



Bharat Heavy Electricals Limited

(A Govt. of India Undertaking)

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CORRIGENDUM - 20 TO NIT NO-63119

Subject: Corrigendum-20 to Tender enquiry for Pre-bid Tie up for Supply & Services of 220KV GIS for IOCL PANIPAT (P25) PROJECT.

Project : IOCL PANIPAT (P25) PROJECT
Equipment / Item : SUPPLY & SERVICES OF 220KV GIS.
Enquiry No/Date : NIT 63119_61G2200211 dated 16.02.2022
BHEL NIT NO : 63119.
Original Tender due date : 23.02.2022

The Corrigendum is being issued by BHEL TBG against above mentioned NIT/ enquiry for following:

1. To incorporate Technical corrigendum-2 & Revised BOQ and price bid format.
2. To extend due date for Offer submission/opening up to **30.05.2022**.

All other terms and conditions for this tender enquiry shall remain unchanged.

Bidder to ensure submission of offer on or before due.

Note: Tender ID in CPP Portal is **2022_BHEL_8362_1**.

Thanking you

-----Sd/-----

Gaurav Agarwal
BHEL TBG, NOIDA

TECHNICAL CORRIGENDUM - 2**Dated 26 May 2022****220kV KV GAS INSULATED SWITCHGEAR for IOCL, Panipat**

SL	DESCRIPTION	REMARKS
2	ANNEXURE_BOQ	REPLACED WITH ANNEXURE_BOQ, REV.03 . THE CHANGES MADE HAS BEEN HIGHLIGHTED.
1	SECTION-1 SCOPE, PROJECT SPECIFIC TECHNICAL REQUIREMENTS & BILL OF QUANTITIES	REPLACED WITH SECTION-1, REV.02
2	SLD	Revised and attached
3	TECHNICAL AMENDMENT NO: 02 (ELECTRICAL)	ENCLOSED B269-999-16-50-TA-0020-02 Rev.0 WITH IT'S ENCLOSURES TO TENDER: B269-999-16-50-EB-T-0020 FOR 220KV GIS PACKAGE (PROJECT: P-25, M/s IOCL-PANIPAT)
4	SPECIAL NOTE	Any clarification(s) for 220kV GIS published by M/s IOCL with reference to Tender No. SG/B269-999-EB-T-0020/22, Pre Bid Tie up for 220 kV GIS Package for Panipat Refinery Expansion Project (P25) of M/s Indian Oil Corporation Limited (IOCL) will also valid for this specification.

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SECTION 1:

SCOPE, PROJECT SPECIFIC TECHNICAL REQUIREMENTS & BILL OF QUANTITIES

1. Scope

This technical specification covers the requirements of (1.) design, type testing, engineering, fabrication, manufacturing, shop assembly, inspection and testing at manufacturer's works, proper packing, supply and delivery to project site, (2.) supervision of material reconciliation, installation / erection, (3.) execution of site testing & commissioning along with necessary kits, tools & equipment, putting GIS with LCC & its Accessories into successful operation complete with all materials, support structures, anchoring bolts, chemical anchor, accessories, commissioning spares & maintenance spares, special spanners, special tools & tackles, any specific required ancillary services, SF6 gas for first filling & spare etc. including design studies, training of BHEL / Customer personnel for offered GIS & its Accessories complete in all respects for efficient & trouble-free operation mentioned under this specification.

This section covers bidder's scope for GIS with LCC & its Accessories. The offered GIS with LCC & its Accessories shall comply with the Section-1, 2 & 3 of technical specification.

This section covers the specific technical requirements of 220kV GIS with LCC & its Accessories. This constitutes minimum technical parameters for the above item as specified by the BHEL/ Customer. The offered 220kV GIS with LCC & its Accessories shall also comply with the Section-3 (Project Details and General technical requirements for all equipment under the Project) of this specification.

The specification comprises of following sections:

Section-1	:	Scope, Project Specific Technical Requirements & Bill of Quantities
Section-2	:	Equipment Specification under scope of Supplies
Section-3	:	Project Details & General Technical Requirements (For All Equipment under the Project)
Section-4	:	Annexures
		Annexure A- Compliance Certificate
		Annexure B- Schedule of Technical Deviations
		Annexure C- Guaranteed Technical Particulars
		Annexure D- Technical Checklist

The following order of priority shall be followed. In case of conflict between requirements specified in various documents, the more stringent one shall be followed. BHEL/Customer concurrence shall, however, be obtained before taking a final decision in such matters.

1. Statutory Regulations

In particular, the latest version of the following statutory regulations, as applicable, shall be followed for system,

- o Indian Electricity Act
- o CEA regulations
- o The Factory Act

Bharat Heavy Electricals Limited

Project: Pre Bid Tie up for 220 kV GIS Package for Panipat Refinery Expansion Project (P25)

Technical Specification: 220kV GIS with LCC & its Accessories

Doc No. TB-PBT-316-PN1

SECTION 1, Rev 02

-
- o The Petroleum Rules
 - o OISD standards
 - o Requirements of other statutory bodies as applicable, e.g. CEA, CCE, LPCB.
2. Section-1
 3. Section-2
 4. Section-3
 5. Codes & Standards

Bidder shall furnish list of conflicts/ ambiguities/ deviations, if any, along with their technical offer and also furnish the basis that is considered for submitting technical offer. BHEL will address the bidder's listed conflicts prior to award. In case of ambiguity, bidder shall inform BHEL of their interpretation. In case bidder fails to convey the same prior to award, BHEL decision on interpretation shall be considered final if need arises during the execution. No additional cost or extra time on account of conflicts/ ambiguities/ deviations shall be admissible.

In general, no deviation from the requirements specified in various clauses of this specification shall be allowed and hence, a certificate to this effect shall have to be furnished along with the offer (Annexure-A), however bidder shall furnish list of conflicts/ ambiguities/ deviations (Annexure-B), if any.

Please note, any deviation not specifically brought out in Annexure-B (Schedule of Technical Deviations) shall not be admissible for any time and commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer. Any conflicts/ ambiguities/ deviations mentioned elsewhere in technical offer shall not be reviewed.

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the notice inviting tender/ enquiry.

Any clarification(s) for 220kV GIS published by M/s IOCL with reference to Tender No. SG/B269-999-EB-T-0020/22, Pre Bid Tie up for 220 kV GIS Package for Panipat Refinery Expansion Project (P25) of M/s Indian Oil Corporation Limited (IOCL) will also valid for this specification.

The equipment is required for the following project:

Name of the Customer	:	Indian Oil Corporation Limited (IOCL)
Name of Consultant	:	Engineers India Limited
Name of Main Contractor	:	Bharat Heavy Electricals Limited
Name of the Project	:	LSTK job for ISBL work of 220KV Grid Power Import at IOCL, Panipat Refinery

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the notice inviting tender/ enquiry. In case of revision of document under technical specification, latest revision is to be followed.

2. Codes & Standards

The performance, testing and rating of the switchgear shall conform to the latest edition of the following IEC / IS publications,

IEC 60694	Common clauses for High Voltage Switchgear & Control Gear
IEC 62271-203	Gas Insulated metal-enclosed Switchgear for rated voltages above 52kV
IEC 62271-207	Seismic Qualification for Gas-insulated Switchgear Assemblies for rated voltages above 52kV
IEC 60376	New Sulphur Hexafluoride
IEC 62271-100	High Voltage Alternating Current Circuit Breakers
IEC 62271-1	Common Clauses for High Voltage Switchgear and Control-Gear Standards
IEC 62271-102	Alternating Current Disconnections (Isolators) and Earthing Switches
IEC 60044-1	Current Transformers
IEC 60044-2	Voltage Transformers
IEC 60137	Bushings for Alternating Voltages above 1000V
IEC 62271-209	Cable Connections for Gas-insulated Switchgear
IEC 60480	Guide to Checking of Sulphur Hexafluoride taken from Electrical Equipment
IEC 60099-1/4	Non-linear Resistor type Arresters for AC Systems
IEC 60439	Factory-built Assemblies of Low-voltage Switchgear and Control Gear.
IEEE 80 (2000)	IEEE Guide for Safety in AC Substation Grounding.
CIGRE-44	Earthing of GIS- An Application Guide. (Electra no. 151, Dec'93).
IEC 61639	Direct connection between Power Transformers and Gas-insulated metal-enclosed Switchgear for Rated Voltage 72.5kV and above

These are only indicative list and hence any other codes & standards, if applicable shall be complied by bidder.

3. Specific Technical Requirements

Specific technical requirements 220kV GIS with LCC & its Accessories shall be as follows,

220 kV Indoor Double Bus Gas Insulated Switchgear, 2000 A, 50 kA (3 Sec.), SF6 Breaker with 3 Position & 2 Position Disconnecter for Bus Side, 3 Position Disconnecter for Line Side, High Speed Make Proof Earthing Switch, Capacitive Voltage Detector, Gas Insulated Current Transformer, LCC and SF6 Gas Analyser, Online Partial Discharge Monitoring System, Online SF6 Gas filling system e.t.c. complete.

~~GIS Outdoor Type Isolating breaker panel 220 kV, 2000 Amps, 50 kA (3 Sec) with Local Control~~

~~Cubicle, GIS shall be suitable for taking power from overhead ACSR conductor and outgoing shall be through cables. Terminal connector for SF6 to AIR bushing is not in bidder's scope of supply.~~

~~Extension of existing 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear with Local Control Cubicle~~ "Extension of transformer feeder bays in existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear with Local Control Cubicle, other details shall be shared with successful bidder.

Although the indoor GIS system shall be installed in Air Conditioned GIS/ Switchgear hall, but same shall also be suitable for installation and satisfactory operation in a non-air conditioned, tropical, humid and corrosive environment.

Sl. No.	Technical Parameters	Unit	Particulars
	Type of GIS		Indoor & Outdoor-Type, Double Bus type
	Installation		Indoor
	Meteorological data		
1.1	Maximum ambient temperature	°C	50
1.2	Minimum ambient temperature	°C	-5
1.3	Average ambient temperature	°C	35
1.4	Design ambient temperature	°C	45
2	Average no. of thunder storm days	Days	45
3.1	Maximum Relative humidity	%	95
3.2	Maximum Relative humidity	%	26
4	Average Annual Rain Fall	mm	900
5	Maximum Wind Pressure	Kg/ sqm	195
6	Maximum Altitude above Mean Sea Level	m	1000
7	Isoceraunic Level	Days/ Year	45
8	Seismic Level (Horizontal Acceleration)	Zone	4
9	Average no. of rainy day per Year	Days/ Year	120
	Switchgear Design Data		
10	Service Voltage	kV	220
11	Maximum Service Voltage	kVp	245
12	Rated Insulation Level		
	-at power frequency 1 min	kV	460
	-at lightning impulse (1.2/50 µs wave)	kV	1050
13	Frequency	Hz	50
14	Rated service current (minimum)		
	- Bus bar	A	2000
	- Input Feeder bay	A	2000
	- Transformer bay	A	1250
	- Bus coupling bay	A	2000

15	Rated short time withstand current (Symmetrical)	kA	50
	- Duration	Seconds	3
16	Internal fault withstand time without burn Through	ms	As per IEC-62271-203
17	Temperature rise at rated service current (indicative)		
	- Conductor	°C	As per IEC-60694
	- Enclosure	°C	
18	Rated SF6 gauge pressure at 20°C		
	- Circuit breaker	bar rel.	As per standard
	- Switchgear	bar rel.	
19	Enclosure design pressure		
	- Circuit breaker	bar rel.	As per standard
	- Switchgear	bar rel.	
20	Leakage rate of SF6 per annum for the whole substation	%	< 0.5
21	Maximum partial discharge level	pC	≤ 5
22	Factory Dielectric routine test 50Hz	kV	460
23	Site dielectric test	kV	380
24	Painting of switchgear		
	- Coating design and execution	RAL	As per detailed Specification/ Standard.
	- Top coat colour	RAL	
25	Surface protection of steel frames		Hot-dip Galvanizing with Zinc with 610gm/ square meter
26	Degree of Protection	IP	42
27	Disconnecter class		M2
28	Rated line charging interrupting current of breaker		As per IEC on light loaded line and 4 km of cable

Insulation co-ordination studies for the 220 kV GIS substation package to finalize location and quantity of surge arrestors required in addition to those shown in SLD. Insulation co-ordination studies for the 220 kV GIS substation package to finalize location and quantity of surge arrestors required in addition to those shown in SLD, cost of the same shall be inclusive in the bidder's scope.

The GIS shall be designed, so as to take care of the Very Fast Transients (VFT) over voltages generated as a result of pre-strikes and re-strikes during isolator operation. Maximum VFT over voltages peak shall not be higher than rated lightning impulse withstand voltage of the equipment. Necessary measures shall be under taken by GIS manufacturer to restrict maximum

VFT over voltages lower than the lightning impulse withstand voltage. Manufacturer shall submit the study report of VFTO generated for GIS installation.

All current carrying components of the equipment specified shall be capable of continuous operation at the specified rated current without exceeding the maximum temperature rise specified in the relevant IEC standards. Thermal calculations shall be based on the climatic conditions mentioned elsewhere in specification.

4. Bill of Quantities

1. SF6 gas for initial installation of complete GIS System, including wastage during installation, testing and successful commissioning shall be deemed included in the bidder's scope.
2. The offered GIS with LCC & its Accessories shall be complete in all respect in compliance to technical specification and relevant IS / IEC / IEEE standards as applicable. Any other equipment/material required to complete the specified GIS scope of work are inclusive of bidder's scope of supply & services.
3. All essential and desirable accessories are deemed inclusive of offer i.e. and not limited to Gas Monitoring Devices, Pressure Switches, PD sensors, Pressure relief device, insulator, expansion joint/ flexible, bellows/ compensators like lateral mounting units, Axial compensators, Parallel compensators, tolerance compensators and vibration compensators etc. complete in all respect.
4. Total contract value may vary up to $\pm 30\%$ at contract stage.
5. Any Item not quoted mentioned "Not Applicable" in bid price schedule and found applicable as per technical specification and system requirement shall be supplied free of cost by bidder without any time / cost implication to BHEL / Customer.
6. Length & route of GIB is purely indicative and same shall be finalized during detailed engineering stage.
7. BHEL reserve rights to amend Bay sequence during contract stage, no separate claim shall be admissible in this regards.
8. Supply scope of Testing & Maintenance Equipment – Scope of supply of following Equipments shall be applicable only if covered in BOQ / BPS.
9. SF6 Gas leakage detector
10. Gas filling and evacuating plant: (Gas Processing unit)
11. SF6 gas analyzer
12. Portable Partial Discharge(PD) monitoring system
13. Online Partial Discharge Monitoring System
14. Main Bus 1 / 2 / Transfer Bus etc. (as applicable) Gas Insulated Bus Bars running across the length of the switchgear to interconnect each of the bay modules (as per layout) and necessary interfaces (as applicable under the technical requirement) is deemed inclusive in the scope. The same may or may not be indicated with break-up in BOQ / BPS. (BPS means Bid Price Schedule)
15. GIS shall be Double Bus configuration complete with local Control Cubical (LCC). Typical Bay includes Busbar, Circuit Breaker, Disconnecter & Maintenance Grounding Switch, Fast Acting

Make Proof Grounding Switches, Voltage Transformer, Current Transformer, Surge Arrestor, SF6 to Air Bushings/ Cable Connection Module, GIS bus duct, Gas Monitoring Devices, Online PD Monitoring System, Pressure Switches, PD sensors, Pressure relief device, insulator, expansion joint/ flexible, compensator, online SF6 Gas filling system etc complete in all respect. (Refer attached Single Line Diagram & Feeder Datasheets). GIS shall be complete in all respect such as and not limited to all necessary terminal boxes, inspection windows, SF6 gas filling, interconnecting cabling & wirings, grounding connections, gas monitoring systems and piping, trays, support structures, wall / floor Inserts, **Anchor Bolts**, Foundation Bolts. Hence, the scope shall include supply erection / mounting of hardware.

16. Power, control & instrumentation cables for Cabling (1.) within GIS, (2.) GIS to LCC, (3.) LCC to LCC shall be deemed inclusive in bidder's scope of supply.
17. Scope includes for completeness for GIS system with LCC & its Accessories
18. Cabling between LCC to LCC shall be applicable if required in bidder's design philosophy.
19. Cables required for bidder supplied GIS sub-system i.e. condition monitoring system (Gas monitoring system, PD monitoring system etc) are to be supplied by bidder as complete system.
20. Necessary Cable Lug, Glands & shroud etc. required for installation of bidder's supplied cable are deemed inclusive in bidder's scope.
21. Bidder to provide detailed "Bill of Quantity" during detailed engineering stage. Cabling & termination schedule for the same shall be provided by successful bidder along with AS BUILT drawing during contract stage.
22. Power Cable TB's (for both AC & DC incoming feeder cables) shall be suitable for termination of requisite cable.
23. Please refer 220kV Feeder Detail Datasheet (B269-999-16-50-DS-0034 & B269-999-16-50-DS-0033), Single Line Diagram and other sections of technical specification.
24. Quantities for supply and services for 220kV GIS with LCC & its Accessories shall be as per Annexure_BOQ. Mandatory spares for applicable items shall be as per BOQ attached with the tender document.
25. **GIS Services:** Site service activities shall be carried out at in stages as per requirement or front availability at site, and hence multiple visits for completion of work are envisaged. Site visit for supervision of unloading & verification of materials for proper storage and up-keeping at site includes following activities but not limited to, (a) Supervision of safe unloading of GIS & its accessories at site. (b) Reconciliation, storage & up keeping of materials, with due instructions/ training to site persons for long storage.
26. Supervision of complete GIS System (as per scope of supply) along with all bay Equipments, indoor & outdoor (excluding Bus duct and SF6 to air bushing covered separate BOQ line item) such as and not limited to GIS extension module, GIS bus extension module, surge arrester, voltage transformer, LCC including structure, cabling, earthing & other associated activities shall be included in the scope.
27. **Training of IOCL's personnel, performance guarantee test run for 72 hours of 220 KV GIS** is in the scope of bidder, cost of the same is deemed inclusive.
28. During tender stage No of bays of 220KV GIS may vary. Number bays of 220KV GIS shall be finalized after receipt of Notification of award (NOA) from IOCL.
29. Bidder to submit price break-up of spares as per Annexure_Sapres (**B269-999-16-50-SL-0020**) FOR GIS during tender stage. It shall not be binding on the BHEL to procure all of these

mandatory spares.

