly covered with coating and wrapping as per specification. Purchaser shall supply and lay these hume pipes of suitable size as per final approved piping layout.

m. Most of piping around control room building shall be underground due to paved area. All underground piping shall be suitable wrapped with wrapping coating material. This wrapping coating material shall be supplied and erected by contractor.

(a) Pipes to be buried underground shall be provided with protection against soil corrosion by coating and wrapping with two coats of coal tar hot enamel paint and two wraps of reinforced fibre glass tissue. The total thickness of coating and wrapping shall not be less than 3 mm. Alternatively corrosion resistant tapes can also be used for protection of pipes against corrosion.
(b) Coating and wrapping and holiday testing shall be in line with IS:10221.
(c) Buried pipelines shall be laid with the top of pipe one meter below ground level.
(d) At site, during erection, all coated and wrapped pipes shall be tested with an approved Holiday detector equipment with a positive signalling device to indicate any fault hole breaks or conductive particle in the protective coating.

n. RCC pedestals for pylon supports around transformer/ reactor from bottom of sump pit to foundation level of transformer/ reactors will be provided by ultimate client. Pylon pipe shall be mounted on top of RCC pedestal by the bidder using suitable fixing arrangements. Pipe size for pylon, size of Anchor fasteners etc. shall be adequate for the support to provide sufficient rigidity against vibration & load during operation. The whole arrangement shall be in bidder's scope. The contractor shall justify adequacy of design during engineering.

o. Its contractor’s responsibility to provide HVWS pylon support drawing to ultimate client on time just after PO placement to ensure provision of aforesaid RCC pedestals.

p. ***All the nozzles and flanges in fire- water reservoir shall be supplied by the contractor. Similarly valves for nozzles for drain shall also be supplied by the contractor. Though not specifically mentioned in the BOQ, bidders shall suitably consider the prices for the same in their respective bids.***

q. Contractor shall submit valid Type test report for approval by owner. Fresh type test of equipment is not envisaged. It is presumed that equipment offered are duly type tested.

Type Test Certificate for degree of protection shall be submitted for the following:

1. Deluge Valve local control panel
2. All other electrical panels in pump house and control room as per customer specification.

In case the type test reports are found un-satisfactory, tests shall be carried out afresh by contractor without any additional cost implication to BHEL. The final decision for accepting/ rejecting of type test report shall be of POWERGRID. Hence contractor must ensure that panel manufacturer has valid and POWERGRID approved type test report before ordering.

r. Makes furnished in Appendix –V of POWERGRID FPS spec Rev.06 (provided as annexure to section-2) is indicative and final make shall be decided after detailed engineering with POWERGRID. Besides, any other vendor listed in POWERGRID's "compendium of approved vendors", which is available on the internet, can also be chosen. In case, no vendor is specified in compendium against a particular item, only reputed makes available in the market shall be considered. All such makes shall be subjected to acceptance of POWERGRID. No additional price implication shall be made to BHEL on account of non-acceptance of proposed makes by POWERGRID.

s. All the components except transformer & reactor as appearing in the P&I diagram (as a part of POWERGRID specification attached in section-2) are in contractor's scope of supply & ETC. **Also, bidder should note that the pipe/valve sizes mentioned in the P&I is minimum and indicative requirement. Bidder should decide the pipe size of header to take care of requirement of hydrant and spray for reactor/transformer based on the hydraulic calculation and consider the same in his offer. There shall not be any price implication to BHEL/POWERGRID due to change of any pipe/valve size during detailed engineering.**

t. **While making his Bid, Bidder should check the requirements carefully for 400kV sub-stations, which are clearly demarcated in Section-2, Appendix-I**

u. Any spares required for commissioning purpose shall be supplied separately by the contractor.

4.2.0 SCOPE OF SERVICES

4.2.1 Erection, Testing & Commissioning (ETC) requirements

a) The scope of ETC shall include receipt of material at site, safe storage of material, handling of equipment/ material at site, erection of equipment /material at site including fabrication, equipment and system testing, commissioning of the entire system at **400kV Neemuch New S/s and Chittorgarh Extension Site. There is no ETC work at Mandsaur S/s.**

b) Erection of pipe pylon supports, with pipe hangers and other pipe supports corresponding to HVW Spray system.

c) Painting of aboveground piping (for hydrant system & HVW spray system in the pump house & switchyard), pipe pylon supports etc. as per customer specification.

d) Surface of over ground pipes shall be thoroughly cleaned of mill scale, rust etc. by wire brushing. Thereafter one (1) coat of **red oxide primer** shall be applied. Finally, two (2) coats of synthetic enamel paint of approved colour shall be applied.

e) The paint thickness shall not be less than 60 microns. Finished parts shall be coated by peelable compound by spraying method to protect the finished surface from scratches, grease, dirt and oily spots during testing, transportation handling and erection.

f) The colour scheme as given below shall be followed for Fire Protection:

Sl. No.	Pipe Line	Base Color	Band Color
01	Hydrant and Emulsifier system pipeline	Fire Red	-----
02	Emulsifier system detection line-water	Fire Red	Sea Green
03	Emulsifier system detection line –	Fire Red	Sky Blue

	Air		
04	Pylon support pipes	Fire Red	--------

g) Land excavation, laying of underground piping for hydrant/ spray system with wrapping & coating & backfilling.

h) Laying and termination of power and control cables for the equipment under the scope this specification.

i) Laying & fixing of cable trays on walls or elsewhere.

j) All the installations in the switchyard and pump house shall be properly earthed by the contractor to the nearest earthmat riser of the Owner / Purchaser.

k) The contractor shall arrange all machinery -tools & tackles and consumables required for erection of the system.

l) Contractor shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The contractor shall furnish a list of commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the Contractor.

m) Conducting Performance Guarantee tests to the satisfaction of Customer/ Purchaser.

n) It is the responsibility of the successful Bidder to obtain necessary approval/ clearance from statutory organizations wherever applicable for the equipment/ systems under the scope specified.

o) After completion of erection and commissioning of the system, the contractor shall train site engineers of Purchaser/Owner so that they are fully conversant with both electrical and mechanical part of the package.

p) The contractor shall furnish the operation and maintenance manual specifically compiled for each of the sub-stations. The draft O&M manual shall be submitted within 20 weeks after award of contract. The O&M manual shall contain the following information:

i) Description of the system and equipment with design particulars
ii) Instruction for erection.
iii) Instruction for operation, maintenance and repair.
iv) Recommended inspection practices and inspection schedule.
v) Ordering information for all replaceable parts
vi) Recommendation for type of lubricants and frequency of lubrication.

4.2.2 Civil Works

The following shall be in the scope of Contractor:

a) Construction of RCC pedestals to support the above ground piping for hydrant & spray system and for pylon supports of HVW spray system outside sump pit, wherever required. The FGL level of complete switchyard is divided in to 3. All level are marked in the drawing attached to this specification. FGL of 220kv yard is at 102.25M, FGL of 400Kv yard including transformer and reactor is at 101.75M and FGL around CRB, DG set, LT yard and pump house area is at 101.5M. Contractor shall take care of this FGL level while designing pedestals for pipe support in those areas accordingly.

b) Construction of housing for deluge valve and painting the same on outside & inside. The housing shall have RCC roof of minimum 75mm thickness.

c) Minor civil works such as grouting, filling up of crevices/ cut outs etc during installation of equipment shall also be in contractor's scope. Any other damage caused to civil works during ETC

work of the equipment/system shall be made good to the original finish by the Contractor at no extra cost to the Purchaser.

Note: Though not specifically mentioned as line item in the BOQ, all prices against above civil works shall be included by Bidder in their offer suitably.

4.2.3 Inspection & Testing

All the equipments shall be inspected prior to dispatch in line with relevant IS, approved GTP/ drawing and technical specification.

Sl. No.	Item / Equipment	Reference document for inspection	Inspection Level
01	Fire Protection System		
A	Panels, Hydro pneumatic tank for fire protection system.	POWERGRID TS/ Approved GTP or document	**III**
B	Deluge valve, Strainers, MS/GI pipes, Pumps, motors, air compressor, and other valves, Diesel Engines	POWERGRID TS/ Approved GTP or document	**II**
C	Others	POWERGRID TS/ Approved GTP or document	**I**

5.0.0 EXCLUSIONS

5.1.0 Supply of Transformer/Reactor.

5.2.0 Supply and laying of hume pipes of suitable size for underground piping.

5.3.0 Supply of power & control cables for the system except for fire detection & alarm system which shall be supplied by contractor.

5.4.0 Supply of necessary cable trays for laying power and control cables, wherever required.

5.5.0 Supply of GI flat for earthing of equipments is free issue item to contractor. However, earthing of all firefighting equipment shall be done by contractor.

5.6.0 Construction of control room building, switchyard panel room, pump house & water storage tank and outdoor cable trench.

5.7.0 Construction of equipment foundations, cable trench inside the pump house. The contractor shall submit foundation details and supply foundation bolts etc. within one month of LOI.

5.8.0 Unloading and safe storage for Chittorgarh & Mandsaur S/s.

5.9.0 ETC work for Mandsaur S/s.

6.0.0 HANDING & TAKING OVER

It is the responsibility of the Contractor to run and maintain the plant till it is handed over to the owner. Contractor shall assist purchaser to hand over the plant to owner.

7.0.0 UTILITIES AVAILABLE

Construction water and 415 V power shall be provided/arranged as per NIT terms and conditions. Please refer the same.

8.0.0 VARIOUS HEADS (BOQ) TO BE QUOTED FOR

8.1.0 Based on the above input it is recommended that the bidders shall submit their offers in the prescribed format only:

A. NEEMUCH New S/s: As per Annexure-BOQ-Neemuch

B. CHITTORGARH Extn. S/s: As per Annexure-BOQ-Chittorgarh S/s Extn.

C. MANDSAUR Extn. S/s: As per BOQ-Mandsaur S/s Extn.

ANNEXURE-BOQ-NEEMUCH

Sl. No.	Item Description	Unit	Qty.	Supply	ETC
I	**Establishment of 400/220kV Neemuch**				
1	Pumping arrangement for HVW system & hydrant system, complete with all piping, valves, fittings, etc. inside pump house for Fire Protection System of 400/220kV (New) Substation	Set	1	Below items and quantity are for 1 set	
1.1	Electric Motor Driven Main Pump 410 cu.m/h	No.	1	Yes	Yes
1.2	Electric Motor Driven Jockey Pump 10.8 cu.m/h	No.	2	Yes	Yes
1.3	Diesel Driven Standby Pump 410 cu.m/h alongwith high speed diesel tank, globe vave etc as per specification	No.	1	Yes	Yes
1.4	MS Pipe (FE410 Grade) - 300NB	m	40	Yes	Yes
1.5	MS Pipe (FE410 Grade) - 250NB	m	30	Yes	Yes
1.6	MS ERW Pipe (Medium Grade) - 100NB	m	60	Yes	Yes
1.7	MS ERW Pipe (Medium Grade) - 80NB	m	6	Yes	Yes
1.8	MS ERW Pipe (Medium Grade) - 50NB	m	18	Yes	Yes
1.9	CI Gate Valve - 300NB	No.	6	Yes	Yes
1.10	CI Gate Valve - 250NB	No.	2	Yes	Yes
1.11	CI Gate Valve - 100NB	No.	6	Yes	Yes
1.12	CI Gate Valve - 80NB	No.	2	Yes	Yes
1.13	CI Gate Valve - 50NB	No.	5	Yes	Yes
1.14	Float Operated Gate Valve	No.	2	Yes	Yes
1.15	CI Non-Return/ Check Valve - 250NB	No.	2	Yes	Yes
1.16	CI Non-Return/ Check Valve - 50NB	No.	2	Yes	Yes

1.17	Basket Type Strainer - 300NB	No.	2	Yes	Yes
1.18	Level Switch for Water tank (2 level- low and very low of each level switch)	No.	2	Yes	Yes
1.19	Level Indicator for Water Tank	No.	2	Yes	Yes
1.20	Level Switch for high speed diesel tank (2 level- low and very low of each level switch)	No.	2	Yes	Yes
1.21	Level Indicator for high speed diesel tank	No.	2	Yes	Yes
1.22	Pressure Switch	No.	9	Yes	Yes
1.23	Pressure Gauge	No.	5	Yes	Yes
1.24	Air Vessel-3 cum.	No.	1	Yes	Yes
1.25	Pressure Relief Valve	No.	1	Yes	Yes
1.26	Annunciation Panel at Pump House	No.	1	Yes	Yes
1.27	Local Control Panel for Hydrant/ HVWS System for Motor Driven Pump	No.	1	Yes	Yes
1.28	Local Control Panel for Hydrant/ HVWS System for Diesel Driven Pump alongwith battery and battery charger	No.	1	Yes	Yes
1.29	Local Control Panel for Jockey Pump	No.	1	Yes	Yes
1.30	ACDB for Fire Fighting Pump House	No.	1	Yes	Yes
1.31	DCDB for Fire Fighting Pump House	No.	1	Yes	Yes
2	Hydrant system, complete piping and accessories, etc. outside the Pump House for Fire Protection of 400/220kV (New) Substation	Set	1	Below items and quantity are for 1 set	
2.1	MS Pipe (FE410 Grade) - 250NB	m	450	Yes	Yes
2.2	MS ERW Pipe (Medium Grade) - 100NB	m	166	Yes	Yes
2.3	MS ERW Pipe (Medium Grade) - 80NB	m	80	Yes	Yes
2.4	CI Gate Valve - 250NB	No.	4	Yes	Yes
2.5	CI Gate Valve - 100NB	No.	4	Yes	Yes
2.6	Single Headed Hydrant Valve - External	No.	12	Yes	Yes
2.7	Hose Box - External	No.	12	Yes	Yes
2.8	Hose Pipe - 15m Long	No.	24	Yes	Yes

2.9	Branch Pipe with Nozzle	No.	12	Yes	Yes
2.10	Wrapping & Coating Material	sq.m	50	Yes	Yes
3	Fire Detection and Alarm System for Control Room Building (400kV)	Set	1	Below items and quantity are for 1 set	
3.1	2Cx1.5 sq.mm unarmoured Control Cable for Fire Detection and Alarm System	m	824	Yes	Yes
3.2	Conventional Smoke Detector	No.	20	Yes	Yes
3.3	Conventional Heat Detector	No.	2	Yes	Yes
3.4	Response Indicator	No.	10	Yes	Yes
3.5	Conventional Manual Call Point	No.	4	Yes	Yes
3.6	Conventional Hooter	No.	2	Yes	Yes
3.7	Annunciation Panel cum Fire Alarm Panel for Control Room	No.	1	Yes	Yes
4	Fire Detection and Alarm System for Switchyard Panel Room of 9m length	Set	2	Below items and quantity are for 2 sets	
4.1	2Cx1.5 sq.mm unarmoured Control Cable for Fire Detection and Alarm system inside SPR Room	m	60	Yes	Yes
4.2	Junction Box (minimum 5 nos. of TB) in SPR	No.	2	Yes	Yes
4.3	Conventional Smoke Detector	No.	6	Yes	Yes
4.4	Conventional Manual Call Point	No.	2	Yes	Yes
4.5	Conventional Hooter	No.	2	Yes	Yes
5	Fire Detection and Alarm System for Switchyard Panel Room of 6m length	Set	2	Below items and quantity are for 2 sets	
5.1	2Cx1.5 sq.mm unarmoured Control Cable for Fire Detection and Alarm Panel inside SPR Room	m	40	Yes	Yes
5.2	Junction Box (minimum 5 nos. of TB) in SPR	No.	2	Yes	Yes
5.3	Conventional Smoke Detector	No.	4	Yes	Yes
5.4	Conventional Manual Call Point	No.	2	Yes	Yes

5.5	Conventional Hooter	No.	2	Yes	Yes
6	HVW spray system, Hydrant system and complete U/G & O/G piping and accessories, etc. outside the pump house for 500MVA, 400KV/220/33kV, 3-phase Autotransformer	Set	2	Below items and quantity are for 2 sets	
6.1	MS ERW Pipe (Medium Grade) - 150NB	m	42	Yes	Yes
6.2	MS ERW Pylon Pipe (Light Grade) - 80NB	m	54	Yes	Yes
6.3	MS ERW Pylon Pipe (Light Grade) - 65NB	m	180	Yes	Yes
6.4	MS ERW Pylon Pipe (Light Grade) - 50NB	m	120	Yes	Yes
6.5	GI Pipe (Medium Grade) - 150NB	m	42	Yes	Yes
6.6	GI Pipe (Medium Grade) - 80NB	m	2	Yes	Yes
6.7	GI Pipe (Medium Grade) - 65NB	m	228	Yes	Yes
6.8	GI Pipe (Medium Grade) - 50NB	m	222	Yes	Yes
6.9	GI Pipe (Medium Grade) - 32NB	m	60	Yes	Yes
6.10	GI Pipe (Medium Grade) - 25NB	m	642	Yes	Yes
6.11	Brass Spray Nozzles (K-18*80) - 20NB	No.	66	Yes	Yes
6.12	Brass Spray Nozzles (K-23*120) - 20NB	No.	190	Yes	Yes
6.13	Deluge Valve - 150NB	No.	2	Yes	Yes
6.14	Quartzoid Bulb Detector	No.	140	Yes	Yes
6.15	Y-Type Strainer - 150NB	No.	2	Yes	Yes
6.16	CI Gate Valve - 150NB	No.	6	Yes	Yes
6.17	Local Control Panel for Deluge Valve	No.	2	Yes	Yes
6.18	Pressure Switch	No.	4	Yes	Yes
6.19	Solenoid Valve	No.	2	Yes	Yes

Project	**400/ 220 KV AIS NEEMUCH NEW SUBSTATION, 400KV CHITTORGARH EXTN., & 400kV MANDSAUR EXTN.**	**TB-418-552-001**	
System	**FIRE FIGHTING SYSTEM**	**REV. 0**	
Customer	**POWERGRID NEEMUCH TRANSMISSION LTD.**	**SECTION-1**	
Purchaser	**BHEL (TRANSMISSION BUSINESS GROUP)**		

7	HVW spray system, Hydrant system and complete U/G & O/G piping and accessories, etc. outside the pump house for 125 MVAR, 420kV, 3 phase Bus Reactor	Set	1	Below items and quantity are for 1 set	
7.1	MS ERW Pipe (Medium Grade) - 100NB	m	24	Yes	Yes
7.2	GI Pipe (Medium Grade) - 100NB	m	30	Yes	Yes
7.3	GI Pipe (Medium Grade) - 65NB	m	48	Yes	Yes
7.4	GI Pipe (Medium Grade) - 50NB	m	48	Yes	Yes
7.5	GI Pipe (Medium Grade) - 25NB	m	114	Yes	Yes
7.6	CI Gate Valve - 100NB	No.	3	Yes	Yes
7.7	Y-Type Strainer - 100NB	No.	1	Yes	Yes
7.8	Deluge Valve - 100NB	No.	1	Yes	Yes
7.9	Brass Spray Nozzles 20NB (K-18)	No.	73	Yes	Yes
7.10	Quartzoid Bulb Detector	No.	52	Yes	Yes
7.11	MS ERW Pylon Pipe (Light Grade) - 65NB	m	78	Yes	Yes
7.12	MS ERW Pylon Pipe (Light Grade) - 50NB	m	18	Yes	Yes
7.13	Pressure Switch	No.	2	Yes	Yes
7.14	Local Control Panel for Deluge Valve	No.	1	Yes	Yes
7.15	Solenoid Valve	No.	1	Yes	Yes
8	9 litre water type Portable Fire extinguisher	No.	6	Yes	Yes
9	4.5 kg CO2 type Portable Fire extinguisher	No.	15	Yes	Yes
10	60 litre foam type trolley/ wheel mounted Fire extinguisher	No.	2	Yes	Yes
11	5 Kg Dry Chemical Powder Type Fire Extinguisher	No.	5	Yes	Yes

12	Junction Box (minimum 20 nos. TB with IP-67) near Transformer/Reactor area	No.	3	Yes	Yes
13	Laying of 3CX2.5 sqmm Armoured cable	meter	300	No	Yes
14	Laying of 2CX6 sqmm Armoured cable	meter	1000	No	Yes
15	Laying of 5CX2.5 sqmm Armoured cable	meter	900	No	Yes
16	Laying of 10CX2.5 sqmm Armoured cable	meter	1500	No	Yes
II	**Spares for Fire Protection System for Neemuch New**				
1	Smoke Detectors	No.	4	Yes	No
2	Pressure Gauge	No.	1	Yes	No
3	Pressure Switch	No.	1	Yes	No

ANNEXURE-BOQ-CHITTORGARH S/S EXTN

III	**Extension of 400kV Chittorgarh S/S**				
1	Fire Detection and Alarm System for Switchyard Panel Room of 6m length	Set	1	Below items and quantity are for 1 set	
1.1	2Cx1.5 sq.mm unarmoured Control Cable for Fire Detection and Alarm Panel inside SPR Room	meter	20	Yes	Yes
1.2	Conventional Smoke Detector	No.	2	Yes	Yes
1.3	Conventional Manual Call Point	No.	1	Yes	Yes
1.4	Conventional Hooter	No.	1	Yes	Yes
1.5	Junction Box (minimum 5 nos. of TB) in SPR	Nos.	1	Yes	Yes
1.6	ZONE CARD FOR FAP (Agni make)	Nos.	2	Yes	Yes
2	Laying of 5CX2.5 sqmm cable	meter	225	No	Yes
3	4.5 kg CO2 type Portable Fire extinguisher	Nos.	1	Yes	Yes
IV	**Spares for Fire Protection System for Chittorgarh Extn.**				
1	Smoke Detectors	No.	4	Yes	No

ANNEXURE-BOQ-MANDSAUR S/S EXTN

Project	**400/ 220 KV AIS NEEMUCH NEW SUBSTATION, 400KV CHITTORGARH EXTN., & 400kV MANDSAUR EXTN.**	**TB-418-552-001**	
System	**FIRE FIGHTING SYSTEM**	**REV. 0**	
Customer	**POWERGRID NEEMUCH TRANSMISSION LTD.**	**SECTION-1**	
Purchaser	**BHEL (TRANSMISSION BUSINESS GROUP)**		

III	**Extension of 400kV Mandsaur S/S**				
1	Fire Stand with 6 nos. Buckets and canopy	Set	1	Yes	No
2	22.5 kg CO2 type trolley mounted Fire extinguisher	Nos.	2	Yes	No
3	50 Litre Foam Type trolley/Wheel mounted Fire Extinguisher	Nos.	2	Yes	No
4	Dry Chemical type 75Kg Trolley mounted fire extinguisher	No.	1	Yes	No

ANNEXURE- 'A'

LIST OF CABLE SIZES

NEEMUCH NEW S/S

Sl. No.	Item Description	Length (Mtrs.)	Remarks
1.A	**Power Cables (PVC) (1100 V Grade)**		**Bidder to furnish the quantity required against the applicable cable size.**
A	1 C X 150 SQ. MM AL.		
B	3.5 C X 70 SQ. MM AL.		
C	3.5 C X 35 SQ. MM AL.		
D	4C X 6 SQ.MM AL.		
E	2C X 6 SQ.MM AL.		
F	4C X 16 SQ.MM AL.		
1.B	**Power Cables (XLPE) (1100 V Grade)**		
G	1 C X 630 SQ. MM AL.		
H	3.5C X 300 SQ.MM AL.		
2.0	**Control Cables (Cu)**		
A	3C X 2.5 SQ. MM CU.		
B	5C X 2.5 SQ. MM CU.		
C	10C X 2.5 SQ. MM CU.		
D	19C X 1.5 SQ. MM CU.		
E	27C X 1.5 SQ. MM CU.		

CHITTORGARH S/s EXTN.

Sl. No.	Item Description	Length (Mtrs.)	Remarks
1.0	**Control Cables (Cu)**		
A	3C X 2.5 SQ. MM CU.		**Bidder to furnish the quantity required against the applicable cable size.**
B	5C X 2.5 SQ. MM CU.		
C	10C X 2.5 SQ. MM CU.		
D	19C X 1.5 SQ. MM CU.		
E	27C X 1.5 SQ. MM CU.		

SECTION 2

EQUIPMENT SPECIFICATION

Refer the enclosed Powergrid's technical specification (Doc ref: C/ENGG/SPEC/FP Rev-6) for Fire Protection System.

All the requirements pertaining to type, make, quality, testing & inspection of equipments, provisions of control, interlocks, indications, annunciations, alarms etc, as laid down in various clauses of this specification shall be satisfied by the contractor in totality.

TECHNICAL SPECIFICATION FOR

FIRE PROTECTION SYSTEM

TABLE OF CONTENTS

TECHNICAL SPECIFICATION FOR

FIRE PROTECTION SYSTEM

1.00.00 INTENT OF SPECIFICATION

This section covers the design and performance requirements of the following types of fire protection systems;

a. Hydrant System

b. High Velocity Water (H.V.W) Spray System

c. Fire Detection and alarm System

d. Portable Fire Extinguishers

e. Wheel/ Trolley mounted Fire Extinguishers

1.00.01 It is not the intent to completely specify all details of design and construction. Nevertheless, the system design and equipment shall conform in all respects to high standard of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the Owner. The system design shall also conform to TAC/ NFPA norms.

1.00.02 The scope of work include complete earthwork (i.e. excavation, backfilling etc.) for the entire buried piping for the system, valve pits and pipe supports for buried, entrenched and overground piping.

1.00.03 The equipment offered shall comply with the relevant Indian Standards **unless specified otherwise**. The equipment conforming to any other approved international standards shall meet the requirement called for in the latest revision of relevant Indian Standard or shall be superior. The Deluge valves, HVW spray nozzles & quartzoid bulb detectors shall have the approval of any of the following agencies;

a. UL of USA.
b. F M of USA
c. LPCB of UK or
d. VDS of Germany,

1.00.04 Ambient temperature for design of all equipment shall be considered as 50°C.

1.00.05 The piping and instruments diagram for Hydrant and HVW spray system for 765kV/400kV substations **and for 220kV&132kV substation** is

enclosed at Appendix-I **and Appendix-VI respectively**. The successful bidder shall prepare detailed layout and piping drawing based on this drawing and other drawings such as road, drainage, cable trench, switch yard layout, etc. as furnished by the Employer during detailed engineering.

` The typical drawings for location of fire detectors and fire extinguishers in control cum administrative building attached in Appendix-II with this section shall be followed for execution.

1.00.06 Equipment under the fire protection system should be supplied from the suppliers approved by POWERGRID (A list of approved vendors is enclosed at Appendix-V). All equipment shall conform to the data sheets attached in Appendix–IV and/or relevant subsections/clauses of this specification. In case of contradiction between data specification sheets and relevant subsections/clauses, then stipulations of the data sheets will prevail.

2.00.00 DESIGN AND CONSTRUCTION

2.01.00 Hydrant System

Hydrant system of fire protection essentially consists of a large network of pipe, both under ground and over ground which feeds pressurised water to a number of hydrant valves, indoor (if applicable) as well as outdoor. These hydrant valves are located at strategic locations near buildings, Transformers and Reactors. Hose pipes of suitable length and fitted with standard accessories like branch pipes, nozzles etc., are kept in Hose boxes. In case of emergency, these hoses are coupled to the respective hydrant valves through instantaneous couplings and jet of water is directed on the equipment on fire. Hydrant protection shall be provided for the following in **all** substations of voltage levels **132kV** and above **(This is not applicable for extension of existing 220kV and 132kV substations where Hydrant system is not available).** At least one hydrant post shall be provided for every 60m of external wall measurement of buildings.

a) Control room building

b) L.T. Transformer area.

c) Fire Fighting pump House.

d) Stores

e) Transformers

f) Shunt Reactors/ Bus Reactors.

2.01.01 A warning plate shall be placed near the hydrant points for the transformers and reactors substations to clearly indicate that water shall be sprayed only after ensuring that the power to the transformer/ reactor which is on fire is switched off and there are no live parts within 20metres of distance from the personnel using the hydrant.

2.02.00. **HIGH VELOCITY WATER (H.V.W) SPRAY SYSTEM**

H.V.W. spray type fire protection essentially consists of a network of projectors and an array of heat detectors around the Transformer/Reactor to be protected. On operation of one or more of heat detectors, Water under pressure is directed to the projector network through a Deluge valve from the pipe network laid for this system. This shall be provided for transformers and reactors in **all 132kV & above** substations **(This is not applicable for extension of existing 220kV and 132kV substations where HVWS system is not available).** Wet detection initiation system shall be employed for automatic operation.

The system shall be designed in such a way that the same can be extended to protect additional Transformer/ Reactor to be installed in future. However, for the purpose of design it shall be assumed that only one Transformer/ Reactor will be on fire. The main header pipe size in the yard shall be 250mmNB **(for 400kV and above level substations) and 200mmNB(for 220kV & 132kV substations). Branch** to the equipment (shall not be more than 20metres length) shall be of the same size as of deluge valve.

2.02.01 The Electrical clearance between the Emulsifier system pipe work and live parts of the protected equipment shall not be less than the values given below :

1.	765 kV bushing	4900 mm
2.	420 kV bushing	3500 mm
3.	245 kV bushing	2150 mm
4.	145 kV bushing	1300 mm
5.	52 kV bushing	630 mm
6.	36 kV bushing	320 mm

2.02.02 System shall be designed in such a way that the Water pressure available at any spray nozzle shall be between 3.5bar and 5.0bar and shall be demonstrated through hydraulic calculations. Water shall be applied at a minimum rate of 10.2 LPM/M^2 of the surface area of the transformer / Reactor including radiator, conservator, oil pipes, bushing turrets, etc. (including bottom surface for transformer). The nozzle arrangement shall ensure direct impingement of water on all exterior surfaces of transformer tank, bushing turrets, conservator and oil pipes, except underneath the transformer, where horizontal spray may be provided. Typical drawings of HVW spray system of a transformer and a reactor is enclosed at Annexure-III for reference.

2.02.03 **Deluge Valve**

Deluge Valve shall be water pressure operated manual reset type. The Deluge valve shall be closed water tight when water pressure in the heat detector pipe work is healthy and the entire pipe work shall be charged with water under pressure upto the inlet of the Deluge valve. On fall of water pressure due to opening of one or more heat detectors, the valve shall open and water shall rush to the spray water network through the open Deluge valve. The valves shall be manually reset to initial position after completion of operation. Each Deluge Valve shall be provided with a water motor gong which shall sound an alarm when water after passing through the Deluge valve, is tapped through the water motor.

Each Deluge valve shall be provided with a local panel with provision of opening of Deluge valve from local and remote from control room/ remote centre. In addition to this, each valve shall be provided with local operation latch.

Deluge valves of 100mmNB size shall be used if the flow requirement is ≤ 200m^3/hr and 150mmNB size shall be used for flow requirement >200m^3/hr.

Test valves shall simulate the operation of Deluge valves and shall be of quick opening type. The general construction shall conform to requirements under clause no.7.00.00 for piping, valves and specialities.

2.02.04 **High Velocity Spray Nozzles (Projectors)**

High velocity spray system shall be designed and installed to discharge water in the form of a conical spray consisting of droplets of water travelling at high velocity, which shall strike the burning surface with sufficient impact to ensure the formation of an emulsion. At the same time the spray shall efficiently cut off oxygen supply and provide sufficient cooling.

2.02.05 Minimum set point of the heat detectors used in the HVW spray system shall be 79^{o}C. The optimum rating shall, however, be selected by the Bidder, keeping in mind the maximum and minimum temperature attained at site.

`

2.03.00 **Fire Detection and alarm System**

This system shall be provided for control room building and Switchyard panel rooms of substations**.**

2.03.01 Suitable fire detection system using smoke detectors and/or heat detectors shall be provided for the entire building, including corridor and toilets. Fire detectors shall be located at strategic locations in various rooms of the building. Each Switchyard panel room shall be considered a separate zone. Adequate number of extra zones shall be provided for Switchyard panel rooms for future bays identified in Single line diagram of the substation. The operation of any of the fire detectors/ manual call point should result in the following;

1. A visual signal exhibited in the annunciation panels indicating the area where the fire is detected.
2. An audible alarm sounded in the panel, and
3. An external audible alarm sounded in the building, location of which shall be decided during detailed engineering.
4. If the zone comprises of more than one room, a visual signal shall be exhibited on the outer wall of each room.

2.03.02 Each zone shall be provided with two zone cards in the panel so that system will remain healthy even if one of the cards becomes defective.

2.03.03 Coverage area of each smoke detector shall not be more than 80 m^2 and that of heat detectors shall not be more than 40 m^2. Ionisation type smoke detectors shall be provided in all areas except pantry room where heat detectors shall be provided. If a detector is concealed, a remote visual indication of its operation shall be provided. Manual call points (Break glass Alarm Stations) shall be provided at strategic locations in the control room building. All cabling shall be done through concealed conduits.

2.03.04 Cables used should be exclusively for fire detection and alarm system and shall be 2Cx1.5sq.mm Cu. cables. Un-armoured PVC insulated FR cables conforming to IS 1554 (Part 1) shall be used.

2.04.00 Portable and Wheel/ Trolley mounted Fire Extinguishers

2.04.01 Portable Fire Extinguishers

Adequate number of portable fire extinguishers of pressurised water, dry chemical powder, and Carbon dioxide type shall be provided in suitable locations in control room building and FFPH building as indicated in the drawing. In addition to this one (1) CO2 type fire extinguisher of 4.5kg capacity shall be provided for each Switchyard panel room. These extinguishers will be used during the early phases of fire to prevent its spread and costly damage.

The design, construction & testing of portable fire extinguishers shall meet the requirements as per clause 10.00.00.

2.04.02 Wheel/ Trolley mounted Fire Extinguishers

Wheel/Trolley mounted Mechanical foam type fire extinguishers of 50litre capacity, conforming to IS:13386, shall be provided for the protection of the following:

1. Transformers and reactors in 220kV and 132 kV substations **where Hydrant/HVWS system is not available**. Two (2) nos. for each 220kV or 132kV transformer and reactor.

2. LT transformers in all substations. One (1) no. for each **LT** transformer.

The design, construction & testing of Mechanical foam type 50 litre capacity shall meet the requirements of relevant IS Codes and clause 10.00.00 of this specification.

2.05.00 Water Supply System

For 400kV and above level substations water for hydrant & HVW system shall be supplied by one electrical motor driven pump of rated capacity 410m3/hr. at 70MWC head **& for 220kV and 132kV substations water for hydrant & HVWS system shall be supplied by one electrical motor driven pump of rated capacity 273m3/hr. at 70MWC head**, with another pump of same capacity , driven by diesel engine, shall be used as standby. Water storage tank with two compartments of adequate capacity shall be provided. Pumps shall work under positive suction head. Annunciations of the hydrant & HVW spray systems shall be provided in fire water pump house and repeated in control room. **Provision for sending data to remote control centre shall also be available.**

The outdoor piping for the system in general shall be laid above ground on concrete pedestals with proper supporting arrangement. However, at

road/rail crossings, in front/access of buildings, places where movement of cranes/vehicles is expected and at any other place where above ground piping is not advisable, the pipes shall be laid underground. Such locations shall be finalised during detailed engineering.

The whole system will be kept pressurised by providing combination of air vessel and jockey pump of 10.8M^3/hr. capacity at 80MWC. The capacity of air vessel shall not be less than 3m^3. Minor leakage will be met by Jockey pump. One additional jockey pump shall be provided as standby. All pumps shall be of horizontal centrifugal type. Pumps and air vessel with all auxiliary equipment will be located in firewater pump house. A pressure relief valve of suitable rating shall be provided in water header to release excess pressure due to atmospheric temperature variations.

Operation of all the pumps shall be automatic and pumps shall be brought into operation at preset pressure. Fire pumps shall only be stopped manually. Manual start/stop provision shall be provided in local control panel.

2.05.01 The general design of the fire fighting pump sets shall meet the requirements under clauses no.5.00.00 for Horizontal centrifugal pumps, no.6.00.00 for Diesel engines and no.12.00.00 for Electrical motors.

2.05.02 Each pump shall be provided with a nameplate indicating suction lift/delivery head, capacity and number of revolutions per minute.

2.05.03 Design, construction, erection, testing and trial operation of piping, valves, strainers, hydrant valves, hoses, nozzles, branch pipes, hose boxes, expansion joints etc. shall conform to the requirements of clause no. 7.00.00.

2.06.00 **Instrumentation and Control System**

2.06.01 All instruments like pressure indicators, differential pressure indicators, pressure switches, level indicators, level switches, temperature indicators, alarms and all other instruments and panels as indicated in the specification and drawings and those needed for safe and efficient operation of the whole system shall be furnished according to the requirements of clause 11.00.00. Pump running/ fails to start signal shall be taken from the pressure switch immediately after the discharge of the pump.

2.06.02 **Control Panel**

Power feeder for motors will be from switchgear board located in control

building but control supply for all local control panels, annunciation panels, battery charger units, space heaters etc. shall be fed from the AC and DC distribution boards located in pump house. These AC & DC distribution boards will be fed from the switchgears and DCDBs located in control building.

a) Panel for motor driven fire water pump

The panel shall be provided with the following:

1.	TPN switch	1 No.
2.	Auto/manual **selection facility**	
3.	Start/Stop **facility** with indication lamp	1 Set
4.	DOL starter with thermal O/L relay	1 Set
5.	Indicating lamp showing power ON	1 Set
6.	Indication lamp with drive ON/OF	1 Set
7.	Indication lamp showing Motor Trip	1 No.

Additional provisions shall be made for controlling the following from the remote control centre:

1. Auto/manual selection facility

2. Start/Stop facility

Main power cable from breaker feeder of main switchboard shall be terminated in this panel and another cable shall emanate from this panel which shall be terminated at motor terminals.

b) Panel for Two nos. Jockey Pump 1No.

The panel shall be provided with the following :

1.	Fuse-switch unit for Jockey pumps	1 Set for each pump

2.	Auto/manual **selection facility for eachpump**	
3.	Selector switch for selecting either jockey pump	1 No.
4.	D.O.L. starter with overload relay self-resetting type, for all the drives.	1 No. each
5.	Start/stop push button for Jockey Pump with indication lamp with pad-locking arrangements in stop position	1 Set for each pump
6.	Indication lamp for trip indication	1 No. each for pump

Additional provisions shall be made for controlling the following from the remote control centre:

1. Auto/manual selection facility for each pump.

c)	Panel for 2 Nos. battery charger & Diesel Engine driven fire water pump	1 No.

The panel shall be provided with the following :

1.	Auto/Manual **selection facility** for Diesel Engine driven pump	1 No.
2.	Start/Stop **facility** with indication lamp	1 Set
3.	Indicating lamp showing drive ON/OFF	1 Set
4.	D.C. Voltmeter/Ammeter in the battery charger circuit	1 No. each
5.	Battery charger will be as per specification described	1 Set
6.	Selector switch for selecting	1 No.

	either of battery chargers for the battery sets.	
7.	Selector switch for selecting either set of batteries for Diesel engine starting.	1No.
8.	Selector switch for boost charging/Trickle charging of battery set.	1 Set

Additional provisions shall be made for controlling the following from the remote control centre:

1. Manual Start/Stop of Diesel Engine

d) Individual local control panel is to be considered for each transformer/ Reactor deluge system wherever these equipment are envisaged. This panel shall contain push buttons with indicating lamps for spray ON/OFF operation in the valve operation circuit. Push buttons shall be concealed behind glass covers, which shall be broken to operate the buttons. Provision shall be made in the panel for the field signal for the annunciations such as spray ON and fire in the Transformer/Reactor. A signal for spray ON shall also be provided in the control room fire alarm panel for employer's event logger. Remote operation facility to open the Deluge valve from control room/ remote centre shall also be provided.

2.06.03 **Annunciation Panels**

a) **Location: Fire Water Pump House**

i) Indicating lamps showing power supply "ON".

ii) Annunciation windows complete with buttons. Details are as follows:

Sl.No.	Description	Number
1.	Electric motor driven fire water pump running	1
2.	Electric motor driven fire water pump fails to start	1
3.	Diesel engine driven fire water pump running.	1
4.	Diesel engine driven water pump fails	1

	to start	
5.	Jockey pump-1 running	1
6.	Jockey pump-1 fails to start	1
7.	Jockey pump-2 running	1
8.	Jockey pump-2 fails to start	1
9.	Fire in Transformer/ Reactor	1 for each equipment
10.	Deluge system operating for Transformer/Reactor	1 for each equipment
11.	Header pressure low	1
12.	Fire in smoke detection system zone (Common Fire Signal)	1
13.	Water storage tank water level low	2
14.	High speed diesel tank level low	1
15.	Spare	10

b) **Location: Substation Control Room**

i) Indication lamp showing power supply 'ON'

ii) Provision shall be made in the panel for a signal for spray ON for each Transformer/Reactor for owner's use for event logger.

iii) Each Switchyard panel room shall be considered as separate zone for fire detection and alarm system.

iv) Following annunciations shall be provided.

Sl.No.	Description	Number

1.	Fire in Transformer/ Reactor	1 for each equipment
2.	Diesel engine driven fire water pump in operation	1
3.	Motor driven fire water pump in operation	1
4.	Jockey pump in operation	1
5.	Fire fighting Water storage tank level Low	2
6.	Fire/Fault (zone alarm module)	1+1(duplicate) For each zone as applicable
7.	Spare windows complete in all respect, with relays	10
8.	Spare zone alarm modules	Number of future A/c Kiosks required for the bays identified as per SLD

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c) Each annunciation panel shall be provided with a hooter**. A hooter in parallel to the hooter in fire panel shall be provided in the security room of substation for alert in case of fire.**

d) Indication for fault in respective areas shall also be provided. Each zone alarm module shall exhibit 'FIRE' and 'FAULT' conditions separately.

e) Provision for sending data to Remote Control Unit for the following

(i) Fire in Switchyard Panel Room (Switchyard Panel room shall be considered as separate zone for fire detection and alarm system).

(ii) Fire in Transformer/Reactor (1 for each equipment)

(iii) Diesel engine driven fire water pump in operation.

(iv) Motor driven fire water pump in operation

(v) Fire/Fault in Control Room.

(vi) Water Storage tank level (low and very low for each storage tank).

(vii) High Speed Diesel tank level (low & very low)

(viii) AC Mains Supply Healthy/Fail for Main Pump & Jockey Pump

(ix) DC Control Supply Healthy/Fail for Main Pump & Jockey Pump

(x) DC Control Supply Healthy/Fail for Diesel Engine driven pump.

2.06.04 The control and interlock system for the fire protection system shall meet the following requirements:

1. **Electric Motor Driven Fire water Pump**

Pump should start automatically when the System header pressure is low.

Pump should be stopped manually only. Pump should also be started manually if required from local control panel.

2. **Diesel Engine Driven Standby Pump**

The pump should automatically start under any of the following conditions:

a) System Header pressure low.

b) Electric motor operated fire water pump fails to start.

Pump should be stopped manually only. Pump should also be started manually if required from the local control panel. The battery set which is connected for starting of Diesel engine shall not be subjected to boost charge.

3. **Jockey Pump**

It shall be possible to select any one of the Jockey pumps as main and the other as standby. Main Jockey pump shall start automatically when water pressure in header falls below the set value. If the main jockey pump fails to start then the standby should start. Jockey pump shall stop automatically when the pressure is restored to its normal value.

Manual starting/stopping shall be possible from the local control

panel.

3.00.00 **TESTS**

3.01.00 **Shop Tests**

3.01.01 Shop tests of all major equipment centrifugal pumps, diesel engines, electrical drive motors, piping, valves and specialties, pressure and storage vessels, MCC, electrical panels, controls, instrumentation etc. shall be conducted as specified in various clauses and as per applicable standards/codes.

3.01.02 Shop tests shall include all tests to be carried out at Contractor's works, works of his sub-contractor and at works where raw materials supplied for manufacture of equipment are fabricated. The tests to be carried out shall include but not be limited to the tests described as follows :

a) Materials analysis and testing.

b) Hydrostatic pressure test of all pressure parts, piping, etc.

c) Dimensional and visual check.

d) Balancing test of rotating components.

e) Response of heat/smoke detectors.

f) Performance characteristics of HVW spray nozzles (projectors).

g) Flow rate and operational test on Flow control valves.

h) Operational test of alarm valve (water-motor gang).

i) Calibration tests on instruments and tests on control panel.

j) Destruction/burst tests on 2% or minimum one (1) no. of hoses and portable type fire extinguishers for each type as applicable. Any fraction number shall be counted as next higher integer.

k) Performance test on fire extinguishers as required in the code.

3.01.03 In the absence of any Code/Standard, equipment shall be tested as per mutually agreed procedure between the supplier and the Employer.

3.01.04 A comprehensive visual and functional check for panels would be conducted and will include a thorough check up of panel dimensions,

material of construction, panel finish, compliance with tubing and wiring specifications, quality of workmanship, proper tagging & locations of instruments/accessories. The wiring check shall be complete point to point ring out and check for agreement with installation drawings and equipment vendor prints of the complete system and an inspection of all field connection terminals and levelling.

3.01.05 All test certificates and reports shall be submitted to the Employer for approval.

3.01.06 The Employer's representative shall be given full access to all tests. The manufacturer shall inform the Employer allowing adequate time so that, if the Employer so desires, his representatives can witness the test.

3.02.00 **Pre-commissioning Tests**

3.02.01 **General**

a) All piping and valves, after installation will be tested hydraulically at a pressure of 16kg/cm^2 for a period of 30 minutes to check against leak tightness.

b) All manually operated valves/gates shall be operated throughout 100% of the travel and these should function without any trouble whatsoever, to the satisfaction of the Employer.

c) All pumps shall be run with the specified fluid from shut off condition to valve wide open condition. Head developed will be checked from the discharge pressure gauge reading. During the test, the pumps and drives shall run smoothly without any undue vibration, leakage through gland, temperature rise in the bearing parts, noise, flow pulsation etc.

d) All pressure vessels should be tested hydraulically at the specified test pressure, singly or in the system.

e) Painting shall be checked by dry type thickness gauges.

f) Visual check on all structural components, welding, painting etc. and if doubt arises, these will be tested again.

g) All test instruments and equipment shall be furnished by the Contractor to the satisfaction of the Employer.

h) Automatic starting of all the fire pumps by operating the test valves.

i) Automatic operation of the Jockey pump

j) Operation of the Deluge valve by breaking a detector as well as manual and remote operation of the deluge valve.

k) Operation of entire annunciation system.

Replacement of fused/damaged quartzoid bulb detectors during the test shall be responsibility of contractor.

3.02.02 After erection at site, the complete HVW spray protection and hydrant system shall be subject to tests to show satisfactory performance for which detailed procedure shall be submitted for Employer's approval.

Full flow tests with water shall be done for the system piping as a means of checking the nozzle layout, discharge pattern and coverage, any obstructions and determination of relation between design criteria and actual performance, also to ensure against clogging of the smaller piping and the discharge devices by foreign matter carried by the water.

Rigidity of pipe supports shall also be checked during the water flow.

3.02.03 All the detectors installed shall be tested for actuation by bringing a suitable source of heat/smoke near the detector and creating a stream of hot air/ smoke over the detector. The exact procedure of this test shall be detailed out by the Employer to the successful Bidder.

4.00.00 **SPARE PARTS**

The Contractor shall indicate in his scope of supply all the mandatory spares in the relevant schedules. The list of mandatory spares is indicated in ‘Section - Projects’.

5.00.00 **HORIZONTAL CENTRIFUGAL PUMPS**

This clause covers the design, performance, manufacturing, construction features and testing of horizontal centrifugal pumps used for the purpose of fire fighting.

5.01.00 The materials of the various components shall conform to the applicable IS/BS/ASTM/DIN Standards.

5.01.01 In case of any contradiction with the aforesaid standards and the stipulations as per the technical specification as specified hereinafter, the stipulations of the technical specification shall prevail.

5.02.00 **General Performance Requirements**

5.02.01 The pump set shall be suitable for continuous operation at any point within the "Range of operation".

5.02.02 Pumps shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum being at shut off.

5.02.03 Pumps shall be capable of furnishing not less than 150% of rated capacity at a head of not less than 65% of the rated head. The shut off head shall not exceed 120% of rated head. Range of operation shall be 20% of rated flow to 150% of rated flow.

5.02.04 The pump-motor set shall be designed in such a way that there is no damage due to the reverse flow through the pump which may occur due to any mal-operation of the system.

5.02.05 **Drive Rating**

The drive rating shall not be less than the maximum power requirement at any point within the "Range of Operation" specified.

During starting under reverse flow condition, the motor shall be capable of bringing the pump to rated speed at normal direction with 90% rated voltage at motor terminals.

5.02.06 Pump set along with its drive shall run smooth without undue noise and vibration. Acceptable peak to peak vibration limits shall generally be guided by Hydraulic Institute Standards.

5.02.07 The Contractor under this specification shall assume full responsibility in the operation of the pump and drive as one unit.

5.03.00 **Design & Construction**

5.03.01 Pump casing may be axially or radially split. The casing shall be designed to withstand the maximum pressure developed by the pump at the pumping temperature.

5.03.02 Pump casing shall be provided with adequate number of vent and priming connections with valves, unless the pump is made self-venting & priming. Casing drain, as required, shall be provided complete with drain valves.

5.03.03 Under certain conditions, the pump casing nozzles will be subjected to reactions from external piping. Pump design must ensure that the nozzles are capable of withstanding external reactions not less than those specified in API-610.

5.03.04 Pump shall preferably be of such construction that it is possible to

service the internals of the pump without disturbing suction and discharge piping connections.

5.03.05 **Impeller**

The impeller shall be secured to the shaft and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft impellers shall be secured to the shaft by an additional locknut or cap screw. All screwed fasteners shall tighten in the direction of normal rotation.

5.03.06 **Wearing Rings**

Replaceable type wearing rings shall be furnished to prevent damage to impeller and casing. Suitable method of locking the wearing ring shall be used.

5.03.07 **Shaft**

Shaft size selected shall take into consideration the critical speed, which shall be at least 20% away from the operating speed. The critical speed shall also be atleast 10% away from runaway speed.

5.03.08 **Shaft Sleeves**

Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the outer faces of gland packing or seal and plate so as to distinguish between the leakage between shaft & shaft sleeve and that past the seals/gland.

5.03.09 Shaft sleeves shall be securely fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.

5.03.10 **Bearings**

Bearings of adequate design shall be furnished for taking the entire pump load arising from all probable conditions of continuous operation throughout its "Range of Operation" and also at the shut-off condition. The bearing shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point.

Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearing housing.