- ~~30. Length of GIB is purely indicative and same shall be finalized during detailed engineering stage in line with final approval of drawings from IOCL.~~
31. Prices for all applicable accessories of GIS shall be included in the equipment prices. All items required for completeness of bay/ module such as SF6 gas, sensors, structure, earthing etc. shall be the part of respective bay/ module price. However, in the case of award of contract, Bidder will submit the price break-up for those items.
32. Any other equipment/material required to complete the specified GIS scope of work are inclusive of bidder's scope of supply.
33. ~~Gas Insulated Bus Duct:~~ GIB length of 1-phase busduct outside the GIS BAY MODULE shall be considered for mode of measurement. Bus duct lengths shall be taken from the end of bay equipment (VT, LA etc.) to end equipment (SF6 to air bushing, SF6 to oil bushing/ connection etc.). This including SF6 Gas, structure, Earthing, foundation bolt, PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, compensator, insulators etc. Complete in all respect.
34. Connection between GIS to cable connection module is deemed inclusive in the scope of respective GIS Bay cost of the same shall not be paid separately.
35. Any change in bay pitch (distance between bays): In a case where shifting of GIS bays shall be called by BHEL (during contract stage) due to layout requirement / cost optimization / revision / change in civil architectural requirement (Refer drawing B26900081410240B, SUBSTATION-100 (MAIN RECEIVING SUBSTATION) or due to expansion joint requirement in the GIS building, Bidder to incorporate the same with full compliance of technical requirement. ~~Payment equivalent of BPS / BOQ item under head "Gas Insulated Bus Duct" shall be operated for additional length of Main Bus, subject to such shifting is not attributed to bidder.~~
36. Total GIS System has three different installation locations in Panipat Refinery Expansion Project (P25)
- a. Substation – 100 MRSS (MAIN RECEIVING SUBSTATION)
 - b. ~~Extension to Existing GIS near Switchyard (2 Bays)~~
 - c. ~~Outdoor Switchyard (2 Bays)~~

5. Other General Requirements

Other general requirements 220kV GIS with LCC & its Accessories shall be as follows,

1. Power, Control & Instrumentation / Special cable: All cables within GIS, GIS to LCC, between LCC to LCC shall be in bidder's scope of supply. Bidder to provide detailed "Bill of Quantity" during detailed engineering stage. Cabling & termination schedule for the same shall be provided by successful bidder along with AS BUILT drawing during contract stage. Power Cable TB's (for both AC & DC incomer cables) shall be suitable for termination of two wire of 16 Sqmm Aluminum (for each phase / polarity). The cables between LCC to CRP/ Bus Bar Panel shall be supplied and laid by BHEL under the supervision and input of the bidder.
2. Storage shall be provided by BHEL/ its contractor. However, bidder shall provide their tentative space requirement for covered and/ or open store area during tender stage only. In addition to this, bidder shall submit their standard storage instruction manual

specifically specifying the item detailed with details of type of storage.

3. Bidder shall submit list of consumables with shelf life of less than six months and same shall be dispatched just before the erection and only after specific clearance from BHEL/Customer.
4. Project Site is located in petrochemical/ process industry, which is highly corrosive & abundance of hydrocarbon area. Hence, GIS should be compatible with above requirements during design, material selection and construction of GIS & its accessories and all equipment, accessories and wiring shall have tropical protection, involving special treatment of metal and insulation against fungus, insects and corrosion.
5. Packing of GIS & its accessories shall be suitable for long term storage without any deterioration in quality and performance (minimum 1 years, if required).
6. Bidder shall offer their latest type tested compact model to accommodate the specified & allocated space as per attached layout drawing of GIS. Bidder to note that if bidder fails to meet above requirement, its technical offer is liable for non-evaluation.
7. Bidder shall conduct insulation co-ordination studies in line with IEC:60071 for establishing surge arrester rating, quantity and any other requirement for successful operation of GIS.
8. Bidder shall check and ensure adequacy of system protection for successful operation of GIS. After checking of system by bidder, GIS shall be installed and if any failure, malfunction of any part occurs after/ during commissioning, same shall be replaced immediately without any extra cost.
9. The 220kV GIS building shall comprise an EOT (Electric overhead travel) crane. EOT crane for GIS is not envisaged in bidder's scope but bidder shall provide all the calculations basis for sizing of EOT crane during tender stage only.
10. CT/ VT parameters mentioned in CT VT parameter document is indicative only. Bidder has to ensure correctness of CT/VT sizing for GIS during contact stage / detailed Engineering stage.
11. Any change in bay pitch (distance between bays) as per civil requirement for during detailed engineering stage shall be incorporated by the bidder without any cost and delivery implication to BHEL.
12. Bidder shall include painting and marking of all buses, individual incomers, all outgoing feeders etc. with details such as tag no., feeder rating, sending end source reference etc. for all switchboards.
13. The GIS shall be designed in such a way that suitable walkways are provided all around the switchgears so that the operators will be able to have free access to all the operating mechanism.
14. The GIS Equipment shall be complete with all necessary supports, ladders, galleries, staircases, catwalks, movable platforms or walkways (for accessing the equipment above two meters for maintenance and operation), mechanism cabinets, internal cable raceways etc for each bay and it shall be of modular construction and extendable design. All structures, galleries, staircases and walkways shall conform to the relevant Occupational Safety and Health Administration (OSHA).
15. Special tools & tackles for installation and testing kits for testing & commissioning including gas handling plant required for successful installation of GIS shall be in bidder's scope, however, it shall be brought at site on returnable basis only.

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16. The general Tools and Tackles shall be provided by BHEL, list of the requirement i.e. general tools-tackle, spanners, gauges, slings and other lifting devices, crane, welding machines, drills, general instruments and appliances necessary for the installation of GIS is to be submit by bidder along the technical bid.
 17. Bidder to furnish detailed BOQ for non-returnable special Tools and Tackles, if applicable along with unit prices to be handed over to ultimate customer. The prices for the same shall be considered during evaluation.
 18. All the testing kits including HV Test Kit required for successful testing / commissioning of offered GIS are to be arranged by bidder on returnable basis. Cost of the same shall be deemed inclusive in the offer.
 19. SF6 Gas handling equipment required during erection, testing & commissioning in bidder' It is the responsibility of the contractor to supply all necessary commissioning spares as required unless/ until the equipment/ systems are handed over to the Purchaser (IOCL). scope.
 20. Start-up & Commissioning spares are included in bidder's scope of supply and shall be included in the base price. Adequate stock of start-up & commissioning spares shall be made available at the site such that the start-up and commissioning of the equipment /systems, performance testing and handing over the equipment/ systems to the Purchaser can be carried out without any hindrance or delays.
 21. ETC work schedule for all the GIS may vary according to readiness of site. Respective dates for the commencement of erection, testing and commissioning activities of GIS shall be communicated to manufacturers from time to time as per the readiness of site.
 22. **Final documentation** shall be submitted in hard copy (Seven prints) and soft (Three CDs/DVDs)
 23. For all control cables minimum 1 Pair shall be provided as spare.
 24. Bidder to submit following **drawings/ documents at tender stage**:
 - Preliminary GAS SLD for the GIS.
 - Preliminary Layout/ section for the GIS.
 - Tentative building size including Colum placement and GIB exit requirement.
 - EOT Crane Details/ sizing.
 - Heat Load calculation for all the three GIS (Indoor part) for AHU load calculation.
 - AC-DC Load cycle, Continuous and Momentary load.

6. Earthing of GIS

1. Bidder to submit detailed calculations and layout drawings for earthing system during detailed engineering stage based on technical specification, bidder's design philosophy, IS/IEC/IEEE requirement as applicable. Bidder to provide the bill of quantity of entire GIS system with LCC & its Accessories
2. Supply of 40 mm MS ROD, 75X12 mm GI Flat, 50X06 mm GI Flat is not in bidder's scope of supply.
3. All other earthing materials including complete Hardwares, nut, bolts washers, lug etc.

required, as per earthing design shall be in bidder's scope of supply.

4. Installation / Erection of earthing will be done by BHEL team under the supervision of bidder/manufacturer, as per manufacturer's design.

7. Modular Design & Future extensions

5. The GIS switch gear shall be of modular design offering high degree of flexibility. Each module shall be complete with SF6 gas circuit breaker, disconnectors, Maintenance Grounding switches, fast Earthing switches, voltage transformers, Current transformers, bus & elbow sections, Gas Insulated Bus-duct, local control cubicle and all necessary components required for safe & reliable operation and maintenance.
6. The GIS shall be of either single-phase enclosure type or three-phase enclosure type for voltage levels of 220kV.
7. In those design where bus bar is continuous, provision is to be made available for isolation of individual bay without disturbing adjacent bay.
8. The switchgear shall be of the freestanding, self-supporting dead-front design, with all high-voltage equipment installed inside gas-insulated, metallic grounded enclosures, and suitably sub-divided into individual arc and gas proof compartments, preferably for:
 - (1) Bus bars
 - (2) Intermediate compartment
 - (3) Circuit breakers
 - (4) Line dis-connectors
 - (5) Voltage transformers
 - (6) Gas Insulated bus duct section between GIS and,
 - (7) Gas insulated bus section between GIS and oil filled transformer.
 - (8) Current Transformers.
9. The bus enclosure shall be sectionalized in a manner that maintenance work on any bus disconnector (when bus and bus disconnector are enclosed in a single enclosure) can be carried out by isolating and evacuating the small effected section and not the entire bus.
10. Arc faults caused by external reasons shall be positively confined to the originating compartment and shall not spread to other parts of the switchgear. In case of any internal arc fault in a busbar, busbar disconnector or circuit breaker, of double bus system, repair works must be possible without shutting down complete substation and at least one busbar and the undisturbed bays must remain in operation.
11. The busbar system shall be sectionalized for each bay and contained in individual SF6 gas tight bus compartments to prevent contamination of the gas of the whole bus bar due to fault in one bay zone and refill lesser quantity of SF6 gas.
12. Where bus Coupler is specified and in case of any internal arc fault in a busbar, busbar disconnector or sectionaliser, repair work must be possible without shutting down the complete substation and at least one half of the substation must remain in operation.
13. Documents indicating sequence of repair work steps and description of necessary restrictions during work shall be submitted with the technical manual during as built drawing submission.
14. Each bay module should be equipped with suitable arrangement for easy dismantling and refitting during maintenance without disturbing other units.
15. Material clearance certificate shall be issued after demonstration of the functionality of maintenance equipment.

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16. Structural Steel, Support Structure & Hardwares (required for installation of complete GIS system with LCC & its Accessories etc.) are deemed inclusive of bidder's scope of supply. The same may or may not be indicated with break-up in BOQ / BPS.
 17. All steel structure members shall be hot-dip galvanized after fabrication (excluding floor embedded items for which standard practice is to be followed). All field assembly joints shall be bolted. Field welding shall generally not be acceptable. Noncorrosive metal or plated steel shall be used for bolts and nuts throughout the work.
 18. Unless otherwise specified, minimum mass of zinc coating for Galvanizing shall be 610 gm/square meter.
 19. Lattice / Pipe structure Materials for support of GIS, Bus Ducts, SF6 to oil bushing/ SF6 to cable connection and SF6 to air bushing/ connection including Anchor Fastener Bolts, Foundation Bolts, Base Plate / Channel / Metallic / Structural Member for seating of GIS system, all floor and wall Embedded Items, wall crossing arrangements, Rails and/ or other items structural items as required. Manufacturer shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts, Anchor Fasteners, foundation bolts, nuts and washers, equipment fixing hardware shall be provided to fasten the switchgear base frames to the foundation channels as applicable
 20. The GIS Equipment shall be complete with all necessary supports, ladders, galleries, staircases, catwalks, movable platforms or walkways (for accessing the equipment above two meters for maintenance and operation), mechanism cabinets, internal cable raceways etc. for each bay and it shall be of modular construction and extendable design.
 21. Structural steel for complete GIS system with LCC & its Accessories is deemed inclusive in bidder's scope of supply.

8. Maintenance and Repair of Circuit Breaker

1. The positioning of the circuit breaker in the GIS shall be such that it shall be possible to access the circuit breaker of any feeder from the front side for routine inspection, maintenance and repair without interfering with the operation of the adjacent feeders.
2. The GIS shall be so designed that any component of the GIS can be removed easily. With minimum flexibility in the layout arrangement it shall be possible to remove the circuit breaker with both busbars remaining in service and it shall be possible to remove the disconnecter of the busbars, with one bus bar remaining in service. For achieving this requirement, adequate number of intermediate compartments, if required, shall be provided to ensure equipment & operating personnel's safety.
3. The bidder shall be required to demonstrate clearly in his submitted documents the suitability of the switchgear design in this respect. The arrangement shall be such that expansion of the original installation can be accomplished with minimum GIS down time.
4. In case of extension, the interface shall incorporate facilities for installation and testing of extension to limit the part of the existing GIS to be re-tested and to allow for connection to the existing GIS without further dielectric testing.
5. All the elements shall be accessible without removing support structures for routine inspections and possible repairs.

9. Interchangeability & Future Extension

1. As much as possible, all the parts shall be of standard manufacturer with similar parts and assemblies being interchangeable.
2. The GIS system shall be suitable for future extension on either end by the addition of extra feeders, bus couplers, bus-bars, circuit breakers, dis-connectors, and other switch gear components. The arrangement of gas sections or compartments shall be such as to facilitate future extension without any drilling, cutting or welding on the existing equipment. To add equipment, it shall not be necessary to move or dislocate the existing switchgear bays
3. The layout shall ensure that GIS bus link section is provided for future extension of the GIS buses to avoid de-gassing and modification of the existing bus.
4. The physical layout shall ensure free movement of the SF6 Gas Cart and easy access to all components of the GIS for maintenance purposes.

10. Drawings / Documents for Manufacturing Clearance

The drawings/ documents, as follows shall be used for providing technical clearance for manufacturing of GIS and furthermore, it shall be used for delay analysis, if any, from bidder. The first drawing submission will be counted from the date of submitting reasonably correct drawings.

Sl. No.	Overall Drawings approval required in Cat I /Cat II
1	220KV GIS- Gas Schematics with Single Line Diagram (Including CT VT Parameters)
2	220KV GIS- Guaranteed Technical Particulars (Including all GIS equipment
3	220KV GIS- Layout Plan & Section
4	220KV GIS- Interfacing Drawings for Cable Connection Module, SF6 to Air Bushing, SF6 to Oil Module with Guaranteed Technical Particulars
5	220KV GIS- Equipment Layout with Earthing philosophy
6	220KV GIS- Type Test Reports (Including all GIS equipment)
7	220KV GIS- Secondary Engineering Base Design
8	220KV GIS- Control Schematics for GIS and Local Control Cabinet
9	220KV GIS- Maintenance Equipment Catalogue with Guaranteed Technical Particulars
10	220KV GIS- Quality Assurance Plan & Inspection Test Schedule
11	220KV GIS- Civil Design Specification with Foundation Loading Diagram (Including interfacing details)
12	220KV GIS- Quantification for main Items, Spares, Consumables
13	220KV GIS- 3D OGA Drawing (3D-Model with complete editable data base) compatible with Autocad & Primtech for complete GIS & its accessories.
14	Other documents as per Technical Specification / BOQ shall be finalized during detailed engineering stage.

The Manufacturing clearance shall be provided Lot wise, however lot item can be clubbed together subject to approval of drawing/ documents. MFC date will be counted from the date of

approval of drawings in Cat I/ cat II , for each lot. **Break-up for lot items shall be done during detailed engineering stage, on receipt of firm order by customer.**

11. Type Testing

The offered 220kV GIS equipment and components shall conform to the type tests as per IEC 62271-203. bidder to ensure at the time of order placement that copies of valid type test certificates for tests conducted on identical design of offered equipment is available. In case of non-availability of type test certificates, same shall be conducted without any cost and time implication to Owner/ EIL

Please refer document 6-81-1066 Rev. 0, Inspection and Test Plan for EHV GIS Switchboard for details of type test requirement.

In case any of Type tests have not been conducted on the offered design or there has been a change in the design after the type tests. The requisite tests shall be conducted by bidder on the offered design without any extra cost and delivery impact to BHEL/ Customer.

12. Quality Plan

The successful bidder shall submit Quality Assurance Plan for major components such as breakers, disconnecting switches, lightning arrestors, earth switches, etc. with in-process inspection methods, tests, records, etc. for BHEL/ Customer approval. Customer hold points will also be included in the plan, which shall be mutually agreed by the BHEL/ Customer and Bidder and approved. In case bidder has reference Quality Assurance Plan agreed with BHEL/Customer, same shall be submitted for specific project to BHEL/ Customer approval. There shall be no commercial implication to BHEL/ Customer on account of Quality Plan approval.

Superior quality control system shall be adopted to assure high product quality. Raw materials of the best commercial grade quality and high reliability shall be used in the manufacture of GIS. High reliability of materials shall be ensured so as to keep maintenance work to a minimum. All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan. The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification. Charges for all these tests for all the equipment & components shall be deemed to be included in bidder's scope.

13. Inspection & Testing

1. GIS and its associated materials shall be subject to inspection by BHEL/ Customer or authorized representative at bidder/manufacturers' works. Hence, Bidder shall furnish all necessary information concerning the supply to BHEL/ Customer.

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2. During fabrication, the equipment shall be subject to inspection by BHEL/ Customer or by an agency authorized by BHEL/ Customer to assess the progress of work as well as to ascertain that only quality raw material is used.
 3. Bidder shall ensure that the hazardous area equipment provided shall have the necessary test certificates and valid CCOE approval certificates.
 4. Bidder shall also furnish factory acceptance test (FAT) from manufacturers for BHEL/ customer approval in line with technical specifications.

14. Field Testing & Commissioning

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1. Bidder shall carry out the supervision of installation, field testing and commissioning of 220kV GIS with LCC & its Accessories. Further appropriate test and commissioning reports and as-built documentation as necessary be submitted.
 2. Field testing and commissioning of 220kV GIS with LCC & its Accessories shall be done by Bidder/OEM only.
 3. Bidder shall also submit site acceptance testing (SAT) procedures and get them approved from BHEL/ Customer before carrying out the site testing at site.
 4. All switchboard protection shall be subject to primary injection test before commissioning.
 5. Bidder/ OEM shall coordinate with manufacturers of other equipment wherever required and shall freely and readily supply all technical information for this purpose as and when called for.
 6. All electrical equipment shall be said to be installed and mechanically complete after circuit testing, primary and secondary injection testing and loop simulation is complete. Due care and consideration shall be given to the installation of 220kV GIS with LCC & its Accessories.

15. Makes of Equipment/ Components

Bidder/ vendor while ordering shall ensure the availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply. Bidder/ OEM shall give a notice of at least one year to the BHEL/ Customer before phasing out the products/spares to enable the owner for placement of order for spares and services.

16. Packing and Dispatch

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1. The equipment shall be carefully packed for transport by sea, rail and road in such a manner that it is protected against the climatic conditions and for any damage during transportation, transit and storage. Packing of the equipment shall be suitable for long storage (minimum 1 year).
 2. The SF6 equipment shall be shipped in the largest factory assembled units within transport and loading limitations and considering handling facilities on site to reduce the erection and installation work on site to a minimum. Where possible all items of equipment or factory assembled units shall be boxed in substantial crates or containers to facilitate handling in a safe and secure manner.
 3. Each individual piece to be shipped, whether crate, container or large unit, shall be marked special notations such as 'Fragile', 'This side up', 'Centre of gravity', 'Weight', 'Owner's particulars', 'PO no.' etc., and other details as per purchase order.

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4. The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains and high ambient temperature.
 5. Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. This applies particularly to the equipment of which each gas section shall be sealed and pressurized prior to shipping. Either dry nitrogen/air or dry SF6 gas shall be used and the pressure shall be such as to ensure that, allowing for reasonable leakage, it will always be greater than the atmospheric pressure for all variations in ambient temperature and the atmospheric pressure encountered during shipment to site and calculating the pressure to which the sections shall be filled to ensure positive pressure at all times during shipment.
 6. All blanking plates, caps, seals, etc., necessary for sealing the gas sections during shipment to site shall be provided. Any seals, gaskets, 'O' rings, etc. that will be used as part of the arrangement for sealing off gas sections for shipment of site, shall not be used in the final installation of the equipment at site. Vendor to provide quantity of components accordingly considering permanent installation and commissioning.