5.03.11 **Stuffing Boxes**

Stuffing box design shall permit replacement of packing without

removing any part other than the gland. Stuffing boxes shall be sealed/cooled by the fluid being pumped and necessary piping, fittings, valves, instruments, etc. shall form an integral part of the pump assembly.

5.03.12 **Shaft Couplings**

All shafts shall be connected with adequately sized flexible couplings of suitable design. Necessary guards shall be provided for the couplings.

5.03.13 **Base Plates & Sole Plate**

A common base plate mounting both for the pump and drive shall be furnished.

The base plate shall be of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the pumping unit so mounted as to minimise misalignment caused by mechanical forces such as normal piping strain, hydraulic piping thrust etc. Suitable drain taps and drip lip shall be provided.

5.03.14 Material of Construction

All materials used for pump construction shall be of tested quality. Material of construction of the major parts of the pumps shall be as given below :

a)	Casing	Casting Grade FG: 260 of IS 210
b)	Impeller	Bronze Grade LTB 2 of IS:318
c)	Wearing ring	Bronze Grade LTB 2 of IS:318
d)	Shaft	Grade 40C8 of IS 1570 (Part 2, section 1.): 1979.
e)	Shaft sleeve	Bronze Grade LTB 2 of IS:318 or Chrome steel 07Cr13 of IS 1570 (part 5) :1985.
f)	Stuffing box	2.5% Nickel CI Grade FG 260 of IS:210
g)	Gland	--- do ---

5.03.15 **Balancing**

All rotating components shall be statically and dynamically balanced at

shop.

5.03.16 All the components of pumps of identical parameters supplied under this specification shall be interchangeable.

5.04.00 **Tests and Inspection**

5.04.01 The manufacturer shall conduct all routine tests required to ensure that the equipment furnished conform to the requirements of this specification and are in compliance with the requirements of applicable Codes and Standards. The particulars of the proposed tests and the procedures for the tests shall be submitted to the Employer/Engineer for approval before conducting the tests.

5.04.02 Where stage inspection is to be witnessed by Employer, in addition to above, the Bidder shall submit to the Employer/Engineer at the beginning of the contract, the detailed PERT-Chart showing the manufacturing programme and indicating the period where Employer or his authorised inspecting agency are required at the shop.

5.04.03 **Material of Construction**

All materials used for pump construction shall be of tested quality. Materials shall be tested as per the relevant standards and test certificates shall be made available to the Employer/Engineer.

5.04.04 Where stage inspection is to be witnessed by Employer, all material test certificates shall be correlated and verified with the actual material used for construction before starting fabrication, by Employer's Inspector who shall stamp the material. In case mill test certificates for the material are not available, the Contractor shall carry out physical and chemical tests at his own cost from a testing agency approved by the Employer, as per the requirements of specified material standard. The samples for physical and chemical tests shall be drawn up in presence of Employer's inspector who shall also witness the tests.

5.04.05 Shaft shall be subjected to 100% ultrasonic test and machined portion of the impeller shall be subject to 100% DP test. On finished shaft DP test will also be carried out.

5.04.06 **Hydraulic test at shop**

All pressure parts shall be subjected to hydraulic testing at a pressure of 150% of maximum pressure generated by the pump at rated speed or 200% of total dynamic head whichever is higher, for a period not less than one (1) hour.

5.04.07 **Performance test at shop**

Pumps shall be subjected to routine tests to determine the performance of the pumps. These tests shall be conducted in presence of

Employer/Engineer's representative as per the requirements of the Hydraulic Institute Standards/ASME Power Test Code PTC 8.2/BS-599/I.S.S., latest edition. Routine tests shall be done on all the pumps.

5.04.08 Performance tests shall be conducted to cover the entire range of operation of the pumps. These shall be carried out to span 150% of rated capacity upto pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point and the two extremities of the Range of operation specified.

5.04.09 Tests shall preferably be conducted alongwith the actual drives being supplied.

5.04.10 The Bidders shall submit in his proposal the facilities available at his works to conduct performance testing. If because of limitations of available facilities, a reduced speed test or model test has to be resorted to establish pump performance, the same has to be highlighted in the offer.

5.04.11 In case of model testing, the stipulations of latest edition of Hydraulic Institute Standards shall be binding. Prototype or model tests, however, shall be conducted with the suction condition identical to the field conditions i.e. sigma values of prototype and model is to be kept same.

5.04.12 Prior to conducting model testing, calculations establishing model parameters, sizes and test procedure will be submitted to Employer/Engineer for approval.

5.04.13 All rotating components of the pumps shall be subjected to static and dynamic balancing tests.

5.04.14 The Employer or his authorised representative shall have full access to all tests. Prior to performance tests, the Contractor shall intimate the Employer allowing adequate time so that if the Employer so desires, his representative can witness the test.

5.04.15 Report and test certificates of the above tests shall be submitted to the Employer/Engineer for approval.

5.04.16 **Pre commissioning tests.**

After installation, pumps offered may be subjected to testing at field also by Employer. If the performances at field are not found to meet the requirement, then the equipment shall be rectified by the Contractor without any extra cost. Prior to performance testing, the procedure for such tests will be mutually agreed between Employer and Contractor. The Contractor shall furnish all necessary instruments, accessories and personnel for testing. Prior to testing, the calibration curves of all instruments and permissible tolerance limit of instruments shall be mutually agreed upon.

6.00.00 **DIESEL ENGINES**

This Clause covers the design, performance, manufacturing construction features and testing of compression ignition diesel engines, used primarily for driving centrifugal pumps, used for the purpose of fire fighting.

6.01.00 **Design and Construction**

General

6.01.01 The diesel engine shall be of multicylinder type four-stroke cycle with mechanical (airless) injection, cold starting type.

6.01.02 The continuous engine brake horse power rating (after accounting for all auxiliary power consumption) at the site conditions shall be atleast 20% greater than the requirement at the duty point of pump at rated RPM and in no case, less than the maximum power requirement at any condition of operation of pump.

6.01.03 Reference conditions for rated output of engine shall be as per IS:10000, part II or ISO:3046, part I.

6.01.04 The engine shall be designed with regard to ease of maintenance, repair, cleaning and inspection.

6.01.05 All parts subjected to substantial temperature changes shall be designed and supported to permit free expansion and contraction without resulting in leakage, harmful distortion or misalignment.

6.01.06 **Starting**

The engine shall be capable of both automatic and manual start. The normal mode of starting is automatic but in the event of failure of automatic start or at the discretion of the operator, the engine can be started manually from the LCP.

Since the fire pumping unit driven by the diesel engine is not required to run continuously for long periods and the operation will not be frequent, special features shall be built into the engine to allow it to start within a very short period against full load even if it has remained idle for a considerable period.

6.01.07 If provision for manual start (cranking) is provided, all controls/ mechanisms, which have to be operated during the starting process, shall be within easy reach of the operator.

6.01.08 Automatic cranking shall be effected by a D.C. motor having high starting torque to overcome full engine compression. Starting power will

be supplied from either of the two (2) sets of storage batteries. The automatic starting arrangement shall include a 'Repeat Start' feature for 3 attempts. The battery capacity shall be adequate for 3 (three) consecutive starts without recharging with a cold engine under full compression.

6.01.09 The batteries shall be used exclusively for starting the diesel engine and be kept fully charged all the time in position. Arrangement for both trickle and booster charge shall be provided.

Diesel engine shall be provided with two (2) battery charger units of air-cooled design. The charger unit shall be capable of charging one (1) set of battery at a time. Provision shall, however, be made so that any one of the charger units can be utilised for charging either of the two (2) batteries.

6.01.10 For detail design of battery and battery charger, sub- section Electrical may be referred to.

6.01.11 **Governing System:**

The engine shall be fitted with a speed control device, which will control the speed under all conditions of load.

6.01.12 The governor shall offer following features:

a) Engine should be provided with an adjustable governor capable of regulating engine speed within 5% of its rated speed under any condition of load between shut-off and maximum load conditions of the pumps. The governor shall be set to maintain rated pump speed at maximum pump load.

b) Engine shall be provided with an over speed shut- down device. It shall be arranged to shut-down the engine at a speed approximately 20% above rated engine speed and for manual reset, such that the automatic engine controller will continue to show an over speed signal until the device is manually reset to normal operating position (Vol.II, NFPA, 1978).

6.01.13 The governor shall be suitable for operation without external power supply.

6.01.14 **Fuel System**

The diesel engine will run on High Speed Diesel.

6.01.15 The engine shall be provided with fuel oil tank of 250 litres capacity. The fuel oil tank shall preferably be mounted near the engine. No fuel oil tank will be provided by the Employer.

6.01.16 The fuel oil tank shall be of welded steel constructed to relevant standards for mild steel drums. The outlet of the tank shall be above the inlet of fuel injection pump of the diesel engine to ensure adequate pressure at suction of injection pump.

6.01.17 The fuel oil tank shall be designed in such a way that the sludge and sediment settles down to the tank bottom and is not carried to the injection pump. A small sump shall be provided and fitted with drain plug to take out sludge/sediment and to drain oil. Adequate hand holes (greater than 80 mm size) shall be provided to facilitate maintenance.

6.01.18 Pipeline carrying fuel oil shall be gradually sloped from the tank to the injection pump. Any valve in the fuel feed pipe between the fuel tank and the engine shall be placed adjacent to the tank and it shall be locked in the open position. A filter shall be incorporated in this pipeline, in addition to other filters in the fuel oil system. Pipe joints shall not be soldered and plastic tubing shall not be used. Reinforced flexible pipes may also be used.

6.01.19 The complete fuel oil system shall be designed to avoid any air pocket in any part of the pipe work, fuel pump, sprayers/injectors, filter system etc. No air relief cock is permitted. However, where air relief is essential, plugs may be used.

6.01.20 A manual fuel pump shall be provided for priming and releasing of air from the fuel pipelines.

6.01.21 **Lubricating Oil System**

Automatic pressure lubrication shall be provided by a pump driven by the crank shaft, taking suction from a sump and delivering pressurised oil through cooler and fine mesh filters to a main supply header fitted in the bed plate casing. High pressure oil shall be supplied to the main and big end bearings, cam-shaft bearings, cam-shaft chain and gear drives, governor, auxiliary drive gears etc. Valve gear shall be lubricated at reduced pressure through a reducing valve and the cams by an oil bath.

6.01.22 **Cooling Water System**

Direct cooling or heat exchanger type cooling system shall be employed for the diesel engine. Water shall be tapped from the fire pump discharge. This water shall be led through duplex strainer, pressure breakdown orifice and then after passing through the engine, the water at the outlet shall be taken directly to the sump through an elevated funnel.

6.02.00 **Testing & Inspection**

6.02.01 The manufacturer shall conduct all tests required, to ensure that the equipment furnished conforms to the requirement of this sub-section

and in compliance with requirements of applicable codes. The particulars of the proposed tests and the procedure for the tests shall be submitted to the Employer for approval before conducting the tests.

6.02.02 At manufacturer's works, tests shall be carried out during and after completion of manufacture of different component/parts and the assembly as applicable. Following tests shall be conducted.

6.02.03 Material analysis and testing.

6.02.04 Hydrostatic pressure testing of all pressure parts.

6.02.05 Static and dynamic balance tests of rotating parts at applicable over-speed and determination of vibration level.

6.02.06 MPI/DPT on machined parts of piston and cylinder.

6.02.07 Ultrasonic testing of crankshaft and connecting rod after heat treatment.

6.02.08 Dimensional check of close tolerance components like piston, cylinder bore etc.

6.02.09 Calibration tests of all fuel pumps, injectors, standard orifices, nozzles, instruments etc.

6.02.10 Over speed test of the assembly at 120% of rated speed.

6.02.11 Power run test.

6.02.12 Performance test of the diesel engine to determine its torque, power and specific fuel consumption as function of shaft speed. Performance test of the engine shall be carried for 12 hours out of which 1 hour at full load and one hour at 110% overload.

6.02.13 Measurement of vibration & noise.

(i) Measurement of vibration

The vibration shall be measured during full load test as well as during the overload test and limit shall be 100 microns.

(ii) Measurement of noise level

The equivalent 'A' weighted sound level measured at a distance of 1.5 M above floor level in elevation and 1.0 M horizontally from the base of the equipment, expressed in dB to a reference of 0.0002 microbar shall not exceed 93 dBA.

Above tests for vibration shall be repeated at site as pre-commissioning

tests.

6.02.14 Adjustment of speed governor as per BS:5514.

6.02.15 Diesel engine shall be subjected to routine tests as per IS:10000/BS:5514.

7.00.00 PIPING, VALVES AND SPECIALITIES

This clause covers the design, manufacture, shop testing, erection, testing and commissioning of piping, valves and specialities.

7.02.00 Scope

The piping system which shall include but not be limited to the following:

7.02.01 Plain run of piping, bends, elbows, tees, branches, laterals, crosses, reducing unions, couplings, caps, expansion joints, flanges, blank flanges, thrust blocks, anchors, hangers, supports, saddles, shoes, vibration dampeners, sampling connections, hume pipes etc.

7.02.02 Gaskets, ring joints, backing rings, jointing material etc. as required. Also all welding electrodes and welding consumables including special ones, if any.

7.02.03 Instrument tapping connections, stubs etc.

7.02.04 Gate and globe valves to start/stop and regulate flow and swing check valves for one directional flow.

7.02.05 Basket strainers and Y-type strainers

7.02.06 Bolts, nuts, fasteners as required for interconnecting piping, valves and fittings as well as for terminal points. For pipe connections into Owner's R.C.C. works, Bidder will furnish all inserts.

7.02.07 Painting, anti-corrosive coatings etc. of pipes and equipment.

Adequate number of air release valves shall be provided at the highest points in the piping system to vent any trapped air in the system.

7.03.00 Design

7.03.01 Material of construction of various pipes shall be as follows :

(a) **Buried Pipes**

Mild steel black pipes as per IS:1239, Part-I medium grade (for pipes of sizes 150 NB and below) or IS:3589, Fe 410 grade (for pipes of sizes 200 NB and above) suitably lagged on the outside to

prevent soil corrosion, as specified elsewhere.

(b) **Overground Pipes normally full of water**

Mild steel black pipes as per IS:1239, Part-I medium grade (for pipes for sizes 150 NB and below) or IS:3589, Fe 410 grade (for pipes of sizes 200 NB and above).

(c) Overground pipes normally empty, but periodic charge of water and for detector line for HVW System**.**

Mild steel galvanised pipes as per IS:1239, Part-I medium grade (for pipes of sizes 150 NB and below) or IS:3589, Fe 410 grade (for pipes of sizes 200 NB and above).

7.03.02 All fittings to be used in connection with steel pipe lines upto a size of 80 mm shall be as per IS:1239. Part-II Mild steel tubulars and other wrought steel pipe fittings, Heavy grade. Fittings with sizes above 80 mm upto 150 mm shall be fabricated from IS:1239 Heavy grade pipes or steel plates having thickness not less than those of IS:1239 Part-I Heavy grade pipes. Fittings with sizes above 150 mm shall be fabricated from IS:3589 Class-2 pipes. All fitting used in GI piping shall be threaded type. Welding shall not be permitted on GI piping.

7.03.03 Pipe sizes shall not be less than the sizes indicated in the attached drawings.

7.03.04 For steel pipeline, welded construction should be adopted unless specified otherwise.

7.03.06 All piping system shall be capable of withstanding the maximum pressure arising from any condition of operation and testing including water hammer effects.

7.03.09 Gate/sluice valve shall be used for isolation of flow in pipe lines and **construction** shall be as per IS:778 (for size up to 40 mm) and IS:14846 (for sizes above 40 mm) except **for valve spindle movement**. Valves shall be of rising spindle type and of PN 1.6 class

7.03.10 Gate Valves shall be provided with the following :

(a) Hand wheel.

(b) Position indicator.

(c) Locking facility (where necessary).

7.03.11 Gate valves shall be provided with back seating bush to facilitate gland removal during full open condition.

7.03.12 Globe valves shall be provided with contoured plug to facilitate regulation and control of flow. All other requirements should generally follow those of gate valve.

7.03.13 Non-return valves shall be swing check type. Valves will have a permanent "arrow" inscription on its body to indicate direction of flow of the fluid. These valves shall generally conform to IS:5312.

7.03.14 Whenever any valve is found to be so located that it cannot be approached manually from the nearest floor/gallery/platform hand wheel with floor stand or chain operator shall be provided for the same.

7.03.15 Valves below 50 mm size shall have screwed ends while those of 50 mm and higher sizes shall have flanged connections.

7.03.14 **Basket Strainer**

a) Basket strainers shall be of 30mesh and have the following materials of construction :

Body: Fabricated mild steel as per IS:2062 (Tested Quality). Strainer Wires: stainless steel (AISI : 316), 30 SWG, suitably reinforced.

b) Inside of basket body shall be protected by two (2) coats of heavy duty bitumastic paint.

c) Strainers shall be Simplex design. Suitable vent and drain connections with valves shall be provided.

d) Screen open area shall be at least 4 times pipe cross sectional area at inlet.

e) Pressure drop across strainer in clean condition shall not exceed 1.5 MWC at 410M3/hr **(for 765kV/400kV substations) and 1 MWC at 273M3/hr flow (for 220kV & 132kV substations)**. Pressure drop test report of strainer of same design shall be furnished.

7.03.15 **Y-type On-line Strainer**

Body shall be constructed of mild steel as per IS:2062 (tested quality). Strainer wires shall be of stainless steel AISI:316, 30 SWG, 30 mesh.

Blowing arrangement shall be provided with removable plug at the outlet. Screen open area shall be atleast 4 times pipe cross-sectional area at inlet.

Pressure drop test report of strainer of same design shall be furnished.

7.03.16 **Hydrant Valve (Outdoor) and Indoor Hydrant Valves (Internal**

Landing Valves).

The general arrangement of outdoor stand post assembly, consisting of a column pipe and a hydrant valve with a quick coupling end shall be as per TAC requirement.

Materials of construction shall be as follows :

a)	Column pipe	M.S. IS:1239 med. grade.
b)	Hydrant Valve	
i)	Body	**Stainless steel.**
ii)	Trim	Leaded tin bronze as per IS:318, Grade-LTB 2.
iii)	Hand Wheel	Cast Iron as per IS:210, Grade FG:200.
iv)	Washer, gasket, etc.	Rubber as per IS:638.
v)	Quick coupling connection	Leaded tin bronze as per IS:318, Grade-LTB 2.
vi)	Spring	Phosphor Bronze as per IS:7608.
vii)	Cap and chain	Leaded tin bronze as per IS:318, Grade-LTB etc.2.

The general design of hydrant valve shall conform to IS:5290.

7.03.17 **Hoses, Nozzles, Branch pipes and Hose boxes**

(a) Hose pipes shall be of reinforced rubber-lined canvas construction as per type A of IS:636 with nominal size of 63 MM (2 1/2") and lengths of 15 metre or 7.5 metre, as indicated elsewhere. All hoses shall be ISI marked.

(b) Hosepipes shall be capable of withstanding an internal water pressure of not less than 35**.7** kg/cm^2 without bursting. It must also withstand a working pressure of 8.5 kg/cm^2 without undue leakage or sweating.

(c) Each hose shall be fitted with instantaneous spring lock type couplings at both ends. Hose shall be fixed to the coupling ends by copper rivets and the joint shall be reinforced by 1.5 mm galvanised mild steel wires and leather bands.

(d) Branch pipes shall be constructed of copper and have rings of leaded tin bronze (as per IS:318 Grade-2) at both ends. One end of the branch pipe will receive the quick coupling while the nozzles will be fixed to the other end.

(e) Nozzles shall be constructed of leaded tin bronze as per IS:318, Grade-2.

(f) Suitable spanners of approved design shall be provided in adequate numbers for easy assembly and dismantling of various components like branch pipes, nozzles, quick coupling ends etc.

(g) Hose pipes fitted with quick coupling ends, branch pipes, nozzles spanner etc. will be kept in a hose box, which will be located near point of use. The furnished design must meet the approval of Tariff Advisory Committee.

(h) All instantaneous couplings, as mentioned under clause Nos.3.03.19, 3.03.20 and 3.03.21 above shall be of identical design (both male and female) so that any one can be interchanged with another. One male, female combination shall get locked in by mere pushing of the two halves together but will provide leak tightness at a pressure of 8 kg/cm^2 of water. Designs employing screwing or turning to have engagement shall not be accepted.

7.04.00 **Fabrication & Erection**

7.04.01 The contractor shall fabricate all the pipe work strictly in accordance with the related approved drawings.

7.04.02 **End Preparation**

(a) For steel pipes, end preparation for butt welding shall be done by machining.

(b) Socket weld end preparation shall be sawing/machining.

(c) For tees, laterals, mitre bends, and other irregular details cutting templates shall be used for accurate cut.

7.04.03 **Pipe Joints**

(a) In general, pipes having sizes over 25 mm shall be joined by butt welding. Pipes having 25 mm size or less shall be joined by socket welding/screwed connections. Galvanised pipes of all sizes shall have screwed joints. No welding shall be permitted on GI pipes. Screwed joints shall have tapered threads and shall be assured of leak tightness without using any sealing compound.

(b) Flanged joints shall be used for connections to vessels, equipment,

flanged valves and also on suitable straight lengths of pipe line of strategic points to facilitate erection and subsequent maintenance work.

7.04.04 **Overground Piping**

(a) Piping to be laid overground shall be supported on pipe rack/supports. Rack/supports details shall have to be approved by Employer/Engineer.

(b) Surface of overground pipes shall be thoroughly cleaned of mill scale, rust etc. by wire brushing. Thereafter one (1) coat of **red oxide primer** shall be applied. Finally two (2) coats of synthetic enamel paint of approved colour shall be applied.

7.04.05 **Buried Pipe Lines**

(a) Pipes to be buried underground shall be provided with protection against soil corrosion by coating and wrapping with two coats of coal tar hot enamel paint and two wraps of reinforced fibre glass tissue. The total thickness of coating and wrapping shall not be less than 3 mm. Alternatively corrosion resistant tapes can also be used for protection of pipes against corrosion.

(b) Coating and wrapping and holiday testing shall be in line with IS:10221.

(c) Buried pipelines shall be laid with the top of pipe one meter below ground level.

(d) At site, during erection, all coated and wrapped pipes shall be tested with an approved Holiday detector equipment with a positive signalling device to indicate any fault hole breaks or conductive particle in the protective coating.

7.05.00 **General Instruction for Piping Design and Construction**

7.05.01 While erecting field run pipes, the contractor shall check, the accessibility of valves, instrument tapping points, and maintain minimum headroom requirement and other necessary clearance from the adjoining work areas.

7.05.02 Modification of prefabricated pipes, if any, shall have to be carried out by the contractor at no extra charge to the Employer.

7.05.03 **Welding**

(i) Welding shall be done by qualified welders only.

(ii) Before welding, the ends shall be cleaned by wire brushing, filing or machine grinding. Each weld-run shall be cleaned of slag before the next run is deposited.

(iii) Welding at any joint shall be completed uninterrupted. If this cannot be followed for some reason, the weld shall be insulated for slow and uniform cooling.

(iv) Welding shall be done by manual oxyacetylene or manual shielded metal arc process. Automatic or semi-automatic welding processes may be done only with the specific approval of Employer/ Consultant.

(v) As far as possible welding shall be carried out in flat position. If not possible, welding shall be done in a position as close to flat position as possible.

(vi) No backing ring shall be used for circumferential butt welds.

(vii) Welding carried out in ambient temperature of 5°C or below shall be heat-treated.

(viii) Tack welding for the alignment of pipe joints shall be done only by qualified welders. Since tack welds form part of final welding, they shall be executed carefully and shall be free from defects. Defective welds shall be removed prior to the welding of joints.

Electrodes size for tack welding shall be selected depending upon the root opening.

(ix) Tacks should be equally spaced as follows **:**

for 65 NB and smaller pipes : 2 tacks

for 80 NB to 300 NB pipes : 4 tacks

for 350 NB and larger pipes : 6 tacks

(x) Root run shall be made with respective electrodes/filler wires. The size of the electrodes/filler wires. The size of the electrodes shall not be greater than 3.25 mm (10 SWG) and should preferably be 2.3 mm (12 SWG). Welding shall be done with direct current values recommended by the electrode manufacturers.

(xi) Upward technique shall be adopted for welding pipes in horizontally fixed position. For pipes with wall thickness less than 3 mm, oxyacetylene welding is recommended.

(xii) The root run of butt joints shall be such as to achieve full penetration with the complete fusion of root edges. The weld projection shall not exceed 3 mm inside the pipe.

(xiii) On completion of each run craters, weld irregularities, slag etc. shall be removed by grinding or chipping.

(xiv) Fillet welds shall be made by shielded metal arc process regardless of thickness and class of piping. Electrode size shall not exceed 10 SWG. (3.25 mm). At least two runs shall be made on socket weld joints.

7.06.00 **Tests at Works**

7.06.01 **Pipes**

(i) Mechanical and chemical tests shall be performed as required in the codes/standards.

(ii) All pipes shall be subjected to hydrostatic tests as required in the codes/standards.

(iii) 10% spot Radiography test on welds of buried pipes shall be carried out as per ASME VIII.

7.06.02 **Valves**

(i) Mechanical and chemical tests shall be conducted on materials of the valve as required in the codes/standards.

(ii) All valves shall be tested hydrostatically for the seat as well as required in the code/standards for a period of ten minutes.

(iii) Air test shall be conducted to detect seat leakage.

(iv) Visual check on the valve and simple operational test in which the valve will be operated thrice from full open to full close condition.

(v) No repair work on CI valve body, bonnet or wedge shall be allowed.

7.06.03 **Strainers**

(i) Mechanical and chemical tests shall be conducted on materials of the strainer.

(ii) Strainers shall be subjected to a hydrostatic test pressure of 1.5 times the design pressure or 10 kg/cm2g whichever is higher for a period of one hour.

7.06.04 **Hydrant valves and Indoor Hydrant Valves (Internal Landing Valves)**

(i) The stand post assembly along with the hydrant valve (valve being open and outlet closed) shall be pressure tested at a hydrostatic pressure of 21 kg/cm2g to detect any leakage through defects of casting.

(ii) Flow test shall be conducted on the hydrant valves at a pressure of 7 kg/cm2g and the flow through the valve shall not be less than 900 litres/min.

(iii) Leak tightness test of the valve seat shall be conducted at a hydrostatic test pressure of 14 kg/cm2g.

7.06.05 **Hoses, Nozzles, Branch Pipes and Hose Boxes**

Reinforced rubber-lined canvas hoses shall be tested hydrostatically. Following tests shall be included as per IS:636.

a) Hydrostatic proof pressure test at 21.4 kgf/cm2g

b) Internal diameter

The branch pipe, coupling and nozzles shall be subjected to a hydrostatic test pressure of 21 kg/cm2g for a period of $2^1/_2$ minutes and shall not show any sign of leakage or sweating.

Dimensional checks shall be made on the hose boxes and nozzle spanners.

8.00.00 **AIR VESSELS**

8.01.00 Air vessels shall be designed and fabricated of mild steel as class-II vessels as per IS:2825 for a pressure of 14kg/cm^2 and shall be minimum 3 m^3 capacity.

8.02.00 Inside surface of the tank shall be protected by anti-corrosive paints/coatings/linings as required.

8.03.00 Outside surfaces of the vessels shall be provided with one (1) coat of red lead primer with two (2) coats of synthetic enamel paint of approved colour and characteristics.

8.04.00 **Tests & Inspection**

8.04.01 Air vessels shall be hydraulically tested at 21kg/cm2 for a period not less than one (1) hour.

8.04.02 All materials used for fabrication shall be of tested quality and test

certificates shall be made available to the Owner.

8.04.03 Welding procedure and Welder's qualification tests will be carried out as per relevant IS Standard.

8.04.04 NDE tests, which will include 100% Radiography on longitudinal seams and spot Radiography for circumferential seams, for pressure vessel will be carried out.

9.00.00 HEAT DETECTORS/FIRE DETECTORS AND SPRAY NOZZLES

9.00.01 Intent of Specification

This specification lays down the requirements of the smoke detectors, heat detectors and spray nozzles for use in various sub-systems of the fire protection system.

9.00.02 Codes and Standards

All equipment supplied shall conform to internationally accepted codes and standards. All equipment offered by Bidders should be TAC approved or have been in use in installations which have been approved by TAC.

9.01.00 **Heat Detectors**, **Quartzoid bulb type.** (Used in HVW spray system)

a) Heat detectors shall be of any approved and tested type. Fusible chemical pellet type heat detectors are however not acceptable.

b) Temperature rating of the heat detector shall be selected by the Bidder taking into consideration the environment in which the detectors shall operate. Minimum set point shall, however, be 79oC.

c) Heat detectors shall be guaranteed to function properly without any maintenance work for a period of not less than twenty five (25) years.

d) The heat detectors shall be mounted on a pipe network charged with water at suitable pressure. On receipt of heat from fire, the heat detector will release the water pressure from the network. This drop in water pressure will actuate the Deluge valve.

9.02.00 HVW Spray Nozzles (Projectors)

High velocity water spray system shall be designed and installed to discharge water in the form of a conical spray consisting of droplets of water travelling at high velocity which shall strike the burning surface with sufficient impact to ensure the formation of an emulsion. At the same time the spray shall efficiently cut off oxygen supply and provide

sufficient cooling. Integral non-ferrous strainers shall be provided in the projectors ahead of the orifice to arrest higher size particle, which are not allowed to pass through the projectors.

9.03.00 **Fire Detectors (Used in fire detection and alarm system)**

9.03.01 Fire detectors shall be approved by FOC-London or similar international authorities.

9.03.02 Both smoke and heat type fire detectors shall be used. Bidder shall clearly indicate the mode of operation of detectors in his proposal.

9.03.03 The set point shall be selected after giving due consideration for ventilating air velocity and cable insulation.

9.03.04 Fire detectors shall be equipped with an integral L.E.D. so that it shall be possible to know which of the detectors has been operated. The detectors, which are to be placed in the space above the false ceiling or in the floor void shall not have the response indicators on the body but shall be provided with remote response indicators.

9.03.05 Approval from Department of Atomic Energy (DAE), Government of India shall be made available for ionisation type smoke detectors. All accessories required to satisfy DAE shall also be included in the scope of supply.

9.03.06 Fire detectors shall be guaranteed to function properly without any maintenance work for a period of not less than ten (10) years.

10.00.00 **PORTABLE AND WHEEL/ TROLLEY MOUNTED FIRE EXTINGUISHERS**

10.00.01 This specification lays down the requirement regarding fire extinguishers of following types :

Portable fire extinguishers.

a) Pressurised water type.

b) Dry chemical powder type

c) Carbon Dioxide type

Wheel/ Trolley mounted fire extinguishers.

a) Mechanical foam type

10.00.02 All the extinguishers offered by the Bidder shall be of reputed make and shall be ISI marked.

10.01.00 **Design and Construction**

10.01.01 All the portable extinguishers shall be of freestanding type and shall be capable of discharging freely and completely in upright position.

10.01.02 Each extinguisher shall have the instructions for operating the extinguishers on its body itself.

10.01.03 All extinguishers shall be supplied with initial charge and accessories as required.

10.01.04 Portable type extinguishers shall be provided with suitable clamps for mounting on walls or columns.

10.01.05 All extinguishers shall be painted with durable enamel paint of fire red colour conforming to relevant Indian Standards.

10.01.06 Pressurisation of water type fire extinguishers shall either be done by compressed air or by using gas cartridge. **Both constant air pressure and the gas pressure type shall conform to IS 15683:2006.** Both these extinguishers shall be ISI marked.

10.01.07 Dry chemical powder type portable extinguisher shall conform to **IS 15683:2006.**

10.01.08 Carbon Dioxide type portable extinguisher shall conform to **IS:15683:2006 and Carbon Dioxide type trolley mounted extinguisher shall conform to IS:2878**.

10.01.09 Wheel/ trolley mounted fire extinguishers of 50 litre capacity Mechanical foam type shall conform to IS:13386

10.02.00 **Tests and Inspection**

10.02.01 A performance demonstration test at site of five (5) percent or one (1) number whichever is higher, of the extinguishers shall be carried out by the Contractor. All consumable and replaceable items require for this test would be supplied by the Contractor without any extra cost to Employer.

10.02.02 Performance testing of extinguisher shall be in line of applicable Indian Standards. In case where no Indian Standard is applicable for a particular type of extinguisher, the method of testing shall be mutually discussed and agreed to before placement of order for the extinguishers.

10.03.00 **Painting**

Each fire extinguisher shall be painted with durable enamel paint of fire red colour conforming to relevant Indian Standards.

11.00.00 **INSTRUMENTS**

11.00.01 **Intent of Specification**

The requirements given in the sub-section shall be applicable to all the instruments being furnished under this specification.

11.00.02 All field mounted instruments shall be weather and dust tight, suitable for use under ambient conditions prevalent in the subject plant. All field mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance can be achieved.

11.01.00 **Local Instruments**

Pressure/ Differential Gauges & Switches.

11.01.01 The pressure sensing elements shall be continuous 'C' bourdon type.

11.01.02 The sensing elements for all gauges/switches shall be properly aged and factory tested to remove all residual stresses. They shall be able to withstand atleast twice the full scale pressure/vacuum without any damage or permanent deformation.

11.01.03 For all instruments, connection between the pressure sensing element and socket shall be braced or hard soldered.

11.01.04 Gauges shall be of 150 mm diameter dial with die-cast aluminium, stoved enamel black finish case, aluminium screwed ring and clear plastic crystal cover glass. Upper range pointer limit stop for all gauges shall be provided.

11.01.05 All gauges shall be with stainless steel bourdon having rotary geared stainless steel movements.

11.01.06 Weatherproof type construction shall be provided for all gauges. This type of construction shall be fully dust tight, drip tight, weather resistant and splash proof with anti-corrosive painting conforming to NEMA- 4.

11.01.07 All gauges shall have micrometer type zero adjuster.

11.01.08 Neoprene safety diaphragm shall be provided on the back of the instruments casing for pressure gauges of ranges 0-10 Kg/cm^2 and above.

11.01.09 Scales shall be concentric, white with black lettering and shall be in metric units.

11.01.10 Accuracy shall be $\pm$ 1.0 percent of full range or better.

11.01.11 Scale range shall be selected so that normal process pressure is approximately 75 percent of full scale reading. For pressure gauges and pressure switches, the range shall not be less than 0 -16 Kg/cm^2

11.01.12 All gauges shall have 1/2 inch NPT bottom connection.

11.01.13 All instruments shall conform to IS: 3624 - 1966.

11.01.14 All instruments shall be provided with 3 way gauge isolation valve or cock. Union nut, nipple and tail pipe shall be provided wherever required.

11.01.15 Switch element contact shall have two (2) NO and two (2) NC contacts rated for 240 Volts, 10 Amperes A.C. or 220 Volts, 5 Amperes D.C. Actuation set point shall be adjustable throughout the range. ON-OFF differential (difference between switch actuation and de-actuation pressures) shall be adjustable. Adjustable range shall be suitable for switch application.

11.01.16 Switches shall be sealed diaphragm, piston actuated type with snap action switch element. Diaphragm shall be of 316 SS.

11.01.18 Necessary accessories shall be furnished.

11.02.00 **Timers**

11.02.01 The timers shall be electro-mechanical type with adjustable delay on pick-up or reset as required.

11.02.02 Each timer shall have two pairs of contacts in required combination of NO and NC.

11.03.00 **Level Gauges/Indicator/Switches**

11.03.01 **Level Gauges**

i) Gauge glasses shall be used for local level indication wherever shown in the flow diagram.

ii) Gauge glasses, in general, shall be flag glass type with bolted cover. Body and cover material shall be of carbon steel with rubber lining.

iii) Level coverage shall be in accordance with operating requirements. Maximum length of a single gauge glass shall not exceed 1.4 M. Should a larger gauge glass be required, multiple gauges of preferably equal length shall be used with 50 mm overlap in visibility.

iv) Reflex type gauge glasses shall be used for colourless liquids and

transparent type gauge glasses shall be used for all liquids having colour.

v) Each gauge glass shall be complete with a pair of offset valves. Valves shall have union bonnet, female union level connection, flanged tank connection, and vent and drain plug.

vi) Offset valves shall have corrosion resistant ball-check to prevent fluid loss in the event of gauge glass breakage. Valve body shall have a working pressure of 200 percent of the maximum static pressure at the maximum process fluid temperature. Valve body materials shall be of carbon steel with rubber lining.

11.03.02 **Level Indicators**

i) Float type mechanical level gauges with linear scale type indicator shall be offered for measuring level of tanks wherever shown in the flow diagram.

ii) AISI-316 stainless steel float, guide rope and tape shall be used. Housing shall be of mild steel painted with anti-corrosive painting.

iii) The scale indicator shall be provided at a suitable height for ease of reading.

iv) Accuracy shall be + 1% of scale range or better.

11.03.03 **Level Switches**

i) Level switches shall be of ball float operated magnetic type complete with cage.

ii) Materials of construction shall be suitable for process and ambient conditions. The float material shall be AISI-316 stainless steel.

iii) Actuating switches shall be either hermetically sealed mercury type or snap acting micro-switches. Actuation set point shall be adjustable. ON-OFF differential (difference between switch actuation and de-actuation levels) shall be adjustable. Adjustable range shall be suitable for switch application. All switches shall be repeatable within + 1.0 percent of liquid level change required to activate switch. Contacts shall be rated for 50 watts resistive at 240 V A.C. Number of contacts shall be two NO and two NC for each level switch.

11.04.00 **Solenoid Valves**

11.04.01 The body of the valves shall be Forged brass or stainless steel.

11.04.02 The coil shall be continuous duty, epoxy moulded type Class-F, suitable for high temperature operation.

11.04.03 The enclosure shall be watertight, dust-tight and shall conform to NEMA-4 Standard.

11.04.04 The valves shall be suitable for mounting in any position.

11.05.00 **Switches, Lamps, Meters Etc.**

All electrical components on the panel namely push buttons, switches, lamps, meters etc. shall meet the requirements of sub-section Electrical enclosed with the specification.

11.06.00 All local instruments shall be inspected by Employer/Consultant as per the agreed quality plan.

11.07.00 Makes of control panel and local instruments, accessories shall be as per Employer's approval.

12.00.00 **ELECTRIC MOTORS**

12.01.00 **General**

12.01.01 This clause covers the requirements of three phase squirrel cage induction motors and single-phase induction motors.

12.01.02 The motors to be furnished, erected and commissioned as covered under this specification shall be engineered, designed, manufactured, erected, tested as per the requirements specified herein. These requirements shall however be read along with the requirements of the respective driven equipment being supplied under the specification of which this specification forms a part.

12.01.03 The motor supplied under this specification shall conform to the standards specified in GTR.

12.01.04 Terminal point for all motors supplied under this specification shall be at the respective terminal boxes.

12.01.05 Materials and components not specifically stated in this specification but are necessary for satisfactory operation of the motor shall be deemed to be included in the scope of supply of this specification.

12.01.06 Notwithstanding anything stated in this motor specification, the motor has to satisfy the requirement of the mechanical system during normal and abnormal conditions. For this the motor manufacturer has to co-ordinate with the mechanical equipment supplier and shall ensure that the motor being offered meets the requirements.

12.02.00 **Codes & Standards**

12.02.21 The design, manufacture, installation and performance of motors shall conform to the provisions of latest Indian Electricity Act and Indian Electricity Rules. Nothing in these specifications shall be construed to relieve the Contractor of his responsibility.

12.02.22 In case of contradiction between this specifications and IS or IEC, the stipulations of this specification shall be treated as applicable.

12.02.23 National Electrical code for hazardous location and relevant NEMA standard shall also be applicable for motors located in hazardous location.

12.03.00 **Design Features**

12.03.01 **Rating and type**

(i) The induction motors shall be of squirrel cage type unless specified otherwise.

(ii) The motors shall be suitable for continuous duty in the specified ambient temperature.

(iii) The MCR KW rating of the motors for 50ºC ambient shall not be less than the power requirement imposed at the motor shaft by the driven equipment under the most onerous operation conditions as defined elsewhere, when the supply frequency is 51.5 Hz (and the motor is running at 103% of its rated speed).

(iv) Motors shall be capable of giving rated output without reduction in the expected life span when operated continuously in the system having the following particulars :

a) Rated terminal voltage

From 0.2 to 200 KW 415V (3 Phase, solidly earthed)

Below 0.2 KW 240 V (1 Phase, solidly earthed)

Variation in voltage $\pm$ 6%.

b) Frequency 50 Hz $\pm$ 3%.

c) Any combination of (a) & (b)

12.03.02 Enclosure

Motors to be installed outdoor and semi-outdoor shall have hose proof enclosure equivalent to IP-55 as per IS: 4691. For motors to be installed indoor, the enclosure shall be dust proof equivalent to IP-54 as

per IS: 4691.

12.03.03 **Cooling method**

Motors shall be TEFC (totally enclosed fan cooled) type.

12.03.04 **Starting requirements**

(i) **Induction motor**

a) All induction motors shall be suitable for full voltage direct on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.

b) Motors shall be capable of withstanding the electro-dynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.

c) The starting current of the motor at rated voltage shall not exceed six (6) times the rated full load current subject to tolerance as given in IS : 325.

d) Motors when started with the driven equipment imposing full starting torque under the supply voltage condition specified under Clause 12.03.01 (iv) (a) shall be capable of withstanding at least two successive starts with coasting to rest between starts and motor initially at the rated load operating temperature. The motors shall also be suitable for three equally spread starts per hour, the motor initially at a temperature not exceeding the rated operating temperature.

e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than the starting time with the driven equipment at minimum permissible voltage (clause 12.03.04 (i) (a) by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speeds lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

12.03.05 **Running requirements**

(i) When the motors are operating at extreme condition of voltage and frequency given under clause no.12.03.01 (iv) the maximum permissible temperature rise over the ambient temperature of 50ºC shall be within the limits specified in IS : 325 after adjustment due

to increase ambient temperature specified herein.

(ii) The double amplitude of motor vibration shall be within the limits specified in IS: 4729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

(iii) All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.

(iv) Induction motors shall be so designed as to be capable of withstanding the voltage and torque stresses developed due to the difference between the motor residual voltage and incoming supply voltage during fast changeover of buses. The necessary feature incorporated in the design to comply with this requirement shall be clearly indicated in the proposal.

(v) Motors shall be capable of developing the rated full load torque even when the supply voltage drops to 70% of rated voltage. Such operation is envisaged for a period of one second. The pull out torque of the induction motors to meet this requirement shall not be less than 205% of full load torque.

(vi) The motors shall be capable of withstanding for 10 seconds without stalling or abrupt change in speed (under gradual increase of torque) an excess torque of 60 percent of their rated torque, the voltage and frequency being maintained at their rated value.

(vii) Guaranteed performance of the motors shall be met with tolerances specified in respective standards.

12.04.00 **Construction Features**

12.04.01 **Stator**

(i) **Stator frame**

The stator frames and all external parts of the motors shall be rigid fabricated steel or of casting. They shall be suitably annealed to eliminate any residual stresses introduced during the process of fabrication and machining.

(ii) **Stator core**

The stator laminations shall be made from suitable grade magnetic sheet steel varnished on both sides. They shall be pressed and clamped adequately to reduce the core and teeth vibration to minimum.

(iii) **Insulation and winding**

All insulated winding conductor shall be of copper. The overall motor winding insulation for all 415 volts motors shall be of epoxy thermoset-ting type i.e., class 'F' but limited to class-B operating from temperature rise consideration. Other motors may be of conventional class-B type. The windings shall be suitable for successful operation in hot, humid, tropical climate with the ambient temperature of 50oC.

12.04.02 **Rotor**

(i) Rotors shall be so designed as to keep the combined critical speed with the driven equipment away from the running speed by atleast 20%.

(ii) Rotors shall also be designed to withstand 120% of the rated speed for 2 minutes in either direction of rotation.

12.04.03 **Terminal box leads**

(i) For motors of 415 Volts and below a single terminal box may be provided for power and accessories leads.

(ii) Terminal boxes shall be of weatherproof construction designed for outdoor service. To eliminate entry of dust and water, gaskets of neoprene or approved equivalent shall be provided at cover joints and between box and motor frame.

(iii) Terminal box shall be suitable for top and bottom entry of cables.

(iv) Unless otherwise approved, the terminal box shall be capable of being turned through 360o in steps in 90o.

(v) The terminals shall be complete with all accessories for connecting external cables. They shall be designed for the current carrying capacity and shall ensure ample phase to phase to ground clearances.

(vi) Suitable tinned brass compression type cable glands and cable lugs shall be supplied by the Contractor to match Employer's cable.

(vii) Terminal box for single core cable shall be of non- magnetic material.

(viii) Marking of all terminals shall be in accordance with IS : 4728.

12.04.04 **Rating Plates**

(i) Rating plates shall be provided for all motors giving the details as called for in IS:325 (for three phase squirrel cage induction

motors).

(ii) In addition to above, the rating plate shall indicate the following :

a) Temperature rise in oC under normal working conditions.

b) Phase sequence corresponding to the direction of rotation for the application.

c) Bearing identification number (in case of ball/ roller bearing) and recommended lubricants.

12.04.05 **Other Constructional Features**

(i) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of Employer's earthing conductor to be specified to the successful Bidder.

(ii) Motor weighing more than 25 kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

12.05.00 **Paint and Finish**

12.05.01 Motor external parts shall be finished and painted to produce a neat and durable surface, which would prevent rusting and corrosion. The equipment shall be thoroughly degreased, all sharp edges and scales removed and treated with one coat of primer and two coats of grey enamel paint.

12.05.02 Motor fans shall also be painted to withstand corrosion.

12.05.03 All fasteners used in the construction of the equipment shall be either of corrosion resistant material or heavy cadmium plated.

12.05.04 Current carrying fasteners shall be either of stainless steel or high tensile brass.

12.06.00 **Tests at Manufacturers Works**

12.06.01 Motors shall be subject to routine tests in accordance with IS : 325 & IS : 4029 standards.

12.06.02 In addition, the following tests shall also be carried out :

a) 20% over speed test for 2 minutes on all rotors.

b) Measurement of vibration.

c) Measurement of noise level.

d) Phase sequence and polarity checks relative to mechanical rotation.

12.06.03 **Tests after installation at site**

(i) After installation and commissioning at site, the motors alongwith the driven equipment shall be subject to tests to ascertain their conformity with the requirement of this specification and those of the driven equipment specification and the performance data quoted by the Bidder.

(ii) In case of non-conformity of the motor with these specifications and performance requirement, the Engineer may at his discretion reject or ask for necessary rectification/replacement as detailed in general Terms and Conditions of Contract (GCC) Volume-I.

13.00.00 **BATTERY & BATTERY CHARGERS**

This clause covers the design, performance, manufacturing, construction features and testing of Battery and Battery charger used primarily for starting the diesel engine driving the fire water pumps. Battery Chargers shall be housed in Diesel Engine Panel.

13.01.00 **General Information**

13.01.01 The equipment specified hereinafter are required for starting the diesel engines and other operation of the plant as required.

13.01.02 For each diesel engine there shall be two (2) sets of Battery and two (2) sets of Battery Charger.

13.01.03 The D.C. voltage shall be obtained normally after necessary rectification by battery charger. The Battery Charging system shall be capable of meeting the following requirements :

13.01.04 Float charging the Battery.

13.01.05 Boost Charging the Battery.

13.01.06 The battery shall be large enough to crank the engine **3** times without charging in between and without getting drained to an extent which will affect its life.

13.01.07 The Bidder shall indicate the battery voltage and battery capacity in Ampere- Hour at ten (10) hour discharge rate. The battery voltage at any time during operation shall not be less than the minimum voltage required for operation of the D.C. loads.

13.02.00 **General Design**

The Battery shall be located indoor

13.02.01 **Battery**

(i) The cells shall be lead-acid type. The Battery shall be automotive type.

(ii) The cells shall be sealed in type with anti-splash type vent plug.

(iii) The cell terminal posts shall be provided with connector bolts and nuts, effectively coated with lead to prevent corrosion. Lead or lead coated copper connectors shall be furnished to connect up cells of battery set.

(iv) Positive and Negative terminal posts shall be clearly and indelibly marked for easy identification.

(v) The electrolyte shall be of battery grade Sulphuric Acid conforming to IS : 226-2962. Water for storage batteries conforming to IS : 1069 shall be used in the preparation of the electrolyte.

13.02.02 **Battery Charger**

(i) The Bidder shall furnish the battery charging scheme complete with all necessary accessories such as transformers, switches, fuses, starters, contactors, diodes, ammeters, voltmeters and other devices as required for trouble free operation. All devices and equipment shall conform to relevant Indian Standard or shall be Superior to it.

(ii) The scheme of the battery charger shall be such that the battery can be charged automatically as well as manually.

(iii) The boost charger shall have sufficient capacity to restore a fully discharged Battery to a state of full charge in eight (8) hours with some spare margin over maximum charging rate. Suitable provision shall be kept so that, for a particular engine, any of the two (2) charger units can be used for charging any of the two (2) batteries.

(iv) The instruments, switches and lamps shall be flush/semi-flush mounted on the front panel. Name plate of approved type shall be provided for each of these equipment.

(v) The panel shall be complete with internal wiring and input-output terminal block. Terminal blocks shall be clip on type of suitable rating. All equipment and wire terminals shall be identified by symbols corresponding to applicable schematic/wiring diagram.

(vi) Space heaters of adequate capacity shall be provided to prevent moisture condensation in the panel.

13.03.00 **Testing**

13.03.01 The Battery Charger shall also be subjected to the following tests at manufacturer's works as per IS - 4540

13.03.02 Insulation test.

13.03.03 Connection checking.

13.03.04 Measurement of voltage regulation.

13.03.05 Auxiliary of devices.

13.03.06 Alternating current measurement.

13.03.07 Performance test.

13.03.08 Temperature rise test.

13.03.09 Following acceptance tests shall be carried out in batteries as per IS:1651.

a) Marking and packing

b) Verification of dimensions

c) Test for capacity

d) Test for voltage during discharge

Battery and battery charger shall be checked for auto charging and providing sufficient power for three consecutive starting kicks to diesel engine within five minutes with A.C. supply switched off.

14.00.00 **CONTROL & ANNUNCIATION PANELS**

14.01.00 **Intent of Specification**

The following requirement shall be applicable to the control and annunciation panels furnished under these specifications.

14.02.00 **General Information**

14.02.01 The equipment specified herein are required for controlling, metering, monitoring and indication of electrical systems of the plant offered.

14.02.02 The selection and design of all the equipment shall be so as to ensure reliable and safe operation of the plant and shall be subjected to approval by the Employer.