17. Abbreviations Used

The following terminology/ acronym hereunder and elsewhere in the technical specification used and their grammatical variations shall unless repugnant to the subject or context thereof, have the following full form hereunder respectively assigned to them, namely,

GIS:	Gas Insulated Switchgear
LCC:	Local Control Centre
IBP:	Isolating breaker panel
CT:	Current Transformer
DC:	Direct Current
HV:	High Voltage
EHV:	Extra High Voltage
kV:	Kilovolt
Hz:	Hertz
IP:	Ingress Protection
SAT:	Site Acceptance Testing
CCOE:	Chief Controller of Explosives
OEM:	Original Equipment Manufacturer
kV:	Kilovolt
Hz:	Hertz
IP:	Ingress Protection
PE:	Poly Ethylene
ANSI:	American National Standards Institute
ASTM:	American Society for Testing and Materials
BIS:	Bureau of Indian Standards
BS:	British Standard
IEC:	International Electro Technical Commission
IEEE:	Institute of Electrical & Electronics Engineers
IS:	Indian Standards

NEMA:	National Electrical Manufactures Association
CEA:	Central Electricity Authority
DIN:	Deutsches Institiut fur Normung
CCE:	Continuous and Comprehensive Evaluation
LPCB:	Loss Prevention Certification Board
CCOE:	Chief Controller of Explosives
OEM:	Original Equipment Manufacturer
BHEL:	Bharat Heavy Electricals Limited
OISD:	Oil Industry Safety Directorate
IOCL:	Indian Oil Corporation Limited
HVPNL:	Haryana Vidyut Prasaran Nigam Limited
ISBL:	Inside Battery Limit
OSBL:	Outside Battery Limit
LSTK:	Lump sum Turnkey
PRPC:	Petroleum Refining and Petrochemical
PNC:	Panipat Naphtha Cracker Complex
PR:	Panipat Refinery Complex
GIS:	Gas Insulated Sub-station
URT:	Unit Ratio Transformer
QAP:	Quality Assurance Plan
BOQ:	Bill of Quantities
PR:	Panipat Refinery

18. Definitions Used

The following expressions hereunder and elsewhere in the technical specification used and their grammatical variations shall unless repugnant to the subject or context thereof, have the following meanings hereunder respectively assigned to them, namely:

1. Battery Limit: The demarcated area within which the Unit is to be located.
2. Bid/Bidding Documents: The totality of the documents comprising the Bidding Document for the notice inviting tender.
3. Contract: The totality of agreement between Customer/ Purchaser/ Owner/IOCL and the Contractor/ LSTK Contractor/ BHEL as derived from the contract documents.
4. Contractor/ LSTK contractor: The bidder selected by the Customer/ Purchaser/ Owner/IOCL for the performance of the work and supply of materials. In this case, it is BHEL.
5. Customer/ Purchaser/ Owner: Indian Oil Corporation Limited.
6. Consultant: Any person(s)/ Firm nominated/ assigned by the Contractor/ LSTK Contractor/ BHEL for providing the engineering consultant services.
7. Bidder/ vendor: The bidder selected for this intended work shall be known as vendor.

19. List of Documents/ Drawings

Following drawing/ documents are attached for information purpose,

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1. NTS B269999165000200C, KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)

In the following documents, bidder to please read as follows

1. EIL / Owner – Please read as BHEL/EIL /IOCL
2. Owner – Please read as BHEL/IOCL
3. Subcontractor – Please read as Bidder
4. Scope of supply & Services mentioned in Section -1 & BOQ shall super shed remaining section of technical specification
5. Please read documents w.r.t. the scope mentioned specifically for GIS, GIS accessories & Other items mentioned in Technical Specifications.

20. Exclusions from Bidder's scope (NOT in bidder's scope)

The following items are specifically excluded from the bidder's scope of supply & services, irrespective of the same if covered under any section of technical specification other than Section-1 (PART-B). If specific requirement mentioned in the Section-1(PART-B) of technical specification shall overrule this specific exclusion.

1. Any scope of supply / services mentioned in Section-2 or Section-3 of technical specification but not having any relationship with GIS, LCC & its Accessories and not covered in Section-1 or BPS / BOQ shall be deemed excluded from bidder's scope. In case of ambiguity bidder to submit the same with technical bid / schedule of technical deviations.
2. 66 kV (& below) GIS system is not in bidder's scope, irrespective of the specification for the same may appear in technical specification.
3. Outdoor AIS Equipments, Air Insulated Bus Duct.
4. 220 kV Cables shall be supplied and laid by others.
5. 220 kV Cable termination kits for GIS shall be supplied by others. Termination of 220 kV Cables at 220 kV GIS end shall be done by others, necessary interfacing supply services are in bidder's scope.
6. Installation / Erection of GIS with LCC & its Accessories except supervision work.
7. Cable laying & terminations, however supervision work & termination of special cables shall be in bidder's scope.
8. Open & Closed stores at site. (Bidder to provide space requirement in tech bid)
9. Local transportation/ conveyance for bidder's engineers shall be arranged by BHEL between local stay and site.
10. Office assistance shall be provided BHEL including sitting facility etc.
11. Receipt & unloading of material at site except supervision work
12. Terminal connector for SF6 to Air Bushing to conductor or any other interfacing equipment.
13. Watch & Ward of GIS material at BHEL Store
14. Civil Works i.e. GIS Hall, civil works requirement for GIS System. (Please refer clause "Structure-Steel" for bidder's scope of supply)
15. EOT crane, Air Conditioning & Ventilation System, Illumination System & Fire Protection System, Fire detection & alarm system, however complete input shall be provided for EOT and other system
16. Control Relay & Protection Panels, Numerical Relays, Bus Bar Protection Panel, SAS & ECS

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- system, AC Distribution Board, DC Distribution Board, Battery, Charger, UPS
17. Earthing material i.e. 40 mm MS Rod, 50X6 GI Flat, 75X12 GI Flat, 100X12 GI Flat for earthing
 18. Power & Control cable beyond LCC
 19. BHEL / Customer / BHEL appointed 3rd party inspector travel, lodging & boarding charges during testing / inspection.
 20. Transformer / Reactor
 21. Plant Communication
 22. Solar photovoltaic system
 23. Fire Proof Sealing System

	Description	UOM	QTY Rev.1	Detailed Description of Scope
1.01	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - BUS BARS	LOT	1	Please refer revised Bay numbers. This covers complete GIS System under this technical specification (TB-PBT-316-PN1) excluding the following BOQ line items. In the event of changes in present scope, payment shall be made on pro-rata basis of number of circuit breaker bays.
1.02	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - TRANSFORMER GIS BAY MODULE (EXTN. TO EXISTING GIS)	SET	0	Extension by addition of transformer feeder bays in existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear (one set each on both side). Feeder details similar to Sr. nos. 1 / 2 (Incomer from PR 220kV GIS with Line PT) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module & Line PT Module which is covered in separate BOQ item)
1.03	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM -DOUBLE MAIN BUS SCHEME - GIS EXTENSION MODULE	SET	0	Bus extension module for interfacing of transformer feeder bays (of present scope) with existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear (one set equals complete extension module for one side of existing GIS).Bidder shall consider the modules including the bellows/ compensators like lateral mounting units, Axial compensators, Parallel compensators, tolerance compensators and vibration compensators etc as applicable. Please note, such extension shall be required on both side of GIS Bays.
1.04	SUPPLY- GIS : 220KV, 50KA FOR 3S, OUTDOOR GIS ISOLATING BREAKER BAY	SET	0	Please refer Sr. nos. 1 / 2 (220kV GIS Outdoor IBP with Line PT) of the document: 220 kV ICOG FEEDER DETAIL DATASHEET (HV-100101/HV-100102), Nos: B269-999-16-50-DS-0033. (Excluding SF6 to air bushing, Surge Arrester Module, Line PT Module, Gas Insulated Bus Duct which are covered in separate BOQ items)
1.05	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A - SF6 TO AIR BUSHING	SET	0	Single phase 220kV , 2000A SF6 to Air Bushing for the air termination of the GIS shall be as per IEC. (a) Single phase, termination module for terminating GIS SF6 bus duct (b) Scope of supply shall be as per latest version of IEC . (c) Gas monitoring system, pressure relief device, busbar, insulator, expansion joint/ flexible connection etc. as required. (d) Barrier cones, mechanism box and other items as required. (e) Any other item required to complete the system in all respects but not limited to above.
1.06	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - LINE GIS BAY	SET	2	Incomer from Panipat Refinery 220kV GIS. Please refer Sr. nos. 1 / 2 (Incomer from PR 220kV GIS with Line PT) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module & Line PT Module which are covered in separate BOQ item)
1.07	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - LINE GIS BAY (TYPE 2)	SET	2	Incomer from Panipat Refinery Isolating Breaker Panel. Please refer Sr. nos. 3 / 4 (Incomer from PR IBP with Line PT) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module & Line PT Module which are covered in separate BOQ item)
1.08	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - BUS COUPLER GIS BAY	SET	2	Please refer Sr. nos. 5 / 6 (Bus Coupler 1A-2A & Bus Coupler 1B-2B) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D
1.09	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - BUS SECTIONALISER BAY MODULE	SET	2	Please refer Sr. nos. 7 / 8 (Bus Coupler 1A-1B & Bus Coupler 2A-2B) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D
1.10	SUPPLY- GIS : 220KV, 50KA FOR 3S, DOUBLE MAIN BUS SCHEME - BUS MEASUREMENT GIS BAY/ VOLTAGE TRANSFORMER BAY	SET	4	Please refer Sr. nos. 9 / 10 / 11 / 12 (Bus PT 1A, 1B, 2A & 2B) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D Complete including Isolator & Bus earth switch.

	Description	UOM	QTY Rev.1	Detailed Description of Scope
1.11	SUPPLY- GIS : 220KV, 50KA FOR 3S, MAIN ITEM - DOUBLE MAIN BUS SCHEME - TRANSFORMER GIS BAY	SET	6	Please refer Sr. nos. 13 / 14 / 15 / 16 / 17 / 18 (Transformer Feeder) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module which is covered in separate BOQ item)
1.12	SUPPLY- GIS : 220KV, 50KA FOR 3S, GIS DOUBLE MAIN BUS SCHEME - SPARE TRANSFORMER GIS BAY MODULE	SET	2	Please refer Sr. nos. 19 / 20 (Transformer Feeder Spare) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module which is covered in separate BOQ item)
1.13	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - SF6 TO EHV CABLE GIS CONNECTION MODULE	SET	0	SF6 to EHV cable GIS connection module suitable upto 1600 Sqmm (above 630 Sqmm) and as per technical requirement mentioned in specification, 1 phase Cable, shall be as follows, but not limited to, (a) It shall be of the plug-in type with dry-type or fluid-filled terminations. The interfaces conform to IEC standards. A removable link, which disconnects and isolates the GIS from the cable during high-voltage test for convenience and ease of operations shall also be provided. (b) Termination kit for fixing of cable shall also be provided in line with IEC62271-209. (c) PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, insulators etc. as required. (d) Any other item required to complete the system in all respects but not limited to above. (e) 1 Set equals to supplies required for one Phase
1.14	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - SF6 TO EHV CABLE GIS CONNECTION MODULE (TYPE 2)	SET	42	SF6 to EHV cable GIS connection module suitable upto 630 Sqmm and as per technical requirement mentioned in specification, 1 phase Cable, shall be as follows, but not limited to, (a) It shall be of the plug-in type with dry-type or fluid-filled terminations. The interfaces conform to IEC standards. A removable link, which disconnects and isolates the GIS from the cable during high-voltage test for convenience and ease of operations shall also be provided. (b) Termination kit for fixing of cable shall also be provided in line with IEC62271-209. (c) PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, insulators etc. as required. (d) Any other item required to complete the system in all respects but not limited to above. (e) (e) 1 Set equals to supplies required for one Phase
1.15	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - GAS INSULATED BUS DUCT	MTR	0	GIB length of 1-phase busduct outside the GIS BAY MODULE shall be considered for mode of measurement. This including SF6 Gas, structure, Earthing, foundation bolt, PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, compensator, insulators etc. Complete in all respect.
1.16	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - BUS EARTH SWITCH GIS BAY	SET	0	220kV, 50kA for 3 second, 2000A GIS double main bus scheme bus earth switch bay GIS bay, each set comprising of following but not limited to, (a) 2 set- 1x3 phase high speed make proof grounding switch, complete with operating mechanism. (b) PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, insulators etc. as required. (c) Any other item required to complete the system in all respects but not limited to above.
1.17	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - GIS SURGE ARRESTER MODULE WITH SURGE COUNTER	SET	42	1 Set equals 1 Phase surge arrestor. Necessary surge counter for every 3 numbers of surge arrestor is inclusive in the scope.
1.18	SUPPLY- GIS : 220KV, LOCAL CONTROL CUBICLE	SET	16	Bidder shall meet the requirement of LCC for the complete GIS System, mode of measurement shall be nos. of Bays with Circuit Breaker. LCC requirements other than Circuit Breaker Bays i.e. Bus PT, Bus earthswitch etc shall be deemed inclusive of bidders scope of supply with respective main item.

	Description	UOM	QTY Rev.1	Detailed Description of Scope
1.19	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - SF6 GAS REQUIRED FOR PLACING GIS INTO SUCCESSFUL OPERATION	LOT	1	(1.) First filling of SF6 gas for the equipment supplied plus (2.) an additional quantity sufficient for conducting all the tests on equipment at site before placing it into successful operation plus (3.) 10% extra quantity of first filling as Quality of spare gas. (4.) In the event of changes in present scope, payment shall be made on pro-rata basis of number of circuit breaker bays.
1.20	SUPPLY- GIS : STRUCTURE MATERIALS FOR SUPPORT OF GIS, BUS DUCTS, SF6 TO OIL BUSHING/ CONNECTION AND SF6 TO AIR BUSHING/ CONNECTION INCLUDING FOUNDATION BOLTS, EMBEDDED ITEMS, RAILS AND/ OR OTHER ITEMS STRUCTURAL ITEMS REQUIRED	LOT	1	Structure Materials for support of GIS, SF6 to oil bushing/ connection and SF6 to air bushing/ connection including Foundation Bolts, Embedded Items, Rails and/ or other items structural items required. All steel structure members shall be hot-dip galvanized after fabrication. Unless otherwise specified, minimum mass of zinc coating for Galvanizing shall be 610 gm/square meter. All field assembly joints shall be bolted. Field welding shall not be acceptable. Noncorrosive metal or plated steel shall be used for bolts and nuts throughout the work. Manufacturer shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts, nuts and washers shall be provided to fasten the switchgear base frames to the foundation channels. In addition to above, supports, platforms, foundation bolts, embedded parts in floors etc., are also included in the scope as per the specification, but not limited to the following, (a) Base Plate, Channel, Metallic / Structural Member for seating of GIS system (b) Lattice / Pipe structure required for GIS bay, GIB,SF6 to oil bushing/ connection and SF6 to air bushing/ connection. (c) Foundation bolt / Anchor Fastening bolts for GIS system, if required. (d) Equipment fixing hardware. (e) Cable tray arrangement (mounted on structures of) GIS bay, GIB,SF6 to oil bushing/ connection and SF6 to air bushing/ connection. (f) Any other structural item required to complete the system in all respects but not limited to above. (Excluding structure for GIB which covered with main GIB item itself) (g) In the event of changes in present scope, payment shall be made on pro-rata basis of number of circuit breaker bays.
1.21	SUPPLY- GIS : EARTHING MATERIALS INCLUDING HIGH FREQUENCY EARTHING, IF APPLICABLE	LOT	1	Earthing Materials, except 40mm MS rod,75x12mm / 50x6 / 100X12 GI Flat, which shall be provided by BHEL as free issue item (FIM), however, exact requirement shall be intimated by bidder based on the earthing philosophy approved, and Supervision of erection of all earthing connection for GIS to Earth Mesh on Floor shall be scope including any special requirements including high frequency earthing. In case, high frequency earthing is not required, necessary design and calculations shall be submitted by bidder. In the event of changes in present scope, payment shall be made on pro-rata basis of number of circuit breaker bays.
1.22	SUPPLY- GIS : 220KV, CONSUMABLES FOR GIS	LOT	1	All consumables including grouting material and chemicals for the chemical anchors bolts etc., if applicable for GIS system shall be provided by bidder, however, in case of consumables with shelf life less than six months shall be supplied with special permission and intimation from BHEL.
1.23	SUPPLY- GIS : 220KV, MAIN ITEM - LINE PT MODULE	SET	18	1 Set equals 1 Phase of line PT module complete in all respect. Please note, this shall be part of main bay & separate BOQ item is created for billing break-up purpose.
2.01	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - ONLINE PARTIAL DISCHARGE (PD) MONITORING SYSTEM	LOT	1	Please refer clause: 5.7.15.4 Online Partial Discharge(PD) monitoring system for (a) 220kV indoor GIS, (b) 220kV outdoor GIS & (c) 220kV GIS extension. Please refer clause: 5.7.15.4 Online Partial Discharge(PD) monitoring system for both indoor & outdoor GIS of document: B269-999-16-50-SP-0020. Following online PD monitoring system shall be provided: (1.) Online PD monitoring system for offered GIS. (2.) One PD monitoring system at Outdoor Switchyard substation (3.) Modification/Integration of existing PD monitoring system to include 2 nos. GIS bay extension.