14.02.03 The reference ambient temperature outside the panel shall be taken as 50oC and relative humidity 100%.

14.03.00 **Equipment to be Furnished**

Control & annunciation panels shall be furnished complete with all accessories and wiring for safe and trouble free operation of the plant. Details are included in sub-section General.

14.04.00 **Constructional Details**

14.04.01 The panel frames shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness not less than 2.5 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary.

14.04.02 Panels shall be of free standing type and shall be provided with hinged door with locking arrangement. The access doors, cutest and covers shall be equipped with neoprene/synthetic rubber gaskets (conforming to IS 11149-1984) all around and the latches sufficiently strong to hold them in alignment when closed. The panels to be installed outdoor or semi outdoor shall have a degree of protection of IP:55 and those installed indoor shall have a degree of protection of IP:52 as per IS:13947 Part-1.

14.04.03 If a panel consists of a number of panels, each panel should be mounted side by side and bolted together to form a compact unit, when two panels meet, the joints shall be smooth, close fittings and un-obstructive.

14.04.04 Removable eye bolt or lifting lugs shall be provided on all panels to facilitate easy lifting.

14.04.05 The heights of all operating equipment on the panel shall be between 800 mm to 1600 mm from the finished floor level. The proper supporting arrangement shall be provided by the Contractor.

14.04.06 Cable entries to the panel may be from bottom or top. The cable entry required will be intimated to the successful Bidder. A suitable removable gland plate of 3 mm thick shall be mounted not less than 200 mm above the floor level.

14.04.07 All equipment mounted on the front face of the panels shall be flush or semi-flush type. All equipment shall be so located that their terminal

and adjustment are readily accessible for inspection or maintenance and their removal and replacement can be done without interruption of service to other equipment. The contractor shall submit the panel general arrangement drawings clearly bringing out internal mounting details, dimensions of equipment, clearance between the equipment and the edges of the panel, for approval.

14.05.00 **Name Plates and Labels**

14.05.01 Each panel shall be provided with prominent, engraved identification plates for all front mounted equipment. Panel identification name plate shall be provided at front and rear as required.

14.05.02 All name plates shall be of non-rusting metal or 3 ply lamicold, with white engraved lettering on black background. Inscription and lettering sizes shall be subjected to Employer's approval.

14.05.03 Suitable plastic sticker labels shall be provided for easy identification of all equipment located inside the panel. These labels shall be positioned so as to be clearly visible and shall give the device number, as mentioned in the wiring drawings.

14.06.00 **AC/DC Power Supply**

14.06.02 The Employer will provide one feeder each for AC and DC to the panel. The Contractor shall make for his own arrangements for providing these power supplies to different panels.

14.06.02 The Contractor shall provide suitable isolating switch fuse unit in the control panel for receiving the above incoming AC and DC supplies. Fuse and link shall be provided for isolating of individual circuit without disturbing other circuits.

14.07.00 **Wiring**

14.07.01 All inter panel wiring and connections between panels (if there is group of panels) including all bus wiring for AC & DC supplies shall be provided by the Contractor.

14.07.02 All internal wiring shall be carried out with 1100 V grade, single core, 1.5 square mm or larger stranded copper wires having colour-coded PVC insulation. CT circuits shall be wired with 2.5 square mm copper wires, otherwise similar to the above.

14.07.03 Extra-flexible wire shall be used for wiring to devices mounted on moving parts such as doors.

14.07.04 Spare contacts of auxiliary relays, timers and switches shall be wired out to the terminal blocks as required by the Employer/Engineer at the time of detailed engineering.

14.08.00 **Terminal Blocks**

14.08.01 Terminal Blocks shall be of 650V grade, rated for 10 Amps and in one-piece moulding. It shall be complete with insulating barriers, clip-on-type terminals, and identification strips. Marking on terminal strip shall correspond to the terminal numbering on wiring diagrams. It shall be similar to 'Elmex-Standard' type terminals.

14.08.02 Terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal block.

14.08.03 The terminal blocks shall have at least 20% spare terminals.

14.09.00 **Grounding**

A continuous copper bus 25 x 3 mm size shall be provided along the bottom of the panel structure. It shall run continuously throughout the length of the panel and shall have provision at both ends for connection to the station grounding grid (25 x 6 mm MS Flat).

14.10.00 **Space Heater and Lighting**

14.10.01 Space heaters shall be provided in the panels for preventing harmful moisture condensation.

14.10.02 The space heaters shall be suitable for continuous operation on 240V AC, 50 Hz, single phase supply and shall be automatically controlled by thermostat. Necessary isolating switches and fuses shall also be provided.

14.10.03 Free standing panel shall have a 240V AC, plug point and a fluorescent light operated by door switch.

14.11.00 **Control and Selector Switches**

14.11.01 Control and selector switches shall be of rotary type, with escutcheon plates clearly marked to show the function and positions.

14.11.02 Control/selector switches shall be spring return or stay put type as per the requirements. Handles of control/selector switches shall be black in colour. Shape and type of handles shall be to the approval of the Employer.

14.11.03 The contact ratings shall be at least the following :

i) Make and carry continuously 10 Amp.

ii) Breaking current at 240V DC 1Amp. (Inductive)

iii) Breaking current at 240V DC 5 Amp. at 0.3 p.f. lagging

14.12.00 **Push Buttons**

14.12.01 Push buttons shall be spring return, push to actuate type and rated to continuously carry and break 10A at 240V AC and 0.5A (Inductive) at 220V DC. The push buttons shall have at least 1 NO and 1 NC contact. All contact faces shall be of silver or silver alloy.

14.12.02 All push buttons shall be provided with integral escutcheon plates marked with its function.

14.12.03 The colour of buttons shall be as follows :

Green For motor START, Breaker CLOSE, Valve/ damper OPEN.

Red For motor TRIP, Breaker OPEN, Valve/ damper CLOSE.

Black For all annunciation functions, overload reset and miscellaneous.

14.12.04 Red push buttons shall always be located to the left of green push buttons. In case of clinker grinder etc. the push buttons would be black-red-green from left to right.

14.13.00 **Indicating Lamps**

14.13.01 Indicating lamps shall be of the panel mounting, filament type and of low-watt consumption. Lamps shall be provided with series resistors preferably built-in- the lamps assembly. The lamps shall have escutcheon plates marked with its function, wherever necessary.

14.13.02 Lamp shall have translucent lamp covers of the following colours :

Red for motor OFF, Valve/damper OPEN, Breaker CLOSED.

Green for motor ON, Valve/damper CLOSED, Breaker OPEN.

White for motor AUTO-TRIP.

Blue for all healthy conditions (e.g. control supply, lub oil pressure and also for spring charged).

Amber for all ALARM conditions (e.g. pressure low, over load and also for 'service' and 'Test' position indication).

14.13.03 Bulbs and lamps covers shall be easily replaceable from the front of the panel.

14.13.04 Indicating lamps should be located directly above the associated push

button/control switches. Red lamps shall variably be located to the right of the green lamp. In case a white lamp is also provided, it shall be placed between the red and green lamps. Blue and amber lamps should normally be located above the red and green lamps.

14.14.00 **Fuses**

14.14.01 All fuses shall be of HRC cartridge plug-in-type and shall be of suitable rating, depending upon circuit requirements.

14.14.02 All fuses shall be mounted on fuse carriers, which shall be mounted on fuse-bases.

14.15.00 **Contactors**

14.15.01 Contactors shall be of air break, electromagnetic type rated as per requirement. These shall be of utilisation category AC 3 as per IS:2959.

14.15.02 Operating coils of AC contactors shall be of 240V AC or 220V DC as required. AC contactors shall operate satisfactorily between 85% to 110% of the rated voltage. The Contactor shall not drop out at 70% of the rated voltage.

14.15.03 DC contactors shall have a coil voltage of 220V DC and shall be suitable for satisfactory continuous operation at 80% to 110% of the rated voltage.

14.16.00 **Relays and Timers**

14.16.01 All auxiliary relays & timers shall be of proven design and of reputed make. Contacts of relays and timers shall be of solid silver or silver cadmium oxide or solid silver faced. Timers shall have the provision to adjust the delay on pick-up or reset as required.

14.16.02 All relays and timers shall have at least two NO and two NC contacts.

14.16.03 All relays and timers shall be suitable for 240V AC and 220V DC as required. DC relays shall operate satisfactorily between 70% to 110% and AC relays shall be suitable for voltage variation between 80% to 110%.

14.17.00 **Indication Instruments**

14.17.01 All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96 mm square size with 90 degree scales and shall have an accuracy class of 2.0 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.

14.17.02 All instruments shall be compensated for temperature errors and factory

calibrated to directly read the primary quantities. Means shall be provided for zero adjustment removing or dismantling the instruments.

14.17.03 All instruments shall have white dials with black numerals and lettering. Black knife edge pointer with parallax free dials will be preferred.

14.17.04 Ammeters provided on motor feeders shall have a compressed scale at the upper current region to cover the starting current.

14.18.00 **Annunciation System**

14.18.01 The annunciation system shall be complete with all necessary relays, flashers and other accessories required for the proper operation of the equipment and shall be completely solid state. The control circuit shall be mounted on plug-in type glass epoxy printed circuit boards. Audible alarms for the system shall be mounted inside the panel. One set of acknowledge, test and reset push buttons shall be mounted on the panel.

14.18.02 Indications shall be engraved on Acrylic inscription plate window and shall be visible clearly when the indication lamp is lighted (black letters on white background). Each window shall be provided with two lamps.

14.18.03 Audible hooter shall sound when a trouble contact operates and shall continue to sound until the acknowledge button is pressed. In addition to the hooters provided on annunciation panels, a hooter shall be provided outside FFPH which shall sound in any fire alarm condition.

14.18.04 Indication lamps shall flash when trouble contact operates and shall continue flashing until acknowledge button is pressed.

14.18.05 After acknowledge button is pressed, the hooter and flashing shall stop but the indication lamp shall remain lighted.

14.18.06 After trouble is cleared indication lamps shall be ready and shall go off only when reset.

14.18.07 Silencing the hooter in conjunction with one trouble contact shall not stop and hooter sounding if another trouble contact operates.

14.18.08 When test button is pressed, all lamps shall flash and hooter shall sound.

14.18.09 Annunciator systems shall operate on 220V DC Systems.

14.18.10 The annunciation system shall include alarm for AC control system failure (working on DC supply), DC supply failure (working on AC supply) and test facilities for these alarms.

14.18.11 List of annunciations required on the panels has been listed elsewhere.

The Contractor shall also provide additional annunciations if desired by the Employer/Engineer during Vendor drawing review stage and for such additional annunciations no extra charges shall be claimed by the Contractor, if the number of such additions are within 10% of the number stipulated in this specification.

14.18.12 20% spare windows shall be provided on the panel.

14.19.00 **Painting**

14.19.01 **Painting procedure adopted shall conform to requirements given in GTR**. The paint thickness shall not be less than **60** microns. Finished parts shall be coated by peelable compound by spraying method to protect the finished surface from scratches, grease, dirt and oily spots during testing, transportation handling and erection.

14.20.00 **Tests**

14.20.01 Following tests/inspection shall be carried out by the Contractor in the presence of Employer's representative :

(A) Factory Tests

1. Compliance with approved drawings, data and specification.

2. Visual check for workmanship.

3. Wiring continuity and functional checks.

4. Calibration of instruments, relays and metres wherever required by inspector.

5. HV test

6. Insulation resistance measurement before and after HV test.

(B) Inspection/Testing at site :

1. IR test before and after HV test

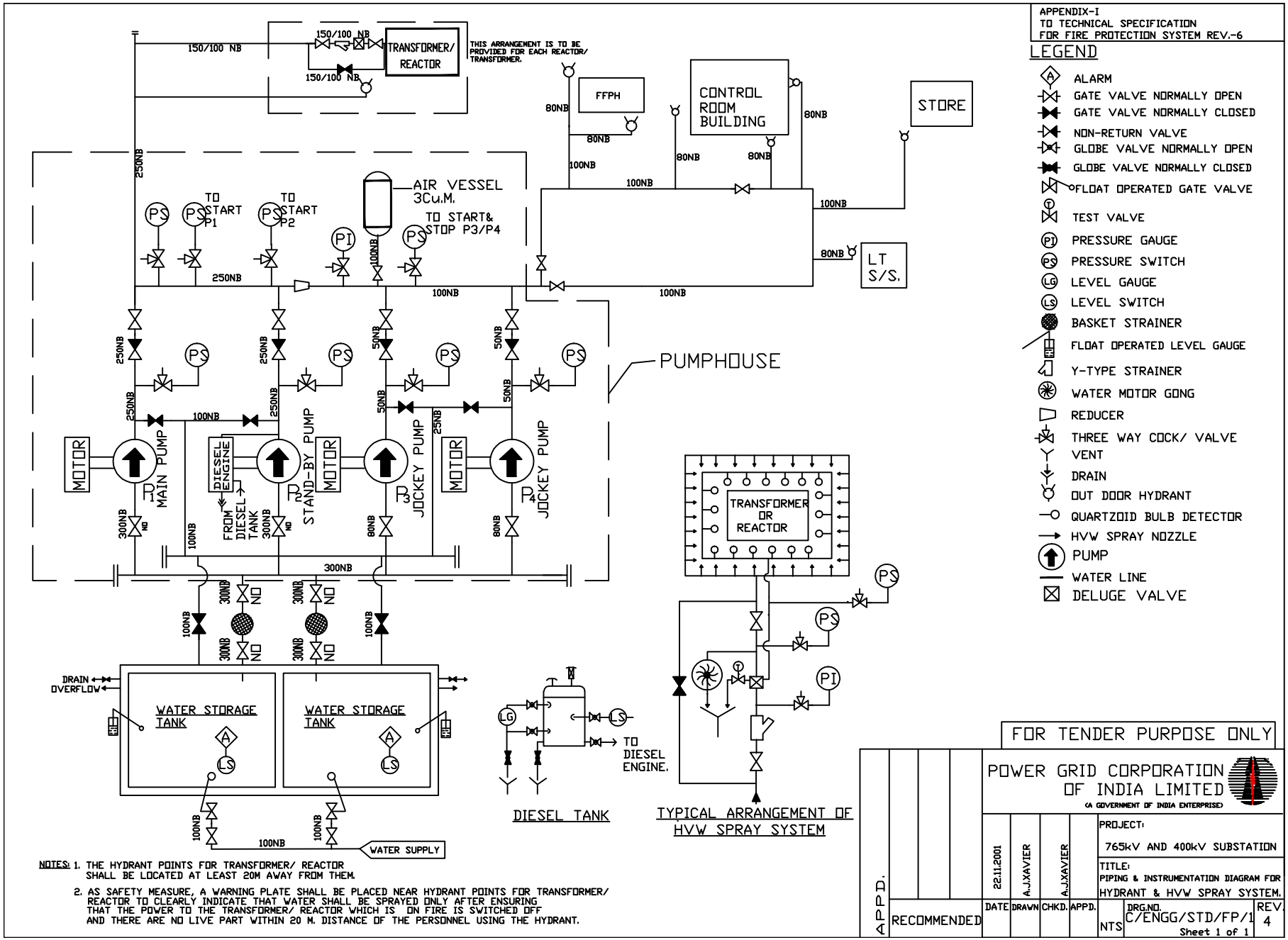
2. HV Test

3. Functional Testing.

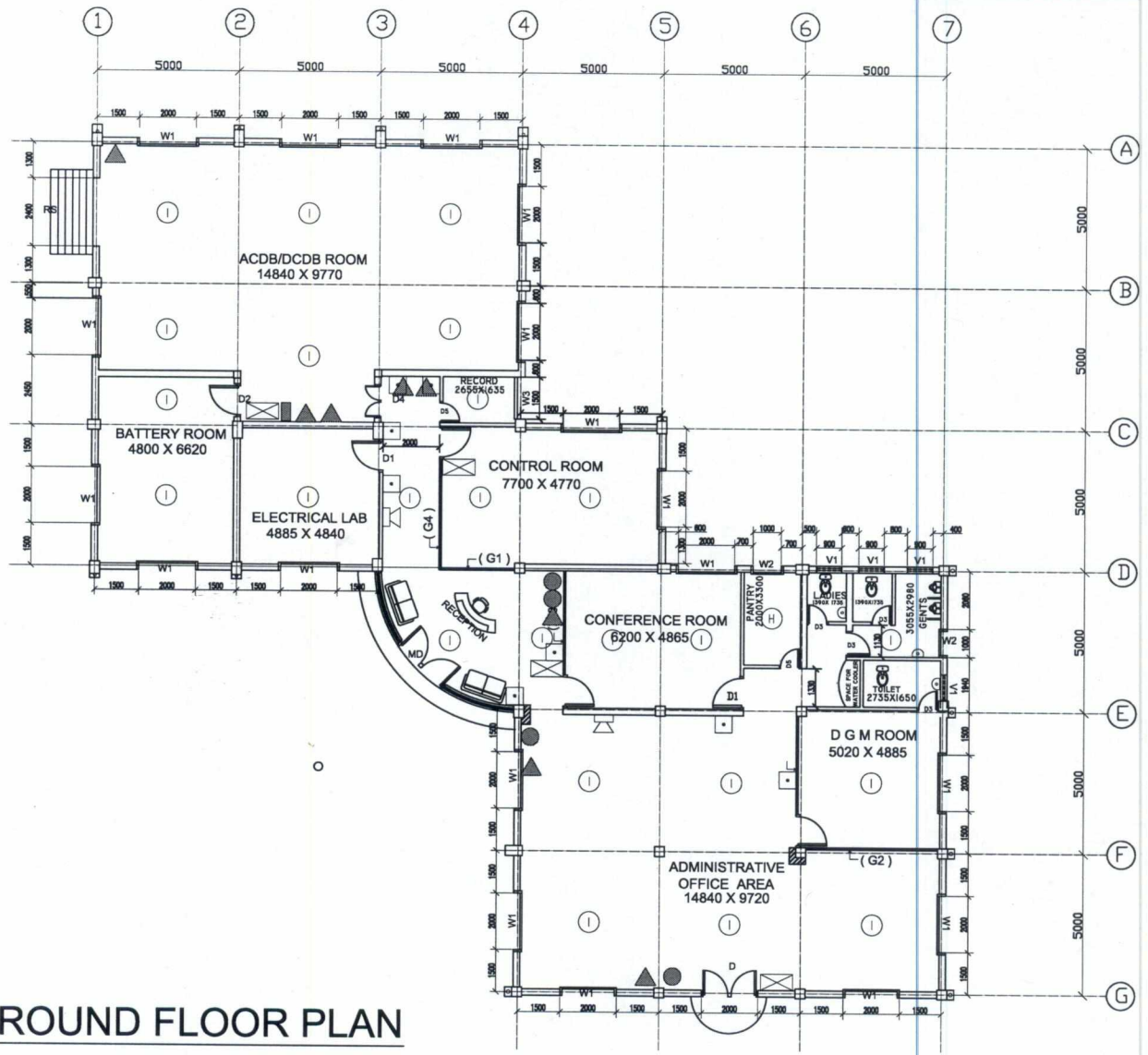
(C)

1. The Fire detection and annunciation panel shall be subjected to functional tests.

2. The Annunciation System shall be routine tested


APPENDIX-I
TO TECHNICAL SPECIFICATION
FOR FIRE PROTECTION SYSTEM REV.-6
LEGEND
ALARM
GATE VALVE NORMALLY OPEN
GATE VALVE NORMALLY CLOSED
NON-RETURN VALVE
GLOBE VALVE NORMALLY OPEN
GLOBE VALVE NORMALLY CLOSED
FLOAT OPERATED GATE VALVE
TEST VALVE
PRESSURE GAUGE
PRESSURE SWITCH
LEVEL GAUGE
LEVEL SWITCH
BASKET STRAINER
FLOAT OPERATED LEVEL GAUGE
Y-TYPE STRAINER
WATER MOTOR GONG
REDUCER
THREE WAY COCK/ VALVE
VENT
DRAIN
OUT DOOR HYDRANT
QUARTZOID BULB DETECTOR
HVW SPRAY NOZZLE
PUMP
WATER LINE
DELUGE VALVE
TRANSFORMER/ REACTOR
THIS ARRANGEMENT IS TO BE PROVIDED FOR EACH REACTOR/ TRANSFORMER.
FFPH
CONTROL ROOM BUILDING
STORE
LT S/S.
AIR VESSEL 3Cu.M.
TO START P1
TO START P2
TO START& STOP P3/P4
PUMPHOUSE
MOTOR
MAIN PUMP P1
DIESEL ENGINE
STAND-BY PUMP P2
JOCKEY PUMP P3
JOCKEY PUMP P4
FROM DIESEL TANK
WATER STORAGE TANK
WATER STORAGE TANK
DRAIN OVERFLOW
WATER SUPPLY
TO DIESEL ENGINE.
DIESEL TANK
TRANSFORMER OR REACTOR
TYPICAL ARRANGEMENT OF HVW SPRAY SYSTEM
NOTES: 1. THE HYDRANT POINTS FOR TRANSFORMER/ REACTOR SHALL BE LOCATED AT LEAST 20M AWAY FROM THEM.
2. AS SAFETY MEASURE, A WARNING PLATE SHALL BE PLACED NEAR HYDRANT POINTS FOR TRANSFORMER/ REACTOR TO CLEARLY INDICATE THAT WATER SHALL BE SPRAYED ONLY AFTER ENSURING THAT THE POWER TO THE TRANSFORMER/ REACTOR WHICH IS ON FIRE IS SWITCHED OFF AND THERE ARE NO LIVE PART WITHIN 20 M. DISTANCE OF THE PERSONNEL USING THE HYDRANT.
FOR TENDER PURPOSE ONLY
POWER GRID CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
PROJECT: 765kV AND 400kV SUBSTATION
TITLE: PIPING & INSTRUMENTATION DIAGRAM FOR HYDRANT & HVW SPRAY SYSTEM.
APPD.
RECOMMENDED
DATE 22.11.2001
DRAWN A.J.XAVIER
CHKD. A.J.XAVIER
APPD.
NTS
DRG.NO. C/ENGG/STD/FP/1 Sheet 1 of 1
REV. 4

APPENDIX-II
TO TECHNICAL SPECIFICATION
FOR FIRE PROTECTION SYSTEM REV.-6



GROUND FLOOR PLAN

BILL OF QUANTITY FOR FIRE EXTINGUISHERS.		
SYMBOL	TYPE	QUANTITY
▲	4.5 KG CO2	08+1*
●	9 LITRE WATER	04
▮	5 KG DCP	01+4*

* FOR FIRE WATER PUMP HOUSE AND DG SET.

BILL OF QUANTITY FOR FIRE DETECTORS.		
SYMBOL	ITEM	QUANTITY
Ⓘ	IONIZATION DETECTORS	24
Ⓗ	HEAT DETECTOR	01
⊡	REMOTE RESPONSE INDICATOR	08
⊠	MANUAL CALL POINT	04
⊠	HOOTER	02+1#

FOR FIRE WATER PUMP HOUSE.

NOTES : -.
ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED.

REV.	DESCRIPTION	CIVIL	REVD.	REVD.	MECH.	ELEC.	REVD.	APPD.	DATE.
0.									
		CLEARED BY							

POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

PROJECT : 800/400/220 KV SUB-STATION

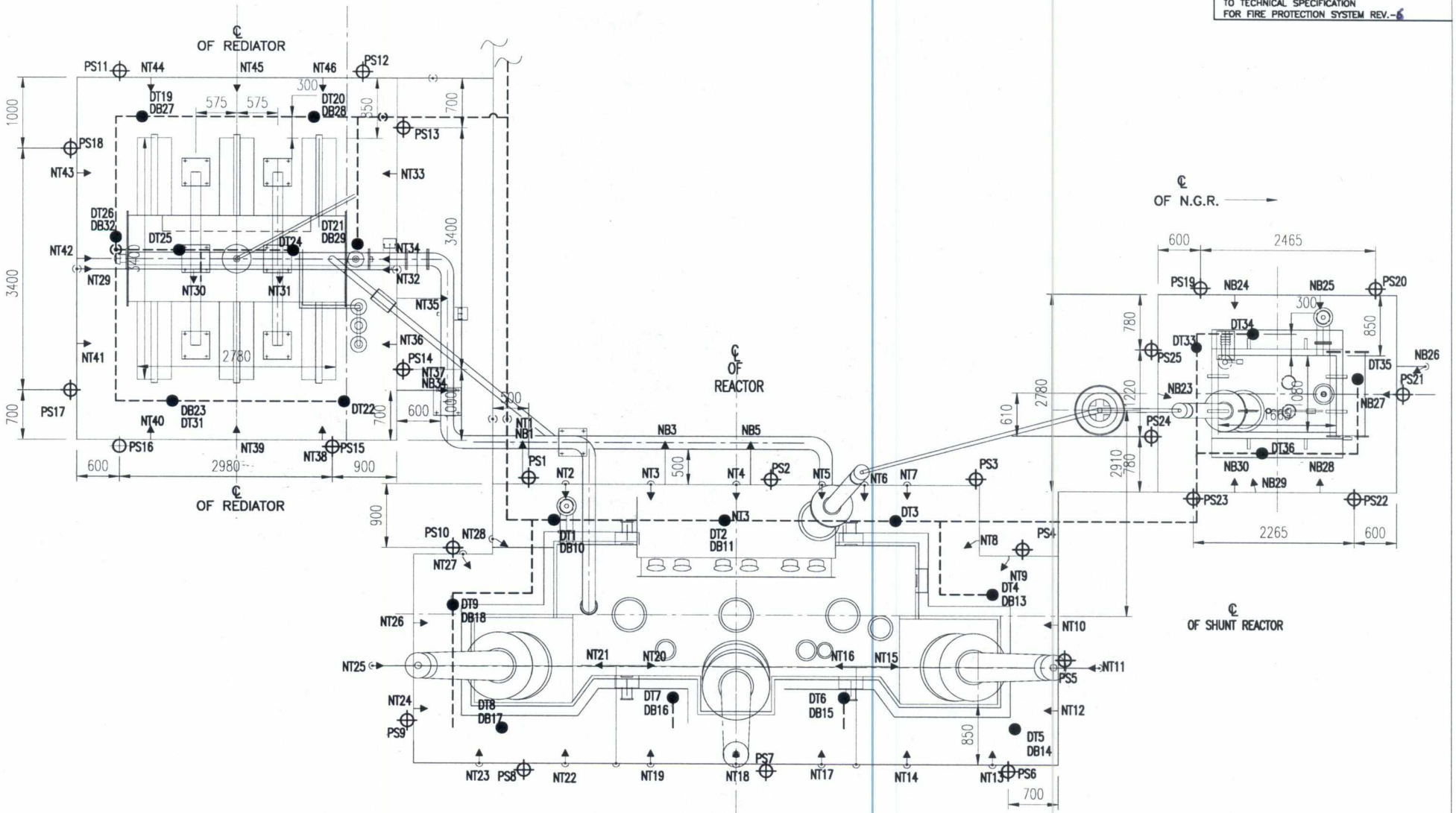
TITLE : STANDARD CONTROL ROOM BUILDING
LOCATION OF DETECTORS AND PORTABLE EXTINGUISHERS

DRAWING NO. C-ENG/CRB-400/FP-STD-02

SCALE 1:100

REV. 0

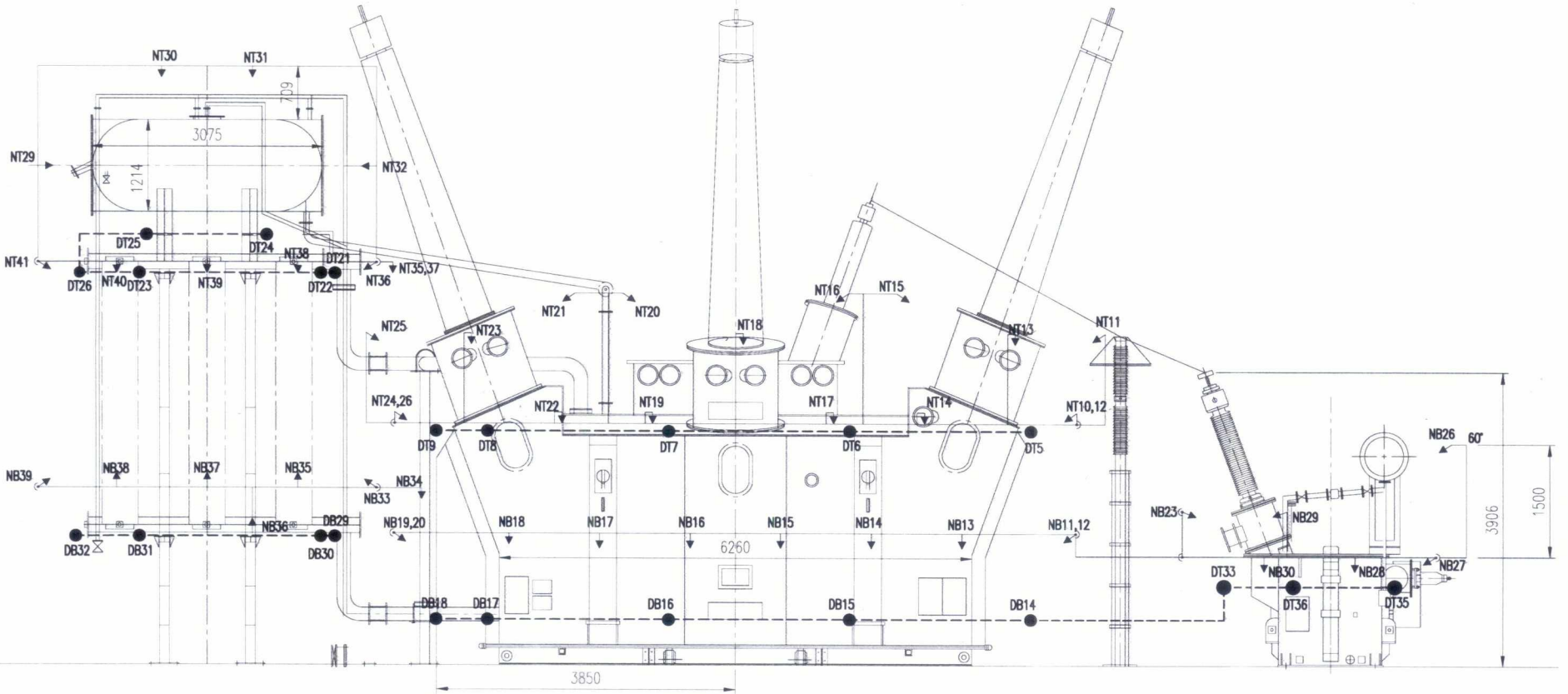
APPENDIX–III (SHEET 1 OF 4)
TO TECHNICAL SPECIFICATION
FOR FIRE PROTECTION SYSTEM REV.-6



PLAN VIEW

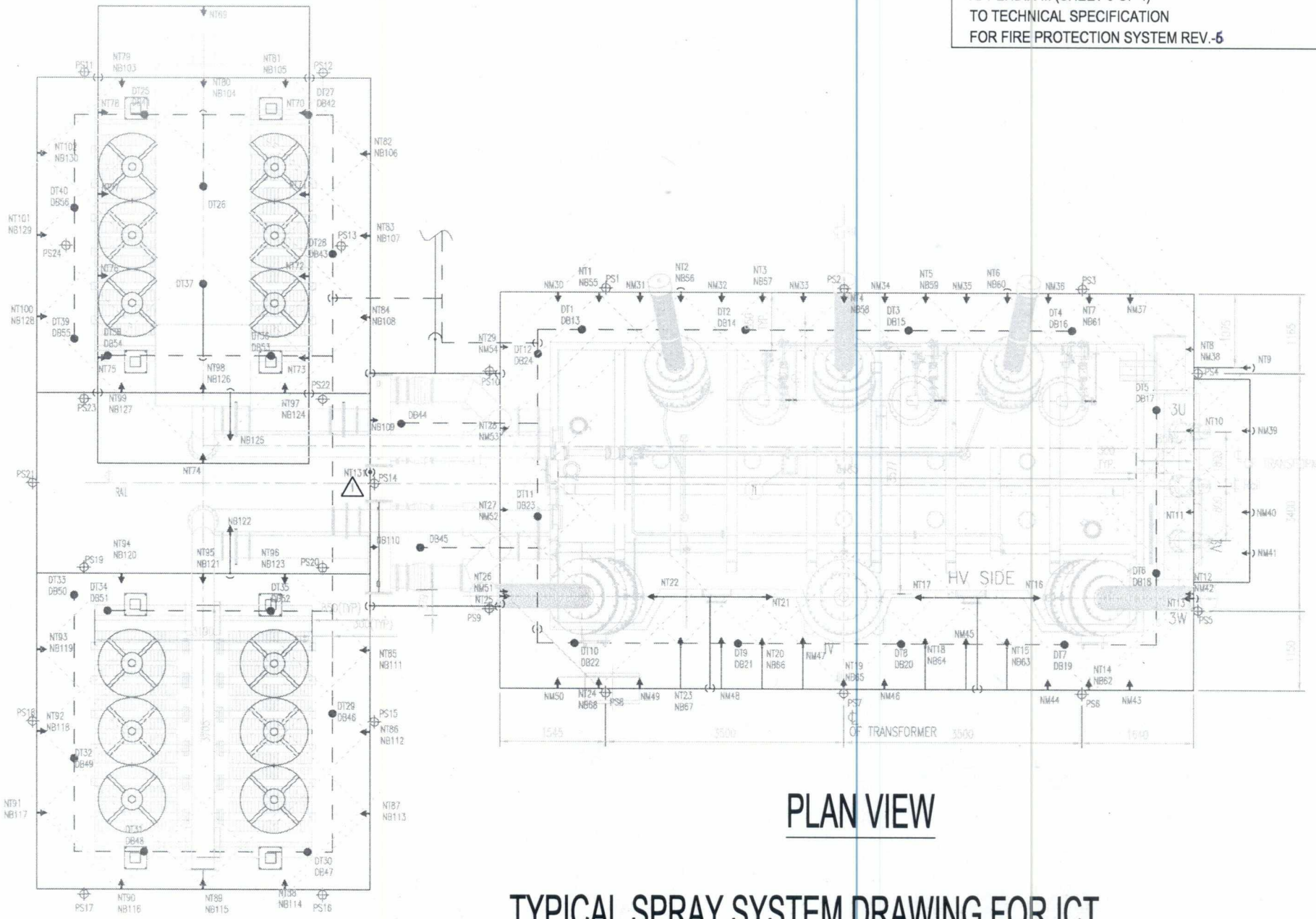
TYPICAL SPRAY SYSTEM DRAWING FOR REACTOR

APPENDIX–III (SHEET 2 OF 4)
TO TECHNICAL SPECIFICATION
FOR FIRE PROTECTION SYSTEM REV.–6



ELEVATION
TYPICAL SPRAY SYSTEM DRAWING FOR REACTOR

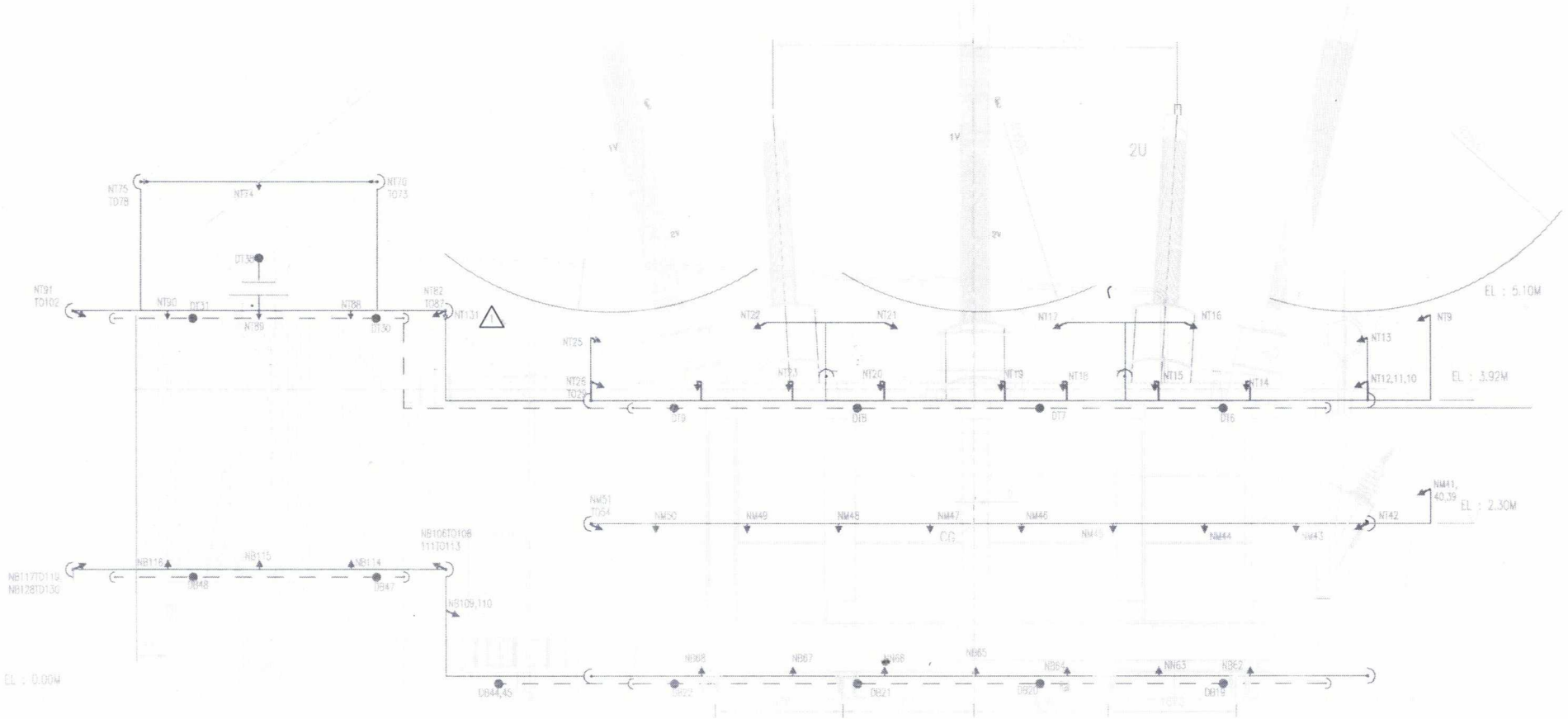
APPENDIX-III (SHEET 3 OF 4)
TO TECHNICAL SPECIFICATION
FOR FIRE PROTECTION SYSTEM REV.-6



PLAN VIEW

TYPICAL SPRAY SYSTEM DRAWING FOR ICT

APPENDIX-III (SHEET 4 OF 4)
TO TECHNICAL SPECIFICATION
FOR FIRE PROTECTION SYSTEM REV.-6



ELEVATION

TYPICAL SPRAY SYSTEM DRAWING FOR ICT

TECHNICAL DATA SHEETS

DATA SHEET FOR DELUGE VALVE		
1.0	Manufacturer	POWERGRID Approved make
2.0	Number & size	As per approved system drawings.
3.0	Type	Differential Diaphragm type.
4.0	Rating	
4.1	Flow in M^3/hr. 1. 150 mm ø 2. 100 mm ø	 170 to 650 50 to 225
4.2	Pressure	Working Pressure – 12.3 kg/cm^2 Test Pressure - 25 kg/cm^2.
4.3	Pressure drop in equivalent length 1. 150 mm ø 2. 100 mm ø	 19M 11M
5.0	**Material of construction**	
5.1	Body	CI IS:210 Gr. FG 260
5.2	Valve internal	Cast Bronze – IS:318-LTB 2
5.3	Seat Seal	Neoprene Rubber
5.4	Diaphragm	Neoprene Rubber
6.0	Differential pressure required for operation	Differential Ratio – 50%
7.0	Water Motor Gong provided	Yes
7.1	Type	Hydraulic type
7.2	**Material of Construction:**	
7.2.1	Housing	Al. Alloy-IS:617
7.2.2	Cover/Rotor./Gong	Aluminium to IS:737
7.2.3	Manual actuation lever provided?	Yes
8.0	Remote actuation with Solenoid Valve provided?	Yes
9.0	Resetting type	Manual resetting type
10.0	Deluge valve complete with test and drain valves, manual operation arrangement, supporting structures and all necessary accessories.	Yes
11.0	Approval of Deluge Valve.	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany

DATASHEET FOR HVW SPRAY NOZZLE

1.0	Make	POWERGRID Approved make
2.0	Type	High velocity water spray type
3.0	Working pressure	3.5 bar to 5 bar
4.0	Material	Brass
5.0	K factor	As per approved design & drawings
6.0	Quantity	As per approved design & drawings
7.0	Integral non-ferrous strainer provide	Yes
8.0	Approval of HVW spray Nozzle.	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany

DATA SHEET FOR QUARTZOID BULB DETECTORS

1.0	Make	POWERGRID Approved make
2.0	Type	Quartzoid bulb type
3.0	Rated pressure	12.3 kg/ cm^2 (175 PSI).
4.0	Hydrotest pressure	30kg/cm^2
5.0	Material of construction	
5.1	Frame	Bronze
5.2	Bulb	Glass
5.3	Deflector	Copper
6.0	Temperature rating	79^oC
7.0	Quantity	As per approved drawings
8.0	Approval of Detector	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany

DATA SHEET FOR OPTICAL SMOKE DECTECTOR

1.0	Manufacturer	POWERGRID Approved make
2.0	Principle of operation	Light scattering by smoke particles.
3.0	Max. recommended spacing	9 m.
4.0	Normal operating temperature	$-10^{o}C$ to $60^{o}C$
5.0	Guaranteed to function properly without any maintenance work for a period of not less than ten (10) years	Yes. Accumulated dust to be removed periodically by blowing air.
6.0	Approval of detector	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany
7.0	Cabling.	2C x 1.5 sq.mm. Un-armoured PVC insulated FR cables conforming to IS 1554 (Part 1).

DATA SHEET FOR HEAT DECTECTOR

1.0	Manufacturer	POWERGRID Approved make
2.0	Principle of operation	Rate of rise-cum-fixed temperature type.
3.0	Set point of operation	5^{o}C per minute / 55^{o}C
4.0	Max. recommended spacing	6 m.
5.0	Normal operating temperature	-20^{o}C to 70^{o}C
6.0	Guaranteed to function properly without any maintenance work for a period of not less than ten (10) years	Yes. Accumulated dust to be removed periodically by blowing air.
7.0	Approval of detector	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany
8.0	Cabling.	2C x 1.5 sq.mm. Un-armoured PVC insulated FR cables conforming to IS 1554 (Part 1).

DATA SHEET FOR IONISATION SMOKE DECTECTOR

1.0	Manufacturer	POWERGRID Approved make
3.0	Principle of operation	Ionisation of air by Radio-active source.
4.0	Radio-active source	Americium - 241
5.0	Max. recommended spacing	9 m.
6.0	Normal operating temperature	$-10^{o}C$ to $60^{o}C$
8.0	Guaranteed to function properly without any maintenance work for a period of not less than ten (10) years	Yes. Accumulated dust to be removed periodically by blowing air.
9.0	Approval of detector	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany
10.0	Cabling.	2C x 1.5 sq.mm. Un-armoured PVC insulated FR cables conforming to IS 1554 (Part 1).

DATA SHEET FOR 2C x 1.5sq.mm Un-armoured cable.		
1	Make	POWERGRID approved make
2	Type	Control Cable
3.	Number of cores	Two (2)
4.	Size	1.5 sq. mm.
5.	Voltage Grade	1.1 kV
6.	Applicable standard	IS:1554 Part 1
7.	Conductor Material	Plain annealed electrolytic copper
8.	Conductor construction	Stranded
9	Conductor resistance.	12.1 Ohms/kM at 20^{o} C
10	Insulation material	PVC insulation Type A as per IS:5831
11	Insulation thickness	0.8 mm Nominal
12	Identification	Red & Black
13	Inner sheath material	PVC compound Type ST1 as per IS:5831
14	Inner sheath thickness	0.3 mm Minimum
15	Outer sheath material	PVC compound Type ST2 as per IS:5381,FR.
16	Outer sheath thickness	1.8 mm Nominal.
17	outer sheath colour	Grey
18	Overall Diameter	As per manufacturer design data

DATA SHEET FOR MANUAL CALL POINT

1.0	Manufacturer	POWERGRID Approved make
2.0	Construction	Deep drawn sheet steel
3.0	Type	Break glass with push button.
4.0	Operating Voltage	24V DC ± 10%
5.0	Type of control	Pole- NO/NC
6.0	Degree of protection	IP 52
7.0	Material of housing.	M.S. 18 Gauge
8.0	Colour	FIRE RED
9.0	Accessories	Hammer & Chain assembly

DATA SHEET FOR FIRE ALARM SOUNDER (HOOTER)

1.0	Manufacturer	POWERGRID Approved make
2.0	Construction	Deep drawn sheet steel
3.0	Type	Dual tone/ Single tone
4.0	Operating Voltage	24V DC ± 10%
5.0	Output	Not less than 80dB(A) but not more than 120dB(A) at 1.5m distance.
6.0	Output frequency range	500Hz. to 1000 Hz.
7.0	Operating time	50 minutes (Minimum)
8.0	Material of housing.	M.S. 18 Gauge
9.0	Colour	FIRE RED
10.0	Marking	FIRE ALARM.

DATA SHEET FOR GLOBE VALVE.		
1.0	Nominal size in mm.	15 TO 40
2.0	Make	POWERGRID approved make
3.0	Type	Globe
4.0	Number	As per approved system drawings.
5.0	**Material of construction**	
5.1	Body	Bronze to IS 318 Grade LTB 2
5.2	Hand wheel	Grey cast iron, grade FG200 of IS 210.
5.3	Bonnet & Bonnet Wedge	Bronze to IS 318 Grade LTB 2
5.4	Trim	Bronze to IS 318 Grade LTB 2
6.0	End connection	Screwed
7.0	Standard	IS:778
8.0	Rating	PN 1.6
9.0	Hydrostatic test pressure	
9.1	Body	24 kg/cm^2
9.2	Seat	16 kg/cm^2

DATA SHEET FOR GUN METAL GATE/ SLUICE VALVE.			
1.0	Nominal size in mm.	15 to 40	50 to 300
2.0	Make	POWERGRID Approved make	
3.0	Type	Gate/Sluice	
4.0	Number	As per approved system drawings.	
5.0	**Material of construction**		
5.1	Body	Bronze to IS 318 Grade LTB 2	Grey cast iron, grade FG200 of IS 210.
5.2	Hand wheel	Grey cast iron, grade FG200 of IS 210.	
5.3	Bonnet & Wedge	Bronze to IS 318 Gr.LTB 2	Grey cast iron, grade FG200 of IS 210.
5.4	Stem	High tensile brass, grade HT1 or HT2 of IS:320	Stainless steel
6.0	End connection	Screwed	Flanged
7.0	Standard	IS:778	IS:14846
8.0	Rating	PN 1.6	
9.0	Hydrostatic test pressure		
9.1	Body	24 kg/cm^2	
9.2	Seat	16 kg/cm^2	

DATA SHEET FOR FLOAT OPERATED VALVE		
1.0	Manufacturer	POWERGRID Approved make
2.0	Type	Float operated valve
3.0	Size	100 MM
4.0	Quantity	2 nos.
5.0	Material of construction	
5.1	Body	Cast Iron (IS:210 FG:200)
5.2	Seat Ring	Gun Metal (IS:318, LTB-2)
5.3	Disc Ring	Gun Metal (IS:318, LTB-2)
5.4.	Spindle	13% Cr. Stainless steel
5.5	Piston	Cast Iron (IS:210, FG:200)
5.6	Lever	Mild Steel (IS:226)
5.7	Float	Tin Coated Copper
5.8	Fulcrum	Mild Steel (IS:226)
5.9	Pilot Valve	Stainless Steel (AISI-304)
5.10	Gland Packing	Graphited Asbestos Rope
5.11	Bonnet	Cast Iron (IS:210, FG:200)
6.0	Hydrostatic test pressure	
6.1	Body	15 kg / cm^2
6.2	Seat	10 kg / cm^2
7.0	End connection	Flanged connection

DATA SHEET FOR CHECK VALVES (NON-RETURN VALVES)		
1.0.0	Make	POWERGRID Approved make
1.1.0	Type	Swing Check Type
1.2.0	Standard followed	IS:5312
1.3.0	Rating	PN 1.6
1.4.0	Material of construction, Dimensions.	As per IS;5312
1.5.0	Inlet Outlet details	Flanged
1.6.0	Hydraulic test pressure, kg/cm^2	
1.6.1	Body	24
1.6.2	Seat	16

VENDOR LIST FOR FIRE PROTECTION PACKAGE

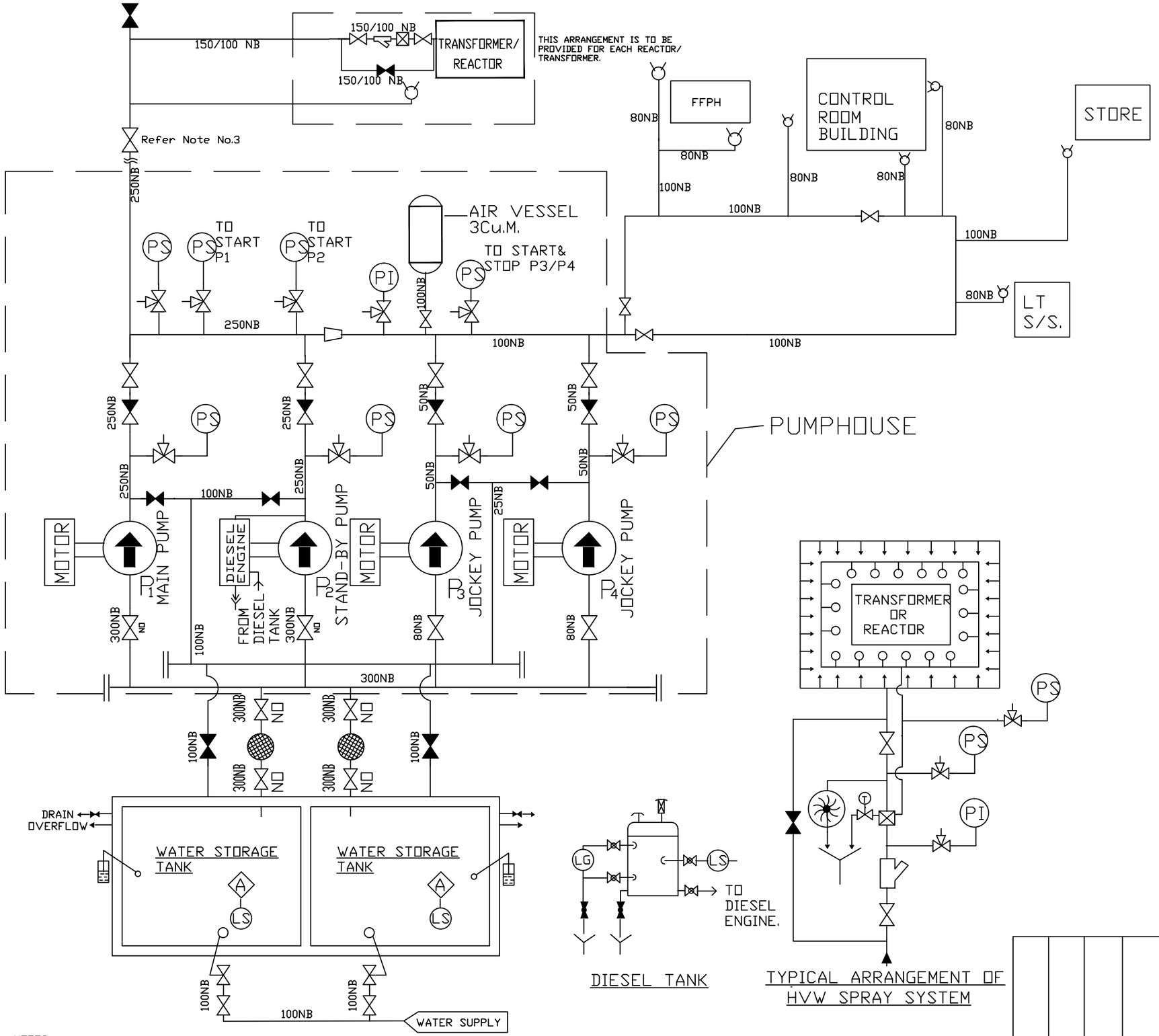
S.No.	Equipment/Material	Make
1.	Pumps (Horizontal Centrifugal)	KBL/M&P/B&C
2.	Motors (L.T.)	RAJENDRA ELECT.IND./GEC SIEMENS/ ABB/CROMPTON
3.	Diesel Engine	Ruston & Hornsby (Greaves)/ KIRLOSKAR OIL ENGINE LTD
4.	Air Compressor	KGK/ELGI/INGERSOL RAND
5.	Batteries	EXIDE/AMCO/AMARA RAJA
6.	M.S./G.I Pipes	JINDAL/PRAKASH/ SAIL/ LLOYD METALS & ENGINEERS LTD.
7.	C. I. Valves (Gate & Check)	H. Sarkar/Venus/Kalpana
8.	Gun Metal Valves (Globe)	Leader
9.	Float operated Gate Valve	Levcon/Sigma
10.	Deluge Valve	ACE Turnkey/H.D. Fire
11.	Strainer (Y-Type & Basket Type)	Grandprix/Jaypee/Multitex/ Gujarat Otofilt
12.	Hume pipe	Indian Hume Pipe/Pargate Concrete Udyog Delhi
13.	H. V. Spray Nozzles	H.D. Fire/ACE Turnkey
14.	Q. B. Detectors	H.D Fire/ACE Turnkey
15.	Pressure Gauge	H. Guru/General Instrument
16.	Pressure Switches	Indfos/Switzer/Verma Trafag
17.	Level Switches	Levcon/Sigma
18.	Level Indicator	Levcon/Sigma

S.No.	Equipment/Material	Make
19.	Level Gauge	Levcon/Sigma
20.	Hydrant Valves & Accessories	Sukan/Shah Bhogilal
21.	Hoses (Flax Canvas)	Jayshree Calcutta/Newage
22.	Solenoid Valves	AVCON/ROTEX
23.	Heat & Smoke Detectors	Apollo, U.K. /Pyrotonics / System Sensor/ Nittan
24.	Cables	Polycab/PRWE/GEMSCAB/ KEI/PARAMOUNT
25.	Fire Extinguishers	Nitin/Vijay Fire/Lightex/ Zenith/ Minimax
26.	Fire alarm Panels	ECD
27.	Annunciators	Peacon/Piri/Procon
28.	Dished Ends	Anoop Engg./Motilal/Kanara
29.	Local control panels & Annunciation panels.	Suchitra/ Vikas Engg./UNILEC/JASPER/ MIKA/ Bose corporation.
30.	Response Indicators/Hooters Break Glass Units	M.C. Engineering Delhi/ Maths, Bombay/ Mehta & Associates, Ahmedabad.

M/s NewAge Fire Fighting Co. Ltd., Surendernagar, Gujrat is approved for fire protection system items viz. landing valve, branch pipe with nozzle, fire hose and hose box for POWERGRID projects.

Note: Any sub vendor already approved by POWERGRID and not appearing in this list can be informed to POWERGRID corporate, QA & I department, Gurgaon with relevant documents/evidence as a proof of approval. On review of those documents and if, necessary after re-assessment, their name may be considered or included in this list

APPENDIX-I
TO TECHNICAL SPECIFICATION
FOR FIRE PROTECTION SYSTEM REV.-6



DIESEL TANK

TYPICAL ARRANGEMENT OF HVW SPRAY SYSTEM

LEGEND

- ALARM
- GATE VALVE NORMALLY OPEN
- GATE VALVE NORMALLY CLOSED
- NON-RETURN VALVE
- GLOBE VALVE NORMALLY OPEN
- GLOBE VALVE NORMALLY CLOSED
- FLOAT OPERATED GATE VALVE
- TEST VALVE
- PRESSURE GAUGE
- PRESSURE SWITCH
- LEVEL GAUGE
- LEVEL SWITCH
- BASKET STRAINER
- FLOAT OPERATED LEVEL GAUGE
- Y-TYPE STRAINER
- WATER MOTOR GONG
- REDUCER
- THREE WAY COCK/ VALVE
- VENT
- DRAIN
- OUT DOOR HYDRANT
- QUARTZOID BULB DETECTOR
- HVW SPRAY NOZZLE
- PUMP
- WATER LINE
- DELUGE VALVE

NOTES:
1. THE HYDRANT POINTS FOR TRANSFORMER/ REACTOR SHALL BE LOCATED AT LEAST 20M AWAY FROM THEM.
2. AS SAFETY MEASURE, A WARNING PLATE SHALL BE PLACED NEAR HYDRANT POINTS FOR TRANSFORMER/ REACTOR TO CLEARLY INDICATE THAT WATER SHALL BE SPRAYED ONLY AFTER ENSURING THAT THE POWER TO THE TRANSFORMER/ REACTOR WHICH IS ON FIRE IS SWITCHED OFF AND THERE ARE NO LIVE PART WITHIN 20 M. DISTANCE OF THE PERSONNEL USING THE HYDRANT.
3. FIRE HYDRANT PIPE LINE OUTSIDE THE PUMP HOUSE SHALL BE SUITABLY SECTIONALIZED AS PER LAYOUT REQUIREMENT. MINIMUM ONE(1) GATE VALVE TO BE PROVIDED FOR EVERY 200 METER OF MAIN HYDRANT PIPE FOR PURPOSE OF MAINTENANCE.

FOR TENDER PURPOSE ONLY

POWER GRID CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

APPD.					PROJECT: 765kV AND 400kV SUBSTATION
					TITLE: PIPING & INSTRUMENTATION DIAGRAM FOR HYDRANT & HVW SPRAY SYSTEM.
RECOMMENDED	DATE 17.07.2019	DRAWN HIMANSHU	CHKD. S K THAKUR	APPD.	NTS DRG.NO. C/ENGG/STD/FP/1 Sheet 1 of 1 REV. 5

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-418-316-000	Rev. No.	00		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			SIGN	Satyaki Chaudhuri	[signature]	Sanjeev
TITLE				NAME	SC	NK	SKS
				DATE	15.10.22	15.10.22	15.10.22
				GROUP	TBEM	W.O.	Awaited

GENERAL TECHNICAL REQUIREMENTS-SECTION 3

CUSTOMER	Powergrid Corporation of India Ltd. (POWERGRID)
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 through TBCB route**
NOA 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**
Station	**400/220kV AIS Neemuch New S/S, Madhya Pradesh** **Extension of 400kV Chittorgarh S/S, Rajasthan** **Extension of 400kV Mandsaur S/S , Madhya Pradesh**

S.No.	Description	Sheet
1	General Technical Requirements – Site Information	2,3
2	General Technical Requirements	4-32
3	Annexure -A	2 Sheets
4	Annexure -B	1 Sheets
5	Annexure -C	23 Sheets
6	Annexure -G	6 Sheets
7	Annexure -K	2 Sheets

RevNo.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	To	TBEM	TBMM	TBQM	Supplier
	Copies	1	1	1	4

GENERAL TECHNICAL REQUIREMENTS-SECTION 3

Site Information

S.No.	Particular	Details
a)	Owner	Neemuch Transmission Limited - a 100% wholly owned subsidiary of Power Grid Corporation of India Limited
b)	Customer	Neemuch Transmission Limited - a 100% wholly owned subsidiary of Power Grid Corporation of India Limited
c)	Project Title	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 through TBCB route
d)	Location	Neemuch, MP Chittorgarh, Rajasthan Mandsaur, MP
e)	Transport Facilities	Road/Train Nearest Rail Head For Neemuch: Neemuch Nearest Rail Head For Chittorgarh: Chittorgarh Nearest Rail Head For Mandsaur: Mandsaur Nearest Airport : Udaipur
	SITE CONDITIONS	
a)	Max. ambient air temp.	50°C
b)	Min. ambient air temp.	0°C
c)	Max. design ambient temp.	50°C
d)	Design reference temp.	50°C
e)	Average Humidity	Max. 100%
f)	Special corrosion conditions	No
g)	Solar Radiation	2 kW/sqmtr
h)	Atmospheric UV radiation	High
i)	Altitude above sea level	Less than 1000 meter above mean sea level (MSL)
j)	Pollution Severity	High Pollution level

k)	Seismic Zone	Zone-II
WIND DATA		
	Wind Zone	47m/sec
	Average No. of thunderstorm days per annum	As per IS
	Main Electrical Parameters:	
	Fault Levels:	400kV: 63kA for 1 sec. 220kV : 50kA for 1 sec.
	Creepage Distance	25mm/kV for All Equipment i.e BPI/Bushings, CB, Isolator, CT, CVT, LA, WT etc. 31mm/kV for string insulators

GENERAL TECHNICAL REQUIREMENTS-SECTION 3

1.0 FOREWORD

The provisions under this section are intended to supplement requirements for the materials, equipment's and services covered under other sections of tender documents and are not exclusive.

The Supplier shall note that the standards mentioned herein are not mutually exclusive or complete in themselves, but are intended to complement each other, with minimum repetition, to define the requirements of the Specification. In the event of a conflict between requirements of any two clauses of the Specification/ documents or requirements of different codes/ standards specified, the more stringent requirement as per the interpretation of the owner shall apply, unless confirmed otherwise by the owner in writing based on a written request from the Supplier.

In case of conflicting requirements between this document (General Technical Requirement Section 3) and equipment specification (Section 1 & Section 2), equipment specification shall prevail.

When specific requirements stipulated in the Specification exceed or change those required by the applicable standards, the stipulations of the Specification shall take precedence.

Unless specifically agreed to by the Purchaser prior to Award of Contract, the Work shall be in accordance with the standards indicated and the requirements of the Specification. The Supplier shall be held responsible for any deviation.

In case of conflict between the various standards, the decision of owner shall be binding & final.

The following words and expressions shall have the meanings hereby assigned to them throughout this document

"Employer/Owner" means Power Grid Corporation of India Ltd.

"Purchaser" means Bharat Heavy Electricals Limited

"Supplier/Manufacturer/Bidder" means the person or persons, firm or company assigned to execute the works as defined by the scope of supply, described here.

"Specification" refers to this document.

The supplier should be approved by Power Grid. If not, it is the responsibility of the vendor to be assessed and approved by Power Grid, before placement of order by BHEL. Any cost involved in vendor assessment/approval must be borne by the vendor himself.

2.0 GENERAL REQUIREMENT

2.1 a) All equipment/materials/items, as per Annexure-K, as applicable under present scope of works, shall be supplied by domestic manufacturers only.

Any imported equipment/material/item/parts/component (comprising of embedded systems) to be supplied under the contract shall be tested in the certified laboratories to check for any kind of embedded malware/trojans/cyber threats and for adherence to Indian Standards as per the directions issued by Ministry of Power/Govt. of India from time to time. In case of such import from specified "prior reference" countries, the requirement of prior permission from the Govt. of India including protocol for testing in certified and designated laboratories by Ministry of Power/Govt. of India shall also be complied with by the Bidder.

The bidder/contractor shall list out the products and components producing Toxic e-waste under the contract and shall furnish to the Employer the procedure of safe disposal at the time of closing of the contract.

2.1 b) The Supplier/Manufacturer shall furnish catalogues, engineering data, technical information, design documents, drawings etc., fully in conformity with the technical specification during detailed engineering.

2.2 It is recognised that the Bidder may have standardised on the use of certain components, materials, processes or procedures different from those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to Employer.

2.3 Wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition.

2.4 Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components which are minor in nature and incidental to the requirement but not specifically stated in the specification, which are necessary for commissioning and satisfactory operation of the switchyard/ substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment provided, shall be inter-changeable with one another.

2.5 Deleted.

2.6 Deleted.

3.0 STANDARDS

3.1 The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

3.2 The equipment offered by the Bidder shall at least conform to the requirements specified under relevant IS standard. In case of discrepancy between IS and other international standard, provisions of IS shall prevail. The Bidder shall also note that the list of standards presented in Annexure-C is not complete. Whenever necessary, the list of standards shall be considered in conjunction with specific IS. If the IS standard is not available for an equipment/material, then other applicable International standard (IEC/Equivalent), as per the specification, shall be accepted.

3.3 The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other.

3.4 When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.5 Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards specified under Annexure-C / individual sections for various equipments shall also, be accepted, however the salient points of difference shall be clearly brought out during detailed engineering along with English language version of such standard. The equipment conforming to standards other than specified under Annexure-C /individual sections for various equipments shall be subject to Employer's approval.

4.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

4.1 Switching surge over voltage and power frequency over voltage is specified in the system parameters below. In case of the 400kV system, the initial value of the temporary overvoltages could be 2.0 p.u. for 1-2 cycles. The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, restrike etc under such over voltage conditions.

4.2 All equipments shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.

4.3 All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc. for the equipment.

4.4 The Bidder shall design terminal connectors of the equipment taking into account various forces as above at Sl.No.4.3 that are required to withstand.

4.5 The equipment shall also comply to the following:

a) To facilitate erection of equipment, all items to be assembled at site shall be "match marked".

b) All piping, if any between equipment control cabinet/operating mechanism to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.

4.6 **System Parameter**

400kV & 220kV System

SL No	Description of parameters	400kV System	220kV System
1.	System operating voltage	400kV	220kV
2.	Maximum operating voltage of the system (rms)	420kV	245kV
3.	Rated frequency	50Hz	50Hz
4.	No. of phase	3	3
5.	Rated Insulation levels		
i)	Full wave impulse withstand voltage (1.2/50 microsec.)	1550kVp	1050 kVp
ii)	Switching impulse withstand voltage (250/2500 micro sec.) dry and wet	1050kVp	-
iii)	One minute power frequency dry withstand voltage (rms)	630kV	-
iv)	One minute power frequency dry and wet withstand voltage (rms)	-	460kV
6.	Corona extinction voltage	320kV	-
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz	1000 μV at 266kV rms	1000 μV at 156kV rms
8.	Minimum creepage distance - for Equipment other than Insulator string	10500 mm	6125 mm
	Minimum creepage distance - for Insulator String	13020 mm	7595 mm
9.	Min. clearances		

i.	Phase to phase	4000mm (for conductor conductor configuration) 4200mm (for rod - conductor configuration)	2100 mm
ii.	Phase to earth	3500 mm	2100 mm
iii)	Sectional clearances	6500 mm	5000 mm
10.	Rated short circuit current for 1 sec. duration	63 kA	50kA
11.	System neutral earthing	Effectively earthed	Effectively earthed

66kV, 52kV , 33kV System

SL No	Description of parameters	66kV System	52 kV System	33 kV System
1.	System operating voltage	66kV	52kV	33kV
2.	Maximum operating voltage of the system(rms)	72.5kV	52kV	36kV
3.	Rated frequency	50Hz	50Hz	50Hz
4.	No. of phase	3	3	3
5.				
i)	Full wave impulse withstand voltage (1.2/50 microsec.)	325 kVp	250 kVp	170 kVp
ii)	One minute power frequency dry and wet withstand voltage (rms)	140kV	95kV	70kV

6.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz	-	-	-
7.	Minimum creepage distance	1813 mm (2248mm for coastal area)	1300mm (1612 mm for coastal area)	900 mm (1116m m for coastal area)
8.	Min. Clearance			
i.	Phase to phase	750 mm	530mm	320 mm
ii.	Phase to earth	630 mm	480mm	320 mm
iii.	Sectional clearances	3100 mm	3100mm	2800 mm
9.	Rated short circuit current	25kA for 3 Sec*	25kA for 1 Sec	25 kA for 3 sec
10.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed

Notes:

1. The above parameters are applicable for installations up to an altitude of 1000m above mean sea level. For altitude exceeding 1000m, necessary altitude correction factor shall be applicable as per relevant IEC/IS.
2. The insulation and RIV levels of the equipments shall be as per values given in the Technical Specification of respective equipment.
3. Corona and radio interference voltage test and seismic withstand test procedures for equipments shall be in line with the procedure given at **Annexure-A** and **Annexure-B** respectively.
4. "*" For tertiary loading Equipment's fault level shall be 25kA for 3 Sec.

5.0 ENGINEERING DATA AND DRAWINGS

5.1 Deleted.

5.2 Deleted.

5.3 Drawings

5.3.1 All drawings submitted by the Bidder shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, dimensions, internal & the external connections, fixing arrangement required and any other information specifically requested in the specifications.

5.3.2 Drawings submitted by the Bidder shall be clearly marked with the name of the Employer, the unit designation, the specifications title, the specification number and the name of the Project. POWERGRID has standardized a large number of drawings/documents of various make including type test reports which can be used for all projects having similar requirements and in such cases no project specific approval (except for list of applicable drawings alongwith type test reports) is required. However, distribution copies of standard drawings/documents shall be submitted as per provision of the contract. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in SI units.

5.3.3 The review of these data by the Employer will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. This review by the Employer may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the Employer shall not be considered by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

5.5 All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Bidder's risk. The Bidder may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Bidder's drawing or work by the Employer shall not relieve the bidder of any of his responsibilities and liabilities under the Contract.

5.6 All engineering data submitted by the Bidder after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

5.7 Approval Procedure

The following schedule shall be followed generally for approval and for providing final documentation.

i)	Approval/comments/ by Employer on initial submission	15 days
ii)	Resubmission (whenever required)	Within 3 (three) weeks from date of comments
iii)	Approval or comments	Within 3 (three) weeks of receipt of resubmission
iv)	Furnishing of distribution copies (2 hard copies to each substation and one scanned copy (pdf format)	Within 3 (three) weeks of receipt of resubmission
v)	Furnishing of distribution copies of test reports	
	a) Type test reports (one scanned softcopy in pdf format to each substation plus one for corporate centre & one hardcopy per substation)	2 weeks from the date of final approval
	b) Routine Test Reports (one copy for each substation)	-do-
vi)	Furnishing of instruction/ operation manuals (2 copies per substation and one softcopy (pdf format) for corporate centre & per substation)	On completion of Engineering

vii)	As built drawings (two sets of hardcopy per substation & one softcopy (pdf format) for corporate centre & per substation)	On completion of entire works

NOTE :

(1) The bidder may please note that all resubmissions must incorporate all comments given in the earlier submission by the Employer or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.

(2) Deleted.

(3) The instruction Manuals shall contain full details of drawings of all equipment being supplied under this contract, their exploded diagrams with complete instructions for storage, handling, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.

(4) If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Employer.

(5) The Bidder shall furnish to the Employer catalogues of spare parts.

(6) Deleted.

5.8 Deleted.

6.0 MATERIAL/ WORKMANSHIP

6.1 General Requirement

6.1.1 Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended.

6.1.2 In case where the equipment, materials or components are indicated in the specification as “similar” to any special standard, the Employer shall decide upon the question of similarity. When required by the specification or when required by the Employer the Contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it is to be understood that the cost as well as the time delay associated with the rejection shall be borne by the Bidder.

6.1.3 The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfil their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Employer.

6.1.4 Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

6.1.5 Deleted.

6.1.6 The Bidder shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Bidder shall apply all operational lubricants to the equipment installed by him.

6.1.7 All oil, grease and other consumables used in the Works/Equipment shall be purchased in India unless the Bidder has any special requirement for the specific application of a type of oil or grease not available in India. If such is the case, he shall declare source of oil/grease /other consumables in the GTP/Drawings, where such oil or grease is available. He shall help Employer in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

6.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

6.2.1 Space Heaters

6.2.1.1 The heaters shall be suitable for continuous operation at 240V as supply voltage. Onoff switch and fuse shall be provided.

6.2.1.2 One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

6.2.2 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

6.2.3 Ventilation opening

Wherever ventilation is provided, the compartments shall have ventilation openings with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust.

6.2.4 Degree of Protection

The enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall comply with following degree of protection as detailed here under:

a) Installed out door: IP- 55
b) Installed indoor in air conditioned area: IP-31
c) Installed in covered area: IP-52
d) Installed indoor in non-air conditioned area where possibility of entry of water is limited: IP-41.
e) For LT Switchgear (AC & DC distribution Boards): IP-52

The degree of protection shall be in accordance with IS/IEC60947; IS/IEC/60529 . Type test report for of relevant Degree of Protection test, shall be submitted for approval.

6.3 RATING PLATES, NAME PLATES AND LABELS

6.3.1 Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, Customer Name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Employer. The rating plate of each equipment shall be according to IS/ IEC requirement.

6.3.2 All such nameplates, instruction plates, rating plates of transformers, reactors, CB, CT, CVT, SA, Isolators, C & R panels and PLCC equipments shall be bilingual with Hindi

inscription first followed by English. Alternatively two separate plates one with Hindi and the other with English inscriptions may be provided.

6.4 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into operation, shall be furnished by the Bidder unless specifically excluded under the exclusions in these specifications and documents.

7.0 DESIGN IMPROVEMENTS / COORDINATION

7.1 Deleted.

7.2 Deleted.

7.3 The Bidder shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

7.4 The Bidder has to coordinate designs and terminations with the agencies (if any) who are Consultants/Bidder for the Employer. The names of agencies shall be intimated to the successful bidders.

7.5 The Bidder will be called upon to attend design co-ordination meetings with the Engineer, other Contractor's and the Consultants of the Employer (if any) during the period of Contract. The Bidder shall attend such meetings at his own cost at POWERGRID Corporate Centre, Gurgaon (Haryana) or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

8.0 QUALITY ASSURANCE PROGRAMME

8.1 To ensure that the equipment and services under the scope of this Contract, whether manufactured or performed within the Bidder's Works or at his Sub-Bidder's premises or at the Employer's site or at any other place of Work as applicable, are in accordance with the specifications, the Contractor shall ensure suitable quality assurance programme to control such activities at all points necessary. A quality assurance programme of the Contractor shall be in line with ISO requirements & shall generally cover the following:

a) The organisation structure for the management and implementation of the proposed quality assurance programme.

b) System for Document and Data Control.

c) Qualification and Experience data of Bidder's key personnel.

d) The procedure for purchases of materials, parts, components and selection of sub-Bidder's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.

e) System for shop manufacturing and site erection controls including process controls, fabrication and assembly control.

f) System for Control of non-conforming products including deviation dispositioning, if any and system for corrective and preventive actions based on the feedback received from the Customers and also internally documented system for Customer complaints.

g) Inspection and test procedure both for manufacture and field activities.

h) System for Control of calibration of testing and measuring equipment and the indication of calibration status on the instruments.

i) System for indication and appraisal of inspection status.

j) System of Internal Quality Audits, Management review and initiation of corrective and Preventive actions based on the above.

k) System for authorising release of manufactured product to the Employer.

l) System for maintenance of records.

m) System for handling, storage and delivery.

n) A quality plan detailing out the specific quality control measures and procedure adopted for controlling the quality characteristics relevant to each item of equipment furnished and /or service rendered.

o) System for various field activities i.e. unloading, receipt at site, proper storage, erection, testing and commissioning of various equipment and maintenance of records. In this regard, the Employer has already prepared Standard Field Quality Plan for transmission line/substation equipments as applicable, Civil/erection Works which is required to be followed for associated works.

The Employer or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Bidder/his vendor's quality management and control activities.

8.2 **Quality Assurance Documents**

The Bidder shall ensure availability of the following Quality Assurance Documents:

i) All Non-Destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication, and reports including radiography interpretation reports.

ii) Welder and welding operator qualification certificates.

iii) Welder's identification list, welding operator's qualification procedure and welding identification symbols.

iv) Raw Material test reports on components as specified by the specification and in the quality plan.

v) The Manufacturing Quality Plan(MQP) indicating Customer Inspection Points (CIPs) at various stages of manufacturing and methods used to verify that the inspection and testing points in the quality plan were performed satisfactorily.

vi) Factory test results for testing required as per applicable quality plan/technical specifications/GTP/Drawings etc.

vii) Stress relief time temperature charts/oil impregnation time temperature charts, wherever applicable.

8.3 INSPECTION, TESTING & INSPECTION CERTIFICATE

8.3.1 The responsibility and the basis of inspection for various items & equipment is placed at **Annexure-G** along with the requirement of MQP (Manufacturing Quality Plan), ITP(Inspection & Test Plan), FAT(Factory Acceptance Test) which should be valid & POWERGRID approved and Level of inspection envisaged against each item.

Bidder shall ensure that order for items where MQP/ITP/FAT is required will be placed only on vendors having valid MQP/ITP/FAT and where the supplier's MQP/ITP/FAT is either not valid or has not been approved by POWERGRID, MQP shall be generally submitted as per POWERGRID format before placing order.

Items not covered under MQP/ITP/FAT shall be offered for inspection as per POWERGRID LOA/technical Specifications/POWERGRID approved data sheets/ POWERGRID approved drawings and relevant Indian/International standards.

Inspection **Levels**: For implementation of projects in a time bound manner and to avoid any delay in deputation of POWERGRID or its authorized representative, involvement of POWERGRID for inspection of various items / equipment will be based on the level below:

Level –I: Bidder to raise all inspection calls and review the report of tests carried out by the manufacturer, on his own, as per applicable standards/ POWERGRID specification, and submit to concerned POWERGRID inspection office/Inspection Engineer. CIP/MICC will be issued by POWERGRID based on review of test reports/certificates of manufacturers.

Level – II: Bidder to raise all inspection calls and carry out the inspection on behalf of POWERGRID on the proposed date of inspection as per applicable standards/specification. However, in case POWERGRID wishes to associate itself during inspection, the same would be intimated to Bidder and CIP/MICC will be issued by POWERGRID. Else, Bidder would submit their test reports/certificates to POWERGRID. CIP/MICC will be issued by POWERGRID based on review of test reports/ certificates.

Level - III: Bidder to raise inspection calls for both, stage (as applicable) & final inspection and carry out the stage inspections (if applicable) on behalf of POWERGRID on the proposed date of inspection as per applicable standards/specification. However, in case POWERGRID wishes to associate itself during stage inspection, the same would be intimated to Bidder and CIP will be issued by POWERGRID. Else, Bidder would submit the test reports / certificates of stage inspection after their own review and CIP will be issued by POWERGRID based on review of test reports / certificates. Final inspection will be carried out by POWERGRID and CIP/MICC will be issued by POWERGRID.

Level – IV: Bidder to raise inspection calls for both, stage (as applicable) & final inspections. POWERGRID will carry out the inspection for both stage & final inspection as per applicable standards/specification and CIP/MICC will be issued by POWERGRID.

8.3.2 Bidder shall ensure that to implement the above inspection levels, particularly for the quality control and inspection at sub-vendor's works, they would depute sufficient qualified & experienced manpower in their Quality Control and Inspection department. Further, to assure quality of construction, Bidder shall have a separate workforce having appropriate qualification & experience and deploy suitable tools and plant for maintaining quality requirement during construction in line with applicable Field Quality Plan (FQP).

8.3.3 The Employer, his duly authorised representative and/or outside inspection agency acting on behalf of the Employer shall have at all reasonable times access to the Bidder's premises or Works and shall have the power at all reasonable times to ensure that proper Quality Management practices / norms are adhered to, inspect and examine the materials & workmanship of the Works, to carry out Quality/Surveillance Audit during manufacture or erection and if part of the Works is being manufactured or assembled at other premises or works. The Bidder shall obtain for the

Employer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Bidder's own premises or works. The item/equipment, if found unsatisfactory with respect to workmanship or material is liable to be rejected. The observations for improvements during product/ process inspection by POWERGRID shall be recorded in Quality Improvement Register (available & maintained at works) for review & timely compliance of observations.

8.3.4 Bidder shall submit inspection calls over internet through POWERGRID website. The required vendor code and password to enable raising inspection call will be furnished to the main Contractor within 30 days of award of contract on submission of documents by Contractor. After raising the inspection calls, Contractor shall then proceed as per the message of that particular call which is available on the message board.

8.3.5 The Employer reserves the right to witness any or all type, acceptance and routine tests specified for which the Bidder shall give the Employer/Inspector Twenty one (21) days written notice of any material being ready for testing for each stage of testing as identified in the approved quality plan as customer inspection point (CIP) for indigenous inspections. All inspection calls for overseas material shall be given at least forty five (45) days in advance. Such tests shall be to the Bidder's account except for the expenses of the Inspection Engineer. The Employer/inspector, unless witnessing of the tests is waived by Employer, will attend such tests within Twenty one (21) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Bidder may proceed with the test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector three copies of tests, duly certified. Bidder shall ensure, before giving notice for type test, that all drawings and quality plans have been got approved. The equipment shall be dispatched to site only after approval of Routine and Acceptance test results and Issuance of Dispatch Clearance in writing by the Employer. CIP/Material Inspection clearance certificate (MICC) shall be issued by the Employer after inspection of the equipment or review of test reports as applicable. Employer may waive off the presence of Employer's inspecting engineer. In that case test will be carried out as per approved QP and test certificate will be furnished by the supplier for approval. CIP/MICC will be issued only after review and approval of the test reports.

8.3.6 Bidder shall generally offer material for inspection as per supply bar chart approved by POWERGRID and not before 30 days from schedule indicated in the bar chart. In case Bidder offers material(s) for inspection prior to 30 days from the scheduled date with necessary approval of POWERGRID, POWERGRID shall inspect the material and issue CIP only. However, in such an exceptional case, MICC shall be issued only as per provision of original / revised approved supply schedule.

8.3.7 Bidder shall minimize the number of inspection calls by offering optimum quantities in each inspection call at the respective manufacturer's works.

8.3.8 Bidder shall inspect the material themselves and only after they are fully convinced about the Quality, they shall offer the material for POWERGRID inspection and shall also ensure that relevant portion of LOA/NOA, approved drawing and data sheets along with applicable Quality Plans are available at the works of Contractor or their Sub-vendor before the material is offered for inspection.

8.3.9 Bidder shall ensure that material which has been cleared for dispatch after inspection will be dispatched within 30 days in case of domestic supplies and within 60 days in case of Off-shore supplies from the date of issuance of CIP. Material which is not dispatched within stipulated time as above will be reoffered for POWERGRID inspection or specific approval of POWERGRID QA&I shall be obtained for delayed dispatch.

8.3.10 The Employer or IE shall give notice in writing to the Bidder, of any objection either to conformance to any drawings or to any equipment and workmanship which in his opinion is not in accordance with the Contract. The Bidder shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Employer/Inspection Engineer giving reasons therein, that no modifications are necessary to comply with the Contract.

8.3.11 All Test Reports and documents to be submitted in English during final inspection of equipment by POWERGRID or as and when required for submission.

8.3.12 When the factory tests have been completed at the Bidder's or Sub-Bidder's works, the Employer/Inspection Engineer(IE) shall issue a certificate to this effect within fifteen (15) days after completion of tests & submission of documents by Bidder/manufacturer but if the tests are not witnessed by the Employer/IE, the certificate shall be issued within fifteen (15) days of receipt of the Bidder's Test certificate by the Employer/IE. Bidder shall, on completion of all tests, submit test reports within Ten (10) days to POWERGRID IE. Failure of the Employer/IE to issue such a certificate shall not prevent the Contractor from proceeding with the Works. The completion of these tests or the issue of the certificate shall not bind the Employer to accept the equipment should, it, on further tests after erection, be found not to comply with the Contract.

8.3.13 In all cases, where the Contract provides for tests whether at the premises or works of the Bidder or of any Sub-Bidder, the Bidder, except where otherwise specified, shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Employer/Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Employer/Inspection Engineer or to his authorised representative to accomplish testing.

8.3.14 The inspection and acceptance by Employer and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract, or if such equipment is found to be defective at a later stage.

8.3.15 The Employer will have the right of having at his own expenses any other test(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

8.3.16 The Employer reserves the right for getting any additional field tests conducted on the completely assembled equipment at site to satisfy that material complies with specifications.

8.3.17 Rework/ Re-engineering, if any, on any item/equipment shall be carried out only after mutual discussions and in accordance with mutually agreed procedure. Bidder shall submit Joint Inspection Report of equipments under Re-Work/Re-Engineering alongwith procedure for the

same to POWERGRID for approval, before taking up the Re-Work/Re-Engineering, failing which POWERGRID reserves the right to reject the equipment.

8.3.18 Bidder may establish a field test Laboratory to execute Civil Construction testing requirements at site with the condition that all testing equipment shall be calibrated from POWERGRID approved accredited Testing laboratories, with calibration certificates kept available at site and all testing personnel employed in the Field Testing Laboratories to be qualified and experienced Engineers or testing to be carried out at POWERGRID approved Third Party Laboratories.

8.3.19 Bidder shall ensure that all possible steps are taken to avoid damages to the equipment during transport, storage and erection.

8.3.20 Deleted.

8.3.21 Bidder shall ensure commissioning of all CSDs along with Circuit Breakers wherever applicable.

8.3.22 For EHV transformers/reactors:

Insulation oil shall be as per POWERGRID Technical specifications and same grade shall be used for impregnation of the active part & testing at the works of Transformer/Reactor Manufacturer and as well as for filling the Transformer/Reactors at site. Bidder to ensure that windings for Transformer/Reactors are made in air conditioned environment. Core-coil assembly shall be performed in positive pressurized dust controlled environment. Dust measurements shall be monitored regularly at Transformer / Reactor Manufacturer works. Contractor shall ensure that respective civil foundations & Fire walls for Transformer/Reactors units to be commissioned, shall be made ready at concerned sites before receipt of Transformer/Reactors units.

8.3.23 The Employer reserves the right to increase or decrease their involvement in inspections at Bidder's Works or at his Sub-Bidder's premises or at the Employer's site or at any other place of Work based on performance of Bidder/sub-bidder.

9.0 TYPE TESTING & CLEARANCE CERTIFICATE

9.1 Deleted.

9.2 Deleted.

9.3 The Employer intends to repeat those type tests which are indicated in the price schedule and the same shall be payable as per provision of contract. The price of conducting type tests shall be included in Bid price and break up of these shall be given in the relevant schedule of Bid Proposal Sheets. These Type test charges would be considered in bid evaluation. In case Bidder does not indicate charges for any of the type tests or does not mention the name of any test in the price schedules, it will be presumed that the particular test has been offered free of charge. Further, in case any Bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected. The Employer reserves the right to waive the repeating of type tests partly or fully and in case of waival, test charges for the same shall not be payable.

9.4 The Employer reserves the right to witness any or all the type tests. The Employer shall bear all expenses for deputation of Employer's representative(s) for witnessing the type tests except in the case of re-deputation if any, necessitated due to no fault of the Employer.

9.5 Deleted

10.0 Deleted.

11.0 PACKAGING & PROTECTION

11.1 All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the Employer, the Bidder shall also submit packing details/associated drawing for any equipment/material under his scope of supply, to facilitate the Employer to repack any equipment/material at a later date, in case the need arises. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Employer/BHEL takes no responsibility of the availability of the wagons.

11.2 All coated surfaces shall be protected against abrasion, impact, discolouration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

12.0 FINISHING OF METAL SURFACES

12.1 All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. All steel conductors including those used for earthing/grounding (above ground level) shall also be galvanized according to IS: 2629.

12.2 HOT DIP GALVANISING

12.2.1 The minimum weight of the zinc coating shall be 610 gm/sq.m and minimum average thickness of coating shall be 86 microns for all items having thickness 6mm and above. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq.m minimum.

12.2.2 The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

12.2.3 After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate or alternate approved treatment shall be provided to avoid formation of white rust after hot dip galvanization.

12.2.4 The galvanized steel shall be subjected to four numbers of one minute dips in copper sulphate solution as per IS-2633.

12.2.5 Sharp edges with radii less than 2.5 mm shall be able to withstand four immersions of the Standard Preece test. All other coatings shall withstand six immersions. The following galvanizing tests should essentially be performed as per relevant Indian Standards.

- Coating thickness
- Uniformity of zinc
- Adhesion test
- Mass of zinc coating

12.2.6 Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of touch-up zinc rich paint at site shall be allowed with approval of Engineer Incharge.

12.3 PAINTING

12.3.1 All sheet steel work shall be degreased, pickled, phosphated in accordance with the IS6005 “Code of practice for phosphating iron and sheet”. All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swaf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

12.3.2 Hot Phosphating shall be done for phosphating process under pretreatment of sheets After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be “flash dried” while the second coat shall be stoved.

12.3.3 After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.

12.3.4 The exterior and interior colour of the paint in case of new substations shall preferably be RAL 7032 for all equipment, marshalling boxes, junction boxes, control cabinets, panels etc. unless specifically mentioned under respective sections of the equipments. Glossy white colour inside the equipments /boards /panels/junction boxes is also acceptable. The exterior colour for panels shall be matching with the existing panels in case of extension of a substation. Each coat of primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments.

12.3.5 In case the contractor proposes to follow his own standard surface finish and protection procedures or any other established painting procedures, like electrostatic painting etc., the procedure shall be submitted during detailed engineering for Employer's review & approval.

12.3.6 The colour scheme as given below shall be followed for Fire Protection and Air Conditioning systems

S.No.	PIPE LINE	Base colour	Band colour
Fire Protection System			
1	Hydrant and Emulsifier system pipeline/NIFPS	FIRE RED	-
2	Emulsifier system detection line – water	FIRE RED	Sea Green
3	Emulsifier system detection line –Air	FIRE RED	Sky Blue
4	Pylon support pipes	FIRE RED	
Air Conditioning Plant			
5	Refrigerant gas pipeline – at compressor suction	Canary Yellow	-
6	Refrigerant gas pipeline – at compressor discharge	Canary Yellow	Red
7	Refrigerant liquid pipeline	Dark Admiralty Green	-
8	Chilled water pipeline	Sea Green	-
9	Condenser water pipeline	Sea Green	Dark Blue

The direction of flow shall be marked by → (arrow) in black colour.

Base Colour Direction of flow Band Colour

12.3.7 For aluminium casted surfaces, the surface shall be with smooth finish. Further, in case of aluminium enclosures, the surface shall be coated with powder (coating thickness of 60 microns) after surface preparation for painting. For stainless steel surfaces, no painting is envisaged.

12.3.8 Band colour is required for Emulsifier system detection line only if both water and air detection lines are present at the same substation. Further, band colour shall be applied at an interval of 2 meters approx. along the length and minimum width of band shall be 25mm.

13.0 Deleted.

14.0 TOOLS

14.1 Deleted.

14.2 SPECIAL TOOLS AND TACKLES

The bidder shall supply all special tools and tackles required for Operation and maintenance of equipment. The special tools and tackles shall only cover items which are specifically required for the equipment offered and are proprietary in nature. The list of special tools and tackles, if any, shall be finalized during detail engineering and the same shall be supplied without any additional cost implication to the Employer.

14.3 Deleted.

15.0 AUXILIARY SUPPLY

15.1 The auxiliary power for station supply, including the equipment drive, cooling system of any equipment, air-conditioning, lighting etc shall be designed for the specified Parameters as under. The DC supply for the instrumentation and PLCC system shall also conform the parameters as indicated in the following table:

Normal Voltage	Variation in Voltage	Frequency in HZ	Phase/Wire	Neutral connection
415V	± 10%	50 ± 5%	3/4 Wire	Solidly Earthed.
240V	± 10%	50 ± 5%	1/2 Wire	Solidly Earthed.
220V	190V to 240V	DC	Isolated 2 wire System	-
110V	95V to 120V	DC	Isolated 2 wire System	-
48V	--	DC	2 wire system (+) earthed	-

Combined variation of voltage and frequency shall be limited to ± 10%.

15.2 Pickup value of binary input modules of Intelligent Electronic Devices, Digital protection couplers, Analog protection couplers shall not be less than 50% of the specified rated station auxiliary DC supply voltage level.

16.0 SUPPORT STRUCTURE (ONLY OF CIRCUIT BREAKER)

16.1 The equipment support structures shall be suitable for equipment connections at the first level i.e 14.0 meter, 8.0 meter, 5.9 meter and 4.6 meter from plinth level for 765kV, 400kV, 220kV and 132kV substations respectively. All equipment support structures shall be supplied alongwith brackets, angles, stools etc. for attaching the operating mechanism, control cabinets & marshalling box (wherever applicable) etc.

16.2 The minimum vertical distance from the bottom of the lowest porcelain/polymer part of the bushing, porcelain/polymer enclosures or supporting insulators to the bottom of the equipment base, where it rests on the foundation pad shall be 2.55 metres.

17.0 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS (For Lightning Arrester & Wave Trap only)

17.1 All power clamps and connectors shall conform to IS:5561 or other equivalent international standard and shall be made of materials listed below :

Sl. No.	Description	Materials
a)	For connecting ACSR conductors/AAC conductors/ Aluminium tube	Aluminum alloy casting, conforming to designation **4600** of IS:617 and all test shall conform to IS:617
b)	For connecting equipment terminals mad of copper with ACSR conductors/AAC conductors/ Aluminium tube	Bimetallic connectors made from aluminum alloy casting, conforming to designation **4600** of IS:617 with 2mm thick bimetallic liner/strip and all test shall conform to IS:617
c)	For connecting G.I	Galvanised mild steel shield wire
d)	Bolts, nuts & plain washers	Electro-galvanised for sizes below M12, for others hot dip galvanised.
e)	Spring washers	Electro-galvanised mild steel suitable for atleast service condition-3 as per IS:1573

17.2 Necessary clamps and connectors shall be supplied for all equipment and connections. If corona rings are required to meet these requirements they shall be considered as part of that equipment and included in the scope of work.

17.3 Where copper to aluminum connections are required, bi-metallic clamps shall be used, which shall be properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to parts which are not current carrying or subjected to stress.

17.4 Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified in each particular case, are also included in the scope of Work.

17.5 No current carrying part of any clamp shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner/strip of minimum 2 mm thickness shall be cast integral with aluminum body or 2 mm thick bi-metallic liner/strips shall be provided for Bi-metallic clamps.

17.6 All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

17.7 Flexible connectors, braids or laminated straps made for the terminal clamps for bus posts shall be suitable for both expansion or through (fixed/sliding) type connection of IPS AL tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.

17.8 Current carrying parts (500A and above) of the clamp/connector shall be provided with minimum four numbers of bolts preferably for 132kV and above.

17.9 All current carrying parts shall be designed and manufactured to have minimum contact resistance.

17.10 Power Clamps and connectors shall be designed to control corona as per requirement.

17.11 Tests

Clamps and connectors should be type tested on minimum three samples as per IS:5561 and shall also be subjected to routine tests as per IS:5561. Following type test reports shall be submitted for approval. Type test once conducted shall hold good. The requirement of test conducted within last ten years, shall not be applicable.

i) Temperature rise test (maximum temperature rise allowed is 35°C over 50°C ambient)

ii) Short time current test

iii) Corona (dry) and RIV (dry) test [for 132kV and above voltage level clamps]

iv) Resistance test and Pullout strength test

v) Cantilever Strength test on bus support clamps & connectors

vi)

18.0 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

18.1 All types of boxes, cabinets etc. shall generally conform to & be tested in accordance with IS/IEC 61439-0, as applicable, and the clauses given below:

18.2 Control cabinets, junction boxes, Marshalling boxes & terminal boxes, Out door ACDB cum DCDB panels shall be made of stainless steel of atleast 1.5 mm thick or aluminum enclosure of atleast 1.6 mm thick and shall be dust, water and vermin proof. Stainless steel used shall be of grade SS304 (SS316 for coastal area) or better. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminum enclosed box the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

Control cabinets, junction boxes, marshalling boxes & terminal boxes, out-door ACDB cum DCDB panels shall have adequate space/clearance as per guidelines/technical specifications to access/replace any component. Necessary component labelling to be also done on non-conducting sheet.

For CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES MARSHALLING BOXES FOR OUTDOOR EQUIPMENT Junction Box, wire should be as per IS or equivalent IEC with FRLS grade

Machine laid PU Foam gasket may be permitted for use in Control Cabinets etc.

18.3 A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes / Control cabinets to prevent ingress of rain water.

18.4 Cabinet/boxes with width more than 700 mm shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere.

18.5 All doors, removable covers and plates shall be gasketed all around with suitably profiled EPDM/Neoprene/PU gaskets. The gasket shall be tested in accordance with approved quality plan, IS:11149 and IS:3400. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

Further, the gasketing arrangement shall be such that gaskets are pasted in slots (in door fabrication/gasket itself) in order to prevent ingression of dust and moisture inside the panels so that no internal rusting occurs in panels during the operation of the equipment.

18.6 All boxes/cabinets shall be designed for the entry of cables by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate above the base of the marshalling kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland plate. Gland plate shall have provision for some future glands to be provided later, if required. The Nickel plated glands shall be dust proof, screw on & double compression type and made of brass. The gland shall have provision for securing armour of the cable separately and shall be provided with earthing tag. The glands shall conform to BS:6121.

18.7 A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.

18.8 LED based illumination of minimum 9 watts shall be provided. The switching of the fittings shall be controlled by the door switch.

For junction boxes of smaller sizes such as lighting junction box, manual operated earth switch mechanism box etc., plug socket, heater and illumination is not required to be provided.

18.9 All control switches shall be of MCB/rotary switch type and Toggle/piano switches shall not be accepted.

18.10 Earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire shall be terminated on to the earthing pad and secured by the use of self etching washer. Earthing of hinged door shall be done by using a separate earth wire.

18.11 The bay marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/feruling by pasting the same on the inside of the door.

18.12 The following routine tests alongwith the routine tests as per IS:5039 shall also be conducted:

i) Check for wiring

ii) Visual and dimension check

18.13 The enclosure of bay marshalling kiosk, junction box, terminal box and control cabinets shall conform to IP-55 as per IS/IEC60947 including application of 1kV rms for 1 (one) minute, after IP-55 test.

19.0 Deleted.

20.0 TERMINAL BLOCKS AND WIRING

20.1 Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All interphase and external connections to equipment or to control cubicles will be made through terminal blocks.

20.2 Terminal blocks shall be 650V grade and have continuous rating to carry the maximum expected current on the terminals and non-breakable type. These shall be of moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But the terminal blocks shall be non-disconnecting stud type except for the secondary junction boxes of Current Transformer and Voltage Transformer.

20.3 Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

20.4 The terminal shall be such that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally.

20.5 The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable.

20.6 The terminal blocks shall be of extensible design, multilayer terminal arrangement is not allowed in any junction box (Common MB, Individual MB, JB etc.). There should be sufficient space at both sides of terminals so that ferrule number of wires / TB numbers are clearly visible during wire removal or insertion.

20.7 The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

20.8 The terminal blocks shall be fully enclosed with removable covers of transparent, nondeteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

20.9 Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

a)	All circuits except CT/PT circuits	Minimum of two of 2.5 sq mm copper flexible.
b)	All CT/PT circuits	Minimum of 4 nos. of 2.5 sq mm copper flexible.

20.10 The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live.

20.11 Atleast 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

20.12 There shall be a minimum clearance of 250 mm between the First/bottom row of terminal block and the associated cable gland plate for outdoor ground mounted marshalling box and the clearance between two rows of terminal blocks shall be a minimum of 150 mm.

20.13 The Contractor shall furnish all wire, conduits and terminals for the necessary interphase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets

21.0 LAMPS & SOCKETS

21.1 Lamps & Sockets

All lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

21.2 Hand Lamp:

A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.

21.3 Switches and Fuses:

21.3.1 Each panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with miniature circuit breaker **/** switch fuse units. Selection of the main and Sub-circuit fuse ratings shall be such as to ensure selective

clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

21.3.2 All fuses shall be of HRC cartridge type conforming to relevant IS mounted on plug-in type fuse bases. Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

22.0 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS:

22.1 Bushings shall be manufactured and tested in accordance with IS:2099 & IEC-60137 while hollow column insulators shall be manufactured and tested in accordance with IEC-62155/IS:5621.The support insulators shall be manufactured and tested as per IS:2544/IEC-60168 and IEC-60273. The insulators shall also conform to IEC-60815 as applicable.

The bidder may also offer composite hollow insulators, conforming to IEC-61462.

22.2 Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.

22.3 Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.

22.4 Support insulators/bushings/hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

22.5 When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the normal rated voltage.

22.6 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

22.7 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.

22.8 Void

22.9 Deleted.

23.0 MOTORS

Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall be subjected to routine tests as per applicable standards. The motors shall be of approved make.

23.1 Enclosures

a) Motors to be installed outdoor without enclosure shall have hose proof enclosure equivalent to IP-55 as per IS: 4691. For motors to be installed indoor i.e. inside a box, the motor enclosure, shall be dust proof equivalent to IP-44 as per IS: 4691.

b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.

c) Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing.

d) Motors weighing more than 25 Kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

23.2 Operational Features

a) Continuous motor rating (name plate rating) shall be at least ten (10) percent above the maximum load demand of the driven equipment at design duty point and the motor shall not be over loaded at any operating point of driven equipment that will rise in service.

b) Motor shall be capable at giving rated output without reduction in the expected life span when operated continuously in the system having the particulars as given in Clause 15.0 of this Section.