	Description	UOM	QTY Rev.1	Detailed Description of Scope
2.02	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - ONLINE SF6 GAS FILLING / TOPPING-UP SYSTEM	SET	1	Please refer clause:5.7.15.5 SF6 topping system of document: B269-999-16-50-SP-0020. SF6 topping system shall be provided for 220 kV GIS for filling / topping up SF6 gas to panel under energized condition manually. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).-
2.03	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - PORTABLE PD (PARTIAL DISCHARGE) ANALYZER/ MEASUREMENT KIT SUITABLE FOR GIS ALONG WITH REQUIRED ACCESSORIES	SET	1	(Remark: 1 Set of each item for each location i.e. separate set for MRSS-100 (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).-).
2.04	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS LEAKAGE DETECTOR	SET	1	Please refer clause: 5.7.15.1 SF6 Gas leakage detector of document: B269-999-16-50-SP-0020. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).-
2.05	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS FILLING, EVACUATING, FILTERING, DRYING, PUMPING & STORAGE PLANT	SET	1	Please refer clause: 5.7.15.2 Gas filling and evacuating plant of document: B269-999-16-50-SP-0020. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).-
2.06	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS ANALYZER	SET	1	Please refer clause: 5.7.15.3 SF6 gas analyser of document: B269-999-16-50-SP-0020. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).-
2.07	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 Gas Handling Unit / Service Cart	SET	1	Please refer clause: 6.11 of document: 6-51-0066, Document title: SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR
2.08	SPARES- GIS : 220KV, MANDATORY SPARES AS PER TECHNICAL SPECIFICATION	LOT	1	Please refer Clause 6.1 of Engineering Design Basis (Electrical), B269-999-16-50-EDB-1001 inclusive of the followings. (2.1 is covered in separate BOQ item) 2.2 Handle for disconnect switch drive 4 Nos. 2.3 Handle for earthing switch drive 4 Nos. 2.4 Pre selection key for three position switch 1 No. 2.5 Power cable termination kit 2 sets 2.6 Tripping coil 2 No. 2.7 Closing coil 2 No. 2.8 Capacitive type voltage detectors 1 Set 2.9 Control fuses / MCB 10 Nos. of each rating & type 2.10 Density monitoring device 2 Nos of each type 2.11 Pressure Gauge 2 Nos of each type 2.12 Indicating lamps covers 5 nos. of each colour 2.13 Indicating lamps 20% or 3 nos. (min.), whichever is more
2.09	SUPPLY- GIS : RECOMMENDED OPERATION AND MAINTENANCE SPARES	LOT	0	Price Break-up are to be submitted with technical bid for information only.
2.10	SPARES- GIS : PORTABLE GAS FILLING EQUIPMENT / SF6 GAS CART	SET	1	
2.11	SUPPLY- GIS : CONTROLLED SWITCHING DEVICE (CSD)	Set	8	CSD: controlled switching device/synchronous switching device in each of the 220kV outgoing transformer feeders (including at all spare feeders) at 220kV GIS substation (MRSS-100) to limit voltage dip during closing of transformer incomer breaker. Bidder to carry out transformer inrush current study for all EHV transformer under various operating conditions including charging through existing CPP SS-28 interconnected with SS-64.

	Description	UOM	QTY Rev.1	Detailed Description of Scope
3.01	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GIS BAYS INCLUDING LCC	LOT	1	Site service activities shall be carried out at in stages as per requirement or front availability at site, and hence multiple visits for completion of work are envisaged. Site visit for supervision of unloading & verification of materials for proper storage and up-keeping at site includes following activities but not limited to, (a) Supervision of safe unloading of GIS & its accessories at site. (b) Reconciliation, storage & up keeping of materials, with due instructions/ training to site persons for long storage. Supervision of complete GIS System (as per scope of supply) along with all bay Equipments, indoor & outdoor (excluding Bus duct and SF6 to air bushing covered separate BOQ line item) such as and not limited to GIS extension module, GIS bus extension module, surge arrester, voltage transformer, LCC including structure, cabling, earthing & other associated activities shall be included in the scope. (Excluding the Services item covered in separate BOQ items)
3.02	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GAS INSULATED BUS DUCT	MTR	0	GIB length of 1-phase busduct outside the <u>GIS BAY MODULE</u> shall be considered for mode of measurement.
3.03	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF SF6 TO AIR BUSHING	SET	0	Complete in all respect
3.04	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GIS	LOT	1	Complete in all respect (excluding Bus duct and SF6 to air bushing covered separate BOQ line item)
3.05	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GAS INSULATED BUS DUCT	MTR	0	Complete in all respect
3.06	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF SF6 TO AIR BUSHING	SET	0	Complete in all respect
3.07	SERVICES- GIS : 220KV, FINAL SUCCESSFUL HV/ POWER FREQUENCY TESTING OF GIS INCLUDING ARRANGING OF HV TEST KIT ALONG WITH OPERATOR	LOT	1	Complete in all respect
3.08	SERVICES- GIS : INSULATION CO-ORDINATION & VFT STUDIES FOR GIS SYSTEM	LOT	1	Complete in all respect
SPARES- GIS : REFERENCE UNIT PRICE FOR ADDITION / DELETION OF SUPPLY ITEMS (Unit Prices of Individual Equipment included here or in mandatory spares are required for any Addition/Deletion of Equipment and replacement of damaged items. Vendor to ensure that the unit prices have a logical relationship with prices of assemblies in main items. Quoting for unit prices is mandatory and shall be considered for evaluation)				
4.01	SPARES- GIS : SINGLE PHASE BUS BAR WITHOUT ENCLOUSER	MTR	1	Complete in all respect.
4.02	SPARES- GIS : GIS METALLIC ENCLOSURE	KG	50	
4.03	SPARES- GIS : EXPANSION BELLOWS/ JOINTS	Set	1	For Single Phase of any type and any rating.
4.04	SPARES- GIS : TEE BEND	Set	1	For Single Phase of any type and any rating.
4.05	SPARES- GIS : ANGLE BEND (135°)	Set	1	For Single Phase of any type and any rating.
4.06	SPARES- GIS : L-BEND	Set	1	For Single Phase of any type and any rating.
4.07	220KV GIS- SINGLE PHASE AND SINGLE CORE OF CURRENT TRANSFORMER EXCLUDING ASSOCIATED ENCLOSURE AND PRIMARY CONDUCTOR	SET	1	For Single Phase and core of any type and any rating.

	Description	UOM	QTY Rev.1	Detailed Description of Scope
4.08	SPARES- GIS : TRIP COIL ASSEMBLY WITH RESISTOR FOR GIS CIRCUIT BREAKER (AS APPLICABLE)	SET	3	
4.09	SPARES- GIS : CLOSING COIL ASSEMBLY WITH RESISTOR FOR GIS CIRCUIT BREAKER (AS APPLICABLE)	SET	3	
4.10	SPARES- GIS : RELAYS, POWER CONTACTORS, PUSH BUTTONS, TIMERS & MCBS ETC. (AS APPLICABLE) OF EACH TYPE FOR GIS CIRCUIT BREAKER	SET	1	
4.11	SPARES- GIS : SINGLE PHASE DISCONNECTOR SWITCH INCLUDING MAINCIRCUIT, ENCLOSURE AND SUPPORT INSULATOR ETC., COMPLETE INALL RESPECT	SET	1	
4.12	SPARES- GIS : SINGLE PHASE MAINTENANCE EARTHING SWITCH INCLUDING MAINCIRCUIT, ENCLOSURE AND SUPPORT INSULATOR ETC.,COMPLETE IN ALL RESPECT	SET	1	
4.13	SPARES- GIS : SINGLE PHASE FAST EARTHING SWITCH INCLUDING MAIN CIRCUIT,ENCLOSURE AND SUPPORT INSULATOR ETC., COMPLETE INALL RESPECT	SET	1	
4.14	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS CIRCUIT BREAKER	SET	1	
4.15	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS DISCONNECTOR SWITCH	SET	1	
4.16	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS MAINTENANCE EARTH SWITCH	SET	1	
4.17	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS FAST EARTHING SWITCH	SET	1	
4.17	SPARES- GIS : GIS-SF6 GAS	Kg	50	
4.21	SPARES- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - SF6 TO EHV CABLE GIS CONNECTION MODULE	SET	1	SF6 to EHV cable GIS connection module suitable upto 1600 Sqmm (above 630 Sqmm) and as per techical requirement mentioned in specification, 1 phase Cable, shall be as follows, but not limited to, (a) It shall be of the plug-in type with dry-type or fluid-filled terminations. The interfaces conform to IEC standards. A removable link, which disconnects and isolates the GIS from the cable during high-voltage test for convenience and ease of operations shall also be provided. (b) Termination kit for fixing of cable shall also be provided in line with IEC62271-209. (c) PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, insulators etc. as required. (d) Any other item required to complete the system in all respects but not limited to above. (e) 1 Set equals to supplies required for one Phase
	SERVICES- GIS : REFERENCE UNIT PRICE FOR ADDITION / DELETION OF SERVICES (Unit Prices of Individual services included here are required for any Addition/Deletion of Equipment and replacement of damaged items. Vendor to ensure that the unit prices have a logical relationship with prices of assemblies in main items. Quoting for unit prices is mandatory and shall be considered for evaluation)			

	Description	UOM	QTY Rev.1	Detailed Description of Scope
5.01	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR SUPERVISION OF ERECTION OF GIS	MANDAY	10	Charges for repetition of services - (if required due to reasons not attributed to the contractor) This item will be executed only if repetition of services is required by BHEL.
5.02	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR TESTING & COMMISSIONING OF GIS	MANDAY	10	Charges for repetition of services - (if required due to reasons not attributed to the contractor) This item will be executed only if repetition of services is required by BHEL.
5.03	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - HIRING CHARGES OF HV TEST KIT WITH OPERATOR	LOT	1	Additional HV test kit charges including charges of operator, HV test kit, accessories & tools required for completion of HV test (Dielectric Test after installation of GIS). This item is executed only if repetition/ additional HV Test is required by BHEL i.e. post successful commissioning of GIS. (if required due to reasons not attributed to the contractor)
5.04	SERVICES- GIS : TRAINING FOR GIS AT SITE	DAY	6	Training for TEN number OWNER' s Engineers at Site for GIS with LCC & its Accessories including Partial Discharge Monitoring system
5.05	SERVICES- GIS : TRAINING FOR GIS AT MANUFACTURER WORKS	DAY	1	

TECHNICAL AMENDMENT NO: 02 (ELECTRICAL)

TO

TENDER: B269-999-16-50-EB-T-0020FOR 220KV GIS PACKAGE

(PROJECT: P-25, M/s IOCL-PANIPAT)

Bidder to please read this documents for scope of supply & services for 220kv GIS System and all associated equipment, sub-system etc. Other portion of document please be considered for reference only. Please refer Section-1 of Technical Specification clause 20 for items and services Exclusions from Bidder's scope (NOT in bidder's scope)

Please read contractor means bidder for GIS scope

19.05.22	Issued as Technical Amendment-2	MKM	RG	HK
DATE	PURPOSE	BY	CHECKED	APPROVED

SUBJECT : **Technical Amendment No.: 02**
TENDER NO. : **B269-999-16-50-EB-T-0020**

The terms, conditions and specifications of Bidding Document stand modified to the extent indicated under column "MODIFICATIONS/ADDITION/DELETION". Corresponding implications of the same, else-where in the bid package shall be taken care appropriately. All other terms & conditions, stipulations and specifications of Bidding Document shall remain unaltered.

S.No	Section No./ Document No.	Clause No./ Item No.	Subject	Modifications / Additions/Deletions/ Clarification
1.	B269-999-16-50-SP-0020 Rev.D	Complete Document	Scope of Work & Job Specification	Modification: Scope of work & Job Specification (Electrical) for 220kV GIS Package (B269-999-16-50-SP-0020 Rev.D) has been replaced by Scope of work & Job Specification (Electrical) for 220kV GIS Package (B269-999-16-50-SP-0020 Rev.E). Copy enclosed herewith.
2.	B269-999-16-50-SL-0020 Rev.E	Complete Document	Mandatory Spare List	Modification: Mandatory spare list-Electrical (B269-999-16-50-SL-0020 Rev.E) has been replaced by next revision (B269-999-16-50-SL-0020 Rev.F). Copy enclosed herewith.
3.	Table of Contents		Data sheet (Electrical)	Deletion: Work related with 220kV incoming gantry in 95x95 m area including associated 220kV outdoor GIS bays, 220/33 kV transformers, 33kV GIS isolation breaker panels, substation and metering room stands deleted. Accordingly, following data sheets stands deleted: a. Feeder details for 220kV Outdoor GIS IBP (B269-999-16-50-DS-0033 Rev.B) b. Hardware datasheet- 220kV GIS- Outdoor Isolating Breaker Panel (B269-999-16-50-S-0037 Rev.B) c. Datasheet for outdoor switchyard (B269-999-16-50-DS-0055 Rev.B) d. Datasheet for EHV Isolator (B269-999-16-50-DS-0056 Rev.B) e. Datasheet for Outdoor EHV current & voltage transformer (B269-999-16-50-DS-0057 Rev.B) f. Datasheet for Lighting Arrester (B269-999-16-50-DS-0058 Rev.A) g. Datasheet for insulators busbar material & earthing system (B269-999-16-50-DS-0059 Rev.A) h. Datasheet for 33kV isolating breaker panel (B269-999-16-50-DS-0071 Rev.C) i. Hardware datasheet- 33kV isolating breaker panel (B269-999-16-50-DS-0073 Rev. B) j. Datasheet for 220/33kV Power Transformer (B269-999-16-50-DS-0306 Rev.B) k. SAS for new gantry substation (B269-999-16-50-DS-0131 Rev.A)

TECHNICAL AMENDMENT NO.02
TO
220KV GIS PACKAGE

DOCUMENT No.
B269-999-16-50-TA-0020-02 Rev.0
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4.	B269-999-16-50-DS-0054 Rev.B	Complete Datasheet	ECS IO List for 220kV GIS Package	Modification: ECS IO List for 220kV GIS Package (B269-999-16-50-DS-0054 Rev.B) has been replaced by B269-999-16-50-DS-0054 Rev.C. Copy enclosed herewith.
5.	B269-999-16-50-DS-0034 Rev.D	Complete Datasheet	220kV Feeder details datasheet	Modification: 220kV Feeder details datasheet (B269-999-16-50-DS-0034 Rev.D) is replaced by B269-999-16-50-DS-0034 Rev.E. Copy enclosed herewith.
6.	~~B269-999-16-50-DS-0034 Rev.E~~	~~Complete Datasheet~~	~~66kV Feeder details datasheet~~	~~Modification: 66kV Feeder details datasheet (B269-999-16-50-DS-0035 Rev.D) is replaced by B269-999-16-50-DS-0035 Rev.E. Copy enclosed herewith.~~
7.	B269-999-16-50-00200 Rev.D	Complete Document	Key SLD	Modification: Key Single Line Diagram (B269-999-16-50-00200 Rev.D) has been replaced by B269-999-16-50-00200 Rev.E. Copy enclosed herewith.
8.	TABLE OF CONTENTS		Standard specification	Deletion: Following EIL standard specification has been deleted: a. Specification for outdoor EHV isolators and earthing switches (6-51-0009 Rev.5) b. Specification for outdoor EHV current and voltage transformers (6-51-0011 Rev.5) c. Specification for High Voltage gas insulated switchgear (6-51-0065 Rev.1) d. Specification for outdoor switchyard (6-51-0085 Rev.4) e. Specification for lightning arrestors (6-51-0096 Rev.6)
9.	TABLE OF CONTENTS		Inspection Test Plan	Deletion: Following inspection test plan have been deleted: a. Inspection and test plan for outdoor EHV isolators and earthing switches (6-81-1009 Rev.3) b. Inspection and test plan for outdoor EHV current transformers and voltage transformers (6-81-1011 Rev.3) c. Inspection & test plan for lightning arrestors (6-81-1096 Rev.3)
10.	TABLE OF CONTENT		General Notes	Addition: Following documents have been added: a. General notes for cabling system (B269-999-16-50-4100 Rev.0) b. General notes for lighting system (B269-999-16-50-4200 Rev.0) c. General notes for earthing & lightning protection system (B269-999-16-50-4300 Rev.0)
11.	B269-999-16-50-EDB-1001 Rev.0	5.3.3, Page No. 15 of 49	Utilisation Voltage for critical supplies	Deletion: Contractor to ignore the reference of 'Note-1' & 'Note-2' in Sl. No. 1 & 2 of Table in cl. no. 5.3.3
12.	B269-999-16-50-EDB-1001 Rev.0	5.6.4 (Note no. 6) Page 31 of 49	Cable termination box	Modification: 6. 220kV side cable terminal box for EHV power transformer i.e. 220/66kV shall be oil filled type only. 66kV side cable terminal box for 66/6.9kV power transformer shall be air insulated phase segregated type.

TECHNICAL AMENDMENT NO.02
TO
220KV GIS PACKAGE

DOCUMENT No.
B269-999-16-50-TA-0020-02 Rev.0
PAGE 4 OF 4

13.	B269-999-16-50-EDB-1001 Rev.0	5.6.4 (Note-2) Page 31 of 49	Power Transformer	Modification: Note-2: EHV transformer with 220kV primary shall be provide with both NIFPS & HWWS based fire fighting system. For all other power transformers rated above 5MVA or with oil quantity greater than 2000 ltrs, HVWS based fire fighting system shall be provided. Deluge valve shall be provided under canopy/shed.
14.	B269-999-16-50-EDB-1001 Rev.0	Cl. no. 5.6.14, Note-6 & cl. no. 5.6.11, Note-8	Online battery bank monitoring system	Modification: Online battery health monitoring system shall have the provision of cell voltage measurement. Measurement of cell temperature & cell impedance is not required.
15.	Annexure-A attached with TA-1	Sl. No. 6 & 8	Fire Alarm System, PLCC System	Deletion: Sl. no. 6 (details of existing fire alarm system) & sl. no. 8 (details of PLCC system) are not applicable & stands deleted.
16.	Annexure-A attached with TA-1	Sl. no. 16 (g)	Location of gantry substation, SS-28 & SS-63	Modification: Location of new gantry substation in (95x95) mtr. area along with SS-28, SS-63 (shown in layout) are not applicable & stands deleted.

(SIGNATURE AND STAMP OF BIDDER)

SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) FOR 220kV GIS PACKAGE (TENDER NO. B269-999-16-50-EB-T-0020)

PROJECT : P25 PROJECT
OWNER : M/s INDIAN OIL CORPORATION LTD.
EPMC : ENGINEERS INDIA LTD.
JOB NO. : B269

Bidder to please read this documents for scope of supply & services for 220kV GIS System and all associated equipment, sub-system etc. Other portion of document please be considered for reference only. Please refer Section-1 of Technical Specification clause 20 for items and services Exclusions from Bidder's scope (NOT in bidder's scope)

Please read contractor means bidder for GIS scope

E	19.05.2022	REVISED & REISSUED WITH TA-2	MKM	RG	HK
D	11.04.2022	REVISED AND REISSUED WITH TA-01	MKM	RG	HK
C	27.09.2021	REVISED AND REISSUED WITH TENDER	AKG	HK	HK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

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1 GENERAL

1.1 INTRODUCTION

- 1.1.1 This section defines the electrical scope of work and job specification for 220 kV Gas Insulated Substation Package for P25 Project of IOCL – Panipat Refinery. This specification along with design basis, design philosophy, equipment datasheets, equipment specifications, drawings/ documents and other codes/ standards attached or referred shall form the basis for detailed design and engineering, manufacturing, supply, erection, testing, pre-commissioning, commissioning of the electrics covered in this tender of 220 kV Gas Insulated Substation Package for P25 Project of IOCL – Panipat Refinery.
- 1.1.2 The work shall be carried out to the best workmanship, in conformity with the specifications, approved drawings/ construction drawings and the instructions of the owner or Engineer-in-Charge from time to time.
- 1.1.3 The contract shall include clearing of temporary constructions, waste materials and loose earth, which might get collected in and nearby the work site during execution of work and after final completion.

1.2 STANDARDS

- 1.2.1 The work / equipment shall also comply with the requirements of latest revision of codes & standards attached or referred with the tender document. In case of any conflict between the various documents, the most stringent one shall be followed and Owner's/ EIL decision in this regard shall be final and binding. It is the responsibility of the Contractor to highlight any contradictions between various documents at the bid stage itself.
- 1.2.2 In case of imported equipment, codes and standards of the country of origin may be followed, if these standards are equivalent or stringent than the applicable Indian standards and meet the statutory regulations of approving Indian statutory bodies.
- 1.2.3 In addition, the work shall also conform to the requirements of latest editions/ amendments of the following:
- The CEA guidelines and rules framed there under.
 - The fire insurance Regulations.
 - Indian Petroleum Rules.
 - The regulations laid down by Electrical Inspectorate (CEA).
 - The regulations laid down by the Factory Inspectorate
 - The regulations laid down by the Chief Controller of Explosives.
 - The regulations laid down by Oil Industries Safety Directorate (OISD).
 - Any other regulations laid down by the Central, State or Local Authorities from time to time during the execution of this contract.