23.3 Starting Requirements:

a) All induction motors shall be suitable for full voltage direct-on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.

b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.

c) The locked rotor current shall not exceed six (6) times the rated full load current for all motors, subject to tolerance as given in IS:325.

d) Motors when started with the driven equipment imposing full starting torque under the supply voltage conditions specified under Clause 15.0 shall be capable of withstanding atleast two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.

e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Bidder shall offer centrifugal type speed switch mounted on the motor shaft

which shall remain closed for speed lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

23.4 Running Requirements:

a) The maximum permissible temperature rise over the ambient temperature of 50 degree C shall be within the limits specified in IS:325 (for 3-phase induction motors) after adjustment due to increased ambient temperature specified.

b) The double amplitude of motor vibration shall be within the limits specified in IS: 4729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

c) All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.

23.5 TESTING AND COMMISSIONING

An indicative list of tests is given below. Contractor shall perform any additional test based on specialities of the items as per the field Q.P./Instructions of the equipment Contractor or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Employer for approval.

(a) Insulation resistance.

(b) Phase sequence and proper direction of rotation.

(c) Any motor operating incorrectly shall be checked to determine the cause and the conditions corrected

SECTION 4
GUARANTEED TECHNICAL PARTICULARS

Powergrid's standard GTPs for the fire fighting items are attached in section-2 for reference. However final GTP shall be submitted and approved by customer during detailed engineering.

Makes furnished in Appendix –V of POWERGRID FPS spec Rev.06 (provided as annexure to section-2) is indicative and final make shall be decided after detailed engineering with POWERGRID. Besides, any other vendor listed in POWERGRID's "compendium of approved vendors", which is available on the internet, can also be chosen. In case, no vendor is specified in compendium against a particular item, only reputed makes available in the market shall be considered. All such makes shall be subjected to acceptance of POWERGRID. No additional price implication shall be made to BHEL on account of non-acceptance of proposed makes by POWERGRID.

SECTION- 5

ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

Schedule 1 **Schedule of Deviations**

Schedule 2 **Details of contact persons (technical & commercial)**

Schedule 3 **Enclosures to Specification**

a) List of Makes (APPENDIX-V of Section-2)

b) Drawings

SCHEDULE-1

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations / variations / exceptions from the specification:

Section	Clause No. / Page No.	Statement of deviation/ Variations/Exceptions

1) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is deemed to be in compliance with the specification.

2) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**

3) Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place

Date

Signature of the authorized representative of Bidder

Name ----------

Designation----------

Company seal----------

SCHEDULE-2

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Date

Signature of the authorized representative of Bidder

Name----------

Designation----------

Company seal ----------

Note: Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

SCHEDULE –3

ENCLOSURES TO SPECIFICATION

a) List of PGCIL Approved makes (Please refer Section 2, Power grid's specification-APPENDIX-V)

b) DRAWINGS

1. NEEMUCH S/S- 400/220 KV SWITCHYARD ELECTRICAL LAYOUT PLAN
   DRG. NO. TB-1-418-316-001A, REV-02
2. NEEMUCH S/S CONTROL ROOM BUILDING EQUIPMENT LAYOUT
   DRG. NO.: TB-2-418-316-003, REV-02.
3. NEEMUCH S/S FIRE FIGHTING PUMP HOUSE ARCHITECTURAL DRAWING
   DRG. NO. TB-2-418-316-***
4. OGA FOR 500 MVA AUTO-TRANSFORMER (BHEL Make)
   DRG. NO. 3 464 00 01835 & 3 464 00 01837
5. OGA of 125 MVAR REACTORS (BHEL make)
   DRG. NO. 34690002261, 34690002262, 34690002263
6. CHITTORGARH S/S 400KV CABLE TRENCH
   DRG. NO. TB-2-418-316-007-C
7. DV HOUSING DRAWING
8. *STANDARD SWITCHYARD AC PANEL ROOM DRAWING*
   DRG. NO. C-ENGG-STD-SPR-2017

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

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

COMPUTER DRG. PATH NAME :

REF. DRG. No.

SIGN. & DATE

INVENTORY No.

MUNAR PILLER

TBM3
104.595

KEY PLAN

Terrace-A
FGL = 102.25M

Terrace-B
FGL = 101.75M

Terrace-C
FGL = 101.5M

HOUSE

400KV CHITTORGARH D/C LINE

400KV MANSAURIA D/C LINE

FUTURE 400KV LINE

3.75M ROAD

TRANSFER BUS

MAIN BUS-II

MAIN BUS-I

SPR 1

SPR 2

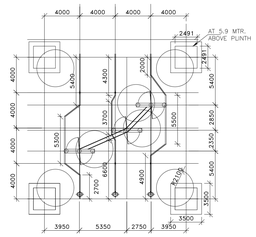
HOLD

Location of Line side equipments of 400kV & 220kV and 33kV LT Yard may change inline with final Dead end TL tower location. Construction at these area to be taken up with instruction from Site-In-Charge

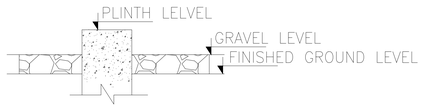
MINIMUM CLEARANCE TABLE	400kV	220kV	72.5kV
PHASE TO PHASE (PP) (mm)	4000	2100	750
PHASE TO EARTH (PE) (mm)	3500	2100	630
SECTION CLEARANCE (SC) (mm)	6500	5000	3100
HEIGHT OF TUBE CENTRE LINE OF FIRST LEVEL (MIN.) MM. (FROM PLINTH LEVEL)	8000	5900	3800
GROUND CLEARANCE TO NEAREST PART NOT AT EARTH POTENTIAL 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
3. THE FENCE SHOWN IS TENTATIVE AND IS SUBJECT TO CHANGE DURING FURTHER ENGINEERING.
4. LOCATION OF 400 & 200KV LINE SIDE EQUIPMENT IS TENTATIVE AND IS SUBJECT TO CHANGE AS PER LINE ORIENTATION



CLEARANCE DIAGRAM FOR TANDEM ISOLATOR



TYPICAL PLINTH LEVEL & SURFACE FINISH

REV.	DATE	ALTERED	SY
		CHECKED	SS
02	17.01.23	APPROVED	SKS
ZONE	REVISED AS PER NEW SITE CONTOUR PLAN RECEIVED FROM POWERGRID		

REV.	DATE	ALTERED	SY
		CHECKED	SS
01	21.10.22	APPROVED	SKS
ZONE	REVISED AS PER CUSTOMER COMMENTS VIA LETTER NO-CC-ENGG-TB202213-1001684-SS3320-400KV-ELECT-LAY-PLAN Dated 14.10.2022		

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.	
STATUS OF DRAWING	
DISTRIBUTION OF PRINTS	

ग्राहक/परियोजना का नाम POWER GRID CORPORATION OF INDIA LIMITED
NAME OF CUSTOMER/PROJECT NEEMUCH 400/220KV SUBSTATION

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
ट्रांसमिशन परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता./SIGN.	दि./DATE
बनाया DRAWN	SANJAY	-sd-	12.10.22
जाँचा CHECKED	SHOBHNA	-sd-	12.10.22
स्वीकृत APPROVED	SKS	-sd-	12.10.22

विभाग DEPT.
कोड CODE
उलपात / SCALE NTS
कार्ड कोड CARD CODE

पावरग्रिड ड्राईंग.क्र./POWERGRID DRAWING NO.
TB202213-1001684-SS3320-400KV-ELECT-LAY-PLAN

शीर्षक/TITLE
NEEMUCH S/S-400/220 kV SWICTHYARD ELECTRICAL LAYOUT PLAN

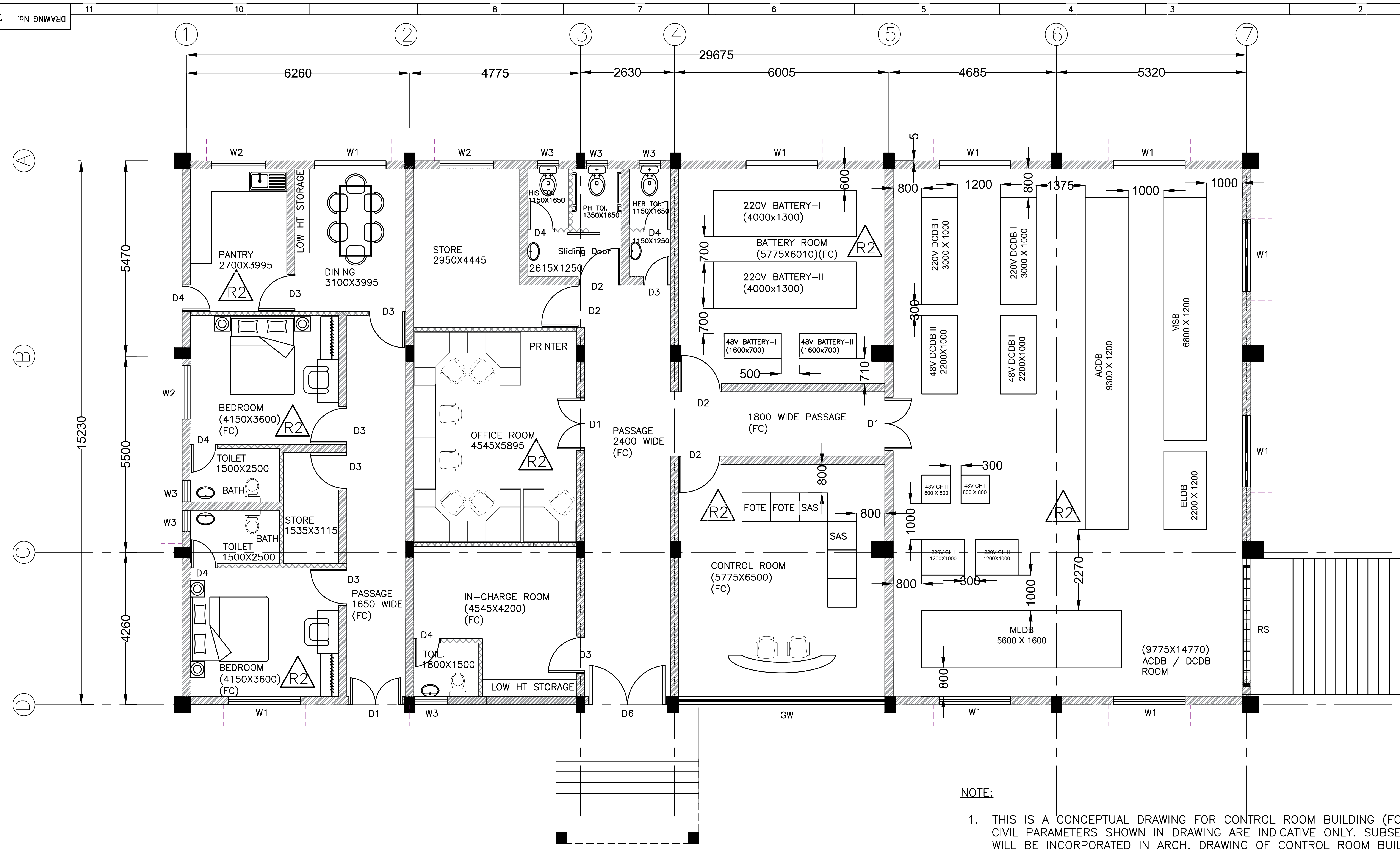
ड्राईंग.क्र./DRAWING NO.
TB-1-418-316-001A

पुनः/REV. 02

पृष्ठ क्र./SHEET No. 01 अगला पृष्ठ /NEXT SHEET — —

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No. TB-2-418-316-003



NOTE:

1. THIS IS A CONCEPTUAL DRAWING FOR CONTROL ROOM BUILDING (FOR SWITCHYARD), CIVIL PARAMETERS SHOWN IN DRAWING ARE INDICATIVE ONLY. SUBSEQUENT COMMENT WILL BE INCORPORATED IN ARCH. DRAWING OF CONTROL ROOM BUILDING.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS (FINISHED FLOOR LEVELS) ARE IN METERS.
3. DOOR WIDTHS ARE CLEAR MASONRY OPENINGS AND DOOR HEIGHTS ARE FROM FINISHED FLOOR LEVEL TO BOTTOM OF LINTEL.
4. ALL EQUIPMENT/PANEL DIMENSION ARE TENTATIVE. FINAL EQUIPMENT DIMENSION WILL BE INCORPORATED IN FUTURE REVISION AFTER APPROVAL OF INDIVIDUAL EQUIPMENT/PANEL DRAWING.
5. CLEAR HEIGHT OF THE BUILDING SHALL BE 4000MM FROM FFL.
6. FALSE CEILING (FC) SHALL BE AT 3000MM FROM FFL.
7. PANEL/BATTERY LAYOUT IN ACDB/DCDB ROOM & BATTERY ROOM IS TENTATIVE AND WILL BE FINALISED AS PER ACTUAL PANEL DRAWINGS.
8. (R2) TERRACE OF THE BUILDING SHALL BE DESIGNED FOR ADDITIONAL LOAD FOR SOLAR PANELS I.E. 50 KG/M2.

DOOR SCHEDULE (R2)

SYMBOL	OPENING SIZE	NOS.	DETAILS
D1	1500x2500	03	ALLUMINIUM GLAZED DOUBLE SHUTTER PARTLY FIXED DOOR AS / SPEC.
D2	1200X2100	05	SHUTTER DOOR AS/SPEC.
D3	1050X2100	06	SINGLE LEAF STEEL DOOR AS /SPEC.
D4	750x2100	07	ALUMINIUM GLAZED SINGLE SHUTTER DOOR AS /SPEC.
RS	3000X3400	01	ROLLING SHUTTER AS/SPEC

WINDOW SCHEDULE (R2)

SYMBOL	OPENING SIZE	NOS.	DETAILS
W1	2000X1600	10	STEEL FRAMED PARTLY FIXED PARTLY GLAZED WINDOW AS/SPEC
W2	1500X1600	03	AL. FRAMED SLIDING WINDOW AS/SPEC
W3	600X900	06	AL. FRAMED SLIDING WINDOW AS/SPEC
GW	AS PER CIVIL DRAWING	01	AS PER CIVIL DRAWING.

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. 80014	ग्राहक/परियोजना का नाम NAME OF CUSTOMER/PROJECT: POWER GRID CORPORATION OF INDIA LIMITED, NEEMUCH 400/220KV CONTROL ROOM BUILDING
STATUS OF DRAWING	
DISTRIBUTION OF PRINTS	भारत हेवी इलेक्ट्रिकल्स लिमिटेड ट्रांसमिशन परियोजना विभाग BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता./SIGN.	दि./DATE
बनाया DRAWN	SANJAY	SANJAY	06.10.22
जाँचा CHECKED	SHOBHNA		
स्वीकृत APPROVED	ARUNA		

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE / DETAILS
02	25.11.22	SY / SS / SKS	Revised as per comments vide letter CC-ENGG-TB202213-1001684-SS3320-CRB-EQPT-LAY dated 31.10.22
01	19.10.22	SY / SS / SKS	Revised as per comments vide letter CC-ENGG-TB202213-1001684-SS3320-CRB-EQPT-LAY dated 13.10.22

विभाग DEPT. — कोड CODE — अनुपात / SCALE 1:1 — कार्ड कोड CARD CODE

पावरग्रिड ड्राइंग.क्र./POWERGRID DRAWING NO. TB202122-1001158-SS3250-CRB-EQPT-LAY

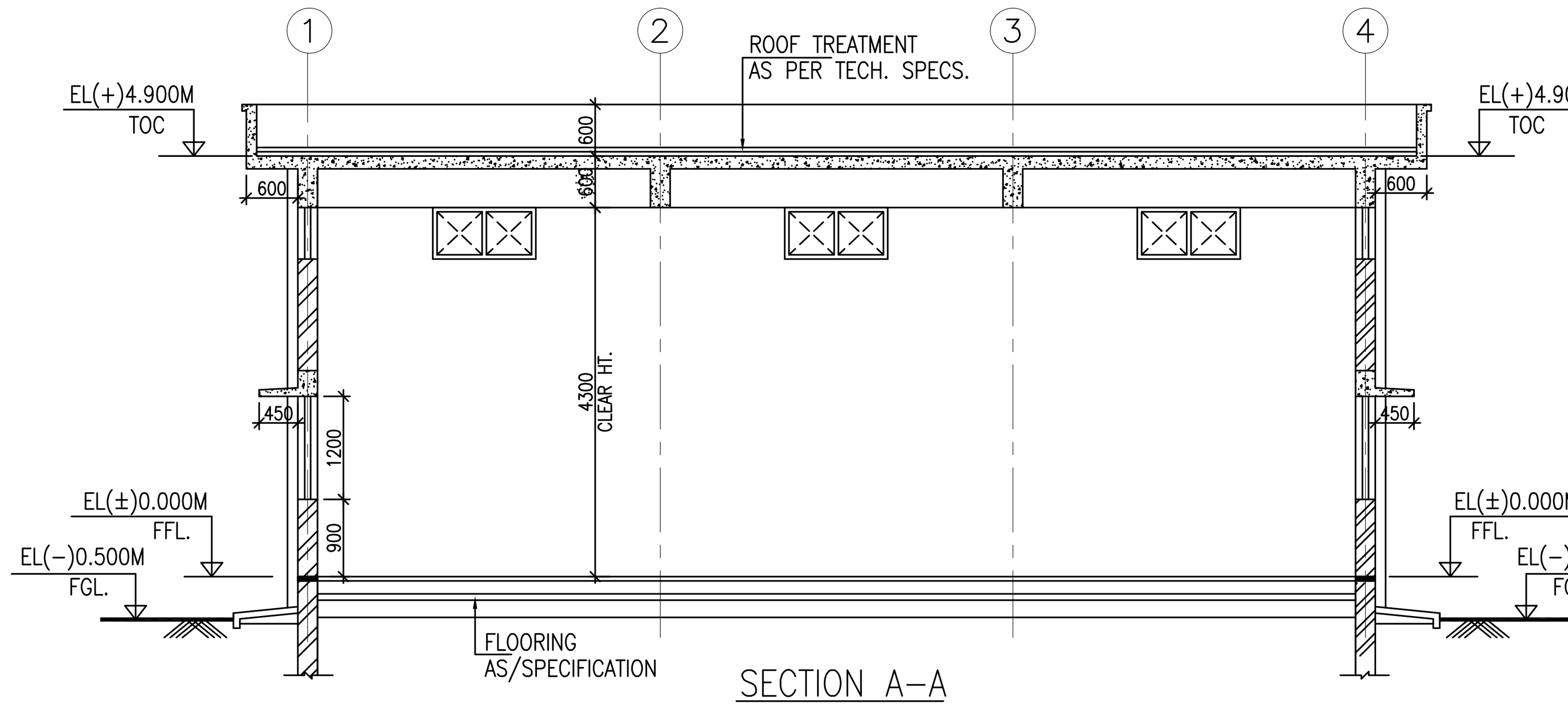
शीर्षक/TITLE: NEEMUCH S/S-CONTROL ROOM BUILDING EQUIPMENT LAYOUT

बीएचईएल ड्राइंग.क्र./BHEL DRAWING NO. TB-2-418-316-003 — पुनः/REV. 02

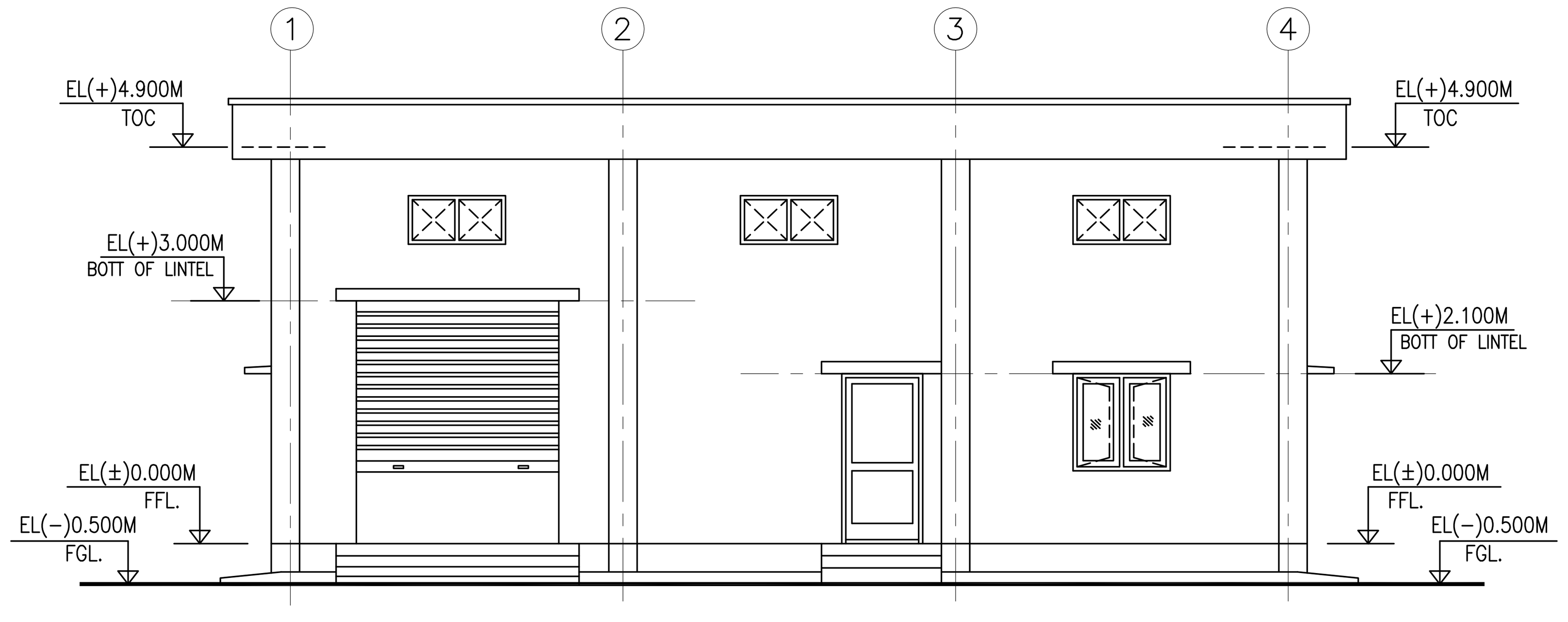
पृष्ठ क्र./SHEET No. 01 — अगला पृष्ठ/NEXT SHEET --

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

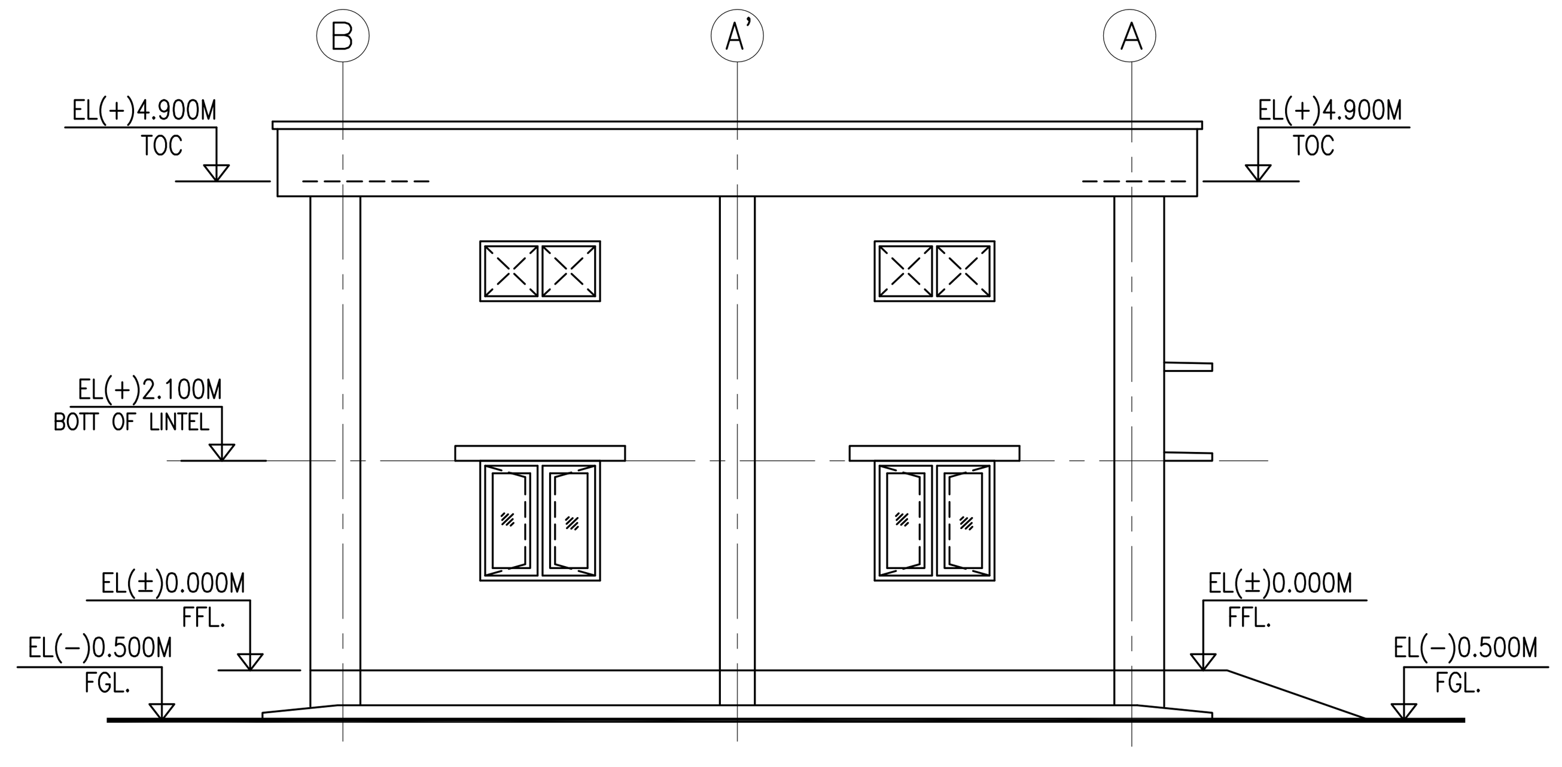
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)



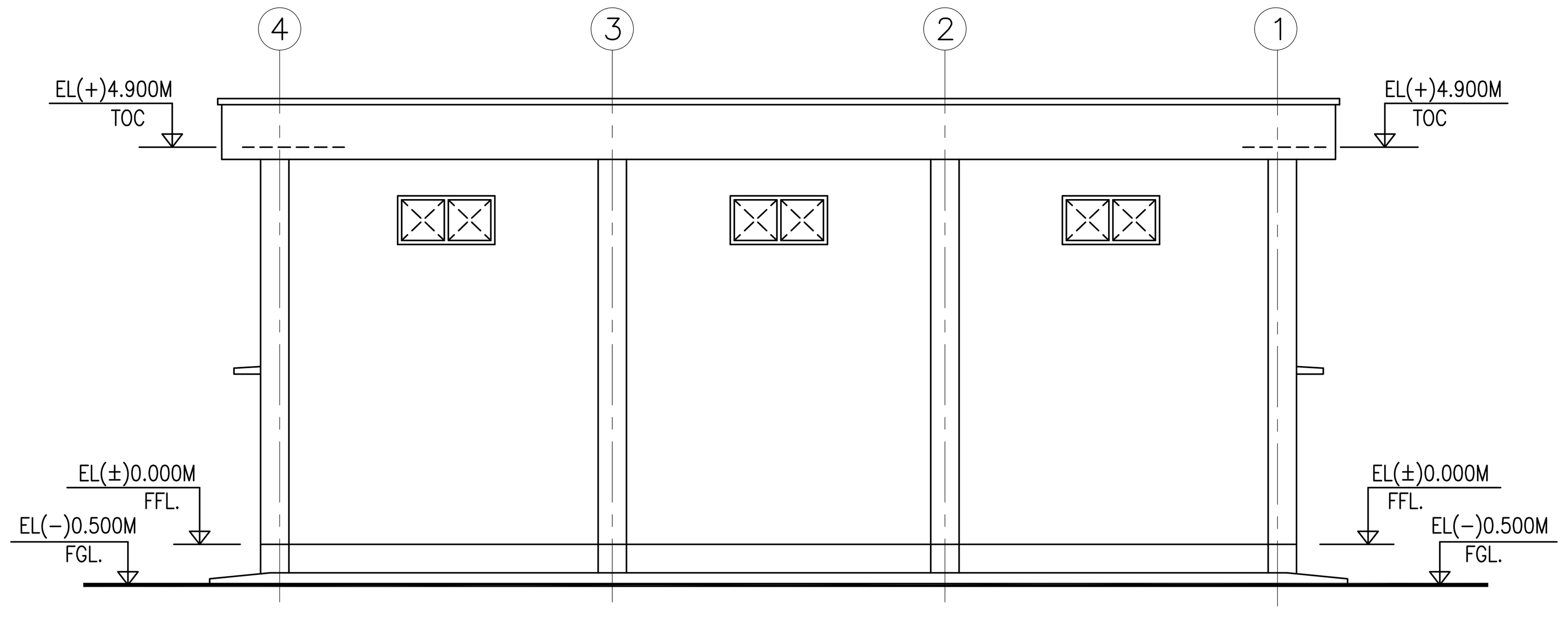
SECTION A-A



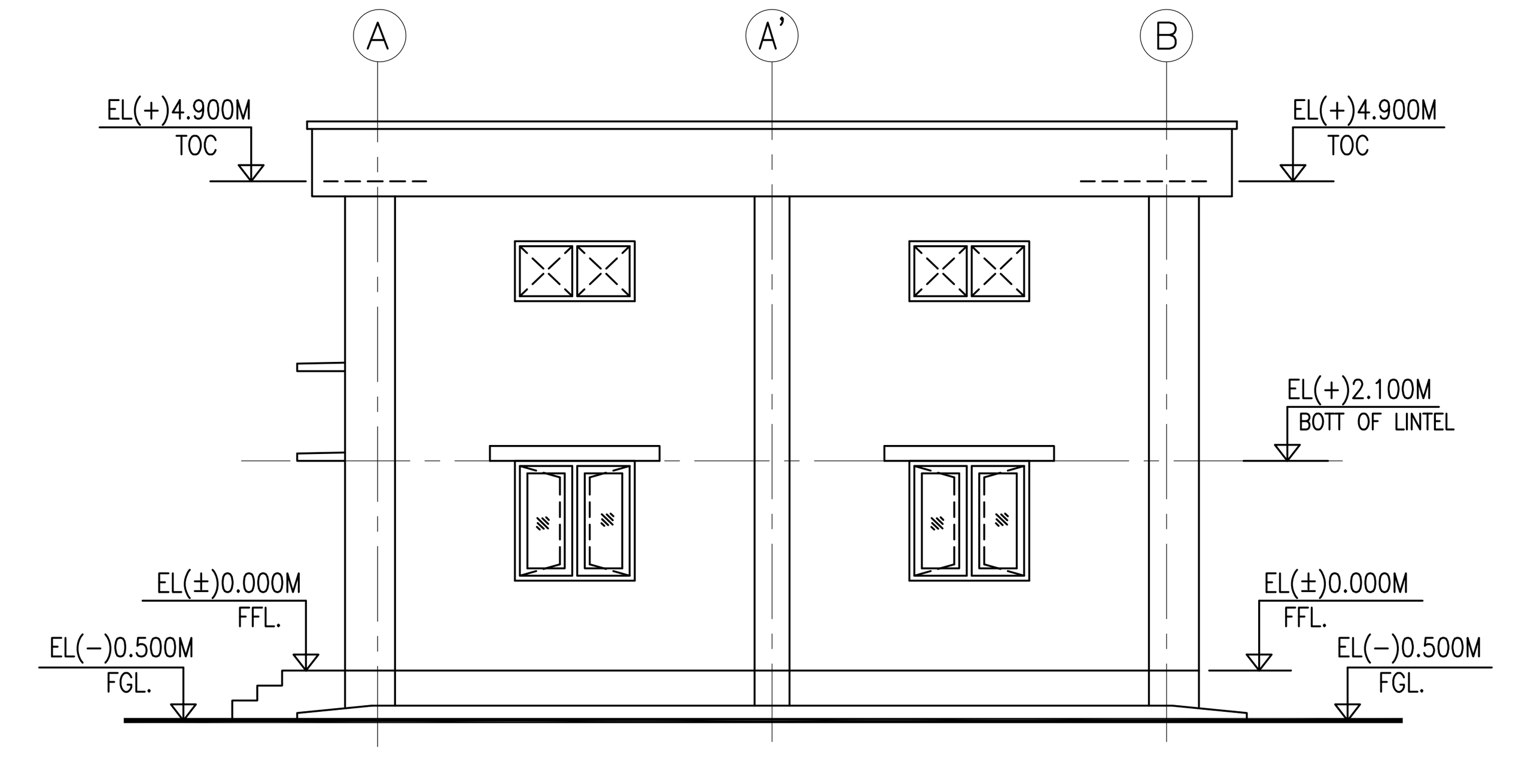
ELEVATION-1



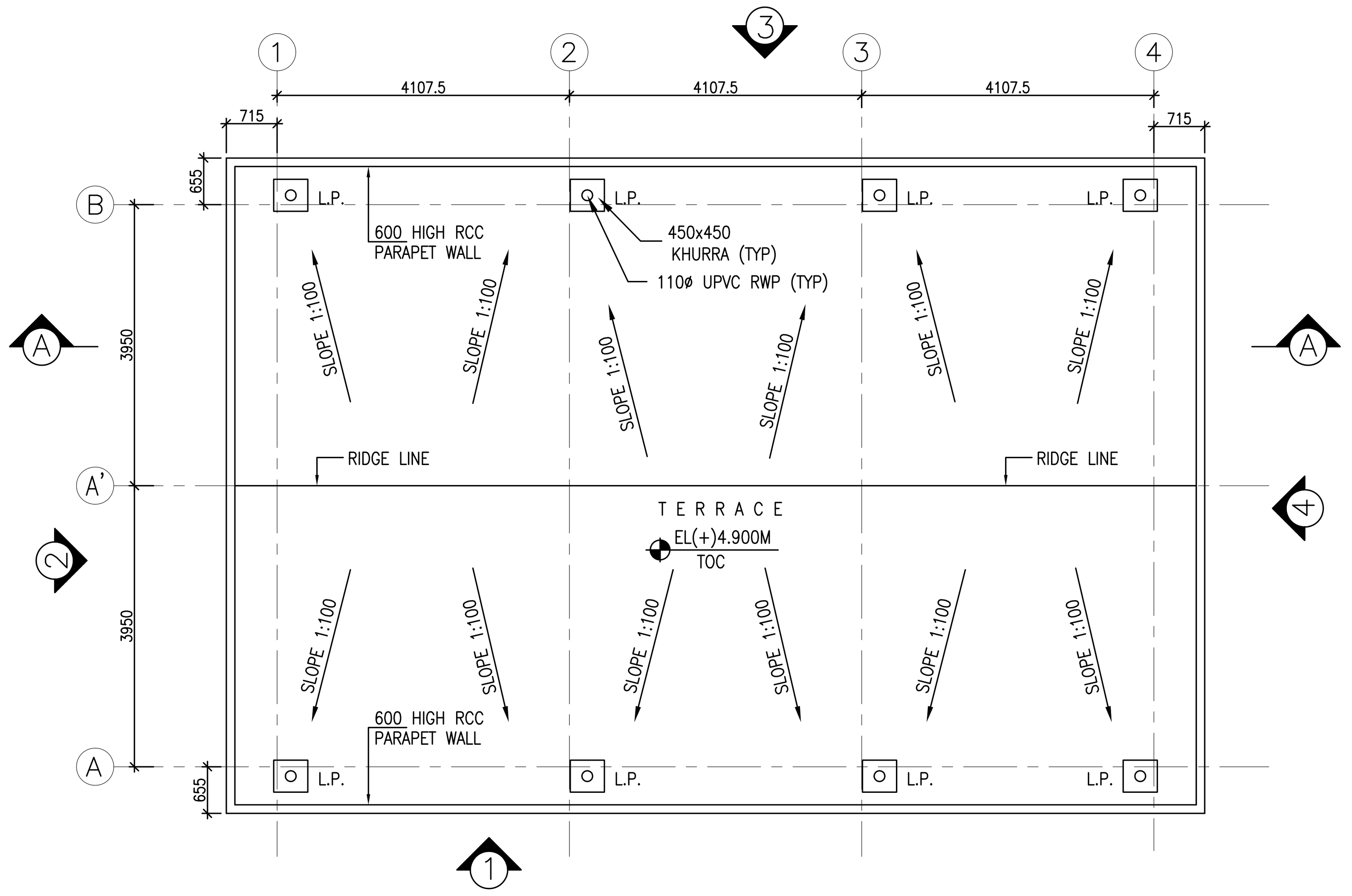
ELEVATION-2



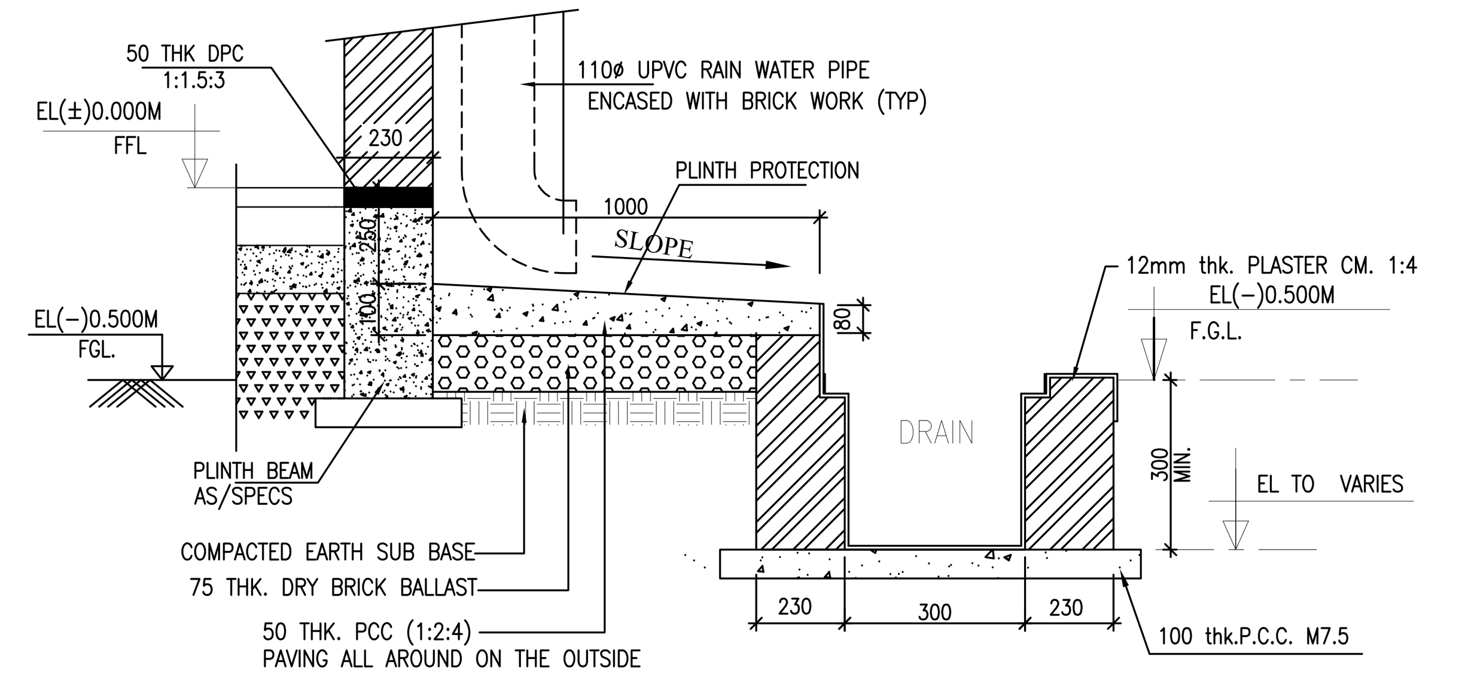
ELEVATION-3



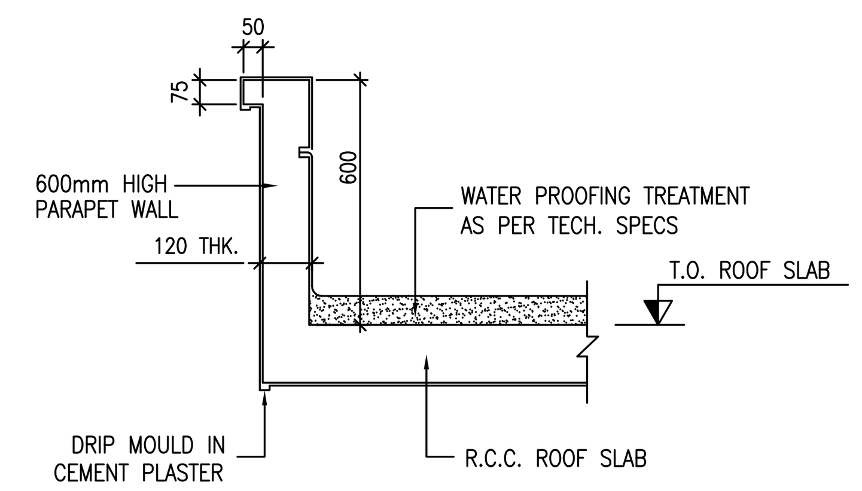
ELEVATION-4



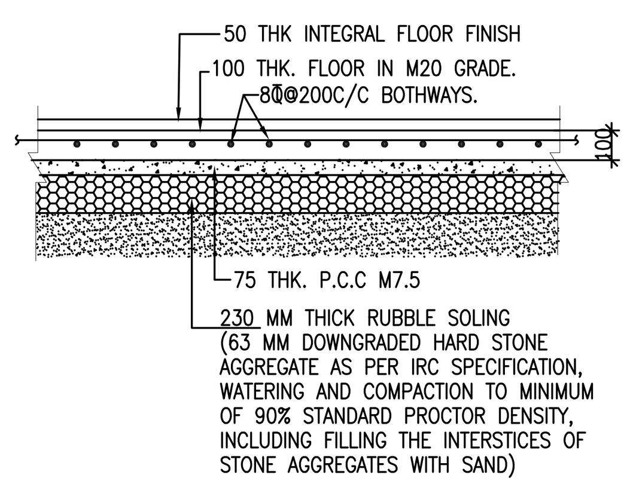
TERRACE PLAN



PLINTH PROTECTION ALONG BUILDING WITH DRAIN-TYPICAL



TYP. DETAIL OF PARAPET



DETAIL OF GRADE SLAB

SCHEDULE OF FINISHES

1.0 BRICK WORK:

1.1 230mm THK. BRICK MASONARY IN C.M. (1:6) USING FLY ASH BRICK/ (IS 12894).

2.0 PLASTER:

2.1 INTERNAL:
12mm THK. PLASTER (1:6 CEMENT : SAND) MORTOR

2.2 EXTERNAL:
18mm THK. SAND FACED
Ist COAT 12MM (1:5 CEMENT : SAND) MORTOR
IInd COAT 6MM (1:6 CEMENT : SAND) MORTOR

2.3 CEILING:
6mm THK. PLAIN PLASTER (1:3 CEMENT : SAND)

3.0 FLOORING:

3.1 PUMP HOUSE
62MM THICK CEMENT CONCRETE FLOORING WITH HARDENER.

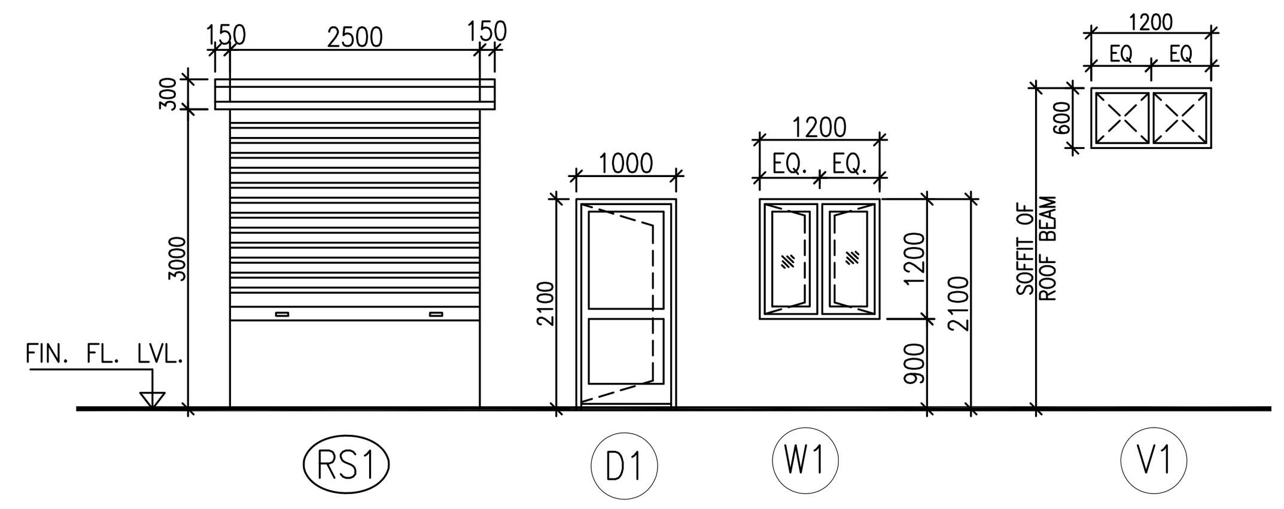
3.2 SKIRTING:
150 HIGH SKIRTING MATCHING WITH THE FLOOR.

4.0 PAINTING.

4.1 INSIDE FACES OF BRICK WALL WILL HAVE NON VOC ACRYLIC EMULSION PAINT.

4.2 OUTSIDE FACES OF WALL BE WATER PROOF EXTERNAL QUALITY ACRYLIC EMULSION PAINT.

4.3 CEILING TO HAVE NON VOC ACRYLIC EMULSION PAINT.



SCHEDULE OF DOORS & WINDOWS (AS PER TECHNICAL SPECIFICATION)

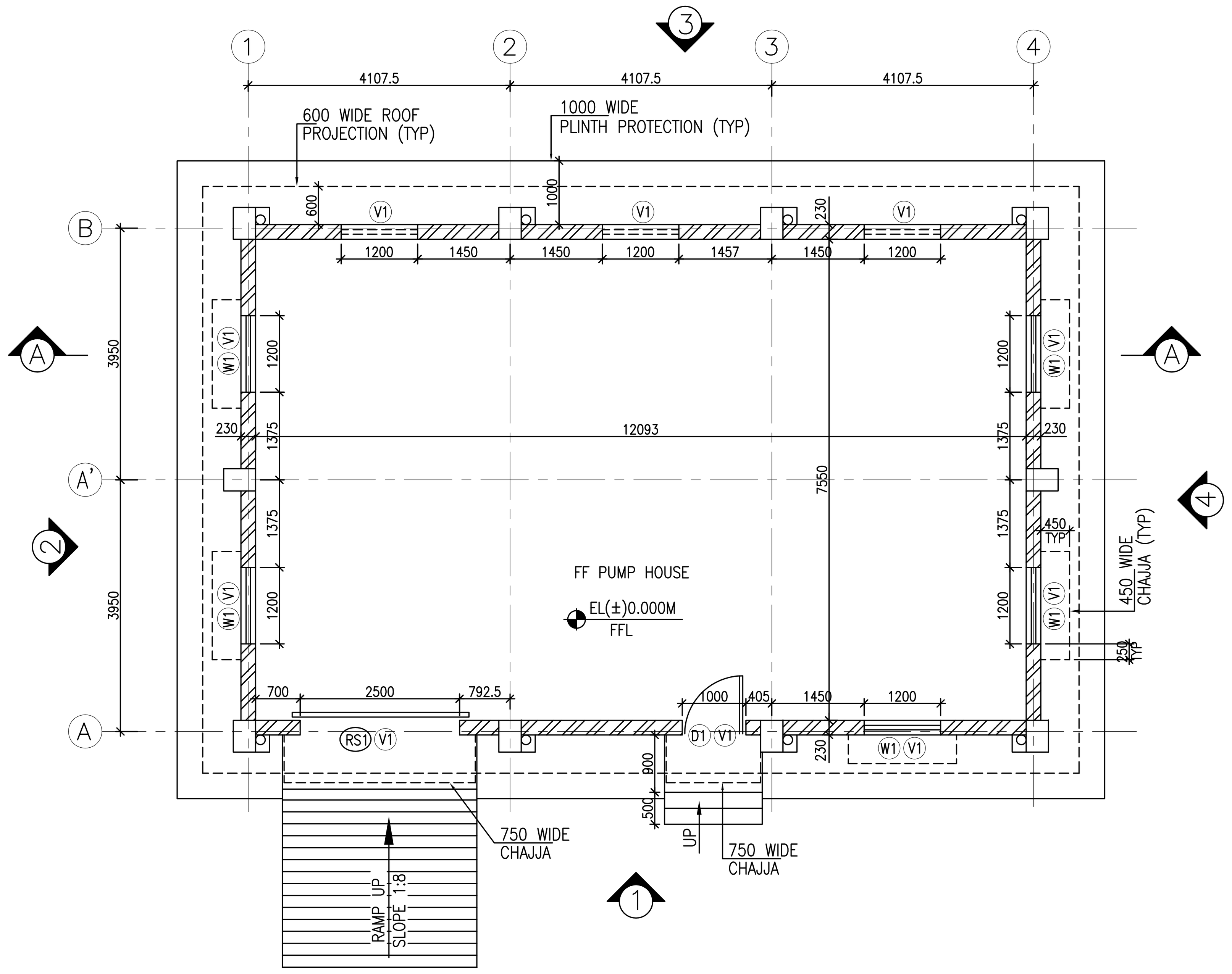
TYPE	OPENING SIZE	CILL LEVEL	LINTEL LEVEL	NOS.	DESCRIPTION
RS1	2500x3000	–	3000	1	STEEL ROLLING SHUTTER
D1	1000x2100	–	2100	1	SINGLE SHUTTER UPVC GLAZED DOOR AS PER SPECS.
W1	1200x1200	900	2100	5	ALUMINIUM FRAME 5.5MM THK. GLAZED SHUTTER OPENABLE WINDOW AS PER SPECS.
V1	1200x600	–	SOFFIT OF ROOF BEAM	10	FIXED GLAZED ALUMINIUM VENTILATOR 5.5MM THK. GLAZED SHUTTER WINDOW AS PER SPECS.

LEGEND:-

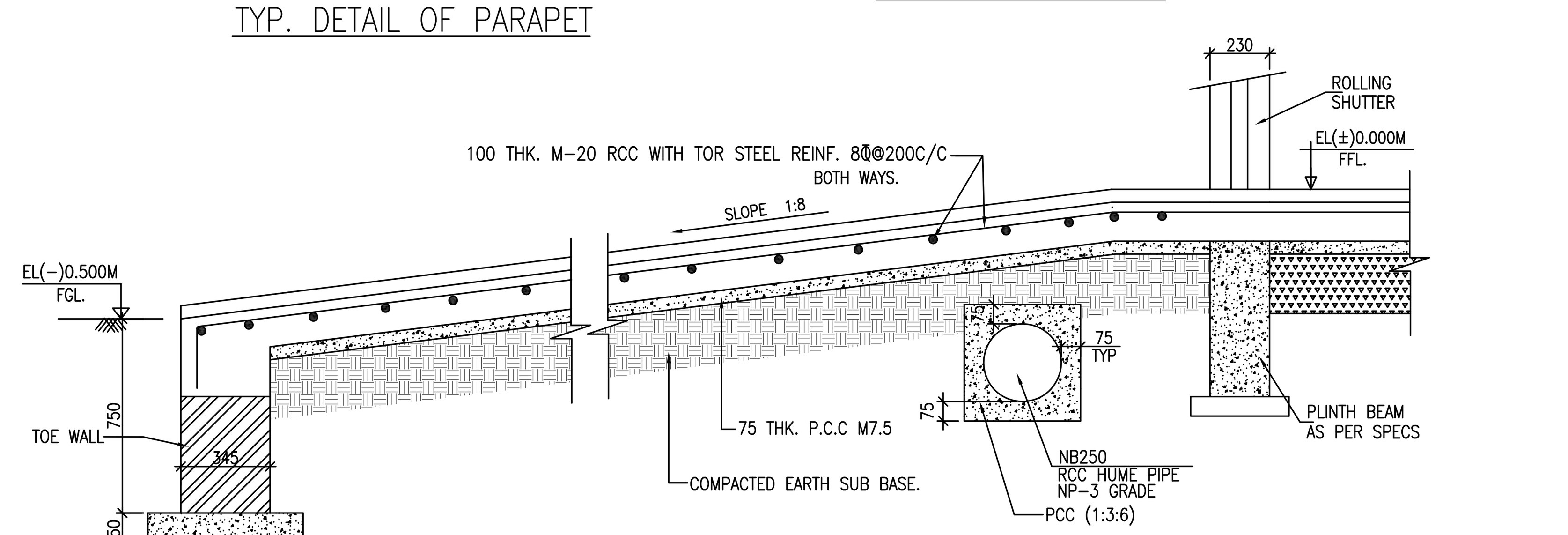
SIDE HUNG OPENABLE PANEL

FIXED GLASS PANEL

FFL. = FINISH FLOOR LEVEL
FGL. = FINISH GRADE LEVEL
H.P. = HIGH POINT
L.P. = LOWER POINT
E.F. = EXHAUST FAN
E.L. = ELEVATION LEVEL
T.O.C = TOP OF CONCRETE
N.T.S = NOT TO SCALE
TYP = TYPICAL



GROUND FLOOR PLAN



DETAIL OF RAMP

NOTES:-

1 ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.

2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.

3 ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.

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. 80014	xzkgd@ifj;kstuk dk uke / NAME OF CUSTOMER/PROJECT: POWER GRID CORPORATION OF INDIA LIMITED, NEEMUCH 400/220KV CONTROL ROOM BUILDING
STATUS OF DRAWING	
DISTRIBUTION OF PRINTS	Hkkjr gsoh bysfDVªdYl fyfeVsM / V~kalfe'ku ifj;kstuk foHkkx BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION

	uke/NAME	gLrk./SIGN.	fn./DATE
cuk;k DRAWN	TKR	TKR	06.01.23
tkapk CHECKED	SHOBHNA		
Lohdr APPROVED	ARUNA		

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE

foHkkx DEPT. | dksM CODE | vuqikr / SCALE 1:1 | dkMZ dksM CARD CODE

ikojfxzM M&zk.d-/POWERGRID DRAWING NO. TB202122-1001158-SS3250-CRB-EQPT-LAY

'kh"kZd/TITLE: NEEMUCH S/S-FIRE FIGHTING PUMP HOUSE-ARCHITECTURAL DRAWING

ch,pbZy M&zk.d-/BHEL DRAWING NO. TB-2-418-316-****

iqu#/REV. 00

i"B d-/SHEET No. 01 | vxyk i"B /NEXT SHEET --

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

F:\TEEKARAM\BHEL TBSM-TBG\NEEMACH\FIRE FIGHTING PUMP HOUSE BLDG\ARCH\ARCH FIRE FIGHTING PUMP HOUSE BUILDING NEEMUCH (R0-06-01-23).dwg

1290936/2023/TBG-TB_ENG_SR

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 464 00 01835

REF.DRG.NO.

SIGN.DATE

INVENTORY NO.

CUSTOMER'S REFERENCE DRAWING

1	NOTES & DETAILS OF OUTLINE GENERAL ARRGT. (SHT. NO. 1)	3 460 00 01835
2	ELEVATION OF OUTLINE GENERAL ARRGT. L.H.S. COOLER BANK (SHT. NO. 2)	3 460 00 01835
3	PLAN OF OUTLINE GENERAL ARRGT. L.H.S. COOLER BANK (SHT. NO. 3)	3 460 00 01835
4	END VIEW OF OUTLINE GENERAL ARRGT. L.H.S. COOLER BANK (SHT. NO. 4)	3 460 00 01835
5	ELEVATION OF OUTLINE GENERAL ARRGT. R.H.S. COOLER BANK (SHT. NO. 5)	3 460 00 01835
6	PLAN OF OUTLINE GENERAL ARRGT. R.H.S. COOLER BANK (SHT. NO. 6)	3 460 00 01835
7	END VIEW OF OUTLINE GENERAL ARRGT. R.H.S. COOLER BANK (SHT. NO. 7)	3 460 00 01835
8	O.G.A. PART LIST	3 460 00 01836

DESCRIPTION	APPROX. WT. IN KG.
CORE AND WINDING	215000
TANK AND FITTINGS	48500
BUSHING	3450
COOLER CONTROL CABINET & WIRING	650
COOLER BANK (INCLUDING CONSERVATORS, COOLER, HEADERS, HEADER SUPPORTS, PUMPS, FANS, FITTINGS & P/W ETC.	36000
OIL IN TRANSFORMER TANK	73100
OIL IN COOLER BANK, CONSERVATORS & PIPE WORK	13450
TOTAL WEIGHT INCLUDING OIL	388150
SHIPPING WT. OF TRANSFORMER (GAS FILLED)	262500
UNTANKING WEIGHT (UPPER TANK)	26000

HIGHEST VOLTAGE	AIR CLEARANCE (MIN.) mm		
		LINE TO EARTH	LINE TO LINE
420 KV	H.V.	2600	3600
245 KV	I.V.	1700	2300
52 KV	L.V.	480	480
36 KV	HVN.	320	-

APPROXIMATE OIL CAPACITIES	LITRES
OIL AND TANK INCLUDING TURRETS & OLTC	84020
OIL IN COOLER BANK, CONSERVATORS & PIPE WORK	15480
TOTAL OIL	99500

List of inspection cover

S.no.	Location	Type	Inside Dimension (mm xmm)	Weight (in kg)	Quantity
1	HV Wall	Elliptical	620 X 320	29	3
			420 X 320	21	1
2	IV Wall	Elliptical	620 X 320	29	1
			780 X 450	43	2
3	Tank Cover	Round	610 Dia	41	2
4	Tertiary Pocket	Elliptical	420 X 320	21	3

Note: Accessories provided for each Substation shall be such that it shall be suitable to place cooler bank in either side.

NOTES :-

1. WHEN REFERRING THE O.G.A. DRG. PLEASE QUOTE MVA & W.O. NO.
2. DIMENSIONS SHOWN THUS ▭ ARE OVERALL SHIPPING DIMENSION.
3. WIRING FROM INSTRUMENTS, C.T'S ETC. NOT SHOWN FOR CLARITY.
4. JACK POINTS ARE FOR UNLOADING FROM WAGON.
5. PAINTING AT OUTSIDE TANK, COOLER CONTROL CABINET SHALL BE RAL: 7035. PAINTING SHALL BE AS PER POWERGRID TECHANICAL SPECIFICATION..
6. THE DESIGN FEATURES SHOWN ON THIS DRAWING (GENERALLY IN LINE WITH IEC:60076 & AGREED CUSTOMER SPECIFICATION) MEETS THE STATUTORY, REGULATORY & SAFETY REQUIREMENTS WITH RESPECT TO EARTHING ARRANGEMENT, DANGER AND OTHER LABELS. AND ANTI EARTH QUAKE CLAMPING ARRANGEMENT.
7. ALL HEIGHT WISE DIMENSIONS ARE GIVEN FROM RAIL LEVEL.
8. WEIGHT & OIL QUANTITIES ARE TENTATIVE.
9. WHEREVER TOLERANCE NOT MENTIONED TO BE CONSIDERED ±3%.
10. CANOPY SHALL BE PROVIDED FOR BUCHHOLZ RELAY, PRD, SPR AND MOG.
11. BUSHING RELATED DIMENSION MAY VARY WITH THE MAKE OF HV,IV AND LV BUSHING. HOWEVER MINIMUM CLEARANCES AS INDICATED SHALL BE MAINTAINED.
12.. THE POSITION OF PAD FOR SENSORS FOR NIFS Ie. ITEM 25c HAVE BEEN INDICATED IN GA DRG. POWERGRID TO KINDLY REVIEW & APPROVE THE SAME.
13. GASKET MATERIAL SHALL BE NITRILE RUBBER.

REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.	TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT	TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER	M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION
W.O.- 62207-A-512-01
STATUS OF DRAWING "PR"
DISTRIBUTION OF PRINTS
TRE-1, TRM-3

भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	-----	COMP.SCALE-1:1

TITLE: **OUTLINE GENERAL ARRANGEMENT NOTES & DETAIL**

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22

DRG. NO. 3 464 00 01835 REV. 00
SHEET 01 OF 07

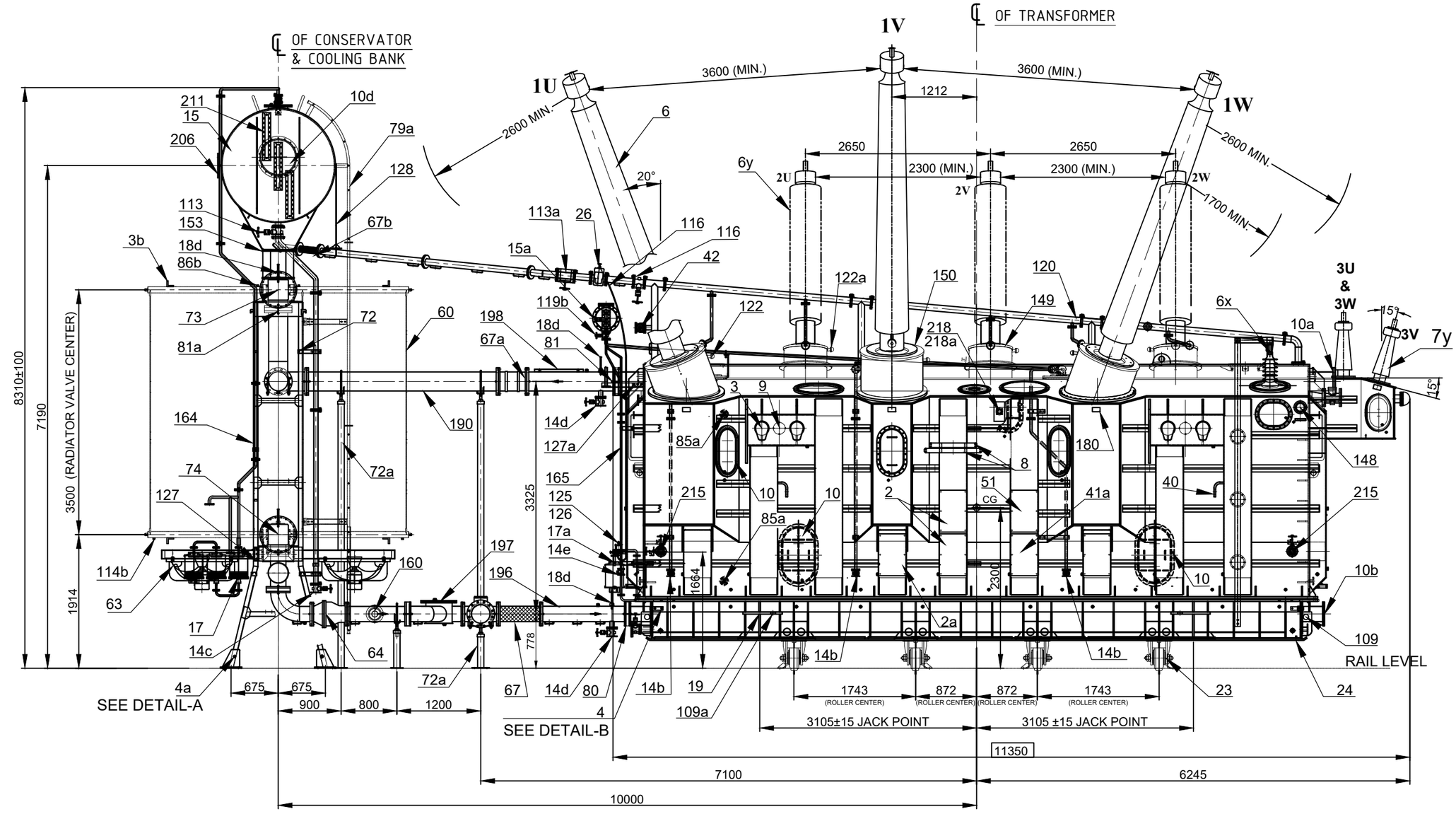
Rakesh

1290936/2023/TBG-TB_ENG_SR

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 464 00 01835



REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.	TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT	TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER	M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION	
W.O.- 62207-A-512-01	
STATUS OF DRAWING	"PR"
DISTRIBUTION OF PRINTS	TRE-1, TRM-3

भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	-----	COMP.SCALE-1:1

TITLE **OUTLINE GENERAL ARRANGEMENT PLAN VIEW (L.H.S)**

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22

DRG. NO. 3 464 00 01835 REV. 00

SHEET 02 OF 07

Rakesh

1290936/2023/TBG-TB_ENG_SR

FIRST ANGLE PROJECTION

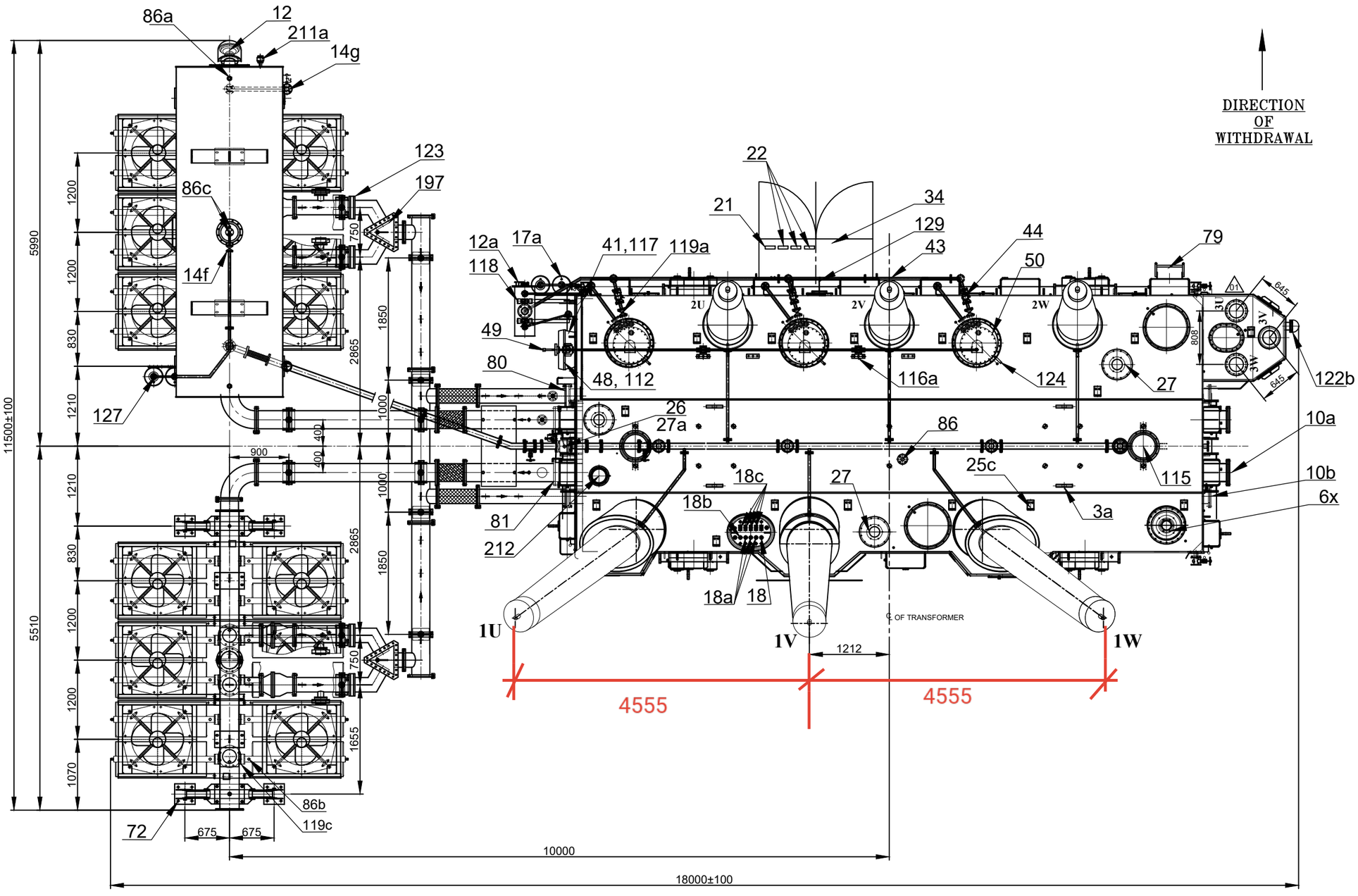
(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 464 00 01835

REF.DRG.NO.

SIGN.DATE

INVENTORY NO.



REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.	TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT	TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER	M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION	
W.O.- 62207-A-512-01	
STATUS OF DRAWING	"PR"
DISTRIBUTION OF PRINTS	TRE-1, TRM-3

भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	- - - - -	COMP.SCALE-1:1

TITLE **OUTLINE GENERAL ARRANGEMENT PLAN VIEW (L.H.S)**

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22

DRG. NO. 3 464 00 01835 REV. 00

SHEET 03 OF 07

Rakesh

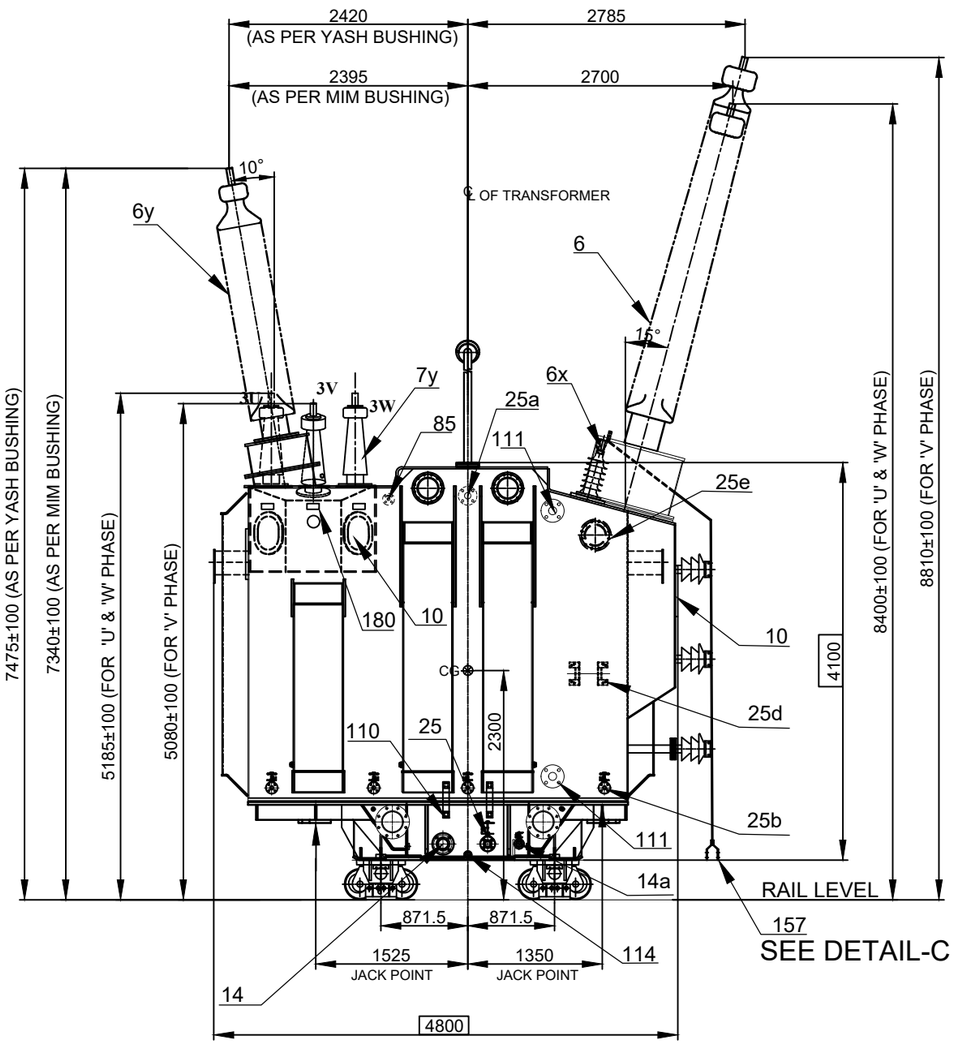
1290936/2023/TBG-TB_ENG_SR

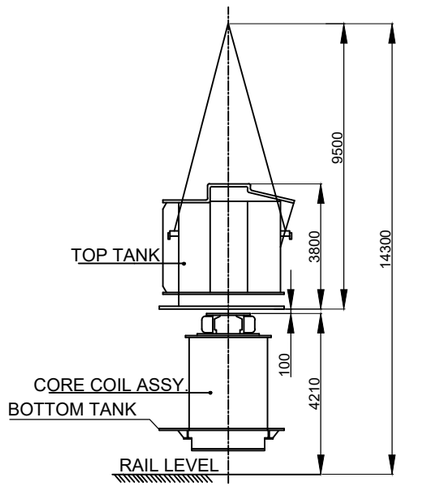
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

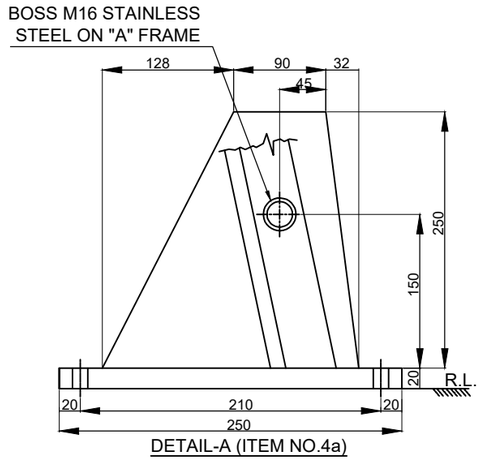
DRG. NO. 3 464 00 01835

INVENTORY NO. | SIGN.DATE | REF.DRG.NO.

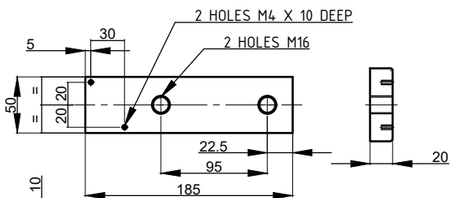




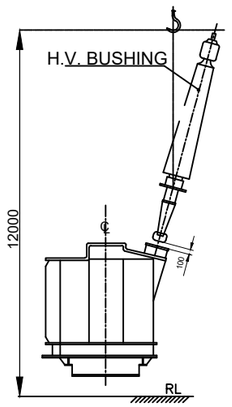
UNTANKING
UNTANKING WEIGHT 26 TONNES (APPROX.)



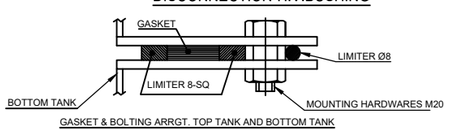
DETAIL-A (ITEM NO.4a)



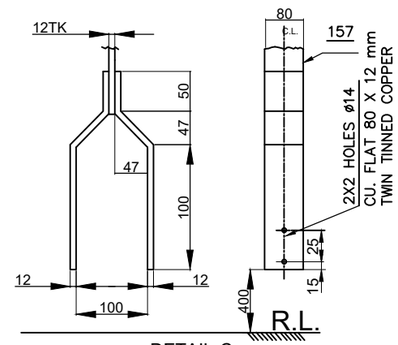
DETAIL- B
EARTHING ARRGT. ON TANK
(SUITABLE FOR CONNECTION
TO 75 X 12 mm M.S. FLAT)



DISCONNECTION-H.V.BUSHING



GASKET & BOLTING ARRGT. TOP TANK AND BOTTOM TANK



DETAIL-C
NEUTRAL GROUNDING ARRGT.

REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.	TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT	TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER	M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION	भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल				
W.O.- 62207-A-512-01	BHARAT HEAVY ELECTRICALS LTD. BHOPAL				
STATUS OF DRAWING "PR"	DEPT	CODE	WEIGHT(kg)	SCALE	
DISTRIBUTION OF PRINTS	TRE	406	- - - - -	COMP.SCALE-1:1	
TRE-1, TRM-3	TITLE OUTLINE GENERAL ARRANGEMENT END VIEW (L.H.S)				

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22
DRG. NO.	3 464 00 01835		REV. 00
SHEET	04 OF 07		

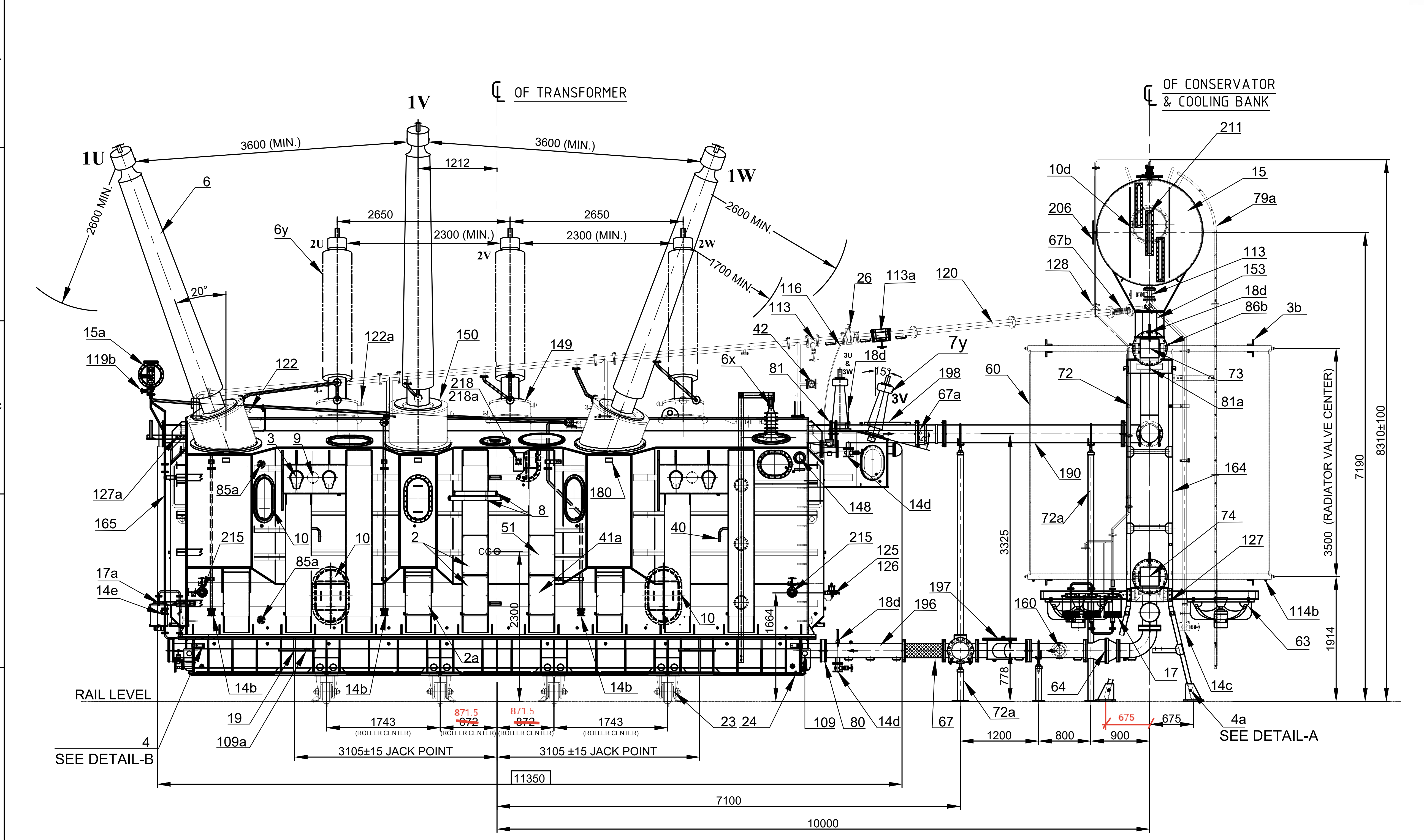
401 | 402 | 403 | 404 | 405 | 406 | 407 | 408

Rakesh

1290936/2023/TBG-TB_ENG_SR

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)



REF.DRG.NO. | SIGN.DATE | INVENTORY NO.

REV	DATE	ALT.	REV	DATE	ALT.
		CKD.			CKD.
		APPD.			APPD.
ZONE			ZONE		

TYPE OF PRODUCT	500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.	TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT	TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER	M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION
W.O.- 62207-A-512-01
STATUS OF DRAWING "PR"
DISTRIBUTION OF PRINTS
TRE-1, TRM-3

भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	-----	COMP.SCALE-1:1

TITLE **OUTLINE GENERAL ARRANGEMENT ELEVATION VIEW (R.H.S)**

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22

DRG. NO. 3 464 00 01835 REV. 00
SHEET 05 OF 07

501 502 503 504 505 506 507 508

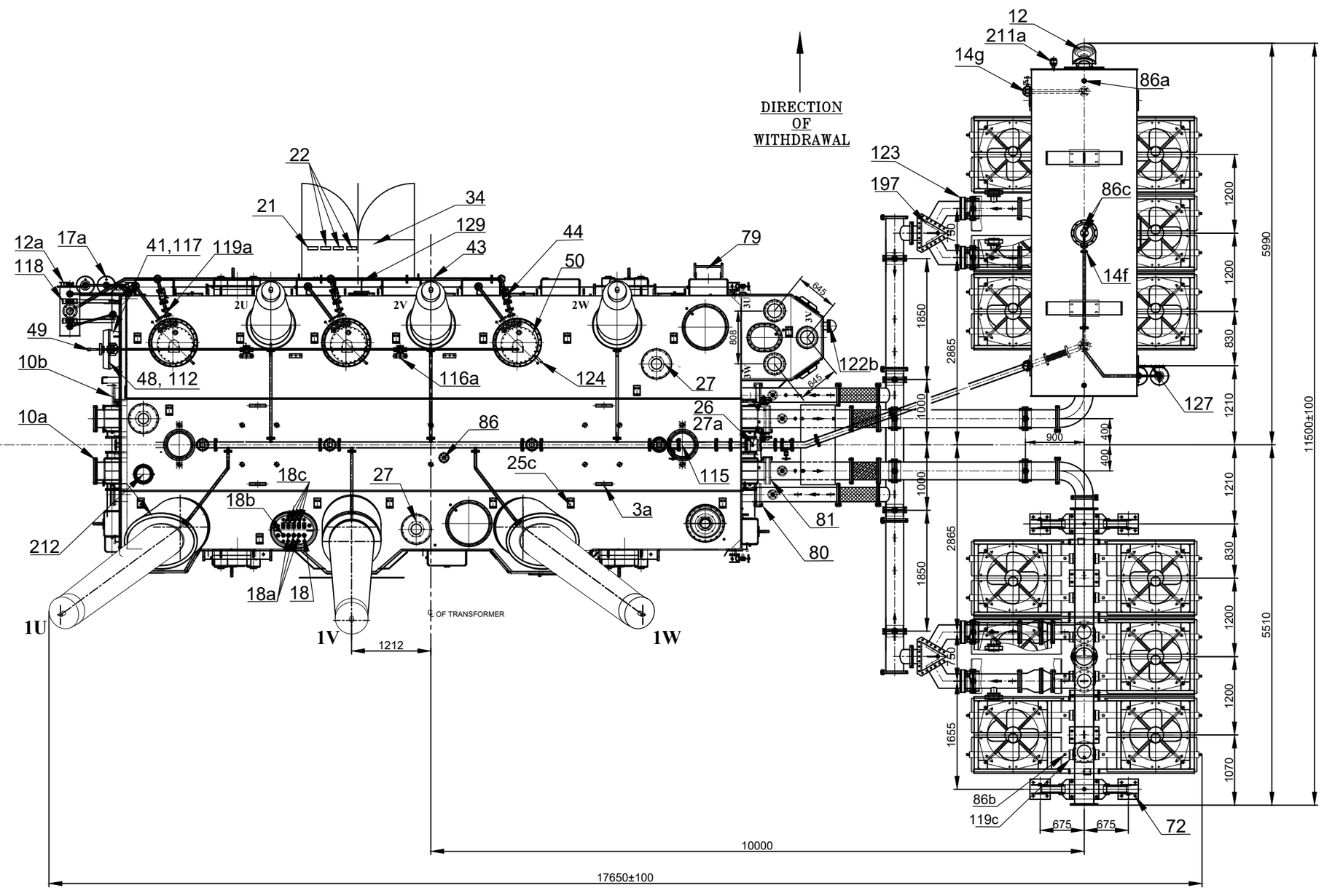
Rakesh

1290936/2023/TBG-TB_ENG_SR

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 460 00 01835



REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.	TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT	TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER	M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION	
W.O.- 62207-A-512-01	
STATUS OF DRAWING	"PR"
DISTRIBUTION OF PRINTS	
TRE-1, TRM-3	

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BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	- - - - -	COMP.SCALE-1:1

TITLE: **OUTLINE GENERAL ARRANGEMENT PLAN VIEW (R.H.S)**

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22

DRG. NO. 3 460 00 01835 REV. 00

SHEET 06 OF 07

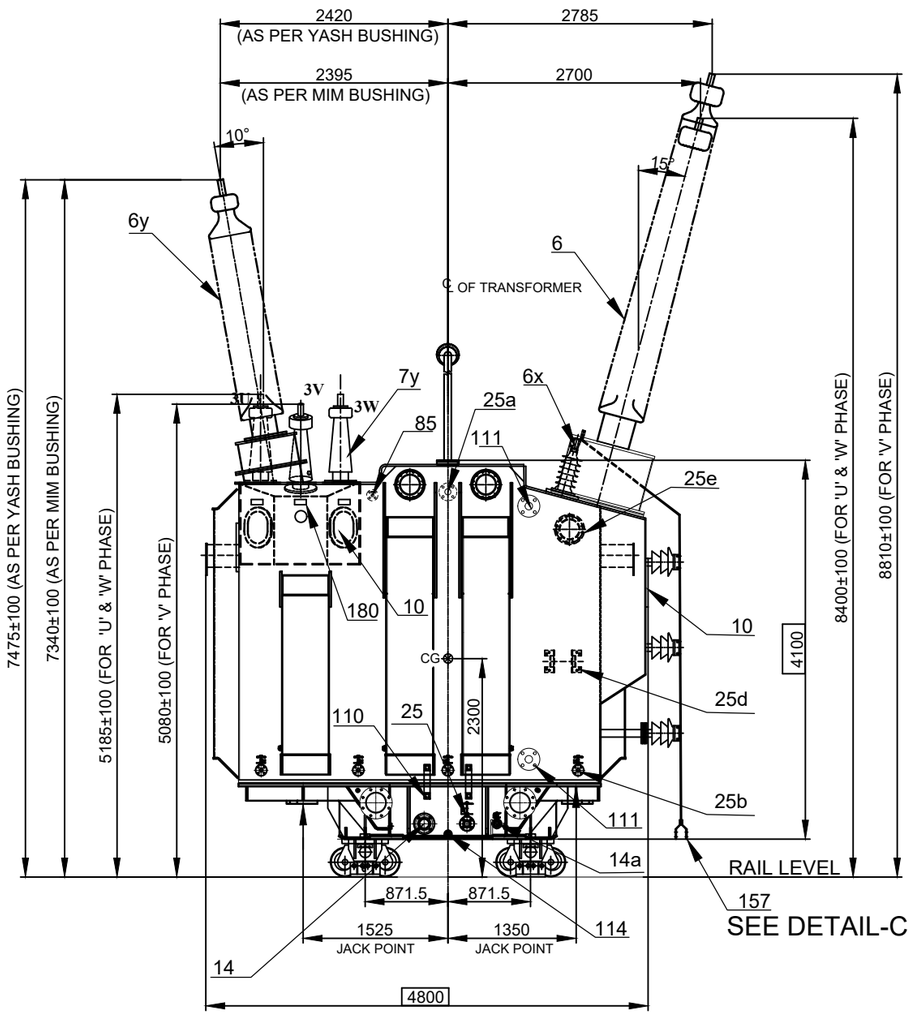
Rakesh

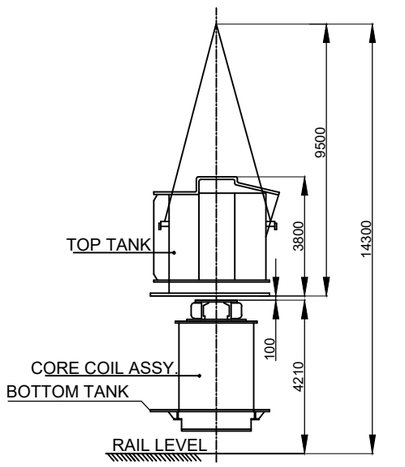
1290936/2023/TBG-TB_ENG_SR

FIRST ANGLE PROJECTION

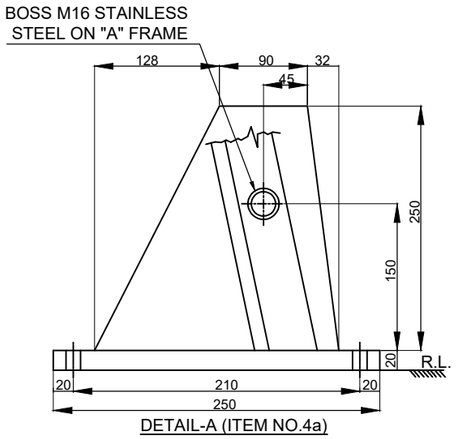
(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 460 00 01835

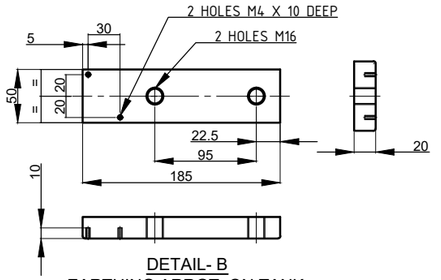




UNTANKING
UNTANKING WEIGHT 26 TONNES (APPROX.)

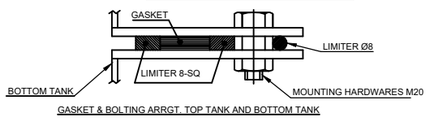


DETAIL-A (ITEM NO.4a)

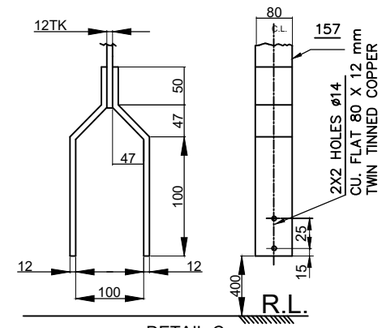


DETAIL- B
EARTHING ARRGT. ON TANK
(SUITABLE FOR CONNECTION
TO 75 X 12 mm M.S. FLAT)

DISCONNECTION-H.V.BUSHING



GASKET & BOLTING ARRGT. TOP TANK AND BOTTOM TANK



DETAIL-C
NEUTRAL GROUNDING ARRGT.

REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.	TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT	TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER	M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION	
W.O.- 62207-A-512-01	
STATUS OF DRAWING	"PR"
DISTRIBUTION OF PRINTS	
TRE-1, TRM-3	

भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	-----	COMP.SCALE-1:1

TITLE: OUTLINE GENERAL ARRANGEMENT
END VIEW (R.H.S)

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22

DRG. NO. 3 460 00 01835 REV. 00

SHEET 07 OF 07

Rakesh

FIRST ANGLE PROJECTION

DRG. NO. 3 464 00 0183 96

TRANSFORMER

IT.NO.	DESCRIPTION	QTY.	ZONE L.H.S	ZONE R.H.S
2	RATING AND DIAGRAM PLATE (BILINGUAL) (2 PLATES)	1	205-D	503-D
2a	OIL FILLING INSTRUCTION PLATE	1	206-D	503-D
3	LIFTING BOLLARD (FOR TRANSFORMER WITH OIL) Ø 200	8	205-C	502-C
3a	LIFTING LUG FOR TANK (HOLE Ø 70)	4	307-D	604-D
4	EARTHING TERMINALS WITH BOLTS, NUTS, PLAIN WASHERS, SPRING WASHER (M16)	2	204-E	501-E
8	NAME PLATE (HINDI & ENGLISH) ONE EACH	2	206-D	504-D
9	INSTRUCTION PLATE FOR LIFTING	4	205-C	502-C
10	INSPECTION COVER ON COVER/TANK WALL	13	207-D	502-D
10a	BLANKING PLATES ON TOP TANK FOR BLANKING OF 250 NB PIPE FLANGE OPPOSITE TO COOLING BANK (NOT IN USE)	2	308-C	601-C
10b	BLANKING PLATES ON BOTTOM TANK FOR BLANKING OF 200 NB PIPE FLANGE OPPOSITE TO COOLING BANK (NOT IN USE)	2	308-C	601-C
14	DRAIN GATE VALVE FOR TOTAL DRAINAGE 100NB	1	402-E	702-E
14a	OIL SAMPLING GLOBE VALVE 2 IN SERIES 15NB WITH PROVISION FOR FIXING RUBBER HOSE OF 10mm SIZE FOR SAMPLING AT BOTTOM	2	403-E	703-E
18	POCKET FOR OIL TEMPERATURE INDICATOR	1	305-D	603-D
18a	POCKET FOR WINDING TEMPERATURE INDICATOR + SPARES	3+2	305-D	603-D
18b	ORDINARY THERMOMETER WITH POCKET	1	305-D	602-C
18c	R.T.D. FOR REMOTE INDICATION (3 FOR WTI +1 FOR OTI)	4	305-C	603-C
19	JACKING PADS (SUITABLE FOR TOTAL WT. WITH OIL)	4	204-E	502-E
21	OIL TEMPERATURE INDIACATOR (150mm DIAL TYPE) MOUNTED IN C.C.C	1	305-B	603-B
22	WINDING TEMPERATURE INDICATOR MOUNTED IN C.C.C	3	305-B	603-B
23	TWIN BI DIRECTIONAL ROLLERS Ø 320 WITH ANTI EARTHQUAKE CLAMP	8	207-E	505-E
24	SKIDS (FOR PULLING IN BOTH DIRECTION WELDED ON BOTTOM TANK BASE)	1	208-E	505-E
25	FILTER GATE VALVE BOTTOM 50NB	2	402-D	702-D
25a	FILTER GATE VALVE WITH SAMPLING ATTACHMENT TOP 50NB	2	403-C	703-C
25b	PAD FOR 25NB GATE VALVE FOR NITROGEN INJECTION F.P.S. (GUN METAL)	8	404-D	704-D
25c	BRACKET FOR MOUNTING OF SENSOR FOR NITROGEN INJECTION F.P.S.	17	306-C	604-C
25d	BRACKET FOR SIGNAL BOX OF NITROGEN INJECTION F.P.S.	1	404-D	704-D
25e	125 NB DRAIN GATE VALVE FOR NITROGEN INJECTION F.P.S. (CAST IRON)	1	403-C	704-C
27	PRESSURE RELIEF VALVE AUTO RECLOSING TYPE WITH PROVISION FOR DISCHARGE OF OIL & ITS PIPE WORK	3	307-C	603-C
34	COOLER CONTROL CABINET	1	306-B	604-B
40	WAGON ANCHORING LUGS (HOLE DIA 70)	4	207-D	504-D
41a	DO'S & DONT'S INSTRUCTION PLATE	1	206-D	504-D
51	VALVE SCHEDULE PLATE	1	206-D	503-D
79	LADDER WITH LOCKING DEVICE TO PREVENT CLIMBING	1	307-B	605-B
80	OIL INLET BUTTERFLY VALVE Ø 200 (BOTTOM)	2	204-E	505-E
81	OIL OUTLET BUTTERFLY VALVE Ø 250 (TOP)	2	204-C	505-C
85	15 NB GLOBE VALVE 2 IN SERIES FOR TANK TOP WITH PROVISION FOR FIXING RUBBER HOSE OF 10mm SIZE FOR SAMPLING	2	402-C	702-C
85a	15 NB GLOBE VALVE TOP & BOTTOM FOR ONLINE MOISTURE REMOVAL SYSTEM	2	205-D	502-C
86	AIR RELEASE PLUG 1/2" (B.S.P.)	1	306-C	604-C
109	HAULAGE LUG LONGITUDINAL Ø 50	4	208-E	505-E
109a	HAULAGE LUG TRANSVERSAL Ø 50	4	204-E	502-E
110	TOP TANK-BOTTOM TANK SHORTING LINK	2	402-D	702-D
111	50 NB GATE VALVE FOR ONLINE DGA(TOP AND BOTTOM)	2	403-D	703-D
114	DRAIN PLUG FOR BOTTOM TANK (1" B.S.P.)	2	403-E	703-E
115	HOLE FOR CLAMPING CORE & COIL TO TOP TANK (Ø 480)	2	307-C	605-C
126	SUPPORT FOR GAS COLLECTING DEVICE	1	204-D	505-D
127a	SUPPORT FOR AUX CONSERVATOR BREATHER ASSY ON TANK	1	204-C	501-C
129	SUPPORT FOR 25 NB. PIPE (AUX. CONSERVATOR P/W)	2	306-B	604-B
212	EARTHING CONNECTION (CORE & END FRAME TO TANK)	1	304-D	601-D
215	UHF GATE VALVE 50 NB ON TANK WALL(2 ON IV+2 ON HV SIDE)	4	204-D	502-D
218	SUDDEN PRESSURE RELAY	1	206-C	503-C
218a	40 NB GATE VALVE FOR SUDDEN PRESSURE RELAY	1	206-C	503-C

NAME OF CUSTOMER	M/S. POWER GRID CORPORATION OF INDIA LTD	TYPE OF PRODUCT	500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PROJECT	TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW	PO NO.	TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08. DATED 19/05/2022
DISTRIBUTION OF PRINTS	TRE-1, TRM-3	STATUS OF DRAWING	"PR"
TITLE	OGA PART LIST	W.O.- 62207-A-512-01	ADDITIONAL INFORMATION

भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE		NAME	SIGN	DATE
TRE	406	-----	COMP: SCALE-1:1	DRN.	RAKESH		26.08.22
				CHD.	GK		26.08.22
				APPD.	LK/CM		26.08.22
				DRG. NO.	3 464 00 01836		REV. 00
				SHEET	01 OF 03		

(ALL DIMENSIONS ARE IN mm)

FIRST ANGLE PROJECTION

DRG. NO. 3 464 00 01836

CONSERVATOR & ITS PIPE WORK

IT.NO.	DESCRIPTION	QTY.	ZONE L.H.S	ZONE R.H.S
10d	INSPECTION COVER FOR CONSERVATOR BOLTED (SIZE Ø 490)	1	203-B	506-B
12	OIL GAUGE MAGNETIC TYPE WITH LOLA	1	302-A	606-A
12a	OIL GAUGE MAGNETIC TYPE WITH LOLA FOR AUX. CONS.	1	304-B	601-B
14c	DRAIN GATE VALVE 50 DIA. MAIN CONSERVATOR	1	202-E	507-E
14e	DRAIN VALVE 15 N.B. AUX. CONSERVATOR	1	204-D	502-D
14f	15 NB GATE VALVE FOR BREATHER PIPE WORK	1	302-B	607-B
14g	25 NB GATE VALVE FOR MAIN CONSERVATOR	1	303-A	606-A
15	OIL CONSERVATOR (ATMOSEAL TYPE) WITH AIR CELL & PRISMATIC OIL GAUGE	1	202-B	507-B
15a	AUX. CONSERVATOR 300 DIA WITH PRISMATIC OIL GAUGE FOR OLTC	1	203-B	501-C
17	DEHYDRATING SILICAGEL BREATHER FOR MAIN CONSERVATOR (3 NOS.)	1	202-E	507-E
17a	DEHYDRATING SILICAGEL BREATHER FOR AUX. CONS. IN SERIES (2 NOS)	1	204-D	501-D
26	BUCHHOLZ RELAY 80 DIA.	1	204-B	505-B
27a	RAINHOOD FOR MOG,SPR & BUCHHOLZ RELAY	3	304-C	605-E
42	50 NB GATE VALVE FOR VACUUM PULLING	1	204-B	504-B
67b	FLEXIBLE HOSE (80 NB)	1	203-B	506-B
79a	LADDER FOR MAIN CONSERVATOR	1	203-B	506-B
86a	AIR RELEASE PLUG 3/4" BSP FOR MAIN CONSERVATOR,	2	302-A	607-A
86c	AIR RELEASE PLUG 1/4" BSP FOR MAIN CONSERVATOR,	2	302-B	607-B
113	ISOLATING GATE VALVE FOR BUCHHOLZ RELAY 80 NB	2	202-B	507-B
113a	FLOW SENSITIVE VALVE 80 NB	1	204-B	506-B
116	BUCHHOLZ GAS RELEASE DEVICE PIPE (COPPER TUBE 6-0/D , 4-I/D)	1 SET	204-B	505-B
120	MAIN CONSERVATOR PIPE 80 NB	2	206-C	502-B
125	GAS COLLECTING DEVICE WITH PIPE	1	204-D	505-D
128	SUPPORT FOR CONSERVATOR P/W ON CONSERVATOR	1	203-B	505-D
153	CONSERVATOR SUPPORT	2	202-B	507-B
164	BREATHER PIPE FOR MAIN CONSERVATOR (25 NB)	1	202-C	507-C
165	BREATHER PIPE FOR AUX. CONSERVATOR (15 NB)	1	204-D	501-C
206	MONOGRAM ON MAIN CONSERVATOR	1	202-B	507-B
211	AIR CELL ARRANGEMENT INSIDE MAIN CONSERVATOR	1	202-B	506-A
211a	OPENING DULY BLANKED FOR AIRCELL RUPTURE RELAY (IF IN SCOPE)	1	303-A	606-A

TAPCHANGER

IT.NO.	DESCRIPTION	QTY.	ZONE L.H.S	ZONE R.H.S
14b	25 N.B. GLOBE VALVE FOR DIVERTER FOR OIL SAMPLING/DRAIN	3	205-E	502-D
41	BEVEL GEAR BOX	1	304-B	602-B
43	O.L.T.C. OIL CONSERVATOR CONNECTION PIPE 25 DIA	1 SET	306-B	604-B
44	O.L.T.C. PROTECTIVE RELAY (OIL SURGE RELAY FOR OLTC)	3	306-B	604-B
48	O.L.T.C. DRIVING UNIT	1	304-C	602-C
49	O.L.T.C. MOTOR DRIVING HANDLE	1	304-C	601-C
50	ON LOAD TAP CHANGER	3	306-B	604-B
112	BRACKET FOR OLTC. MOTOR DRIVING GEAR UNIT MTG.	2	304-C	602-C
116a	BRACKET FOR OLTC. HORIZONTAL BEARING ASSY	2	306-C	604-C
117	BRACKET FOR OLTC. BEVEL GEAR	1	304-B	602-B
118	SUPPORT FOR AUX. CONSERVATOR	2	303-B	601-B
119a	ISOLATING GATE VALVE 25 DIA (FOR OLTC)	3	305-B	602-B
119b	ISOLATING GATE VALVE FOR AUX.CONSERVATOR 25 N.B.	1	203-C	501-C
124	COPPER SHORTING LINK FOR T. C. HEAD	3	307-C	604-C

	ZONE	REV	DATE	ALT.	CKD. APPD.
	ZONE	REV	DATE	ALT.	CKD. APPD.