1.3 GUARANTEE

- 1.3.1 The contractor shall guarantee the installation for satisfactory operation against any defects of workmanship and materials (supplied by the contractor) for a period as specified elsewhere. Any damage or defect connected with the erection of materials, equipments or fittings supplied by the contractor that may be discovered at the time of issue of the completion certificate, or arise or come to light thereafter, shall be rectified or replaced by the contractor at his own expense as deemed necessary and as per the instruction of Owner or Engineer-in-Charge within the time limit specified by the Owner or Engineer-in-Charge.
- 1.3.2 The above guarantee shall be applicable for the quality of the work executed as well as for all equipment/ cables/ fixtures/ fittings/ other materials supplied by the contractor.

1.4 SITE CONDITION

For site conditions refer the clause 5.1 of Electrical Design Basis document B269-999-16-50-EDB-1001 enclosed with the package.

1.5 UTILIZATION VOLTAGE

For details of the utilization voltage refer the electrical design basis document B269-999-16-50-EDB-1001 enclosed with the package.

For the works to be executed in existing refinery area, utilisation voltage for control supplies i.e. 110V / 220V DC OR 110V AC UPS, shall be finalised during detailed engineering.

1.6 ENGINEERING AND JOB SPECIFIC REQUIREMENTS

- 1.6.1 Various equipment (to be supplied by contractor) covered in this tender, shall be in compliance with the requirements defined in design philosophy, equipment datasheets and specifications attached/ referred. Besides these, the requirements as defined in respective clauses for individual equipment, referred elsewhere in this document shall also be considered/ complied with.
- 1.6.2 Contractor shall ensure that all electrical equipment shall comply with the site and system conditions, ratings and other technical requirement specified elsewhere with the documents attached with the tender.
- 1.6.3 CONTRACTOR shall use this specification, datasheet, design philosophy document and OWNER/ Consultant's standard specifications for various equipments. For equipments, where OWNER/Consultant standard specifications are not available, have not been attached, CONTRACTOR/ SUPPLIER shall use their own specification, developed based on project specific requirement and good engineering practices prevalent in petroleum industry, so as to ensure satisfactory operation and maintenance conditions. CONTRACTOR to however check from OWNER/ EIL with respect to availability of EIL standard/ specification, before use of their own specification
- 1.6.4 CONTRACTOR shall note that data sheets for some of the equipment are not enclosed separately. Equipment data sheets for such equipments shall be prepared by the CONTRACTOR/ SUPPLIER based on relevant codes and specifications and the data sheet shall contain all technical data and information which is essential for the purpose of review and technical acceptability, detailed engineering, installation, testing, repair and maintenance, replacement, etc. of the equipments. CONTRACTOR to however check from OWNER/ EIL with respect to availability of standard datasheet, before use of their own datasheet
- 1.6.5 The CONTRACTOR shall also prepare data sheets mentioned in OWNER/ Consultant standard specifications, but not enclosed with the package.
- 1.6.6 The equipment shall in general conform to latest revision of statutory regulations, Indian Standards, IEC/ Other international standards applicable for the country of origin of the equipment
- 1.6.7 All equipment shall be subjected to routine and acceptance tests as per applicable specifications.
- 1.6.8 CONTRACTOR shall clearly specify in their purchase specifications, the requirement of conducting other special tests/ type tests, envisaged for various electrical equipment. Same shall be conducted without any time/ cost implication to OWNER/ Consultant.

2 POWER SYSTEM DESCRIPTION

To meet the power requirement of P-25 project in IOCL Panipat Refinery, power shall be received at MRSS-100 at 220kV level from owner's existing 220kV substation, SS-64 through 4 nos. 220kV GIS bays. Existing two (2) nos. 220kV outgoing spare GIS bays available in CG

make 220kV GIS of SS-64 shall be utilised. In addition to that, 2 nos. 220kV GIS bays shall be added with existing CG make 220kV GIS. Each of these four (4) nos. GIS bays shall be suitable to evacuate 200MVA power to downstream substation, MRSS-100. Suitable modification shall be done by contractor through GIS OEM in existing 2 nos. 220kV spare GIS bay s to accommodate owner's 220kV cable termination. .

Once this power is received at the 220kV GIS, same shall be then stepped down to 66kV using 220/66kV power transformers. These power transformers in turn will be connected to 66kV GIS. MRSS-100 shall also include 2 nos. 66/6.9kV power transformers & 4 nos. 6.6/0.433kV distribution transformers to feed internal loads of MRSS-100 by contractor as well as to feed external loads by owner.

Primary distribution in the plant shall be done at 66kV using the 66kV GIS located in Main Receiving Substation (MRSS). 66kV transformer feeders from MRSS, each rated for 100% load, will supply power to downstream substation. Power will be received at 66/6.9kV power transformers via 66 kV (Earthed grade) cables. The step down power at 6.6 kV shall be fed to 6.6 kV switchboard having two incomers & two bus sections interconnected by means of a bus coupler set (one normal bus coupler & one dummy bus coupler) and having fast bus transfer system. This 6.6kV board shall cater to all 6.6 kV loads. All HV motors rated above 160kW shall be at 6.6 kV fed from 6.6 kV switchboard. Power shall be stepped down to 415 V using 6.6 kV / 0.433 kV distribution transformers for feeding 415V loads through power control centers, motor control centers and Auxiliary service boards.

MV motors up to 55 kW will be fed from MCC whereas, motors rated above 55 kW and up to 160 kW will be fed from PCC. Auto/Manual changeover facility shall be provided in PCC & MCC while mechanical interlock shall be provided in incomers for ASB/LDB.

Auxiliary service board (ASB) shall have two incomers, one from normal PCC and other from emergency PCC. Normally bus coupler in auxiliary switchboard shall remain closed while incomer from emergency PCC shall remain open. During normal supply failure, bus coupler and normal supply incomer shall be opened. Auxiliary service board shall feed miscellaneous loads like welding receptacles, power panels etc.

220kV, 66 kV and 415 V systems are solidly earthed, whereas, 6.6 kV system is resistance earthed.

A separate EPMC has been envisaged for feeding plant emergency loads. EPMC will be fed via 1 no. 6.6/0.433 kV distribution transformer and through DG to provide reliability in the system.

EPMC will have two sections interconnected by a normally open bus coupler. EPMC shall be provided with auto transfer facility.

Plant normal lighting loads will be fed through normal lighting distribution board having two incoming supplies fed through 415V/415V lighting transformers fed from each bus section of normal PCC.

25% of plant lighting will be on emergency. Emergency lighting load will be fed through an emergency lighting distribution board having both incoming supplies fed through 415V/415V lighting transformers from each bus section of emergency PMCC.

230V AC UPS shall be provided in the substation for feeding control supply for ECS Panels, LAN, HMIs, etc., in substation.

220V DC battery and chargers shall be provided to feed critical DC lighting, and 110V DC system for switchgear protection and control circuits which will be located in the substation building.

ECS system shall be procured by Owner. All equipments shall be connected to ECS for monitoring and control as per ECS IO list.

Refer key single line diagram and scope demarcation drawing for typical power distribution scheme and broad scope demarcation.

3 SCOPE OF WORK (ELECTRICAL)

3.1 GENERAL

The electrical scope of work under this tender shall include but not be limited to basic and detailed engineering, manufacturing, supply, transportation to site, storage at site, inspection at manufacturer's work, erection, testing, commissioning of all equipments, supply of all mandatory spares, commissioning spares, special tools and tackles, cabling, earthing, lighting, fire alarm, plant communication works as defined in the scope document, drawings, installation standards, equipment datasheets, standard specifications, etc. attached or referred with the tender document.

3.2 SCOPE OF BASIC AND DETAILED ENGINEERING

The scope of basic and detailed engineering includes sizing and selection of electrical equipment, cables, earthing, lighting, fire alarm system, and preparation of layouts and other items covered in the scope of CONTRACTOR. This shall include but not be limited to the following

- 3.2.1 Basic and detail engineering activities for design of MRSS-100 substation building and co-ordination with Civil, Mechanical for cut-outs, cable trays, trenches, designing of air conditioning system, EOT crane, etc.
- 3.2.2 Design and engineering of electrical system for air conditioning system, EOT crane, etc.
- 3.2.3 Design and engineering of grid connected rooftop solar photovoltaic system comprising of array layout, SLD, mounting structure design, shadow analysis, etc., on the roof of substation building in P25 plot area.
- 3.2.4 Basic engineering calculations i.e. load analysis, load flow, short circuit, for selection of electrical equipments.
- 3.2.5 Design, engineering, sizing and selection of equipment and facilities comprising of switchboards, NIFPS, HV water spray system, DC system, UPS system, Fiber Optic transmission system, lighting transformer, etc. and submission of sizing calculation report for OWNER/ PMC review.
- 3.2.6 Overall single line diagram and protection & metering SLDs for individual switchboards, DC systems, UPS system, and auxiliary power supply system in CONTRACTOR's scope.
- 3.2.7 Cable sizing, illumination level calculation and preparation of power supply distribution scheme for normal, emergency and critical lighting, design calculation for earthing system (as per IEEE-80 in support of step and touch potential) and lightning protection system (as per IEC 62305) for the 220 kV GIS substation MRSS-100 .
- 3.2.8 Preparation of equipment layouts, lighting layouts, cabling layouts, earthing layouts, lightning protection layout, NIFPS piping layout, plant communication layouts, fire alarm layouts, telephone layouts, LAN system layout for 220 kV GIS substation (MRSS-100) Preparation of bill of materials for cabling, lighting, earthing and lightning protection, , plant communication, fire alarm, telephone system, LAN and miscellaneous items.
- 3.2.9 Preparation of system architecture drawings for Substation automation system.
- 3.2.10 Insulation co-ordination studies for the 220 kV GIS substation package to finalize location and quantity of surge arrestors required in addition to those shown in SLD.
- 3.2.11 Calculation of requirement of IOs for ECS Interface Panels (transducer panel, Dummy panel, Interposing relay panel) and ECS RTU Panels etc. for interface of 220 kV GIS substation

package with client's ECS System. ECS interface panel shall be free issued by owner at MRSS-100. Installation of the same is in scope of contractor.

- 3.2.12 Relay Co-ordination studies including protection coordination charts, relay setting calculations; relay parameterization for complete system in scope of CONTRACTOR. ETAP Project files (i.e. *.oti file) for the new system along with coordinated relay setting shall be provided by contractor. Contractor to verify and co-ordinate the relay settings with upstream 220kV feeders of SS-64 and hand over the updated ETAP project file (OTI file) to Owner/ EIL.
- 3.2.13 Preparation of miscellaneous engineering document such as electrical equipment list, lighting/ power panel schedule, cable schedule, interconnection drawing, ECS interface document, etc.
- 3.2.14 3D Modelling shall be done for substation buildings consisting of all the equipment like FA system, HVAC/VAM (including ducts), equipment layout (panels and transformers), etc. to avoid fouling of various systems and subsequent re-work. Also, cable tray and cable trench design in cable cellar of substation shall be reviewed in 3D model.
- 3.2.15 Preparation of specification for procurement of electrical equipment in CONTRACTOR's scope of supply, review of sub vendor drawings and then submission of electrical equipment drawing for review/ information, preparation of site executable (AFC) engineering drawings and details for installation work, wherever applicable.
- 3.2.16 Collection of data from Site/ Owner as required for carrying out detailed engineering.
- 3.2.17 Shop inspection and testing procedures and QA schedule.
- 3.2.18 Field testing and commissioning procedures.
- 3.2.19 Preparation of as-built drawings on completion of the project for final records.
- 3.2.20 Preparation of operation and maintenance schedule/manuals.
- 3.2.21 The CONTRACTOR while performing design and engineering activities shall adhere to following guidelines:
 - 3.2.21.1 CONTRACTOR, if not stated but required shall prepare any additional specifications for equipment or bulk material. CONTRACTOR shall follow current national & international standards/specifications for the equipment that are not covered by OWNER/ EIL's specifications.
 - 3.2.21.2 The drawings attached with tender define the basic system design and distribution philosophy for the package and are for guidance purpose only. CONTRACTOR shall develop detailed drawings and submit for EIL/owner review.
 - 3.2.21.3 Contractor to note that equipment ratings and quantity, wherever specified in the bid package shall be considered as minimum rating & quantity. Contractor shall be responsible to verify the same and provide equipment with higher rating & quantity subject to minimum rating as per bid package requirements. Compliance to the same shall be without any extra cost and time implications to owner.
- 3.2.22 Interface engineering and drawing, as required for the completeness of erection, testing and commissioning of electrical system.
- 3.2.23 Any other work/activity which is not listed above, but however found necessary for completeness and satisfactory operation of the electrical system.

3.3 SCOPE OF SUPPLY, ERECTION, TESTING AND COMMISSIONING

The electrical scope covered under this package includes but shall not be limited to supply erection, testing and commissioning of the following (**Equipment rating and specifications mentioned here are preliminary and approval has to be taken from EIL/owner before finalizing the rating and placing order**) :

- 3.3.1 Extension by addition of 2 Number 220kV GIS bays in existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear (1 no. bays at each bus section) with Local Control Cubicle and Separate control and relay panel complete with numerical relay, metering, protection and synchronization panel. Other details shall be shared with successful contractor. Make of 220kV GIS extension bays and associated LCC & CRP shall be of same make as existing. Regarding details of 220kV existing GIS & associated LCC, CRP, Contractor shall coordinate with BHEL (main execution contractor) & CG (220kV GIS OEM) and obtain the requisite details. UHF sensors for 2 nos. 220kV CG make GIS extension bays envisaged at existing 220kV substation shall be hooked up with existing PD monitoring system. All required hardware, software, interconnecting cable including modification in existing HMI is included in contractor's scope.
- 3.3.2 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear with Local Control Cubicle and Separate control and relay panel complete with numerical relay, metering, protection and synchronization panel at MRSS-100. Control and relay panel for GIS shall be simplex type.
- 3.3.3 Modification in existing 2 nos. 220kV spare CG make GIS bays at SS-64 (owner's substation) to accommodate owner's 220kV cable termination.
- 3.3.4 Communicable type power quality meter along with HMI shall be provided at all 220kV incomer feeders of 220kV switchboard envisaged at MRSS-100 for monitoring of various current & voltage harmonics at 220kV level. Communication protocol of this meter shall be selected by contractor so that same can be hooked up with 220kV SAS for centralised monitoring at ECS.
- 3.3.5 SCAP panel for 220kV GIS system shall be provided in MRSS-100. The SCAP scheme shall also include momentary paralleling of two separate grid supplies i.e. one set of grid supply through SS-64 & second set of grid supply through future 220kV/66kV grid connection.
- 3.3.6 4 Number of 220/66 kV, 160/200 MVA, ONAN/ ONAF, YNyn0, Z= 12.5% (-0% to +10%), Oil filled transformer with OLTC and RTCC and suitable for bidirectional power flow as per enclosed specification and datasheets. Power transformer shall be provided with Nitrogen Injection Fire Protection System (NIFPS) along with HVWS based fire fighting system. Also Online dehydration facility shall be provided and the RTCC Panel shall be with dual redundant AVR facility.
- 3.3.7 66kV, 2000A, 40kA (3 sec.), SF6 Gas Insulated, single phase, 3 phase enclosure or single phase enclosure busduct with all bends and flexibles comprising of the Gas monitoring devices, barriers, pressure switches, UHF PD sensors etc.
- 3.3.8 66 kV, 3150 Amps, 40 kA (3 Sec), Double Bus Gas Insulated Switchgear with Local Control Cubicle and Separate control and relay panel complete with numerical relay, metering, protection and synchronization panel. Control and relay panel for GIS shall be simplex type. 66kV outgoing feeder envisaged for power recovery turbine shall be suitable for bidirectional power flow. The hardware mentioned in datasheet (DS-0046) is minimum and any additional including scheme implementation to achieve bidirectional flow power shall be provided by Contractor without any time and cost implication to Owner/EIL.
- 3.3.9 1 No 6.6 kV, 800 Amps, 40 kA (1 Sec), Isolating breaker panel with earthing truck, lifting truck (wherever applicable) complete with numerical relay, metering and protection as per enclosed specification and datasheet. Note that Internal Arc Classification (IAC) rating of switchboard shall be 40 kA for 0.2 sec.
- 3.3.10 4 Numbers, 6.6/0.433 kV, 2500KVA (minimum), Off Circuit tap changer, Dyn11, oil filled distribution transformer with Energy Efficiency Level 2 as per IS 1180 (Part-1) including amendments for feeding normal & emergency substation loads.
- 3.3.11 415 V, 4000Amps (minimum), 65 kA (1 Sec) TPN Bus duct air insulated for connection between Transformer and Switchboard.

- 3.3.12 1 no. 415 V, 4000 Amps (minimum), 65 kA (1 Sec) and draw out type TPN switchboard (Power and Motor control center – PMCC) complete with numerical relay, metering and protection as per enclosed specification and datasheet. PMCC shall have two incomer from transformers and one incomer from rooftop solar photovoltaic system and bus coupler with auto changeover facility. Outgoing feeders shall be sufficient to cater CONTRACTOR load, Owner's load and spare feeders as per spare philosophy.
- 3.3.13 1 no. 415 V, 4000 Amps (minimum), 65 kA (1 Sec) and draw out type TPN switchboard (Emergency Power and Motor control center – EPMCC) complete with numerical relay, metering and protection as per enclosed specification and datasheet. EPMCC shall have one incomer from 6.6kV switchboard through 6.6/0.433kV transformer and second incomer from owner's substation SS-106 (CT-1) through 6.6kV IBP, 6.6/0.433kV transformer and bus coupler with auto changeover facility. Outgoing feeders shall be sufficient to cater CONTRACTOR load, Owner's load and spare feeders as per spare philosophy.
- 3.3.14 415 V, 400 Amps (Minimum), 25 kA for 1 Sec (Minimum) and draw out type TPN lighting distribution board (LDB) as per enclosed specification and datasheet for all the normal and emergency lighting transformer including those for owner's use. LDB shall have two incomer and one bus coupler. Quantity and rating/ type of outgoing feeders shall be sufficient to cater CONTRACTOR load, Owner's load and spare feeders as per spare philosophy.
- 3.3.15 Substation Automation System (SAS) is in the scope of supply of CONTRACTOR. Hardware for Substation Automation system includes all cables, Ethernet switches, gateway, FO cable, HMI, industrial grade laptop for interfacing with Numerical relays over IEC-61850 etc. Provision of hook-up of soft electrical control, monitoring and status signals to ECS system, SCAP system of MRSS-100 & SS-64 shall be provided in SAS. Software for all interfacing & control for Numerical Relays and other system components shall be installed in HMI and Laptop. All hardwired signals shall be connected upto the ECS interface panels by CONTRACTOR.
- Separate SAS shall be provided each for 220 kV GIS and 66kV GIS system at MRSS-100. Further common SAS shall be provided for 6.6kV & 415V system at MRSS-100.
- Interface between Contractor's SAS & owner's DCS is not envisaged. However for other connectivity of contractor supplied equipment, refer instrumentation part of tender.
- 3.3.16 Modification of existing SAS & ECS system interface for incorporation of extension panels for existing 220kV GIS at SS-64, including all hardware & software required as per existing systems design / make / model.
- 3.3.17 ECS of MRSS-100 is new & included in owner's scope (supply, testing & commissioning). However, installation of owner's supplied ECS panels i.e. interface panels (transducer panel, dummy panel, interposing relay panel) & RTU panel at MRSS-100 is kept in contractor's scope.
- 3.3.18 110V DC supply system comprising parallel redundant battery chargers, 2 x 50% Nickel Cadmium battery, DCDB, cell booster and online battery bank monitoring system, for switchgear protection & control including spare feeders and feeders for Owner's use as required. Existing 110V DC feeders available at existing 220kV GIS substation shall be extended by contractor for 2 nos. 220kV GIS extension panels. Contractor's scope shall start from outgoing terminal of 110V DC feeder module. Supply, laying & termination of cable is included in contractor's scope.
- 3.3.19 220V DC supply system comprising parallel redundant battery chargers, 2 x 50% Nickel Cadmium battery, DCDB, cell booster for critical lighting including spare feeders and feeders for Owner's use as required.
- 3.3.20 230V, Double Parallel Redundant UPS with Bypass (2+2 Design) and Ni-Cd battery backup (2 X 100%) with ACDB, Cell Booster and self-powered disturbance recorder with internal battery backup shall be provided for providing for control supply to ECS Panels, LAN, SAS HMIs, etc., installed in substation
- 3.3.21 4 nos. 415V/415V, Off Circuit, Dyn1, dry type lighting transformer for feeding normal & emergency lighting loads of substation buildings & outdoor switchyards. Note that minimum

rating of lighting transformers shall be considered as 100KVA (normal lighting) & 50KVA (emergency lighting) at MRSS-100. Telephone system for 220 kV GIS package including supply of telephone distribution JB, telephone handsets and wiring from JB upto telephone sockets in substation building.

- 3.3.22 LAN system for 220 kV GIS package complete with LAN wiring, UTP jacks, rack panels, LIUs and associated power sockets is included in CONTRACTOR scope. Connection with refinery LAN system shall be done by others.
- 3.3.23 MV Motors, as required. All MV motors shall be energy efficient IE3 type as per IS 12615.
- 3.3.24 Local control stations/ push button stations for motors/ transformers, lighting control, etc. as required. Lighting panel/ power panel/ Welding receptacles/ convenience sockets/ junction boxes/ marshalling panel, as required, industrial grade, suitable for installation in safe area.
- 3.3.25 Flameproof and corrosion proof, certified for gas group IIC classified locations equipment (Lighting fixture, exhaust fan, etc.) suitable for installation in battery room.
- 3.3.26 All incoming and outgoing, XLPE Insulated, armoured, FRLS type outer sheath MV cables for power, control and space heater complete with laying and termination accessories for equipment supplied by contractor.
- 3.3.27 All fibre optic cables (Single mode type only) required for communication between various equipment supplied & installed by contractor, shall be supplied, laid and terminated by the contractor including all accessories (termination kits, pig tails, LIUs, patch cords, etc.) as required.
- 3.3.28 All cabling accessories i.e. straight through joints, end termination kits, GI pipes, GI cable trays complete with structural supports, top and bottom tray covers, cable glands and lugs, cable markers, HDPE ducts for laying FO cables, etc. as required for the complete package inside substation building including cables being supplied and laid by owner/others.
- 3.3.29 Complete earthing and lightning protection system comprising of maintenance free chemical earth pit with Cu bonded high tensile low carbon steel core electrode, earth grid of MS Rods, earth plates, GI earth strips for earth connection between equipment and earth plates, lightning arrestors, earthing conductor, etc. as required for earthing and lightning protection of the various equipment.
- 3.3.30 Normal and Emergency lighting system comprising of lighting panels, LED type lighting fixtures with clamps/ connectors/ adaptors, for indoor and outdoor lighting, DC critical lighting, plug, socket, etc. as per design basis for the complete 220 kV GIS substation.
- 3.3.31 Free standing floor mounted type PDB for space heater outgoing supply to various switchboards/ bus duct/ other equipment, with 415 V, TPN incomer and 240 V SPN outgoing feeders as required.
- 3.3.32 Solar rooftop photovoltaic system consists of SPV array, Module Mounting Structure, Power Conditioning Unit (PCU), etc. suitable for installation on roof of substation building of MRSS-100 in P25 plot area.
- 3.3.33 Electrics for various mechanical systems like EOT cranes, Air conditioning, etc. as applicable.
- 3.3.34 Fire-proof sealing system and fire protection coating system to prevent spreading of fire from one zone to another through the openings in wall / floor, along cables laid in trays / racks and through openings below floor-mounted Electrical Switchgear, PMCC, Distribution Boards, Junction boxes, Cabinets and Panels.
- 3.3.35 Canopies complete with fixing arrangement and hardware for all outdoor electrical equipment in scope of the CONTRACTOR.
- 3.3.36 Distribution boards for various DC & AC supplies.

- 3.3.37 One set of special tools and tackles, erection hardware and touch up paint as required, Start-up & commissioning spares, as required during commissioning.
- 3.3.38 Mandatory spares as per the spares list attached elsewhere in the document.
- 3.3.39 List of recommended spares for 2 years of normal operation and maintenance of all electrical equipments, along with unit rates and quantity.
- 3.3.40 All Civil works required for installation of electrical equipment, supports for cables/ cable trays, equipment foundations, etc., for completion of electrical works in substation CONTRACTOR shall include painting and marking of all buses, individual incomers, all outgoing feeders etc. with details such as tag no., feeder rating, CT details, sending end source reference etc. for all switchboards. Painting and marking of important parameters of all other indoor and outdoor equipments, lighting and FA devices, earth pits, etc. (supplied and/ or installed by CONTRACTOR) is also included in CONTRACTOR's scope.
- 3.3.41 Inspection and Factory Acceptance Tests including type tests for electrical equipment. Contractor shall also furnish factory acceptance and site acceptance testing procedures from manufacturers for OWNER/EIL approval. Site acceptance testing shall be included for equipment's such as numerical relays, substation automation system, etc. The equipment manufacturer shall carry out these tests at site only. Site testing procedures shall be got approved from OWNER/EIL before performing these tests at Site
- 3.3.42 For the following equipment, CONTRACTOR shall ensure that installation, testing and commissioning of the equipment at site shall be done by the respective equipment manufacturer (OEM):
- 220 kV Double bus GIS and associated LCC
 - Control and Relay panel for 220 kV Double Bus GIS (Testing & Commissioning only)
 - 66 kV Double bus GIS and associated LCC
 - Control and Relay panel for 66 kV Double Bus GIS (Testing & Commissioning only)
 - Grid transformer including NIFPS & online moisture removal system
 - Power transformer including online moisture removal system
 - 6.6 kV switchboard & 6.6kV Isolating Breaker Panel (Testing and Commissioning only)
 - Numerical relays and Substation Automation System (Testing and Commissioning only)
 - MV switchboards (Testing and Commissioning only)
 - Complete DC System & AC UPS (Testing and Commissioning only)
 - Solar rooftop photovoltaic system.
- However for other equipment's, contractor shall ensure services of manufacturer's representative as required during testing and commissioning.
- 3.3.43 Contractor is advised to visit site prior to submission of bid in consultation with EIL/ IOCL to collect all interfacing data from site including details of existing equipment / systems which require augmentation / extension for successful execution of job. Contractor shall inform issues, if any along with their resolution to EIL/ IOCL and include the same in the scope of tender after obtaining concurrence from EIL/ IOCL.
- 3.3.44 Contractor shall carry out the installation, field testing and commissioning of all electrical equipment supplied as part of this package, including installation, assistance in field testing and commissioning of free issue items, provision of appropriate test and commissioning reports and as-built documentation as necessary for all but not limited to equipment and systems specified above.
- 3.3.45 The contractor shall obtain approvals from the concerned electrical inspectorate (e.g. CEA, State Authority etc.) for installation drawings and engineering of the electrical system and equipment covered under the contractor's scope. Any modification or additional requirements of the electrical inspectorate shall have to be carried out by the contractor at his own cost without affecting time schedule. Any additional testing, if required, shall be carried out by the contractor without affecting project time schedule at no extra cost to owner.

installation supervision

- 3.3.46 Providing training for TEN number OWNER' s Engineers for a period of at least three days for each item at Site for the following equipment's is included in the Contractor's scope:
- 220 kV Double bus GIS and associated LCC
 - Partial Discharge Monitoring of 220 kV GIS
 - Control and Relay panel for 220 kV Double Bus GIS
 - 66 kV Double bus GIS and associated LCC
 - Partial Discharge Monitoring of 66 kV GIS
 - Control and Relay panel for 66 kV Double Bus GIS
 - NIFPS of Power transformer
 - Online Dehydration Facility for transformer
 - Numerical relays and Substation Automation System
 - Complete DC System & UPS
 - Solar rooftop photovoltaic system.
- 3.3.47 All other electrical equipment materials and work not explicitly mentioned but nevertheless required to fulfil the following minimum requirements shall deemed to be included in the scope of the CONTRACTOR with no additional cost and time implication to the owner/ EIL.
- 3.3.47.1 To meet equipment and personnel safety.
- 3.3.47.2 To suit site facilities and environmental conditions.
- 3.3.47.3 To meet the requirements of statutory approving authorities.
- 3.3.47.4 To coordinate with other contractors and agencies involved at site for other activities and site work.
- 3.3.48 2 nos. 66/ 6.9 kV, 20/25 MVA, Z=10% (-0% to +10%), Dyn1, ONAN/ONAF transformer with OLTC and RTCC as per attached data sheet. Power transformer shall be provided with HVWS based fire fighting system. Also Online dehydration facility shall be provided and the RTCC Panel shall be with dual redundant AVR facility.
- 3.3.49 2 nos. neutral grounding resistor (3.81kV, 600A for 10 sec.) as per attached data sheet& EIL specification, 6-51-0043.
- 3.3.50 2 sets of 6.6 kV, 2500A, 40kA for 1sec. air insulated segregated phase bus duct as per enclosed datasheet. Drawing of MRSS-100 is attached with tender based on which length of bus duct shall be estimated by contractor.
- 3.3.51 1 no. 6.6kV, 2500Amps, 40kA (1sec.), AIS switchboard as per attached data sheet & feeder list for feeding package loads including owner's loads:
- Note: Supply, laying & termination of 6.6kV power & control cable from outgoing terminal of owner's feeders shall be taken care by owner. Cable route within battery limit shall be provided by contractor. Also the receiving end unit of feeder differential protection (87F) shall be free issued by contractor for installation at the downstream 6.6kV switchboard by the respective package contractor.
- 3.3.52 Design, supply, laying, termination (including termination kit), testing & commissioning of 66kV (E) copper conductor cable with aluminium corrugated sheath (1Rx1Cx300 sqmm.) from outgoing terminal of 66kV GIS switchboard of MRSS-100 to primary cable box of 20/25MVA (min.), 66/6.9kV transformer envisaged at MRSS-100 shall be supplied, laid & terminated by contractor. In this regard, contractor to follow the EIL standard specification, 6-51-0067 & data sheet.
- 3.3.53 Design, supply & laying of 66kV (E) cable from outgoing terminal of contractor supplied GIS switchboard to downstream individual package unit shall be done by others. However, termination of cable including 66 kV termination kits required at contractor supplied 66kV GIS at MRSS-100 shall be supplied by contractor.

Design, supply, laying, termination (including termination kit), testing & commissioning of 6.6kV (UE) cable shall be supplied, laid & terminated by contractor. Contractor to follow the cable data sheet & applicable EIL standard specification, 6-51-0051. Laying & termination of 6.6kV cable (except the owner's feeders) for contractor supplied equipment including termination kit is in scope of contractor.

- 3.3.54 2 nos. adequate rated indoor panel mounted capacitor bank each rated 50% of total rating with APFC relay at 6.6kV level for maintaining power factor at input of 66/6.9kV power transformer as 0.95 (lag). Each bank shall have vacuum contactor for ON/OFF control.

- 3.3.55 Contractor shall provide controlled switching device/synchronous switching device in each of the 220kV outgoing transformer feeders (including at all spare feeders) at 220kV GIS substation (MRSS-100) to limit voltage dip during closing of transformer incomer breaker. Details of CSD along with reference list of past executed projects & filed proven test record shall be furnished by the contractor for review/approval of EIL/owner. Contractor shall carry out transformer inrush current study for all EHV transformer under various operating conditions including charging through existing CPP SS-28 interconnected with SS-64. & shall submit the report to EIL/owner for review/approval.

3.4 FREE ISSUE EQUIPMENTS/ ITEMS

Following equipment/ items shall be free-issued by the owner to the contractor for Engineering/ Installation/ testing and commissioning as per scope of work defined:

- 3.4.1 220 kV Cables shall be supplied and laid by others.
- 3.4.2 220 kV termination kits for GIS shall be supplied by others. Termination of 220 kV Cables at 220 kV GIS end shall be done by others. scope break-up as per IEC
- 3.4.3 Fire Alarm devices for 220 kV GIS package substation building (MRSS-100) shall be supplied (free issued) by Owner. Preparation of fire alarm layout, block diagram and installation of fire alarm devices in MRSS-100 substation building as per approved layout including FA system cabling is in scope of CONTRACTOR. Testing and commissioning of Fire alarm devices shall be done by others.
- 3.4.4 Plant communication equipment for 220 kV GIS package substation building (MRSS-100) shall be supplied (free issued) by Owner. Preparation of PA layout, block diagram, speech diagram and installation of Plant communication devices in MRSS-100 substation building as per approved layout including PA system cabling is in scope of CONTRACTOR. Testing and commissioning of plant communication devices shall be done by others.
- 3.4.5 ECS System in 220 kV GIS substation (MRSS-100) shall be supplied, installed, tested and commissioned by others. MV power and control cables from CONTRACTOR's equipment to ECS Panels shall be supplied, laid and terminated by CONTRACTOR. Space for ECS panels shall be provided in the GIS building as specified elsewhere.
- 3.4.6 Receiving end unit of Feeder Differential relay for installation in 6.6 kV Isolating breaker panel will be free issued to the CONTRACTOR. Installation of relay shall be in scope of CONTRACTOR. Testing and commissioning of relay shall be by others.

3.5 INTERFACE WITH OWNER'S SYSTEM

Following interfaces with other plant system shall be in scope of CONTRACTOR. Contractor to also refer Interface drawing for detail.

- 3.5.1 Incoming 6.6kV cable up to 6.6kV IBPs shall be supplied and laid by others. However, termination of 6.6kV cable in IBPs shall be in scope of CONTRACTOR.
- 3.5.2 CONTRACTOR to supply Transformer + Feeder Differential Relay (87T+F) for installation in downstream switchboards outside package battery limit for each outgoing 66 kV transformer feeder. Relay shall be provided with redundant ports for OFC communication. Same OFC with

multiple fibers shall be used for redundant communication between these ports on relays at both ends. FO cable (single mode type only) and HDPE conduit for these differential relays shall be supplied Owner/EIL.

- 3.5.3 Receiving end unit of 87F relay in 6.6 kV IBP will be free issued to the CONTRACTOR. Installation of relay and connection to Ethernet switch on RJ45/ FO shall be in scope of this tender. Testing and commissioning of relay shall be by others. CT and end termination accessories of FO cable for 87F shall be in scope of this tender.
- 3.5.4 Space for installation of Panels & HMI for Online Temperature Monitoring System for 220kV incoming cables.
- 3.5.5 Cabling from CONTRACTOR's equipments (i.e. DC System, AC Supply, Space Heater supply, etc.) to Owner's DGFAP, ECS Panels, EPABX gateway etc., shall be supplied, laid and terminated at both ends by CONTRACTOR. Control cable (If any) from CONTRACTOR's equipments to Owner's DGFAP, ECS Panels, etc., shall be supplied, laid and terminated at both ends by CONTRACTOR.
- 3.5.6 Earthing of Owner's equipments installed in 220 kV GIS substation (MRSS-100) shall be in scope of CONTRACTOR. However, provision of earthing grid/ earth plates, including clean earth, if required, for ECS, shall be in scope of CONTRACTOR.
- 3.5.7 ECS system shall be in scope of OWNER. However, MV power and control cables from CONTRACTOR's equipment to ECS Panels shall be supplied, laid and terminated in ECS panels by CONTRACTOR. Connection of SAS to ECS shall be by ECS vendor. CONTRACTOR to provide redundant FO Port for connection with ECS. PA Junction Box and Telephone Junction box shall be supplied by CONTRACTOR. Incoming PA and Telephone cables shall be supplied and laid by OWNER. However, termination of these cables in PAJB and TJB shall be by CONTRACTOR.

4 EQUIPMENT SIZING AND SELECTION CRITERIA

4.1 ELECTRICAL DESIGN BASIS

- 4.1.1 Engineering design basis for electrical (B269-999-16-50-EDB-1001) & standard design philosophy for electrical facilities (6-51-0099) along with details indicates in this specification shall form the basis for basic design and developing detailed design and engineering for electrical facilities including electrical power system, electrical equipment and electrical installation etc.

4.2 EQUIPMENT SIZING

- 4.2.1 The fault level for various voltage levels of Electrical system for this complex shall be limited and provided as under. Accordingly the associated electrical equipment shall be selected suitable for same:
 - i). 50 kA (RMS) (3 Sec)/ 135 kA (Peak) for 220 kV System.
 - ii). 40 kA (RMS) (3 Sec)/ 100 kA (Peak) for 66 kV System.
 - iii). 40 kA (RMS) (1sec.) / 100kA (Peak) for 6.6 kV systems.
 - iv). 65 kA (RMS) (1sec.) / 143kA (Peak) for 415 V System.
 - v). 25kA (RMS) (1 sec.) / 62.5 kA (Peak) for 415V System for LDB/ ELDB
- 4.2.2 CONTRACTOR to note that during sizing and selection of the equipment (i.e. oil filled and dry type transformers, DC system, UPS System, 415V switchboard, Ethernet switches, etc.), 20% spare feeders and 20% spare capacity (25% in case of DC System) shall be provided. This shall be over and above design margin.
- 4.2.3 CONTRACTOR to consider maximum cable de-rating factor of 0.5 for sizing of cables on ground rating at 30 degree specified in cable catalogue. This shall be considered for all underground cables.