TYPE OF PRODUCT: 500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.: TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT: TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER: M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION: W.O.- 62207-A-512-01
STATUS OF DRAWING "PR"
DISTRIBUTION OF PRINTS: TRE-1, TRM-3

TITLE: OGA PART LIST

भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22

DEPT: TRE | CODE: 406 | WEIGHT(kg): ----- | SCALE: COMP.SCALE-1:1
DRG. NO. 3 464 00 01836 | REV. 00
SHEET 02 OF 03

(ALL DIMENSIONS ARE IN mm)

FIRST ANGLE PROJECTION

DRG. NO. 3 464 00 01836

BUSHINGS & TURRETS

IT.NO.	DESCRIPTION	QTY.	ZONE L.H.S	ZONE R.H.S
6	H.V. LINE BUSHING 420KV , 1250Amp RIP / RIS / RIF BUSHING	3	204-B	502-B
6x	H.V.NEUTRAL BUSHING 36KV , 2000Amp PORCELAIN BUSHING	1	207-C	505-C
6y	I.V. BUSHING 245KV , 2000Amp RIP / RIS / RIF BUSHING	3	205-B	502-B
7y	TERTIARY BUSHING 52KV , 3150Amp OIP / RIP / RIS / RIF BUSHING	3	208-C	506-C
122	CONNECTION BOX FOR C.T. TERMINAL (H.V. SIDE)	3	205-C	502-C
122a	CONNECTION BOX C.T. TERMINAL (I.V. SIDE)	3	205-C	503-c
122b	CONNECTION BOX C.T. TERMINAL (TERTIARY SIDE)	1	308-C	606-C
148	CONNECTION BOX C.T. TERMINAL (NEUTRAL SIDE)	1	208-D	505-D
149	I.V. TURRET	3	206-C	504-C
150	H.V. TURRET	3	206-C	503-C
157	NEUTRAL GROUNDING CONNECTION WITH 36 KV CLASS INSULATOR (TINNED COPPER STRAP SIZE 12 TK X 80 WIDE)	6	404-E	704-E
180	TERMINAL MARKING PLATES	10	402-D	504-C

COOLING SYSTEM

IT.NO.	DESCRIPTION	QTY.	ZONE L.H.S	ZONE R.H.S
3b	LIFTING LUG FOR RADIATORS/HEADERS (2NO. ON EACH RADIATOR/HEADER)	56	201-B	508-B
4a	BOSS FOR EARTHING M16 WITH BOLT, PLAIN WASHER & SPRING WASHER M16 ON 'A' FRAME	8	202-E	507-E
14d	DRAIN/FILTER GATE VALVE FOR COOLING SYSTEM 50NB	4	204-C	506-C
18d	THERMOMETER ON COOLING SYSTEM (4 ON P/W, 4 ON HEADERS)	8	202-B	505-C
60	BANK OF RADIATORS (12 RADIATORS EACH BANK) 2 X 50%	2	203-C	506-C
63	FAN AND MOTOR (5 NOS WORKING + 1 NO STANDBY PER BANK) 36"SIZE.	12	201-D	508-D
64	OIL PUMP & MOTOR (1NO. WORKING+1NO. STANDBY PER BANK) 600 GPM, CAPACITY	4	203-E	506-E
67	FLEXIBLE HOSE (200 NB)	2	203-E	506-E
67a	FLEXIBLE HOSE (250 NB)	2	203-C	506-C
72	A FRAME SUPPORT 2 PAIRS	4	203-C	506-C
72a	PIPE SUPPORT (8 NOs FOR 200 NB PIPE , 4 NOS FOR 250 NBs & 2 NOs BETWEEN HEADERS)	14	203-D	506-D
73	TOP HEADERS	2	202-C	507-C
74	BOTTOM HEADERS	2	202-D	507-D
81a	BUTTERFLY VALVE FOR HEADERS 250 N.B.	2	202-C	507-C
86b	AIR RELEASE PLUG 24 NOs FOR RADIATORS & 08 NOs HEADERS & P/W	32	202-C	507-B
114b	DRAIN PLUG 24 NOs FOR RADIATORS & 10 NOs HEADERS & P/W	34	201-D	508-D
119c	ISOLATING BUTTERFLY VALVE FOR RADIATORS Ø 80	48	303-E	606-E
123	ISOLATING B/F VALVE FOR PUMP & MOTOR SET & O. F. INDICATOR 200 NB	4	303-B	606-B
127	SUPPORT FOR BREATHER MTG ON A FRAME ASSY.	1	202-D	607-C
160	OIL FLOW INDICATOR	4	203-D	506-D
190	TOP OIL PIPE (RADIATOR BANK) 250 N.B.	2	203-C	506-C
196	BOTTOM OIL PIPE (RADIATOR BANK) 250 & 200 NB	1 set	203-D	506-D
197	200 NB NON RETURN VALVE	2	203-D	506-D
198	PLATFORM FOR ACCESSING PRD/VALVE.	1	203-C	506-C

	ZONE	REV	DATE	ALT.	CKD. APPD.

TYPE OF PRODUCT: 500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.: TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT: TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER: M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION: W.O.- 62207-A-512-01
STATUS OF DRAWING: "PR"
DISTRIBUTION OF PRINTS: TRE-1, TRM-3

भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	-----	COMP.SCALE-1:1

TITLE: OGA PART LIST

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22

DRG. NO. 3 464 00 01836 REV. 00
SHEET 03 OF 03

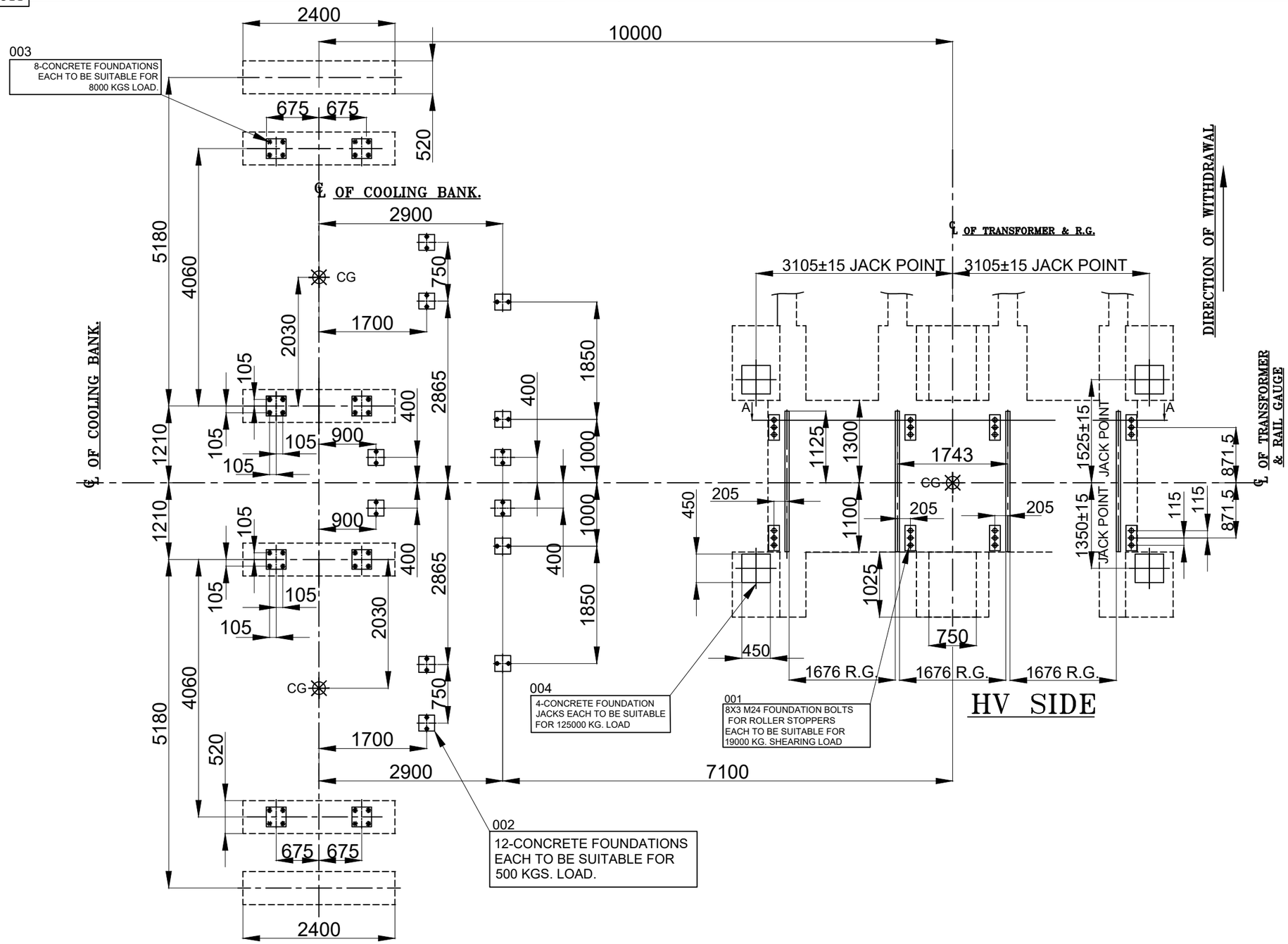
(ALL DIMENSIONS ARE IN mm)

1290936/2023/TBG-TB_ENG_SR

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 464 00 01837



REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.	TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT	TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER	M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION	
W.O.- 62207-A-512-01	
STATUS OF DRAWING	"PR"
DISTRIBUTION OF PRINTS	
TRE-1, TRM-3	

भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	- - - - -	COMP.SCALE-1:1

TITLE: FOUNDATION PLAN FOR (L.H.S COOLING BANK)

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22

DRG. NO. 3 464 00 01837 REV. 00

SHEET 01 OF 03

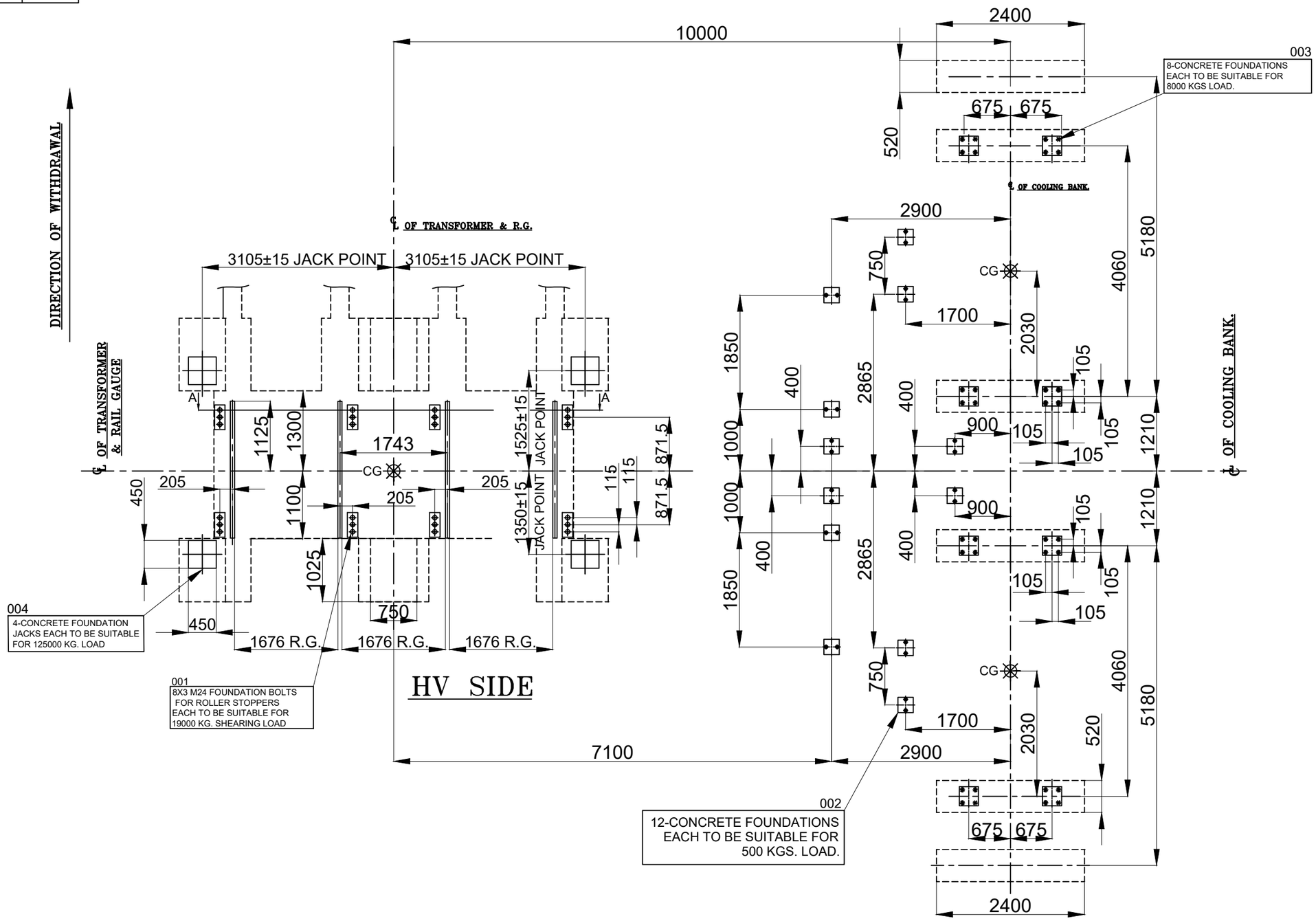
Rakesh

1290936/2023/TBG-TB_ENG_SR

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 464 00 01837



REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.	TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT	TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER	M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION: W.O.- 62207-A-512-01

STATUS OF DRAWING "PR" | DISTRIBUTION OF PRINTS: TRE-1, TRM-3

भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	-----	COMP.SCALE-1:1

TITLE: FOUNDATION PLAN FOR (R.H.S COOLING BANK)

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22

DRG. NO. 3 464 00 01837 REV. 00

SHEET 02 OF 03

Rakesh

1290936/2023/TBG-TB_ENG_SR

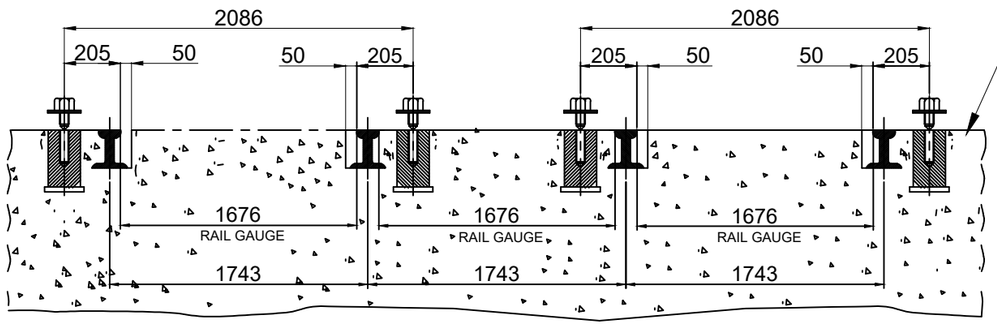
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 464 00 01837

TABLE FOR FOUNDATION BOLT					ON EACH FOUNDA. LOAD(Kg)
IT.NO.	BOLT SIZE "M" TAP	QTY.	DESCRIPTION	FOUND-ATION SYMBOL	
001	M-24	24	ROLLER SUPPORTS MARKED THUS.	⊕	19000 SHEARING
002	M-20	24	PIPE SUPPORT MARKED THUS	⊕	500
003	M-20	32	RADIATOR SUPPORT MARKED THUS	✳	8000
004	-	-	JACK POINT		125000

NOTES :-

1. FOUNDATION BOLTS WILL BE SUPPLIED BY B.H.E.L AS PER SCOPE OF SUPPLY.
2. FOR OUTLINE GENERAL ARRANGEMENT REFER DRAWING NO. 3464 00 01835.
3. POCKET OF SUITABLE SIZE MAY BE LEFT WHILE CASTING. FOUNDATION FOR FEMALE PART OF FOUNDATION BOLT TO BE DONE AT THE TIME OF FINAL CASTING.
4. THE FOUNDATION(PLINTH)SHALL BE FLAT IN LEVEL. THE DEVIATION FROM A HORIZONTAL PLANE MAY NOT EXCEED 3/ 1000 FOR 10MM TOTALLY.
5. ANCHOR FASTENER FOR COOLER AND COOLER PIPE SUPPORT WILL BE SUPPLIED BY BHEL.
6. LINES SHOWN AS ___ ARE THE BOUNDARY FOR STANDARD PGCIL FOUNDATION.
7. TRANSFORMER TO BE ROLLER MOUNTED.



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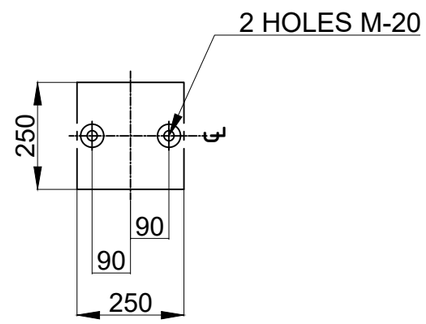
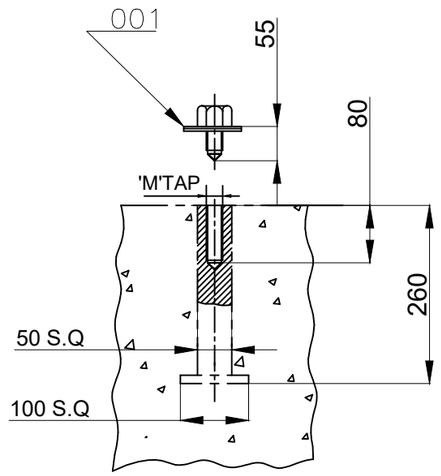


IT. 002



DETAIL OF FOUNDATION BOLTS

REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	500 MVA, 400/220/33KV, 3PH AUTO TRANSFORMER.
PO NO.	TBCB/400KV/MOHANLALGANJ/TR01/G2/NOA-I&II/07&08, DATED 19/05/2022
PROJECT	TRANSFORMER PACKAGE (TR01) FOR 500 MVA MOHANLALGANJ, LOCKNOW
NAME OF CUSTOMER	M/S. POWER GRID CORPORATION OF INDIA LTD

ADDITIONAL INFORMATION
W.O.- 62207-A-512-01
STATUS OF DRAWING "PR"
DISTRIBUTION OF PRINTS
TRE-1, TRM-3

भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	- - - - -	COMP.SCALE-1:1

TITLE: FOUNDATION PLAN FOR (L.H.S & R.H.S COOLING BANK)

	NAME	SIGN	DATE
DRN.	RAKESH		26.08.22
CHD.	GK		26.08.22
APPD.	LK/CM		26.08.22

DRG. NO. 3 464 00 01837 REV. 00
SHEET 03 OF 03

Rakesh

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 469 00 02261

REF.DRG.NO. | SIGN.DATE | INVENTORY NO.

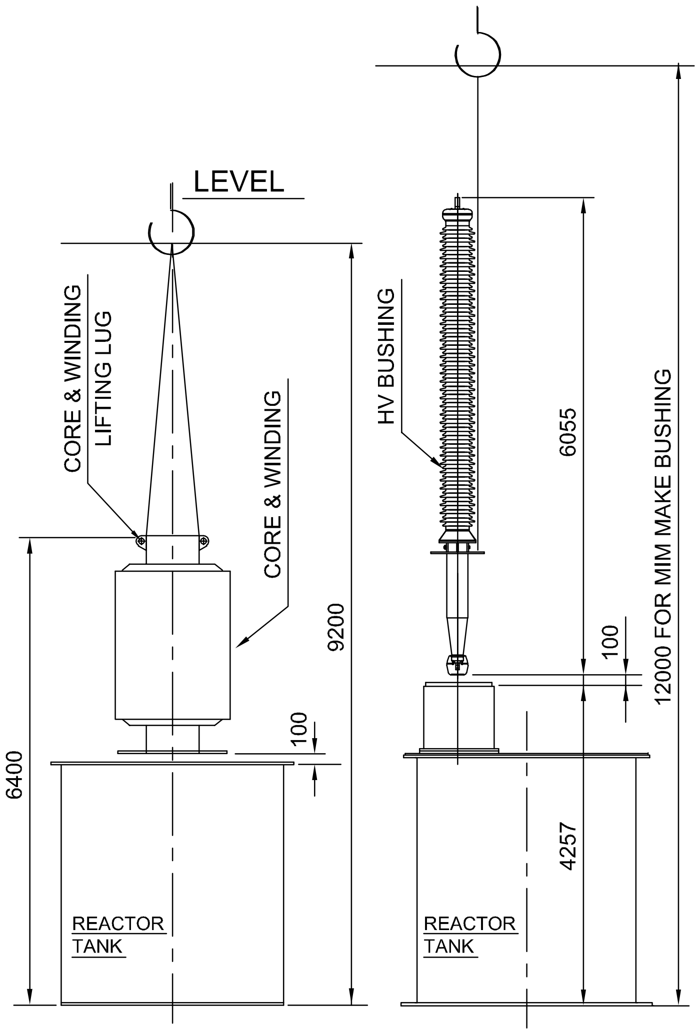
NOTES :-

1. WHEN REFERRING THIS DRAWING PLEASE QUOTE MVAR & W.O. NO.
2. 320 DIA. TWIN BI-DIRECTIONAL ROLLERS MOUNTED AT 1676 mm RAIL GAUGE IN BOTH DIRECTION ARE PROVIDED FOR MOVEMENT OF REACTOR AT SITE AND ROLLERS ARE TO BE REMOVED BEFORE ERECTION .
3. PAINT SHADE SHALL BE RAL 7035.
4. WIRING FROM INSTRUMENT CTS. ETC. ARE NOT SHOWN FOR CLARITY.
5. FOUNDATION BOLTS ARE IN THE SCOPE OF BHEL SUPPLY.
6. FOR PART LIST OF OUTLINE GENERAL ARRANGEMENT REFER DRAWING NO. 3 469 00 02262.
7. DIMENSIONS SHOWN THUS [ ] ARE OVERALL SHIPPING DIMENSIONS EXCLUSIVE OF PACKING.
8. DIMENSIONS SHOWN ARE WITH REF.TO PLINTH LEVEL.
9. FOR TANK COVER BOLTED REFER DETAIL 'B' SHEET NO. 03.
10. HV, HVN BUSHING ARE BOUGHT OUT ITEM. HENCE, DIMENSION / WEIGHT RELATED TO THESE BUSHINGS ARE TENTATIVE. IT WILL BE FINALIZED (IF REQUIRED) AFTER VENDOR FINALIZATION.
11. FOR CRITICAL DIMENSIONS TOLERANCES ARE INDICATED IN THE DRAWING. FOR OTHER DIMENSION, GENERAL TOLERANCE MAY BE TREATED AS ±3%.

IMPORTANT NOTE :-

1. THE DESIGN FEATURES SHOWN ON THIS DRAWING (GENERALLY INLINE WITH IS:5553/IEC: 60076-6 APPLICABLE STANDARD & AGREED CUSTOMER SPECIFICATION) MEETS THE STATUTORY, REGULATORY & SAFETY REQUIREMENTS WITH RESPECT TO EARTHING ARRANGEMENT, DANGER & OTHER LABELS, CLEARANCES IN AIR PROVISION FOR PRESSURE RELIEF DEVICE, BUCHHOLZ RELAY AND ANTI-EARTHQUAKE CLAMPING ARRANGEMENT.

MIN. AIR CLEARANCES		
	420 KV	145 KV
PHASE TO PHASE	3600	NA
PHASE TO EARTH	3100	1050



REV	DATE	ALT.	REV	DATE	ALT.
		CKD.			CKD.
		APPD.			APPD.
ZONE			ZONE		

TYPE OF PRODUCT	125 MVAR, 420KV, 3-PHASE, SHUNT REACTOR
LOA. NO.	CC-CS/1077-NR1/RT-4242/3/G3/NOA-I/9207 DATED 02.08.2021.
PROJECT	REACTOR PACKAGE RT-02 FOR BULK PROCUREMENT OF 400KV SR.
NAME OF CUSTOMER	M/S POWER GRID CORPORATION OF INDIA LTD.

ADDITIONAL INFORMATION
W.O.- 61206-A-517-01
STATUS OF DRAWING "PR"
DISTRIBUTION OF PRINTS
TRE-1, TRM-3

भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	-----	COMP.SCALE-1:1

TITLE: OUTLINE GENERAL ARRANGEMENT

	NAME	SIGN	DATE
DRN.	MKP		08.11.2021
CHD.	KD/SD		10.11.2021
APPD.	KD/AD		12.11.2021

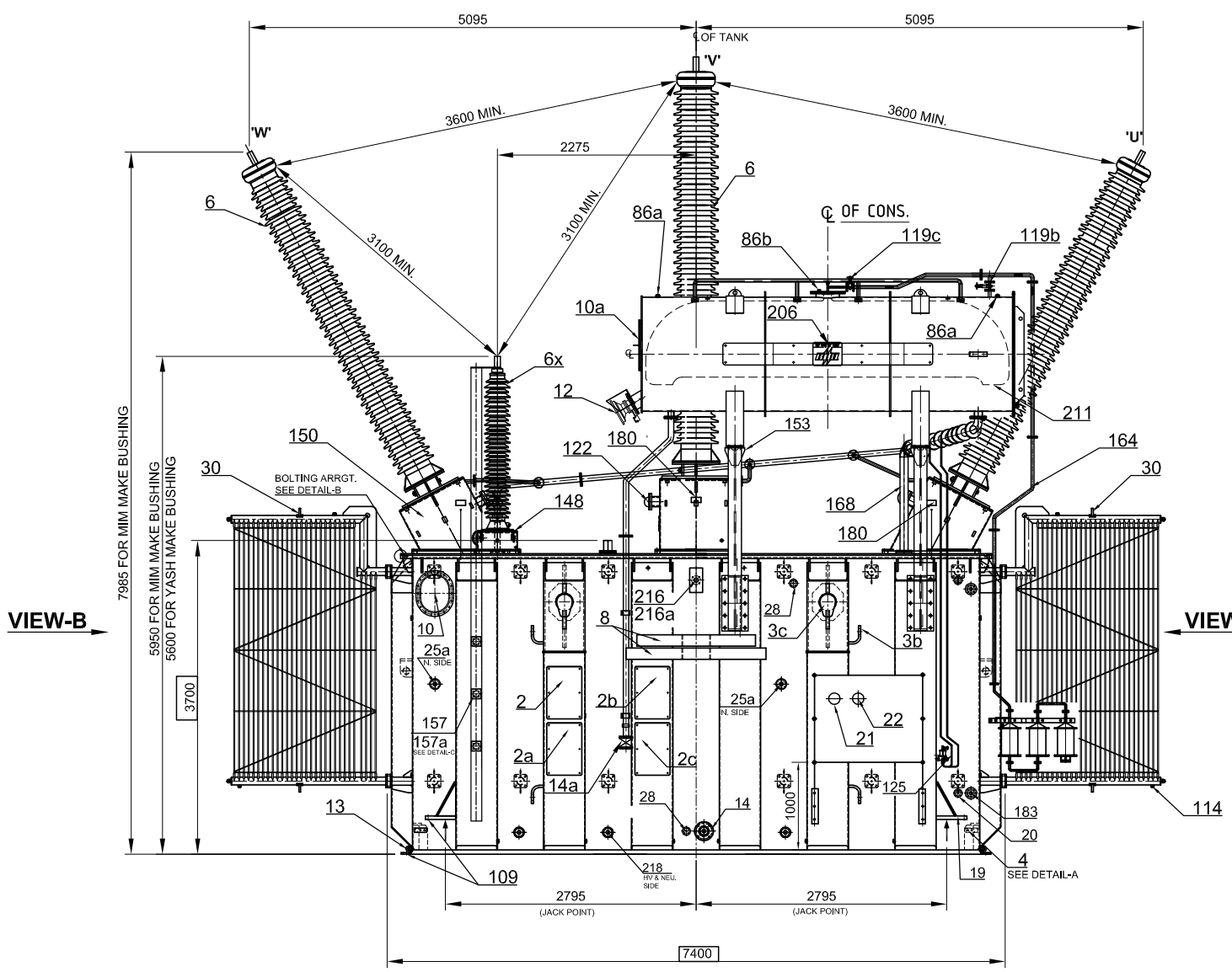
DRG. NO. 3 469 00 02261 REV. 00
SHEET 01 OF 04

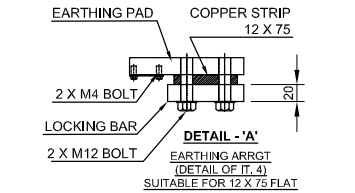
Manish

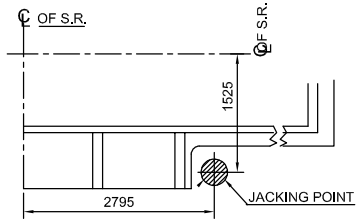
FIRST ANGLE PROJECTION

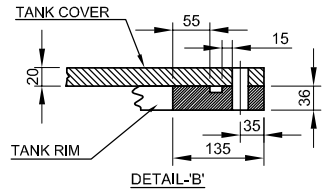
(ALL DIMENSIONS ARE IN mm)

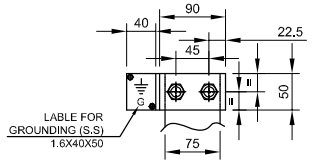
DRG. NO. 3 469 00 02261

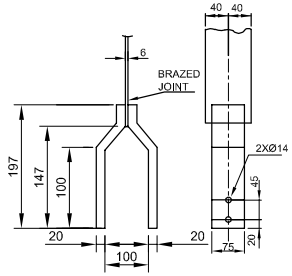












REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	125 MVAR, 420KV, 3-PHASE, SHUNT REACTOR
NOA.	CC-CS/1077-NR1/RT-4242/3/G3/NOA-I/9207 DATED 02.08.2021.
PROJECT	REACTOR PACKAGE RT-02 FOR BULK PROCUREMENT OF 400KV SR.
NAME OF CUSTOMER	M/S POWERGRID CORPORATION OF INDIA LTD.

ADDITIONAL INFORMATION
W.O.- 61206-A-517-01
STATUS OF DRAWING "PR"
DISTRIBUTION OF PRINTS
TRE-1, TRM-3

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BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	-----	COMP.SCALE-1:1

TITLE: OUTLINE GENERAL ARRANGEMENT (ELEVATION VIEW)

	NAME	SIGN	DATE
DRN.	MKP		08.11.2021
CHD.	KD/SD		10.11.2021
APPD.	KD/AD		12.11.2021.

DRG. NO. 3 469 00 02261 REV. 00
SHEET 02 OF 04

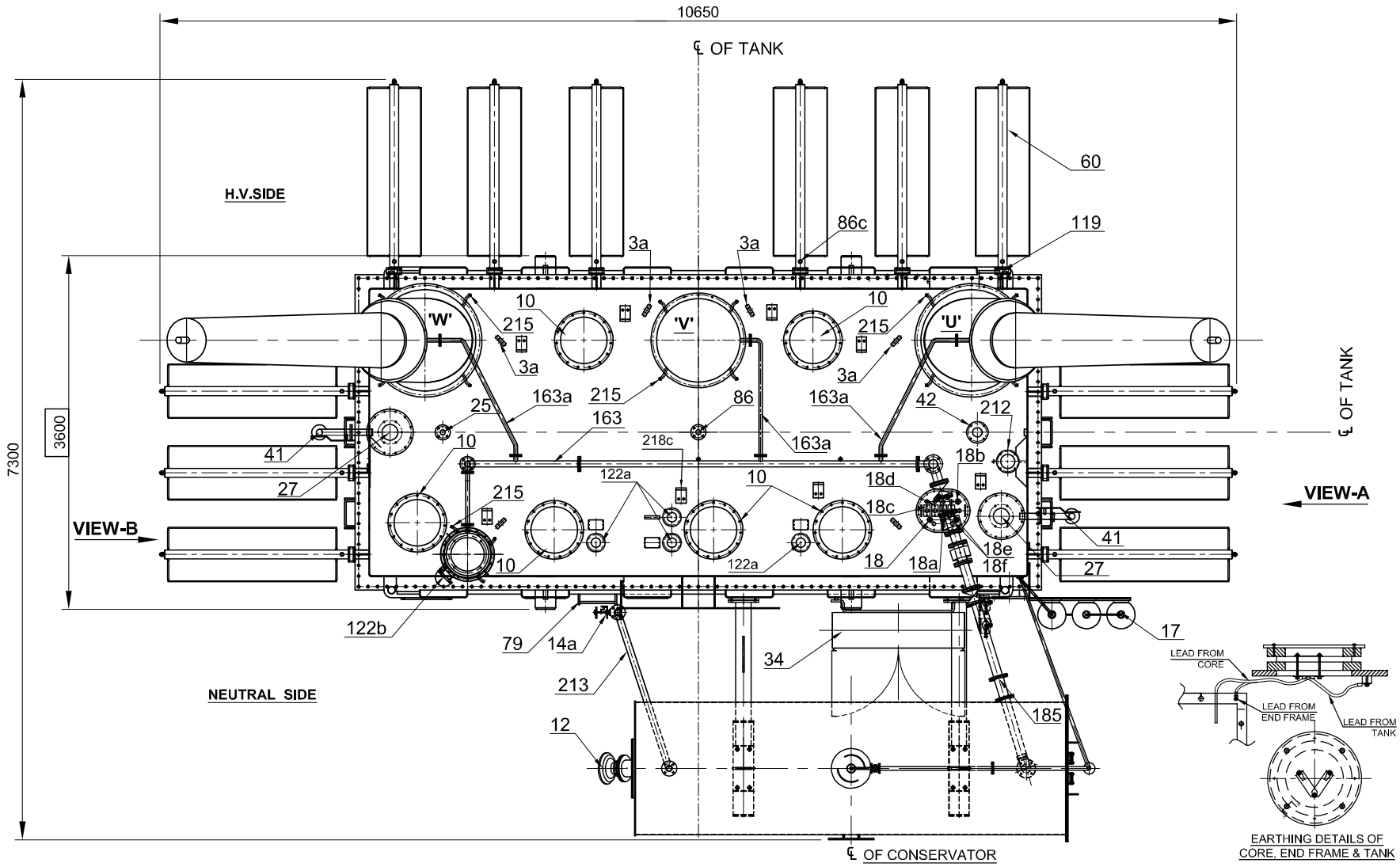
INVENTORY NO. | SIGN.DATE | REF.DRG.NO.

Manish

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 469 00 02261



REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	125 MVAR, 420KV, 3-PHASE, SHUNT REACTOR
NOA.	CC-CS/1077-NR1/RT-4242/3/G3/NOA-I/9207 DATED 02.08.2021.
PROJECT	REACTOR PACKAGE RT-02 FOR BULK PROCUREMENT OF 400KV SR.
NAME OF CUSTOMER	M/S POWERGRID CORPORATION OF INDIA LTD.

ADDITIONAL INFORMATION
W.O.- 61206-A-517-01
STATUS OF DRAWING "PR"
DISTRIBUTION OF PRINTS
TRE-1, TRM-3

भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	-----	COMP.SCALE-1:1

TITLE: OUTLINE GENERAL ARRANGEMENT (PLAN VIEW)

	NAME	SIGN	DATE
DRN.	MKP		08.11.2021
CHD.	KD/KG		10.11.2021
APPD.	KD/KG		12.11.2021

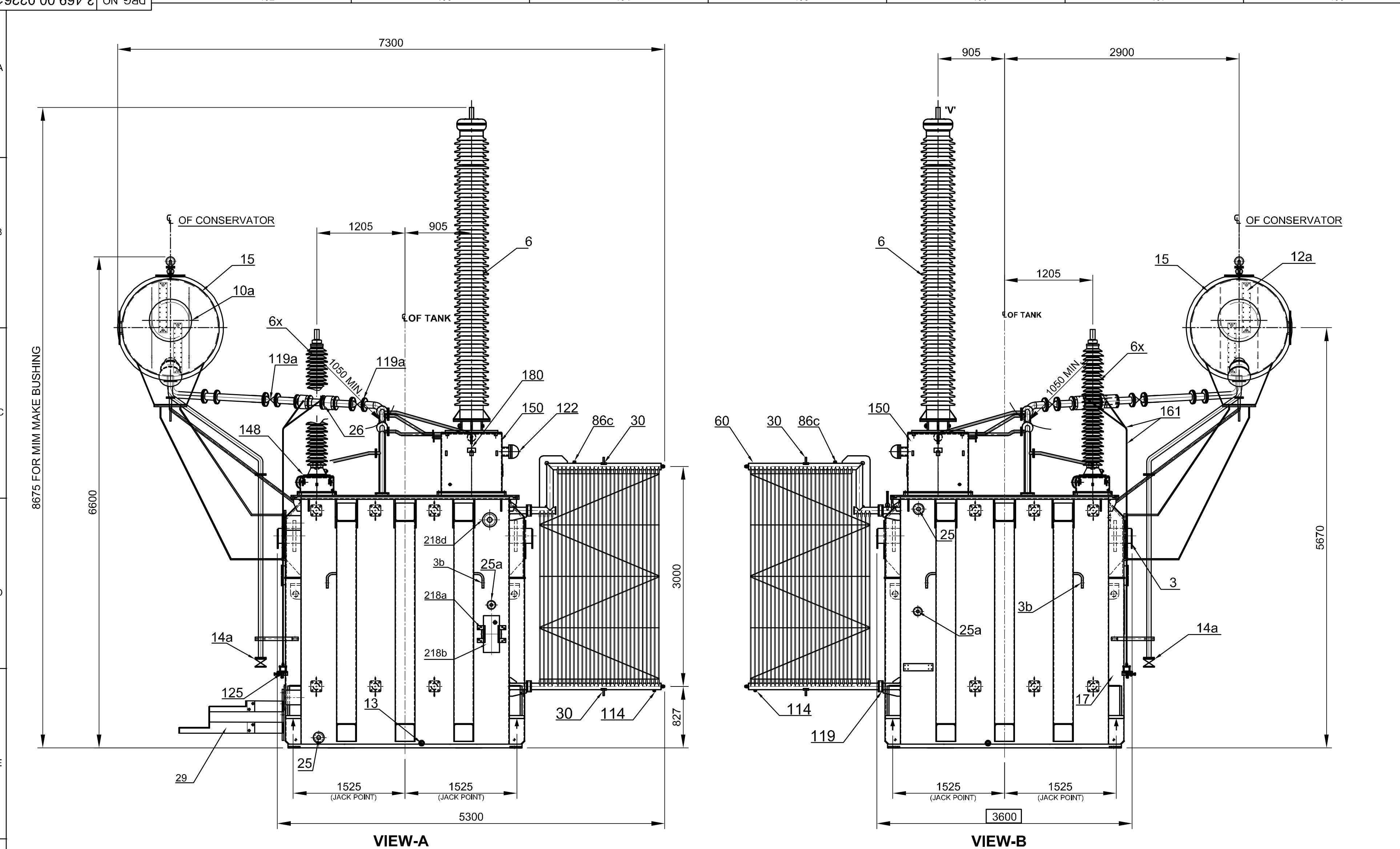
DRG. NO. 3 469 00 02261 REV. 00
SHEET 03 OF 05

INVENTORY NO. | SIGN.DATE | REF.DRG.NO.

Manish

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)



REV	DATE	ALT.	REV	DATE	ALT.
		CKD.			CKD.
		APPD.			APPD.
ZONE			ZONE		

TYPE OF PRODUCT	125 MVAR, 420KV, 3-PHASE, SHUNT REACTOR
NOA.	CC-CS/1077-NR1/RT-4242/3/G3/NOA-I/9207 DATED 02.08.2021.
PROJECT	REACTOR PACKAGE RT-02 FOR BULK PROCUREMENT OF 400KV SR.
NAME OF CUSTOMER	M/S POWERGRID CORPORATION OF INDIA LTD.

ADDITIONAL INFORMATION
W.O.- 69121-A-517-01
STATUS OF DRAWING "PR"
DISTRIBUTION OF PRINTS
TRE-1, TRM-3

भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	- - - - -	COMP.SCALE-1:1

TITLE: OUTLINE GENERAL ARRANGEMENT (END VIEW)

	NAME	SIGN	DATE
DRN.	MKP		08.11.2021
CHD.	KD/SD		10.11.2021
APPD.	KD/AD		12.11.2021

DRG. NO. 3 469 00 02261 REV. 00
SHEET 04 OF 04

DRG. NO. 3 469 00 02261

Manish

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 469 00 02262

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD.
IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

APPROXIMATE WEIGHT & OIL QTY.

DESCRIPTION	WT. IN KG	OIL (L)
CORE AND WINDING	97000	
TANK & FITTINGS	25600	45400
BUSHINGS	2300	
RADIATOR & CONSERVATOR PIPE WORK	16000	6600
CONTROL CABNET	350	
TOTAL OIL	45250	52000
TOTAL WEIGHT	186500	

NOTES:-

1. CABLE TRAY ON REACTOR TANK PROVIDED FOR CABLING OF INSTRUMENT.
2. FOLLOWING THINGS / ITEMS ARE EXCLUDED FROM SCOPE OF SUPPLY:-
   a. TERMINAL CONNECTOR
   b. NIFPS
   c. ONLINE INSULATING OIL DRYING SYSTEM
   d. ONLINE DGA
   e. AIR CELL RUPTURE RELAY

HOWEVER, PROVISION WILL BE PROVIDED FOR THESE ITEMS.

TABLE OF FITTINGS

GROUP	ITEM NO	DESCRIPTION	QTY	ZONE
COOLING SYSTEM	30	LIFTING LUGS FOR RADIATORS (LIFTING CAPACITY 1100 KG EACH)	24	405-C
	60	RADIATOR BANK	12	405-C
	86C	AIR RELEASE PLUGS (3/4"BSP) 12 NOS FOR RADITORS	12	405-C
	114	DRAIN PLUGS (3/4"BSP) 12 NOS FOR RADIATORS	12	405-E
	119	ISOLATING VALVES FOR RADIATORS (80 NB BUTTERFLY)	24	405-E
	161	GAS COLLECTING DEVICE PIPE (6 NB)	2	407-C
	163	EQUALISING PIPE (50NB)	1	304-C
	163a	EQUALISING PIPE (25NB) FOR TURRETS	4	304-C
CONSERVATOR AND PIPE WORK	10a	INSPECTION COVER FOR OIL CONSERVATOR (BOLTED) (20 KG)	1	402-B
	12	OIL GAUGE MAGNETIC TYPE WITH LOLA & HOLA (PLUG AND SOCKET TYPE)	1	304-E
	12a	PRISMATIC OIL LEVEL GAUGE (OVER LAPPED)	1	408-B
	14a	50 NB DRAIN GATE VALVE FOR OIL CONSERVATOR	1	407-D
	15	OIL CONSERVATOR 1300 DIA (ATMOSEAL TYPE)	1	402-B
	17	DEHYDRATING BREATHER WITH SILICA GEL (3 IN SERIES)	3	307-D
	26	BUCHHOLZ RELAY (80 NB) (PLUG AND SOCKET TYPE)	2	403-C
	86a	AIR RELEASE PLUG (3/4"BSP) ON CONSERVATOR	2	204-B
	86b	AIR RELEASE PLUG (1/4"BSP) FOR CONSERVATOR.	1	204-B
	119a	ISOLATING GATE VALVE FOR BUCHHOLZ RELAY(80 NB)	2	403-C
	119b	50 NB GATE VALVE FOR VACUUMING	1	205-B
	119c	15 NB GATE VALVE FOR BREATHER/VACUUMING	1	205-B
	125	GAS COLLECTING DEVICE.	2	402-E
	153	CONSERVATOR SUPPORTS	2	204-C
	164	BREATHER PIPE (25 NB)	1	206-C
	168	CONSERVATOR PIPE (80 NB)	1	205-C
	185	FLOW SENSITIVE CONSERVATOR ISOLATION VALVE	1	306-D
	206	BHEL MONOGRAM	1	205-B
	211	ATMOSEAL ARRANGEMENT (INSIDE THE CONSERVATOR)	1	206-C
	213	CONSERVATOR DRAIN PIPE (50 NB)	1	304-D

TABLE OF FITTINGS

GROUP	ITEM NO	DESCRIPTION	QTY	ZONE
TURRETS & BUSHINGS	6	420KV, 1250AMP, H V LINE BUSHINGS	3	202-B
	6X	145KV, 1250AMP, H V NEUTRAL BUSHING	1	203-C
	122	CONNECTION BOX FOR C T TERMINAL (H V)	3	203-C
	122a	CONNECTION BOX FOR C T TERMINAL(H V N) ON COVER	4	304-C
	122b	CONNECTION BOX FOR C T TERMINAL (H V N)	1	303-D
	148	NEUTRAL TURRET	1	203-C
	150	H V TURRETS	3	202-C
	157	NEUTRAL GROUNDING STRIPS	1 SET	203-D
	157a	22KV POST INSULATOR	3	203-D
	180	TERMINAL MARKING PLATE	4	204-C

TABLE OF FITTINGS

GROUP	ITEM NO	DESCRIPTION	QTY	ZONE
REACTOR	2	RATING AND DIAGRAM PLATE	1	203-D
	2a	DO'S & DONT'S INSTRUCTION PLATE	1	203-E
	2b	VALVE SCHEDULE PLATE	1	204-D
	2c	OIL FILLING INSTRUCTION PLATE	1	204-E
	3	LIFTING BOLLARD (60000 KG. EACH)	4	407-D
	3a	LIFTING LUGS FOR TANK COVER	6	304-C
	3b	LASHING LUG	8	205-D
	3c	INSTRUCTION PLATE FOR LIFTING	4	204-D
	4	EARTHING TERMINAL DIAGONALLY OPPOSITE (SIZE 20 TK X 50X 120 LG.) (STAINLESS STEEL)	2	206-E
	8	NAME PLATES (ENGLISH & HINDI)	1+1	204-D
	10	INSPECTION COVERS (6 NOS. ON TANK COVER, 1 NO. ON TANK)	6+1	203-D 305-C
	13	DRAIN PLUGS ON TANK 1"BSP	2	202-E
	14	100 NB DRAIN GATE VALVE	1	204-E
	18	POCKET FOR OTI	1	305-D
	18a	POCKET FOR WTI	1	306-D
	18b	ORDINARY THERMOMETER WITH POCKET (1 NO ON TANK COVER)	1	306-C
	18c	RTD WITH POCKET FOR OTI	1	305-C
	18d	RTD WITH POCKET FOR WTI	1	305-C
	18e	SPARE POCKET FOR OTI	1	306-C
	18f	SPARE POCKET FOR WTI	1	306-C
	19	JACKING PADS 70000 KG EACH	4	205-E
	20	15 NB GATE VALVE FOR ONLINE INSULATION DRY KEEP SYSTEM	2	206-E
	21	OIL TEMPERATURE INDICATOR.	1	205-D
	22	WINDING TEMPERATURE INDICATOR	1	205-D
	25	50 NB GATE VALVE ON TANK AND COVER [2 NOS ON TANK, 1 NO ON COVER]	2+1	303-C 402-D 406-D
	25a	UHF SENSOR VALVE (50 NB GATE VALVE)	4	203-D 204-D 403-D 406-D
	27	PRESSURE RELIEF DEVICE (PLUG AND SOCKET TYPE)	2	303-C 306-D
	28	15 NB GLOBE VALVE FOR OIL SAMPLING (1SET= 2 IN SERIES)	2 SET	204-E
	29	PLATFORM FOR MARSHALLING BOX	1	402-E
	34	MARSHALING BOX (TANK MOUNTED)	1	305-D
	41	OIL COLLECTING ARRGT. FOR PRV WITH PIPE WORK	2	306-C
	42	100 NB GATE VALVE FOR CONNECTION TO VACUUM PUMP	1	306-C
	79	LADDER WITH LOCKING DEVICE	1	304-D
	86	AIR RELEASE PLUG 1/2"BSP.	1	305-C
	109	PULLING HOLE DIA 64	8	203-E
	183	50 NB GATE VALVE FOR ONLINE GAS MONITORING SYSTEM(1 FOR TOP & 1 FOR BOTTOM).	2	206-E
	212	COVER EARTHING OF CORE AND CORE CLAMPS.	1	306-C
	215	EARTHING STRIP 30SQMM FOR TURRET	16	304-C
	216	SUDDEN PRESSURE RELAY (PLUG AND SOCKET TYPE)	1	204-D
	216a	40 NB GATE VALVE FOR SUDDEN PRESSURE RELAY	1	204-D
	218	N2 INJECTION VALVE (25NB GATE)	6	204-E
	218a	MOUNTING BRACKET FOR FIRE PROTECTION SYSTEM BOX	1	403-D
	218b	SIGNAL BOX FOR FIRE PROTECTION SYSTEM	1	403-D
	218c	PAD FOR FIRE PROTECTION DETECTION SYSTEM	8	304-C
	218d	QUICK OIL DISCHARGE VALVE (125NB GATE)	1	403-D

REF.DRG.NO.