- 4.2.4 CONTRACTOR to consider sizing factor for normal, standby and intermittent loads as per EIL Spec. 6-51-0099. Contractor to consider 10% design margin and 20% spare capacity for future.
- 4.2.5 CONTRACTOR to note that each switchboard/ transformer shall be loaded upto maximum 80% of its bus bar/ transformer capacity.
- 4.2.6 Lightning protection of building shall be designed for LPS level as per IS/IEC-62305 based on the geographical location of the package. Lightning strip size shall be minimum 25 x 3 mm.
- 4.2.7 Earth Resistivity Value shall be measured by CONTRACTOR before earthing system design calculation. For earthing conductor sizing, duration of earth fault current duration to be considered, shall be minimum one (1) second.
- 4.2.8 For lighting system design, overall maintenance factor shall not be more than 0.63
- 4.3 **SUBSTATION BUILDING**
- 4.3.1 Design, engineering and construction of Main substation building MRSS-100 in P25 plot areas included in the scope of CONTRACTOR. For detailed scope refer Civil/ Structural scope of work. Main Substation building MRSS-100 shall have cable cellar and battery room on ground floor and GIS Hall of double height, Switchgear hall, ECS Hall, UPS Room on first floor. Refer indicative architectural layout for detail wherein the minimum substation sizing requirements are indicated. Final substation building layout shall be developed and submitted by Contractor for review/ approval by EIL/Owner.
- 4.3.2 Cut-outs shall be provided along the complete length of switchgear hall. Beams in between cut-outs shall be provided with PVC sleeves of 150 mm dia. Opening of 200 x 100 mm shall be provided in all under slab beams of switchgear hall slab for FA cable laying. Cut-out of 1200 x 200 mm shall be provided in slab along columns on switchgear floor for cabling to wall mounted panels. Base frame work for all switchgear hall cut-outs is in scope of Contractor. All unused cut-outs shall be covered with 6 mm thick chequered plate after installation of all equipment. Cut outs provided for switchboards shall be covered with 6mm thick chequered plate during construction to prevent falling of people through cut outs.
- 4.3.3 All door/ gates in substation shall be provided with facility to padlocking the doors. Monorail shall be provided for equipment loading/ unloading.
- 4.3.4 All switchboards shall be installed considering provision for installation of two future panels on each side of switchboard.
- 4.3.5 CONTRACTOR to keep space for installation of Owner's ECS System panels in the switchgear hall. Approx. area of ECS Panel Room and ECS Operator Room is indicated in the architectural layout. Exact dimension of both the rooms shall be finalized during detailed engineering.
- 4.3.6 Structural support for Owner's supplied panels is also in the scope of CONTRACTOR. In addition to the base frame of panel, additional framework base channels for embedding in the concrete/ welding to the insert plates on concrete surface shall be supplied and erected by the CONTRACTOR. Supporting structure for 220 kV & 66 kV Cables from cable cellar to GIS structure shall also be provided by CONTRACTOR.
- 4.3.7 Power transformers shall be provided with a RCC oil soak pit below the transformer. Following guidelines shall be followed in this regard:
- 4.3.7.1 The RCC oil soak pit shall be dimensioned such that the clearance between the pit extension and the transformer body shall be 20% of the height of the transformer (highest point) or minimum 800 mm beyond transformer body (Tank and Radiator) all around.
- 4.3.7.2 For the transformers, which are having their soak pits connected to a common waste oil pit, the individual soak pit shall be sized to hold one third of the oil content of the particular transformer (Tank, Cooler, Conservator, OLTC and Cable Box) plus volume of water due to HV water spray system and a margin of approximately 20% for rain water.

- 4.3.7.3 However, the transformers with oil capacity more than 2000 litres, but not connected to waste oil pit, soak pit shall be sized to take the whole of the oil of the transformer plus 30% design margin.
- 4.3.7.4 The pit shall be filled with 40 mm size gravel and a porosity factor of 40% shall be considered for sizing of the pit.
- 4.3.7.5 Total pit volume shall also account for the transformer foundation or any other foundation in the pit.
- 4.3.7.6 Pit shall be raised at least 150 mm above the external level.
- 4.3.8 In addition, provision shall also be made to drain away the oil from individual soak pit to a separate waste oil tank/ pit, where use of more than 9,000 liters of oil in any oil tank/ pit or chamber is involved. This tank/pit shall be connected by a suitable Hume/ HDPE drain pipe of not less than 200 mm diameter to each soak pit. Waste oil tank/ pit shall be located away from the transformer, in the lowest part of the switchyard to assist drainage. The tank/ pit shall be of sufficient capacity to receive, without overflowing, the contents of the largest transformer plus the water of any fixed fire-fighting system and a certain quantity of rain water collected from all tanks/ pits. No other drain shall lead to the tank/pit. This pit shall be provided with an air vent large enough to avoid over pressure during operation. The whole internal surface shall be impermeable.
- 4.3.9 This pit shall not have stone filling. Suitable manhole with ladder shall be provided for the waste oil pit. For taking out the oil from the waste oil pit, a portable pump of suitable rating as per OISD-173 shall be provided.
- 4.3.10 Rail track/ Channel shall be provided for the movement of the main transformers. Same shall be extended on the main approach road. Mooring post shall be provided at a suitable location. Necessary arrangement along with suitable foundation shall be provided for jacking pad, wherever it is required to change the direction of transformer wheels.
- 4.3.11 Wherever cables cross the rail-track/ foundation, suitable size ducts in Concrete block shall be provided.
- 4.3.12 Main gate for power transformers and Maintenance Gates for routine operation & maintenance shall be provided in transformer bay. Transformer bays to be covered with concrete roof at double height.
- 4.3.13 Each transformer bay shall be provided with 1 Nos. 100 Amps outlet for oil filtration and other maintenance activities.
- 4.3.14 Fire wall between two adjacent transformers shall be extended at least 1 meter above the top most point of the Transformers. Fire wall shall also be designed to withstand the explosion of transformer bushing. Firewall thickness shall be minimum 355 mm in case of brick construction or 230 mm in case of RCC construction.
- 4.3.15 Battery room shall be well ventilated along with necessary exhaust system and water connection with sink. Battery room shall be provided with minimum two exhaust fans and louvered opening in the opposite wall/door. Floor of the battery room and walls up to 1.5 M height shall have acid/alkaline (as applicable) resistant protective material coating. Maintenance platform and wash basin/sink shall be provided in the battery room. Neutralization pit for battery room shall be considered, which shall be connected to plant drain.
- 4.3.16 Switchgear/ control room shall have fire-fighting equipment, first aid boxes, insulating floor mats all around the switchboards, hand-gloves and other safety equipment as per statutory requirements. Flooring of switchgear hall shall be painted with insulation paint.
- 4.3.17 Epoxy based insulation coating with breakdown voltage as per IS, suitable for installation on concrete flooring shall be applied on switchgear hall and GIS Hall of substation in air-conditioned/ non-air-conditioned area. Rubber mats shall also be provided around switchboards as per CEA safety regulations.

- 4.3.18 The fire-proof sealing system and fire protection coating system are required to prevent the spreading of fire from one place to another (or one zone to another) through the openings in wall / floor, along cables laid in trays / racks and through openings below floor-mounted Electrical Switchgear, PMCC, Distribution Boards, Junction boxes, Cabinets and Panels. The systems shall be installed in the specified locations in consultation with the purchaser's engineer after all cables have been laid and terminated.
- 4.3.19 Emergency escape route is mandatory to be maintained and marked from all locations in the cable cellar of substation.
- 4.3.20 Contractor shall note that 220kV & 66kV EHV cables inside cable cellar of MRSS-100 shall be laid in RCC trenches. Accordingly, required facility for the same shall be considered by contractor.

4.4 SINGLE LINE DIAGRAM

It is the responsibility of the contractor to provide number of outgoing feeders in each switchboard as per actual loads, other electrical system requirements plus spare feeders in each switchboard in line with engineering design basis.

Contractor shall prepare Single line diagram for complete package and submit the same to Owner/ Consultant for approval. Equipment s as required, as per the bid package to cater the load demand of package and owner's load shall be supplied without any price and time impact to Owner/Consultant.

5 EQUIPMENT SPECIFICATIONS

5.1 GRID TRANSFORMER (220kV primary)

- 5.1.1 Tag Number for various transformers is as per table below:

Tag Number	Rating	Impedance	Cable Termination	
TR-100011	220/66 kV, 160/200 MVA, ONAN/ ONAF, YNyn0, OLTC -17.5% to +12.5 % (In step of $\pm 1.25\%$)	$Z = 12.5\%(-0\%$ to $+10\%$ tolerance)	At 220 kV Side 245 kV (E), 1 Run/ phase, 1C x 630 Sq.mm, Cu Conductor, XLPE Insulated, Armoured, Corrugated Aluminium, PVC Outer sheath Cable	At 66 kV Side GIBD
TR-100012				
TR-100013				
TR-100014				

- 5.1.2 220kV grid transformer shall be as per the enclosed transformer datasheets and EIL standard specification 6-51-0068 attached with the tender. In addition to the requirements specified in 6-51-0068, following clauses shall also be complied.

- | | |
|--------------------------------------|--|
| a) Lighting Impulse Withstand | : 1050 kV _p |
| b) Power Frequency Withstand | : 460 kV _{rms} |
| c) Conservator for Cable Box | : Separate from main tank conservator |
| d) Conservator for OLTC | : Common/ Separate, as per vendor design |
| e) Air Cell Puncture Detection Relay | : Not Required |
| f) Sudden/ Rapid Pressure Rise Relay | : Required |
| g) Automatic Regenerative Breather | : Not Required |

- | | | | |
|-------|--|---|--|
| h) | Remote Indication for pressure relief devices | : | Through separate measuring system |
| i) | NIFPS System | : | Required separately for tank and 220 kV cable box |
| j) | HV Water Spray System | : | Required |
| k) | Rollers | : | Flat type |
| l) | 220 kV Termination | : | Oil insulated phase separated cable box with oil/ oil bushings |
| m) | 66 kV Termination | : | Phase separated cable chambers suitable for Gas Insulated Busduct termination |
| n) | | | |
| o) | Dissolve Gas Analyser | : | Required (Offline Type) |
| p) | Gases to be monitored | : | H ₂ , CH ₄ , C ₂ H ₄ , C ₂ H ₆ , C ₂ H ₂ , CO, CO ₂ |
| q) | Online Moisture Removal System | : | Required (Refer doc. –SP-0023) |
| r) | OLTC | : | Bi-directional |
| s) | Microprocessor bases AVR Interface for communication | : | FO Port on IEC 61850. LIU shall be provided to terminate armoured cable. |
| t) | Impact Recorders | : | Required |
| u) | Type tests to be conducted on offered transformers, even if type test reports are available: | | |
| i. | Temperature Rise | : | Required (One transformer of each rating) |
| ii. | Loss Measurement | : | Required |
| iii. | Short Circuit | : | Not Required |
| iv. | Dielectric Test (As per IS 2026 Part 3)
For both transformer and cable box | : | Not Required |
| v. | Dissolved Gas Analysis of transformer Oil | : | Required |
| vi. | Frequency Response Analysis | : | Required (At works and at site) |
| vii. | Measurement of the harmonics of the no load current | : | Not Required |
| viii. | Fault current withstand capacity test of 220 kV oil filled cable box. | : | Not Required |
| ix. | Pressure Test | : | Required (On each tank size) & Cable box |
| x. | Vacuum Test | : | Required (On each tank size) & Cable box |
| xi. | Parallel operation | : | Yes |
| xii. | SFRA test | : | To be done on all 220kV EHV Grid transformer at factory (before dispatch) & at site as part of pre-commissioning procedure. |

5.1.2.1 Neutral point at 220 kV side shall be provided by means of the outdoor type bushing with minimum continuous voltage rating of 33 kV.

5.1.2.2 Contractor to ensure that valid type test certificates of offered design of transformer are available for Heat run test, short circuit test, IP test of panels, dielectric test, etc. as per type tests listed in IS:2026. In case of non-availability of short circuit test reports, dielectric test reports, IP test reports, impulse test reports, etc. same shall be conducted without any cost and time implication to Owner/ EIL. Type test certificates for EHV bushings and other transformer components shall

also be furnished. Type test of transformer shall only be acceptable provided the offered transformer have been manufactured from the same plant/works from where type tested transformer was manufactured..

- 5.1.2.3 The transformer cable chambers shall be provided with disconnecting arrangement for 220kV terminations to facilitate testing of cables and/or transformers independently. It shall also facilitate removal of the transformer without disturbing cables. The disconnecting arrangement can consist of links in the cable chamber or in a separate disconnecting chamber. The disconnecting arrangement shall be suitably insulated with provision of vermin proof breathing arrangement where applicable.
- 5.1.2.4 The clearances between the cable terminals and transformer bushings shall be adequate to subject each cable or transformer separately to high voltage tests. The cable box and the disconnecting arrangement shall be capable of withstanding both at the time of the first test on cables and at any subsequent time as required.
- 5.1.2.5 Supply of termination kits for entry of 220 kV cables in the oil filled chambers is excluded from CONTRACTOR's scope however all data / details required for procurement of same by owner and provision of required facilities & earthing connection shall be in CONTRACTOR's scope.
- 5.1.2.6 For each cable chamber of 220 kV cable terminal box, separate PRV shall be provided along with prismatic level gauges on both the legs of the cable chamber i.e. cable end and transformer end.
- 5.1.2.7 Separate conservator provided for 3-phase cable chambers shall be provided with a flexible oil resistance air bag and shall also be supplied with following accessories as a minimum :
 - Buchholz relay (double float type) with separate normally open trip and alarm contacts for each cable chamber connection
 - Prismatic level gauge
 - De-hydrating breather
 - Air release Device
 - Oil filling hole with cover
 - Oil Level indicator with alarm contact
 - Pressure relief valve shall be provided (with alarm contact).
 - Sampling valve
 - Conservator drain valve
 - Top oil filter valve
 - Drain cum bottom filter valve
 - NIFPS System
- 5.1.3 Buchholz relay, OTI & WTI shall be provided with reed type switches in place of mercury switches.
- 5.1.4 Supporting arrangement for raising the power cable to transformer end termination shall be provided.
- 5.1.5 Grid transformers shall be provided with OLTC and shall have RTCC facility.
- 5.1.6 Grid transformers shall be used for bi-directional flow of rated power. Tap changer shall be suitable for bidirectional power flow. The tap changer rating shall be more than maximum rated current of transformer at selected tap position and at ONAF rating.
- 5.1.7 CT for 51G and 64R shall be provided at both sides of transformer. CT for 51G shall be class 5P10 and CT for 64R shall be class PS for all the transformers. Technical details of class PS CT (CT Ratio, V_k , I_{mag} and RCT) shall be submitted by contractor for EIL/owner review.
- 5.1.8 Grid transformer shall be transported with transformer tank/ OLTC/ terminal box/ etc. filled with dry air or nitrogen at positive pressure to ensure that no ingress of moisture, humidity or contamination takes place. Necessary arrangement shall be ensured by the contractor to take care of pressure drop of dry air or nitrogen during transit and storage till completion of oil filling

during erection. A dry air or nitrogen pressure testing valve with necessary pressure gauge and adaptor valve shall be provided.

- 5.1.9 Transformer shall be fitted with sufficient number of electronic impact recorders (on returnable basis) during transportation to measure the magnitude and duration of the impact in all three directions. The acceptance criteria and limits of impact in all three directions which can be withstood by the equipment during transportation and handling shall be submitted by the contractor during detailed engineering. The recording shall commence in the factory and must continue till the units reach site. The data of electronic impact recorders shall be downloaded at site and a soft copy of it shall be handed over to Engineer – in –charge.
- 5.1.10 GA of transformer shall be planned in such a manner, that it is possible to pull transformer tank outside the bay without withdrawing the radiators/ any other accessories of transformer.
- 5.1.11 Grid transformers shall be provided with Dissolved Gas Analyser (DGA) kit (This kit shall be supplied as Mandatory spare, defined elsewhere in this document). Provision shall be provided on tank and cable box for connecting the supplied DGA kit for online analysis
- 5.1.12 220kV EHV grid transformers shall be provided with Nitrogen Injection Fire Protection System (NIFPS) along with HVWS based fire fighting system. NIFPS shall be as per EIL specification attached with tender. NIFPS system shall be separate for cable box. Contractor to furnish PTR of NIFPS supplier before finalization of vendor.
- 5.1.13 Grid transformers shall be provided with Online Moisture Removal System. This systems shall be as per the specification attached with the tender. Contractor to furnish PTR of Online dehydration system supplier before finalization of vendor.
- 5.1.14 Bushing for voltage above 52 kV shall be RIP bushing with composite layer insulator. RIP type bushing shall be provided with tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable. Bushing shall be removable without disturbing the current transformer.
- 5.1.15 The Maximum Limit of value of tan delta shall be 1% for windings, 0.5% for bushings and 0.2 % for oil.
- 5.1.16 All the instruments, meters, etc., used for testing shall be duly calibrated at NABL laboratory and necessary calibration certificate shall be made available during inspection.
- 5.1.17 All transformers shall have WTI/ OTI transducer for interfacing with SCAP/ ECS. Duplicate set of terminals shall be provided for interface with SCAP and ECS. All contacts including “spare contacts” and “contacts for owner’s interface” shall be duly wired and terminated upto the terminal block.
- 5.1.18 All signals as per ECS IO List shall be provided for interface with the Electrical control system.
- 5.1.19 All internal wiring inside RTCC Marshalling Box etc. shall be with FRLS insulation.
- 5.1.20 Transformers shall be provided with emergency trip pushbutton station in the transformer bay. Push button station shall have Dual pushbutton with logic to press both for transformer trip.
- 5.1.21 As per Ministry of Environment, Forest and Climate Change (MoEF&CC), Regulation of Polychlorinated Biphenyls Order, 2016, manufacture and import of the Polychlorinated Biphenyls (PCBs) and PCBs containing equipment is banned and hence compliance of same in transformer oil shall be ensured.
- 5.1.22 Contractor to ensure that valid type test certificates for offered design of transformer are available for heat run test, short circuit test and impulse test. The same shall also be furnished for Owner’s review/approval during detail engineering. In case the valid type test certificates are not available, contractor shall carryout the type tests without any additional cost and time implication to Owner/EIL. In case of non-availability of short circuit test reports, manufacturer certified comparative statement in line with IEC-60076 part 7 / IS 2026 part 5 shall be furnished.

5.1.23 CONTRACTOR to also ensure the following:

5.1.23.1 TRANSFORMER CORE

Core material type shall be low loss, non-ageing, high permeability PRIME GRADE, CRGO M4 Grade or better. Design of the core shall fulfil the requirements as listed below.

- It shall be perfectly insulated and clamped to minimize noise and vibrations
- Lower thickness material grades shall be used. Prime grade Cold rolled grain oriented M4 grade or better (Hi-B Grain Oriented Steel grades (HG-OS)) shall be used.
- Lap joints for core shall be of Step type.
- Yoke for the core shall be of boltless.
- The derived building factor shall range from 1.05 to 1.15.
- Certified Mill Test Report for core material shall be submitted.

5.1.23.2 DESIGN CRITERIA

Following vendor data shall also be submitted for scrutiny after design finalization post order.

Yoke Lamination, Type of Core Joint, Number of Lamination/ Lay, Overlap length, Angle of Overlap, Gaps at Joint, Operational Flux density, Proportion of corner weight, X0/ R0, X/R, Z variation at $\pm 10\%$ Tap position (@ ONAF) on Maximum, Normal and Minimum Tapping.

5.1.23.3 OVER-EXCITATION TEST REPORTS

Over excitation conditions and test reports for the following level and duration of supply voltage shall be submitted post order for review by Client/ EIL.

- 110% continuous
- 125% for 1 min
- 140% for 5 sec
- 150% for 1 sec.

Over excitation graphs meeting the requirements specified above may also be accepted.