SIGN.DATE

INVENTORY NO.

REV	DATE	ALT.		REV	DATE	ALT.
		CKD.				CKD.
		APPD.				APPD.
ZONE				ZONE		

TYPE OF PRODUCT	125 MVAR, 420KV, 3-PHASE, SHUNT REACTOR.
LOA NO.	CC-CS/1077-NR1/RT-4242/3/G3/NOA-I/9207 DATED 02.08.2021.
PROJECT	REACTOR PACKAGE RT-02 FOR BULK PROCUREMENT OF 400KV SR.
NAME OF CUSTOMER	M/S POWERGRID CORPORATION OF INDIA LTD.

ADDITIONAL INFORMATION
W.O.- 61206-A-517-01
STATUS OF DRAWING "PR"
DISTRIBUTION OF PRINTS
TRE-1, TRM-3

भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	-----	COMP.SCALE-1:1

TITLE: **LIST OF FITTING & ACCESSORIES**

	NAME	SIGN	DATE
DRN.	MKP		08.11.2021
CHD.	KD/SD		10.11.2021
APPD.	KD/AD		12.11.2021

DRG. NO 3 469 00 02262 REV. 00
SHEET 01 OF 01

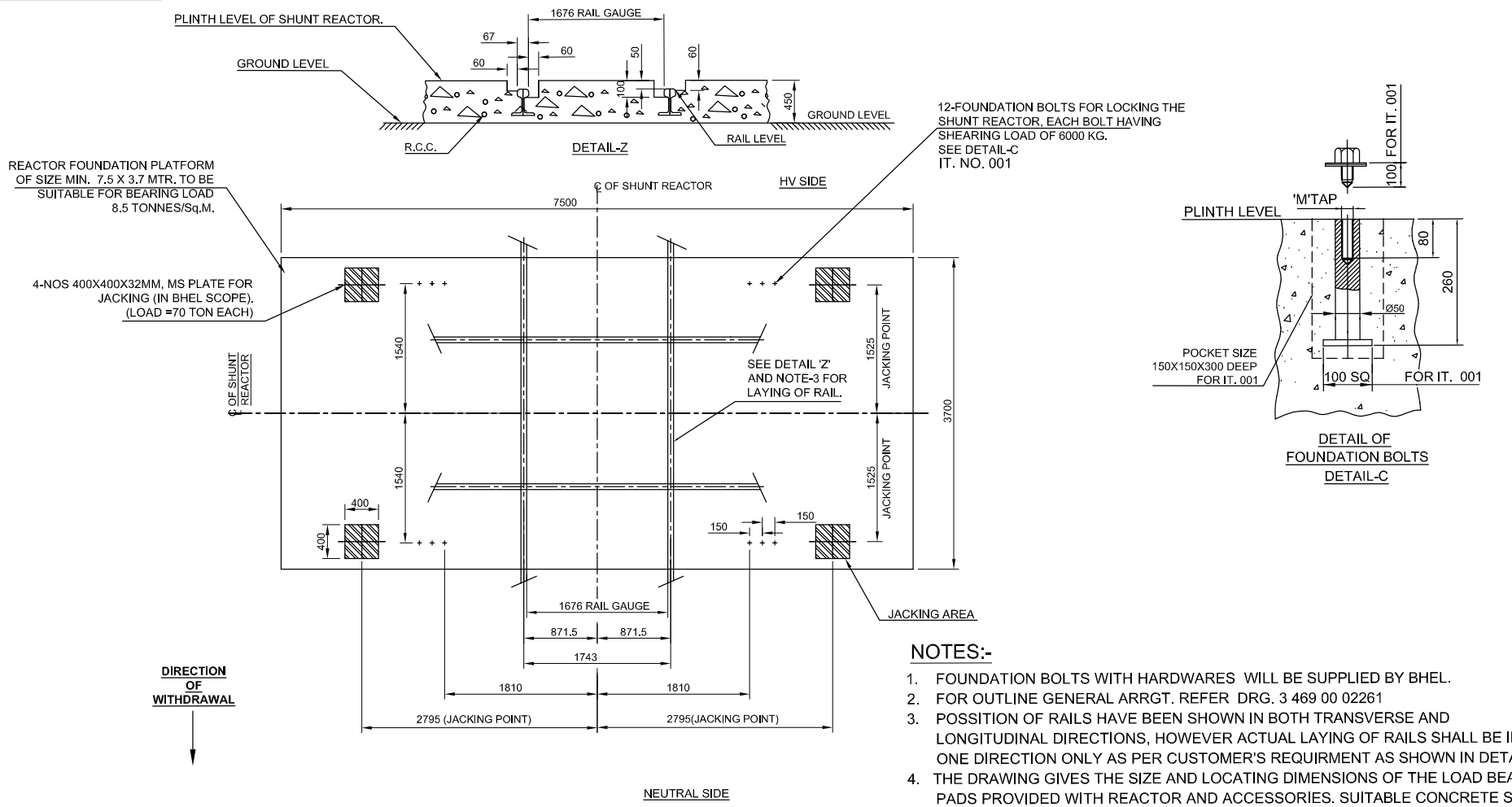
Manish

TR220101-1001369-COMMON-420KV-125MVAR-RT-GA & FDN00(CAT-I) Page 9 of 10

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 469 00 02263



NOTES:-

1. FOUNDATION BOLTS WITH HARDWARES WILL BE SUPPLIED BY BHEL.
2. FOR OUTLINE GENERAL ARRGT. REFER DRG. 3 469 00 02261
3. POSSITION OF RAILS HAVE BEEN SHOWN IN BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS, HOWEVER ACTUAL LAYING OF RAILS SHALL BE IN ONE DIRECTION ONLY AS PER CUSTOMER'S REQUIRMENT AS SHOWN IN DETAIL 'Z'.
4. THE DRAWING GIVES THE SIZE AND LOCATING DIMENSIONS OF THE LOAD BEARING PADS PROVIDED WITH REACTOR AND ACCESSORIES. SUITABLE CONCRETE SLAB SIZE TO RECEIVE THESE PADS TO BE DECIDED BY CUSTOMER'S CIVIL ENGINEER.
5. POCKETS OF SUITABLE SIZE MAY BE LEFT WHILE CASTING. FOUNDATION FOR EMBEDDING FEMALE PART OF FOUNDATION BOLT (TO BE SUPPLIED BY BHEL) AT THE TIME OF FINAL.
6. ONLY 12 NOS. FOUNDATION BOLTS ARE REQD. AS PER REACTOR RATING.
7. 400X400X32 (MM) PLATES (4 NOS) PER REACTOR SHALL BE PROVIDED FOR JACKING THE REACTOR.
8. THE FOUNDATION PLINTH SHALL BE FLAT IN LEVEL. THE DEVIATION FROM A HORIZONTAL PLANE MAY NOT EXCEED 3/1000 OF 10MM TOTALLY.

TABLE FOR FOUNDATION BOLT

IT. NO.	DESCRIPTION	BOLT SIZE M TAP	HOLE SIZE IN PAD (Ø)	QTY. (EACH PAD)	QTY. OF HOLE FOR PAD	TOTAL QTY. OF BOLTS
001	SHUNT REACTOR MTG.	M-20	24	1	12	12

REV	DATE	ALT.			REV	DATE	ALT.		
		CKD.					CKD.		
		APPD.					APPD.		
ZONE					ZONE				

TYPE OF PRODUCT	125 MVAR, 420KV, 3-PHASE, SHUNT REACTOR.
LOA NO.	CC-CS/1077-NR1/RT-4242/3/G3/NOA-I/9207 DATED 02.08.2021.
PROJECT	REACTOR PACKAGE RT-02 FOR BULK PROCUREMENT OF 400KV SR.
NAME OF CUSTOMER	M/S POWERGRID CORPORATION OF INDIA LTD.

ADDITIONAL INFORMATION
W.O.- 61206-A-517-01
STATUS OF DRAWING "PR"
DISTRIBUTION OF PRINTS
TRE-1, TRM-3

भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	WEIGHT(kg)	SCALE
TRE	406	-----	COMP.SCALE-1:1

TITLE
FOUNDATION PLAN

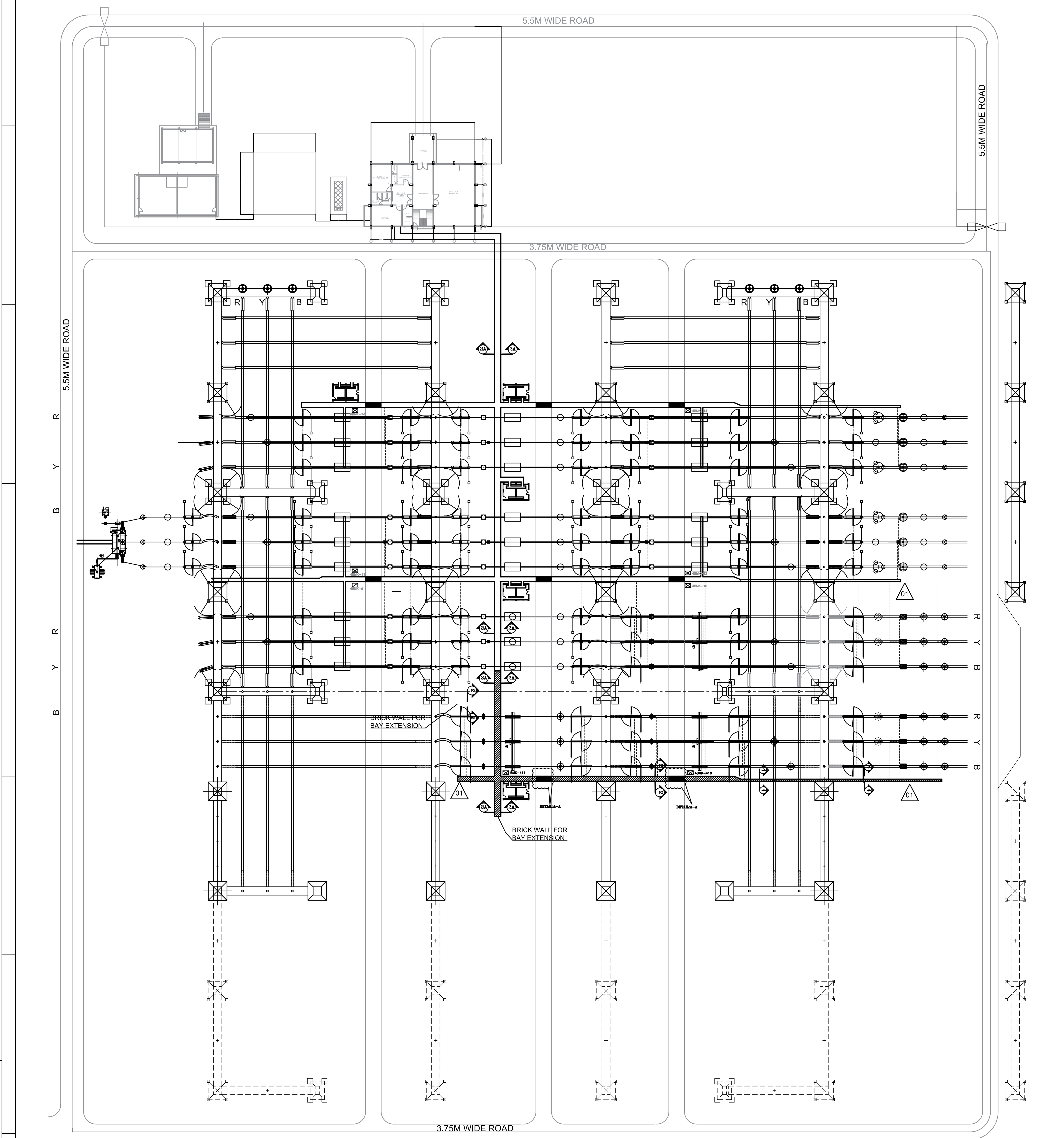
	NAME	SIGN	DATE
DRN.	MKP		08.11.2021
CHD.	KD/SD		10.11.2021
APPD.	KD/AD		11.11.2021

DRG. NO. 3 469 00 02263 REV. 00
SHEET 01 OF 01

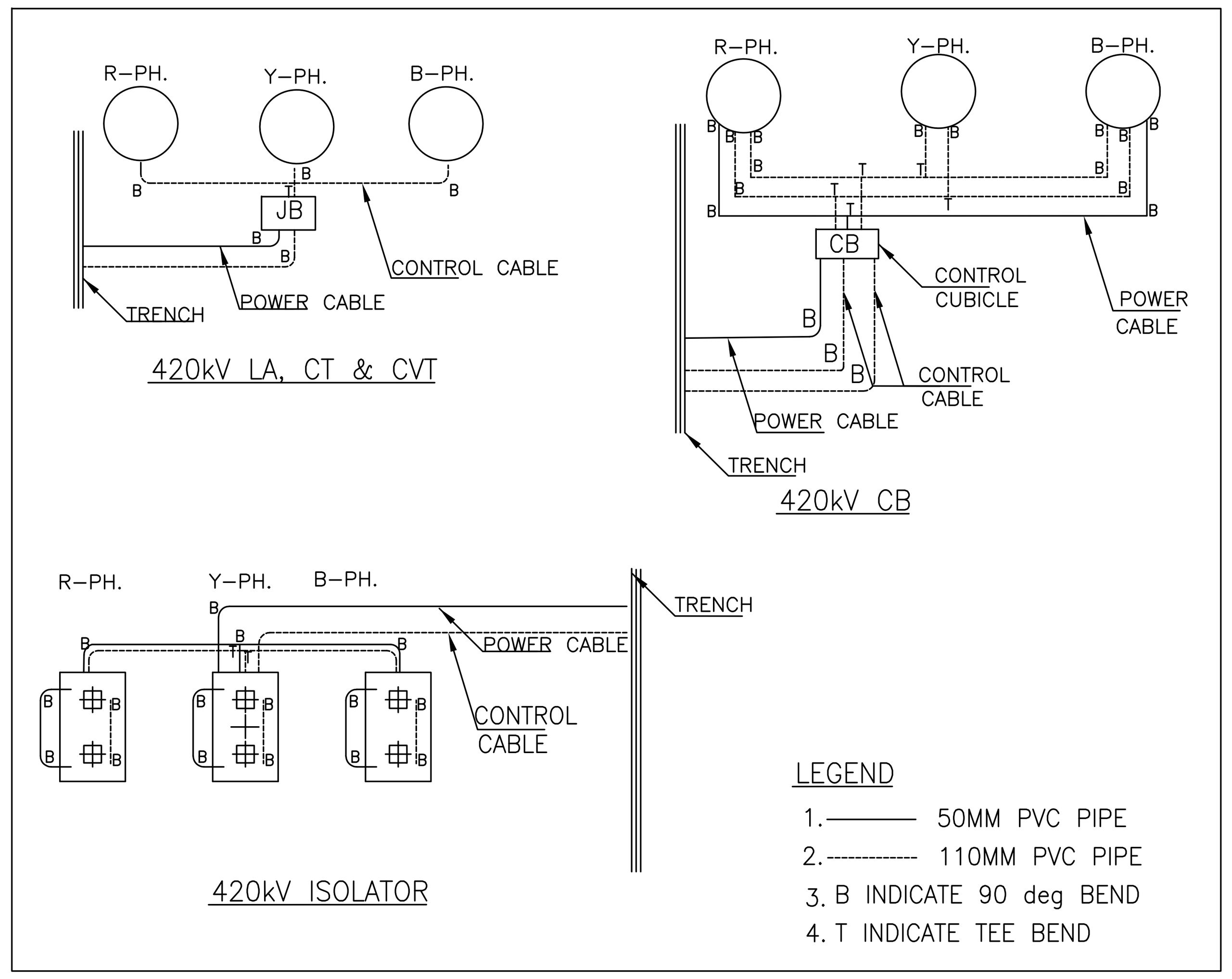
INVENTORY NO. | SIGN.DATE | REF.DRG.NO.

Manish

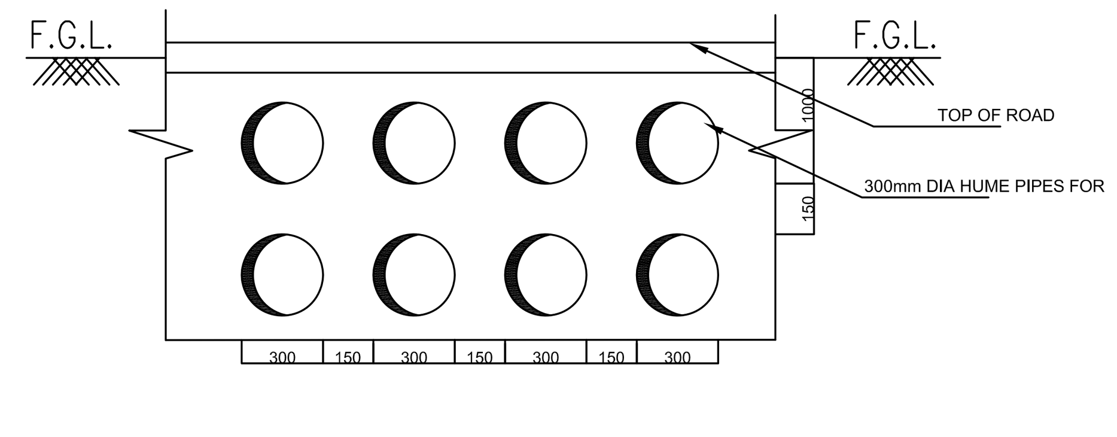
TB-1-418-316-007-C



PVC PIPE DETAILS OF 420/220 kV EQUIPMENTS



(symbol)	BHEL SCOPE TRENCH
(symbol)	EXISTING TRENCH
(symbol)	50/110MM DIA PVC PIPE



DETAIL:A-A
TYPICAL DETAIL SHOWING TRENCH CROSSING ROAD

NOTE:-

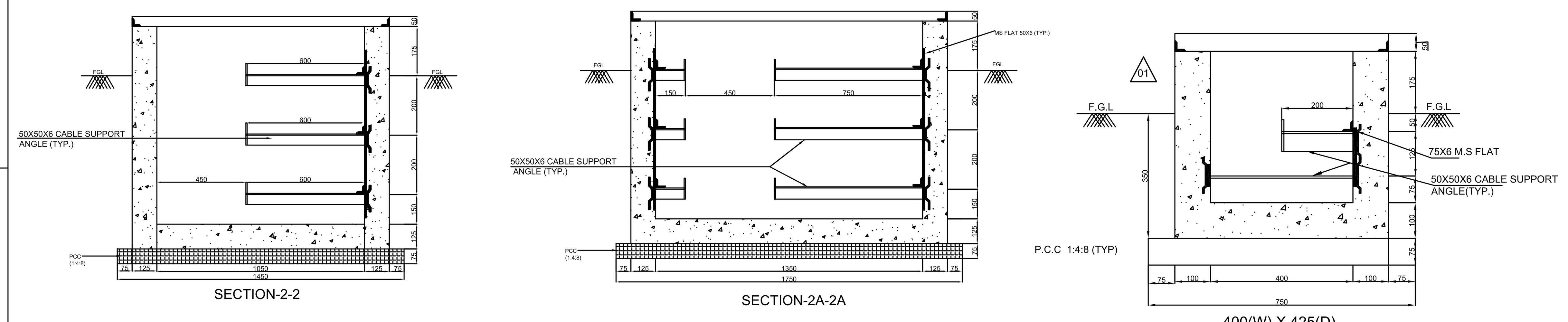
1. ALL DIMENSIONS ARE IN mm.
2. THE LOCATION OF CABLE TRENCHES MARKED IN THIS DWG MAY BE SLIGHTLY MODIFIED TO SUIT SITE CONDITIONS.
3. OPENINGS FOR TAKING OUT PVC PIPES TO EQUIPMENTS SHALL BE PROVIDED AT APPROPRIATE LOCATION IN CABLE TRENCHES SIZE OF OPENING SHALL BE SUITABLE TO DIA. 50/110 PIPE SHALL BE PROVIDED BELOW TOP CABLE SUPPORT.
4. CABLES SHALL BE LAID IN MULTILAYER ON CABLE SUPPORT (ANGLES)
5. CABLE SUPPORT SHALL BE PROVIDED AT EVERY 0.75m INTERVAL.
6. INSERTS MUST BE EMBEDDED AT EVERY 750mm INTERVAL FOR FIXING CABLE SUPPORT.
7. AUXILIARY POWER CABLES SHALL BE LAID IN TOP TIERS AND CONTROL CABLES IN BOTTOM TIERS, AS PER TECHNICAL SPECIFICATION
8. BURIED CABLES FOR LIGHTING PURPOSE SHALL BE AS PER LIGHTING LAYOUT.
9. EARTH CONDUCTOR 50x6 MS FLAT SHALL BE RUN ALONG THE TOP TIER AND TO BE WELDED ON THE CABLE SUPPORT BEFORE INSTALLATION OF CABLES.
10. DETAILS OF CABLE TRENCHES AND ITS ROAD CROSSING SHALL BE AS PER POWERGRID STANDARD DRAWINGS.
11. 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.
12. PVC PIPES SHALL BE SECURELY FIXED AT BOTH ENDS, EITHER EMBEDDED IN CONCRETE OR PROPERLY CLAMPED.
13. AFTER LAYING THE CABLES THE ENDS OF PIPES SHALL BE FULLY SEALED TO PREVENT INGRESS OF WATER INSIDE THE PIPE.
14. CABLE TRENCH SHALL BE PROVIDED ON MARSHALLING BOX SIDE OF EQUIPMENT.
15. CABLE RACK AND SUPPORTS SHALL BE PAINTED AFTER INSTALLATION WITH 2 COATS OF METEL PRIMER (COMPRISING OF RED OXIDE & ZINC CHROMATE IN A SYNTHETIC MEDIUM) FOLLOWED BY TWO FINISHING COAT OF ALUMINIUM PAINT.
16. SUITABLE PULL OUT BOX SHALL BE PROVIDED (IF REQUIRED), WHERE CABLE SHALL BE LAID IN PVC PIPE.
17. LONGITUDINAL SLOPE IN CABLE TRENCH SHALL BE AS PER CIVIL DRG.
18. FOR ALL CIVIL WORKS EXECUTION POWERGRID APPROVED/RELEASED DRGS SHALL BE FOLLOWED.
19. PROVISION FOR CONNECTING EARTH FLAT TO EXTERNAL EARTH GRID AT AN INTERVAL OF 30 METRE SHALL BE PROVIDED.
20. ALL CABLE FROM BAY CABLE TRENCH TO EQUIPMENT AND ALL INTERPOLE CABLES (BOTH POWER & CONTROL) FOR ALL EQUIPMENT SHALL BE LAID IN PVC PIPE.
21. FIBRE OPTIC CABLES SHALL RUN THROUGH G.I. PIPES IN BOTTOM TIER OF TRENCH/ANGLE SIZE 150mm (AS APPLICABLE).
22. 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.
23. ALL OTHER DETAILS PERTAINING TO CIVIL WORKS SHALL BE REFLECTED IN THE RESPECTIVE CIVIL DRAWINGS.
24. LOCATION OF LINE SIDE EQUIPMENTS WT, CVT, BPI & LA ARE INDICATIVE. FINAL LOCATION SHALL BE AFTER DEAD END TOWER LOCATION IS FINALISED.

REFERENCE DRAWINGS OF POWERGRID:

1. EXISTING SWYRD CABLE TRENCH DRAWING :DRG. NO. 0712CH CHTR SUBS SWYD E DRG 22 001 REV.02

BHEL's REF DRAWING:

1. Chittorgarh S/S-400kV ELECTRICAL LAYOUT PLAN : DRG NO. TB-1-418-316-001A-C Rev00



SECTION-2-2

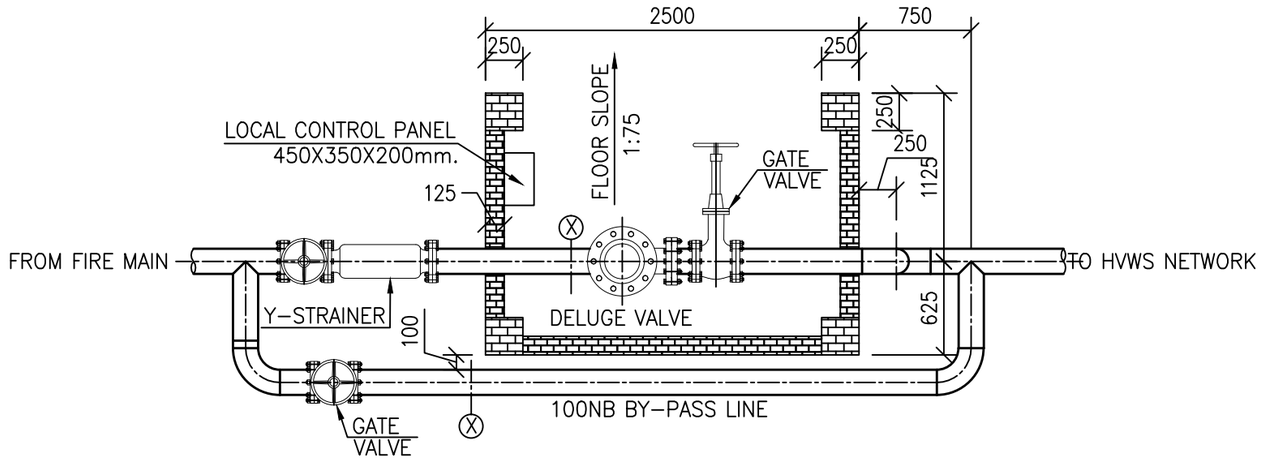
SECTION-2A-2A

400(W) X 425(D)
SECTION-4-4

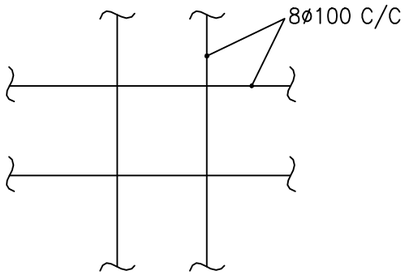
CA NO.	TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-I/05 dtd. 23/09/2022 TBCB/Neemuch REZ/400kV AIS/SS01/G5/NOA-II/06 dtd. 23/09/2022				
ADDITIONAL INFORMATION W.O.No.	xzkgd@ifj;kstuk dk uke / NAME OF CUSTOMER/PROJECT: POWER GRID CORPORATION OF INDIA LIMITED, NEEMUCH 400/220KV SUBSTATION				
STATUS OF DRAWING					
DISTRIBUTION OF PRINTS	Hkkjr gsoh bysfDVªdYl fyfeVsM V~kalfe'ku ifj;kstuk foHkkx BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION		uke/NAME	gLrk/SIGN	fnu/DATE
		cuk;k DRAWN	MANVENDER	-SD-	20.12.22
		tkWapk CHECKED	NEERAJ KUMAR	-SD-	20.12.22
		Lohd`r APPROVED	SKS	-SD-	20.12.22

REV.	DATE		
01	07.01.23	ALTERED	SY
		CHECKED	MSP
		APPROVED	SKS
ZONE	REVISED AS PER CUSTOMER COMMENTS VIA LETTER NO- CC-ENGG-TB202213-1001684-SS1844-400kV-CABTR-LAY, DTD : 31/12/2022		

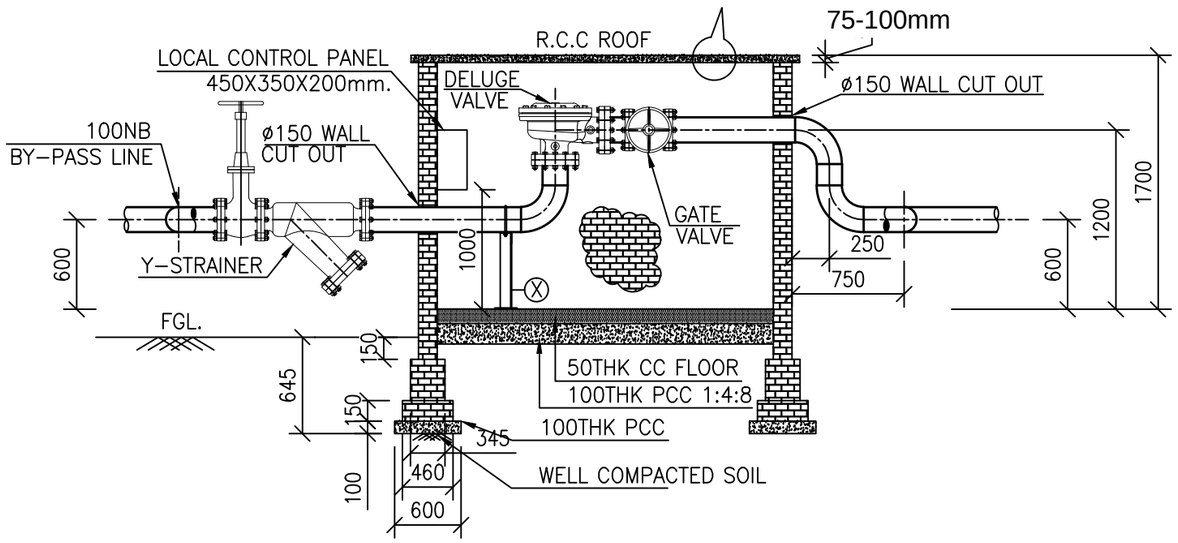
foHkkx DEPT.	vuqikr / SCALE: NTS	dkMZ dksM CARD CODE	POWERGRID DRAWING NO. TB202213-1001684-SS1844-400kV-CABTR-LAY
dksM CODE			
'kh"kZd/TITLE: Chittorgarh S/S-400kV CABLE TRENCH LAYOUT			M&k;a d-/DRAWING NO. TB-1-418-316-007-C — iqu#/REV. 00
			i`"B d-/SHEET No. 01 — vxyk i`"B /NEXT SHEET --



PLAN



TYP. DETAIL – 'A'



ELEVATION

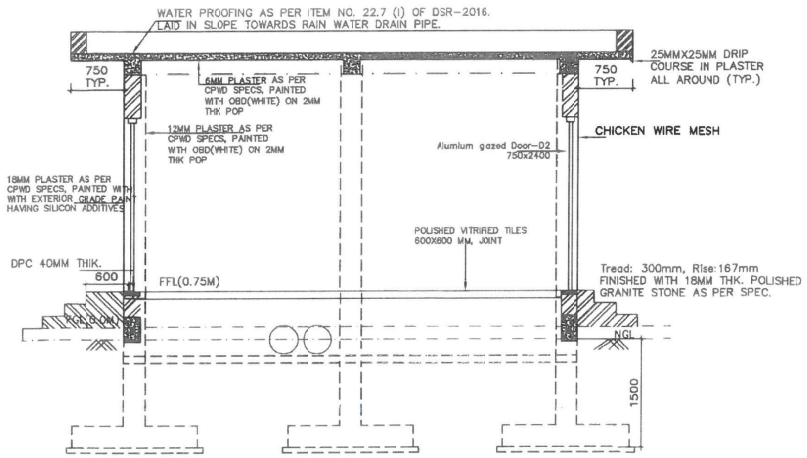
NOTES:–

1. ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE NOTED.
2. THIS DRAWING IS TYPICAL FOR ALL DV HOUSE FOR ALL TRANSFORMER.
3. INTERNAL & EXTERNAL PAINTING IN DV HOUSE SHALL BE DONE AS PER SPECIFICATION.
4. MINOR MODIFICATION MAY BE DONE DURING ERECTION TO SUIT SITE CONDITION.

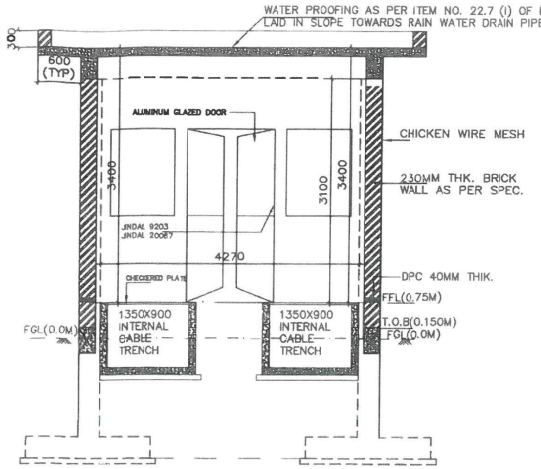
OWNER:– Power Grid Corporation Of India Ltd. *(A Govt.Of India Enterprise)*

CLIENT:– BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP TOWER–A, 5TH FLOOR, ADVANT NAVIS IT BUSINESS PARK PLOT NO–7, SECTOR – 142, EXPRESSWAY NOIDA(UP)–201305

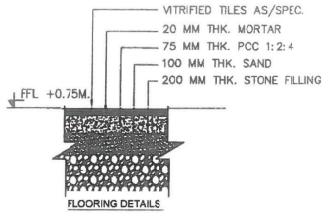
TITLE: **GA–DELUGE VALVE HOUSE**



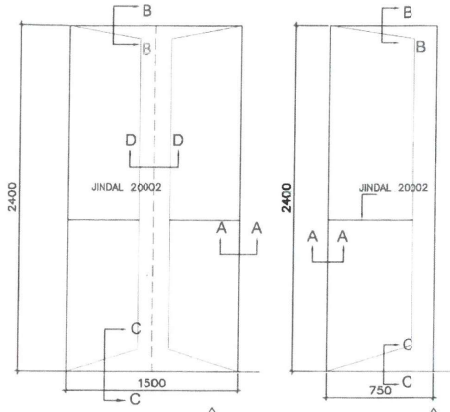
SECTION C-C (6M)



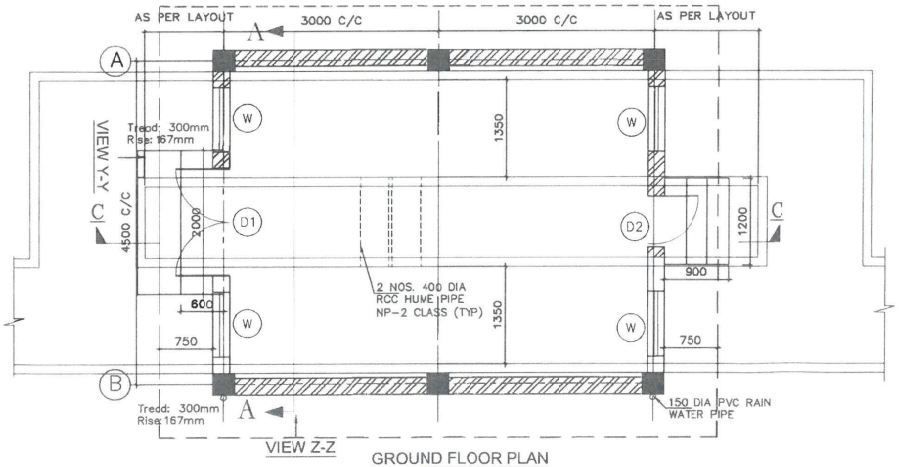
SECTION A-A



FLOORING DETAILS

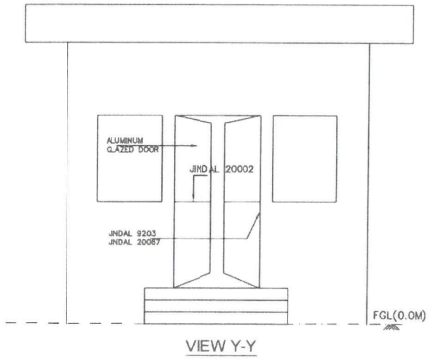


DOOR-D1 R1 DOOR-D2 R1

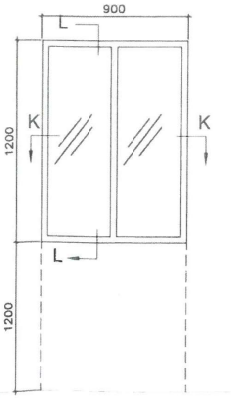


VIEW Z-Z

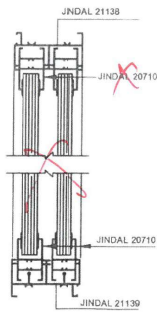
GROUND FLOOR PLAN



VIEW Y-Y



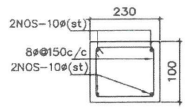
WINDOW - W



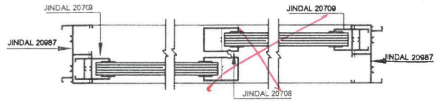
SECTION L-L (2-TRACK)

GENERAL NOTES:

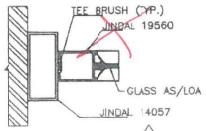
1. ALL DIMENSIONS ARE IN MM. AND LEVELS ARE IN MTR.
2. ALL EXTERNAL SURFACE SHALL HAVE 18MM PLASTER AS PER CPWD SPECS, PAINTED WITH WITH EXTERIOR GRADE PAINT HAVING SILICON ADDITIVES.
3. THE WIRE MESH SHALL BE CONNECTED WITH EARTHING SYSTEM THROUGH 75X12MM FLAT FIXED ON DIAGONALLY OPPOSITE COLUMNS ON ITS OUTER SURFACE
4. INTERNAL CABLE TRENCH SHALL HAVE SLOPE OF 1:1000 TOWARDS THE EXTERNAL CABLE TRENCH.
5. ALL MISC. STEEL SHALL BE PAINTED WITH ONE COAT OF ANTI CORROSIVE PAINT OVER APPROVED PRIMER COAT.
6. INTERNAL CABLE TRENCH LAYOUT SHALL BE VERIFIED/MODIFIED AS PER THE FINAL APPROVED CABLE TRENCH LAYOUT BEFORE CONSTRUCTION.
7. ALL WELDS ARE 5MM FILLET CONTINUOUS WELD UNLESS OTHERWISE SPECIFIED.
8. 22GX12 MM. CHICKEN WRE MESH TO BE PROVIDED FOR OUTER WALL, AND ROOF. CHICKEN WIRE MESH SHALL BE CONNECTED WITH EARTHING SYSTEM THROUGH 75X12NM FLAT FIXED ON DIAGONALLY OPPOSITE COLUMNS ON ITS OUTER SURFACE.
9. FOR OPENING OF AIR CONDITIONER SUITABLE LOCATION AND SIZE TO BE DECIDED AT SITE.
10. ALL STEPS SHALL BE FINISHED WITH 18MM THK. POLISHED GRANITE STONE AS PER SPECIFICATION.
11. All doors and windows shall be of UPVC type as per specification. (TS) 16/03/2020.



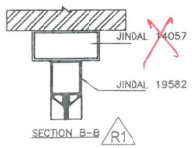
LINTEL BEAM (TYP.)



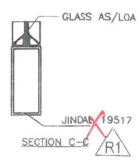
SECTION K-K (2-TRACK)



SECTION A-A R1



SECTION B-B R1



SECTION C-C R1

REVISED AS MARKED R1

REV.	DESCRIPTION	PREP. (ENGG-CIVIL)	REVD. (ENGG-CIVIL)	REVD. (ENGG-ELECT.)	REVD. GM (ENGG-CIVIL)	REVD. DGM (ENGG-ELECT.)	APPD. ED ENGG-S/S,TL&CIVIL	DATE
0	REVISED AS MARKED							12/11/19

RELEASED FOR TENDER/CONSTRUCTION

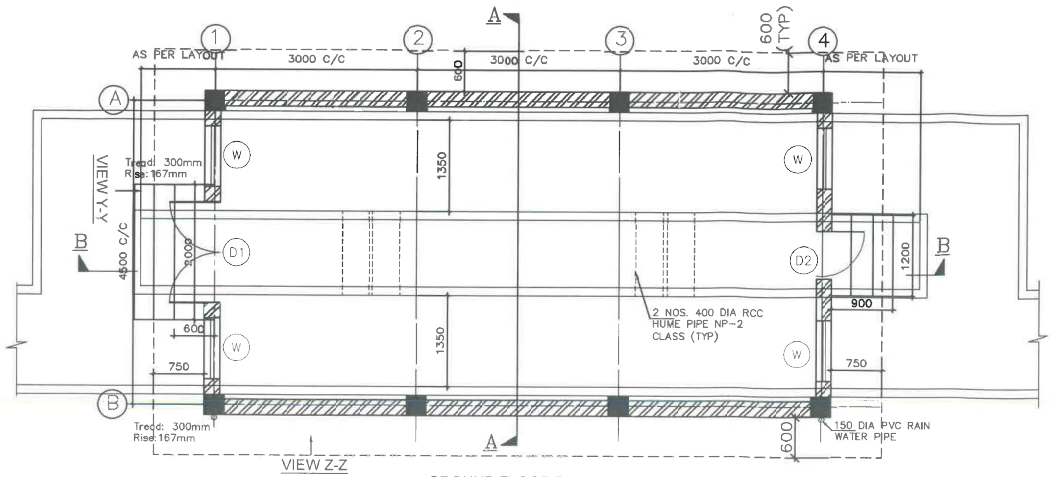
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

TITLE: STANDARD PANEL ROOM (6 M.)

SUB TITLE: STANDARD SWITCHYARD PANEL ROOM GENERAL ARRANGEMENT DETAIL OF PANEL ROOM

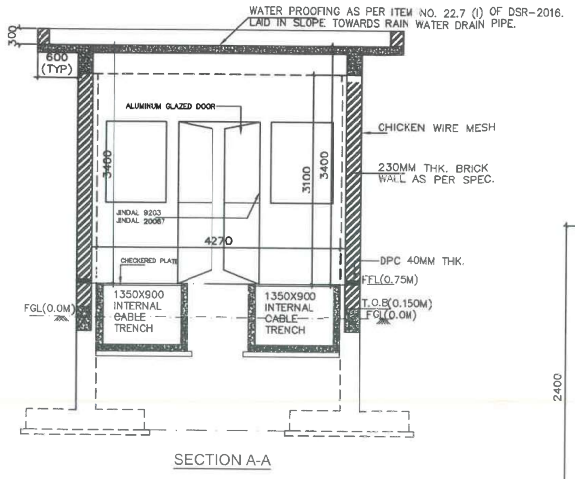
DRAWING NO: C/ENGG/STD/PR/2017 (01 OF 03)

SCALE NTS | REV 01

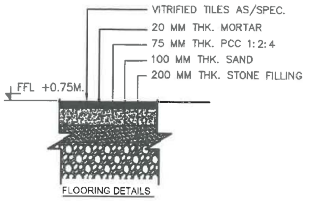


VIEW Z-Z

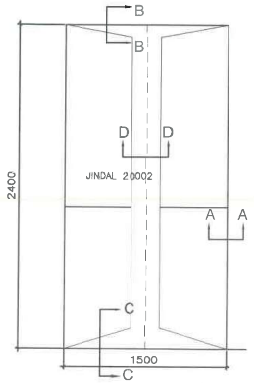
GROUND FLOOR PLAN



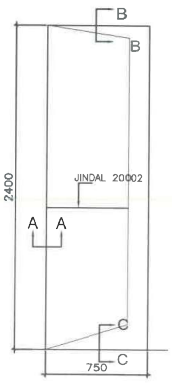
SECTION A-A



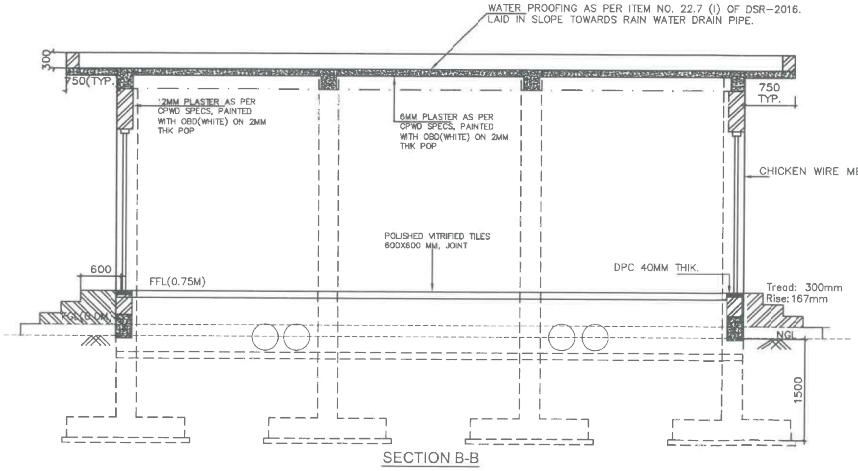
FLOORING DETAILS



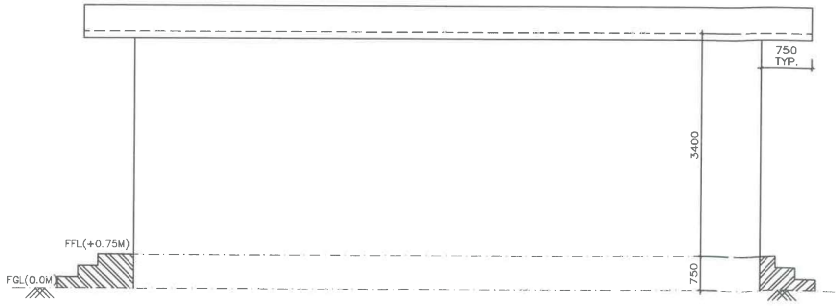
DOOR -D1 R1



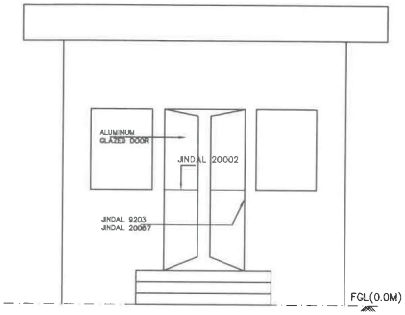
DOOR -D2 R1



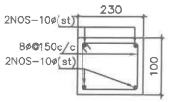
SECTION B-B



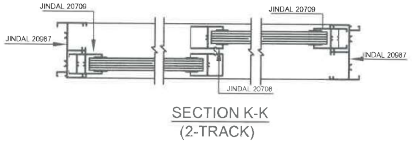
VIEW Z-Z



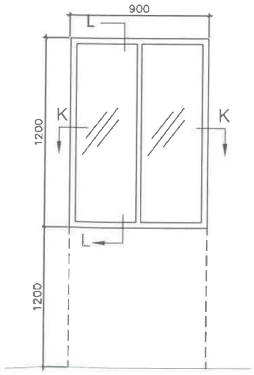
VIEW Y-Y



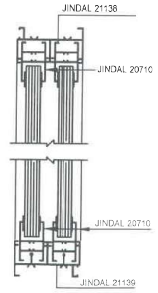
LINTEL BEAM (TYP.)



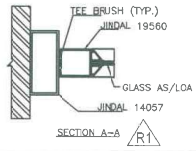
SECTION K-K
(2-TRACK)



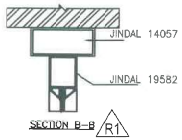
WINDOW - W



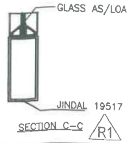
SECTION L-L
(2-TRACK)



SECTION A-A R1



SECTION B-B R1



SECTION C-C R1

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM. AND LEVELS ARE IN MTR.
2. ALL EXTERNAL SURFACE SHALL HAVE 18MM PLASTER AS PER CPWD SPECS, PAINTED WITH WITH EXTERIOR GRADE PAINT HAVING SILICON ADDITIVES.
3. THE WIRE MESH SHALL BE CONNECTED WITH EARTHING SYSTEM THROUGH 75X12MM FLAT FIXED ON DIAGONALLY OPPOSITE COLUMNS ON ITS OUTER SURFACE
4. INTERNAL CABLE TRENCH SHALL HAVE SLOPE OF 1:1000 TOWARDS THE EXTERNAL CABLE TRENCH.
5. ALL MISC. STEEL SHALL BE PAINTED WITH ONE COAT OF ANTI CORROSIVE PAINT OVER APPROVED PRIMER COAT.
6. INTERNAL CABLE TRENCH LAYOUT SHALL BE VERIFIED/MODIFIED AS PER THE FINAL APPROVED CABLE TRENCH LAYOUT BEFORE CONSTRUCTION.
7. ALL WELDS ARE 6MM FILLET CONTINUOUS WELD UNLESS OTHERWISE SPECIFIED.
8. 22GX12 MM. CHICKEN WIRE MESH TO BE PROVIDED FOR OUTER WALL, AND ROOF. CHICKEN WIRE MESH SHALL BE CONNECTED WITH EARTHING SYSTEM THROUGH 75X12MM FLAT FIXED ON DIAGONALLY OPPOSITE COLUMNS ON ITS OUTER SURFACE.
9. FOR OPENING OF AIR CONDITIONER SUITABLE LOCATION AND SIZE TO BE DECIDED AT SITE.
10. ALL STEPS SHALL BE FINISHED WITH 18MM THK. POLISHED GRANITE STONE AS PER SPECIFICATION.

REVISED AS MARKED R1

REV.	DESCRIPTION	PREP. (ENGG-CIVIL)	REVD. (ENGG-CIVIL)	REVD. (ENGG-ELECT.)	REVD. GM (ENGG-CIVIL)	REVD. CGM (ENGG-ELECT.)	APPD. ED (ENGG-S/S,T&C,CIVIL)	DATE
0.	REVISED AS MARKED							12/11/19

RELEASED FOR TENDER/CONSTRUCTION.

POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

TITLE: STANDARD PANEL ROOM (9 M.)

SUB TITLE: STANDARD SWITCHYARD PANEL ROOM GENERAL ARRANGEMENT DETAIL OF PANEL ROOM

DRAWING NO: C/ENGG/STD/PR/2017 (01 OF 03)

SCALE NTS | REV 01