5.1.23.4 CORE LAMINATIONS ASSEMBLY

Core lamination assembly shall be done while taking care of following points

- Shall be done appropriately (preferably using automatic pressure bed) to ensure that no air pockets are trapped within the laminations.
- Stage inspections of material during fabrication of the Laminations shall be carried out to ensure that only Prime material is being used.

5.1.23.5 ACCREDITED LABS

Labs where heat run, loss measurements tests can be carried out shall either be CPRI Bhopal /Bangalore or any other NABL accredited labs under supervision of CPRI.

5.2 POWER TRANSFORMER (66kV primary)

5.2.1 Tag nos. of power transformer are as follows:

Tag Number	Rating	Impedance	Cable Termination	
TR-100031	66kV/ 6.9kV 20/25 MVA, Dyn1, ONAN/ONAF	Z=10% (-0% to +10%),	At 66 kV Side 1 Run/ phase, 1C x 300 Sq.mm, Cu Conductor, XLPE Insulated, Armoured, Corrugated Aluminium, PVC Outer sheath Cable	At 6.9kV Busduct (phase segregated)
TR-100032	66kV/ 6.9kV 20/25 MVA, Dyn1, ONAN/ONAF			

5.2.2 66kV power transformer shall be as per the enclosed transformer datasheets and EIL standard specification 6-51-0068 attached with the tender. In addition to the requirements specified in 6-51-0068, following clauses shall also be complied.

- a) Lighting Impulse Withstand : 325 kV_p
- b) Power Frequency Withstand : 140 kV_{rms}
- c) Conservator for OLTC : Common/ Separate, as per vendor design
- d) Air Cell Puncture Detection Relay : Not Required
- e) Sudden/ Rapid Pressure Rise Relay : Required
- f) Automatic Regenerative Breather : Not Required
- g) Remote Indication for pressure relief devices : Through separate measuring system
- h) HV Water Spray System : Required
- i) Rollers : Flat type
- j) 66 kV Termination : Phase separated cable chambers suitable for Gas Insulated Busduct termination
- k) Online Moisture Removal System : Required (Refer doc. –SP-0023)
- l) OLTC : Uni-directional
- m) Type tests to be conducted on offered transformers, even if type test reports are available:
 - i. Temperature Rise : Required (One transformer of each rating)
 - ii. Loss Measurement : Required
 - iii. Short Circuit : Not Required
 - iv. Dielectric Test (As per IS 2026 Part 3) : Not Required
For both transformer and cable box
 - v. Measurement of the harmonics of the no load current : Not Required
 - vi. Pressure Test : Required (On each tank size) & Cable box
 - vii. Vacuum Test : Required (On each tank size) & Cable box
 - viii. Parallel operation : Yes

5.2.2.1 Contractor to ensure that valid type test certificates of offered design of transformer are available for Heat run test, short circuit test, IP test of panels, dielectric test, etc. as per type tests listed

in IS:2026. In case of non-availability of short circuit test reports, dielectric test reports, IP test reports, impulse test reports, etc. same shall be conducted without any cost and time implication to Owner/ EIL. Type test certificates for bushings and other transformer components shall also be furnished. Type test of transformer shall only be acceptable provided the offered transformer have been manufactured from the same plant/works from where type tested transformer was manufactured.

- 5.2.2.2 The transformer cable chambers shall be provided with disconnecting arrangement for 66kV terminations to facilitate testing of cables and/or transformers independently. It shall also facilitate removal of the transformer without disturbing cables. The disconnecting arrangement can consist of links in the cable chamber or in a separate disconnecting chamber. The disconnecting arrangement shall be suitably insulated with provision of vermin proof breathing arrangement where applicable.
- 5.2.2.3 The clearances between the cable terminals and transformer bushings shall be adequate to subject each cable or transformer separately to high voltage tests. The cable box and the disconnecting arrangement shall be capable of withstanding both at the time of the first test on cables and at any subsequent time as required.
- 5.2.2.4 Separate conservator provided for 3-phase cable chambers shall be provided with a flexible oil resistance air bag and shall also be supplied with following accessories as a minimum :
 - Buchholz relay (double float type) with separate normally open trip and alarm contacts for each cable chamber connection
 - Prismatic level gauge
 - De-hydrating breather
 - Air release Device
 - Oil filling hole with cover
 - Oil Level indicator with alarm contact
 - Pressure relief valve shall be provided (with alarm contact).
 - Sampling valve
 - Conservator drain valve
 - Top oil filter valve
 - Drain cum bottom filter valve
- 5.2.3 Bucholz relay, OTI & WTI shall be provided with reed type switches in place of mercury switches.
- 5.2.4 Supporting arrangement for raising the power cable to transformer end termination shall be provided.
- 5.2.5 Power transformers shall be provided with OLTC and shall have RTCC facility.
- 5.2.6 Power transformers shall be used for uni-directional flow of rated power. Tap changer shall be suitable for bidirectional power flow. The tap changer rating shall be more than maximum rated current of transformer at selected tap position and at ONAF rating.
- 5.2.7 CT for 51G and 64R shall be provided at both sides of transformer. CT for 51G shall be class 5P10 and CT for 64R shall be class PS for all the transformers. Technical details of class PS CT (CT Ratio, V_k , I_{mag} and RCT) shall be submitted by contractor for EIL/owner review.
- 5.2.8 Power transformer shall be transported with transformer tank/ OLTC/ terminal box/ etc. filled with dry air or nitrogen at positive pressure to ensure that no ingress of moisture, humidity or contamination takes place. Necessary arrangement shall be ensured by the contractor to take care of pressure drop of dry air or nitrogen during transit and storage till completion of oil filling during erection. A dry air or nitrogen pressure testing valve with necessary pressure gauge and adaptor valve shall be provided.
- 5.2.9 GA of transformer shall be planned in such a manner, that it is possible to pull transformer tank outside the bay without withdrawing the radiators/ any other accessories of transformer.

- 5.2.10 Power transformers shall be provided with Online Moisture Removal System. This systems shall be as per the specification attached with the tender. Contractor to furnish PTR of Online dehydration system supplier before finalization of vendor.
- 5.2.11 Bushing for voltage above 52 kV shall be RIP bushing with composite layer insulator. RIP type bushing shall be provided with tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable. Bushing shall be removable without disturbing the current transformer.
- 5.2.12 The Maximum Limit of value of tan delta shall be 1% for windings, 0.5% for bushings and 0.2 % for oil.
- 5.2.13 All the instruments, meters, etc., used for testing shall be duly calibrated at NABL laboratory and necessary calibration certificate shall be made available during inspection.
- 5.2.14 All transformers shall have WTI/ OTI transducer for interfacing with SCAP/ ECS. Duplicate set of terminals shall be provided for interface with SCAP and ECS. All contacts including "spare contacts" and "contacts for owner's interface" shall be duly wired and terminated upto the terminal block.
- 5.2.15 All signals as per ECS IO List shall be provided for interface with the Electrical control system.
- 5.2.16 All internal wiring inside RTCC Marshalling Box etc. shall be with FRLS insulation.
- 5.2.17 Transformers shall be provided with emergency trip pushbutton station in the transformer bay. Push button station shall have Dual pushbutton with logic to press both for transformer trip.
- 5.2.18 As per Ministry of Environment, Forest and Climate Change (MoEF&CC), Regulation of Polychlorinated Biphenyls Order, 2016, manufacture and import of the Polychlorinated Biphenyls (PCBs) and PCBs containing equipment is banned and hence compliance of same in transformer oil shall be ensured.
- 5.2.19 Contractor to ensure that valid type test certificates for offered design of transformer are available for heat run test, short circuit test and impulse test. The same shall also be furnished for Owner's review/approval during detail engineering. In case the valid type test certificates are not available, contractor shall carryout the type tests without any additional cost and time implication to Owner/EIL. In case of non-availability of short circuit test reports, manufacturer certified comparative statement in line with IEC-60076 part 7 / IS 2026 part 5 shall be furnished.
- 5.2.20 CONTRACTOR to also ensure the following:

5.2.20.1 TRANSFORMER CORE

Core material type shall be low loss, non-ageing, high permeability PRIME GRADE, CRGO M4 Grade or better. Design of the core shall fulfil the requirements as listed below.

- It shall be perfectly insulated and clamped to minimize noise and vibrations
- Lower thickness material grades shall be used. Prime grade Cold rolled grain oriented M4 grade or better (Hi-B Grain Oriented Steel grades (HG-OS)) shall be used.
- Lap joints for core shall be of Step type.
- Yoke for the core shall be of boltless.
- The derived building factor shall range from 1.05 to 1.15.
- Certified Mill Test Report for core material shall be submitted.

5.2.20.2 DESIGN CRITERIA

Following vendor data shall also be submitted for scrutiny after design finalization post order.

Yoke Lamination, Type of Core Joint, Number of Lamination/ Lay, Overlap length, Angle of Overlap, Gaps at Joint, Operational Flux density, Proportion of corner weight, X0/ R0, X/R, Z variation at $\pm 10\%$ Tap position (@ ONAF) on Maximum, Normal and Minimum Tapping.

5.2.20.3 OVER-EXCITATION TEST REPORTS

Over excitation conditions and test reports for the following level and duration of supply voltage shall be submitted post order for review by Client/ EIL.

- 110% continuous
- 125% for 1 min
- 140% for 5 sec
- 150% for 1 sec.

Over excitation graphs meeting the requirements specified above may also be accepted.

5.2.20.4 CORE LAMINATIONS ASSEMBLY

Core lamination assembly shall be done while taking care of following points

- Shall be done appropriately (preferably using automatic pressure bed) to ensure that no air pockets are trapped within the laminations.
- Stage inspections of material during fabrication of the Laminations shall be carried out to ensure that only Prime material is being used.

5.2.20.5 ACCREDITED LABS

Labs where heat run, loss measurements tests can be carried out shall either be CPRI Bhopal /Bangalore or any other NABL accredited labs under supervision of CPRI.

5.3 DISTRIBUTION TRANSFORMER

- 5.3.1 Maximum rating of distribution transformer shall be limited to 2500kVA however the transformer rating shall be finalized based on load analysis, considering 10% design margin and 20% capacity for future load. Each transformer shall be sized to feed the complete load independently
- 5.3.2 Transformers shall be provided with emergency trip pushbutton station in the transformer bay. Push button station shall have Dual pushbutton with logic to press both for transformer trip.
- 5.3.3 The transformers impedances shall be chosen to suit switchgear fault withstand capabilities and large motor start-up (if any).
- 5.3.4 Distribution transformer rated upto 2500kVA shall comply to latest IS-1180 (Part-1): 2014 and its amendments including but not limited to amendment-4 and latest Gazette of India Order. Accordingly, efficiency of transformer at 50% and 100% load shall be considered with total losses at 50% and 100% loading not exceeding maximum losses values specified in Table-6 of IS-1180 (Part-1) for Energy Efficiency Level-2.
- 5.3.5 The transformer shall bear standard mark of Bureau of Indian Standards in line with Gazette of India. Copy of license obtained from Bureau of Indian Standards in compliance with IS 1180(Part-1) shall be furnished by the contractor along with transformer vendor drawings post order.
- 5.3.6 The overall dimensions of the transformers shall be limited in accordance with 7-51-0337 enclosed with the package.
- 5.3.7 Bucholz relay, OTI & WTI shall be provided with reed type switches in place of mercury switches.
- 5.3.8 Fire fighting system is generally not envisaged for distribution transformers, accordingly, oil quantity for distribution transformer shall be restricted up to 2000 liters. In case, oil quantity is more than 2000 litre, HVWS system shall be provided by contractor.
- 5.3.9 CT for 51G shall be class 5P10 and CT for 64R shall be class PS for all the transformers. Technical details of class PS CT (Vk, Imag and RCT) shall be submitted by contractor for EIL review.
- 5.3.10 All transformers shall have WTI/ OTI transducer for interfacing with ECS.

- 5.3.11 All contacts including “spare contacts” and “contacts for owner’s interface” shall be duly wired and terminated upto the terminal block.
- 5.3.12 Contractor to ensure that valid type test certificates for offered design of transformer are available for heat run test, short circuit test and impulse test. The same shall also be furnished for Owner’s review/approval during detail engineering. In case the valid type test certificates are not available, contractor shall carryout the type tests without any additional cost and time implication to Owner/EIL. In case of non-availability of short circuit test reports, manufacturer certified comparative statement in line with IEC-60076 part 5 / IS 2026 part 5 shall be furnished.
- 5.3.13 Heat run test shall be done on one distribution transformer of each rating, even if type test report for same is available with the vendor. Pressure test and vacuum test shall be done on one transformer tank of each size.
- 5.3.14 All signals as per ECS IO List shall be provided for interface with the Electrical control system.
- 5.3.15 As per Ministry of Environment, Forest and Climate Change (MoEF & CC), Regulation of Polychlorinated Biphenyls Order, 2016, manufacture and import of the Polychlorinated Biphenyls (PCBs) and PCBs containing equipment is banned and hence compliance of same in transformer oil shall be ensured.
- 5.3.16 Transformers with 80% loading shall be equal to Peak Demand (including 10% design margin) & does not include 20% spare capacity for future.
- 5.4 EHV GAS INSULATED BUSDUCT (GIB) FOR 66kV**
- 5.4.1 Maximum weight of gas in gas tight section of GIB shall not exceed 250kg.
- 5.4.2 GIS bus ducts of each circuit shall be arranged in preferably horizontal formation and the clearance (outer to outer) between nearest bus ducts of two adjacent circuits shall be minimum one meter.
- 5.4.3 GIB shall be generally in only one horizontal layer. However in exceptional circumstance two horizontal GIB layers can be provided with the approval of owner/EIL and the vertical clearance between layers shall be minimum one meter in such case.
- 5.4.4 The minimum outer to outer horizontal clearance between each GIS bus duct shall be 0.5 meter.
- 5.4.5 The minimum vertical ground clearance of GIB at road crossing shall be 5.5 meters.
- 5.4.6 The horizontal clearance between GIB and GIS building /any other building wall shall be minimum three meters for GIB running parallel to the building/wall.
- 5.4.7 The GIB route inside the GIS Hall shall not obstruct easy access to GIS and control room buildings and shall not obstruct movement of crane, equipment including HV test equipment for maintenance works.
- 5.4.8 The GIB height outside the GIS hall in switchyard area shall not obstruct easy access to GIB, movement of crane for maintenance work.
- 5.4.9 For the maintenance of GIB of one circuit, only that circuit shall be isolated.
- 5.4.10 Contractor shall finalise the make of 66kV GIBD meeting the criteria indicated in attached Experience Record Proforma (ERP), B269-999-16-50-ERP-0021. Completely filled in ERP sheet along with all supporting documents shall be furnished along with bid.
- 5.5 HV & MV BUSDUCT**
- 5.5.1 Bus duct shall be provided for connection between the transformer and switchboards where the board rating is more than 1250A.
- 5.5.2 Note-4 of EDB doc. No. B269-999-16-50-1001 rev-0 (page 39 of 49) stands deleted and is replaced by following:

“Non segregated phase air insulated type MV bus duct shall be provided in place of sandwich type busduct.”

- 5.5.3 Bus-duct layout drawings shall be prepared by the CONTRACTOR based on substation equipment layout and Structural and Architectural drawings of substation and transformer drawings at the time of detail engineering.
- 5.5.4 It is CONTRACTOR's responsibility to close the gap between the bus-duct and the cut-out left for bus-duct routing. Closing of gap shall be done with material suitable for minimum 2 hours fire rating.
- 5.5.5 All other requirements for HV & MV Bus duct shall be as per EIL Specification 6-51-0054 and HV & MV bus duct datasheet attached with the tender.
- 5.5.6 All the offered HV, MV bus duct shall be type tested. CONTRACTOR to ensure at the time of order placement that copies of valid type test certificates for the following tests conducted on identical design of offered bus ducts are available.
- Short time current withstand test
 - Power frequency & lightning impulse voltage withstand capacity
 - Heat run test.
 - Ingress Protection test.
- 5.5.7 CONTRACTOR to conduct heat run test on each rating of MV bus duct at vendor's works as part of scope of this tender and no extra payment for the same shall be provided.
- 5.5.8 The busduct bus bar material shall be same as that used for switchgear busbar. In case different material are provided for busbar of switchboards/transformers and busduct, bimetallic washer/plates shall be provided.
- 5.6 GENERAL REQUIREMENT FOR ALL EHV, HV & MV SWITCHGEAR**
- 5.6.1 Selection, sizing and suitability of all components shall be the CONTRACTOR's responsibility. The equipment as required for safe and satisfactory operation shall be considered included in CONTRACTOR's scope even if not specifically mentioned.
- 5.6.2 Hardware data sheet for feeders include only the major relays, meters and control switches. Any auxiliary relays, timers, switches, etc., as required, while developing the control schematics and for safe operation, even if these are not specifically mentioned, shall be supplied by the CONTRACTOR without any price and time implication. All logic shall be implemented in the relay itself and not externally. Provision of adequate I/O count in the relays shall be ensured.
- 5.6.3 The CONTRACTOR's shall be solely responsible to coordinate the relay characteristics with relay supplier for the proper selection of all CTs with special care to select class PS CTs. The VA burden, knee-point voltage, CT resistance and magnetizing current shall be calculated by the vendor for Owner/ EIL's review before proceeding with manufacturing.
- 5.6.4 Following sizing calculation for Class PS CT's shall be submitted by CONTRACTOR's during drawing review stage.
- Knee point voltage V_k
 - Metrosil
 - Stabilizing resistor.
- 5.6.5 CT ratios/ details, load details, cable sizes, feeder nos., name plate details etc., for all feeders at switchboards shall be finalized at the time of review of vendor drawings which shall be taken care by the CONTRACTOR without any impact on cost and time to Owner.
- 5.6.6 The size of bus-bar from horizontal bus to breaker and breaker to outgoing shall be designed based on breaker rating and not on CT/feeder rating.
- 5.6.7 Relay Setting
- 5.6.7.1 Relay settings for other outgoing feeders in CONTRACTOR's scope shall be undertaken by the CONTRACTOR/ Vendor and CONTRACTOR/ Vendor shall furnish the relay setting chart and

relay coordination curves. During drawing review stage, vendor shall furnish numerical relay selection chart showing complete model no. of numerical relay and various functionalities offered meeting all requirements specified in tender.

- 5.6.7.2 Any other data required for relay setting to be done by the CONTRACTOR's shall be provided during engineering stage.
- 5.6.7.3 Design calculations for selection of relay setting and relay parameterization, relay coordination, providing relay-setting table & relay parameterization, etc. for all feeders is included in the CONTRACTOR's scope. Relay parameterization for all relays shall be provided and implemented by vendor.
- 5.6.8 Dummy panels and rear extensions, as required, to avoid fouling with beam/ column, adequacy of space for cable terminations, bus trunking, mounting of relays, meters, control components etc. shall be supplied as required without time & cost implication to owner.
- 5.6.9 Breaker rating as specified in the data sheet is 'in-panel' rating at design ambient. CONTRACTOR may select higher rating of breaker if there is de-rating factor for 'in-panel' rating and due to design ambient. No force cooling shall be accepted
- 5.6.10 Breaker control switches shall be hardwired type. All TNC and Trip Switch shall be lockable type.
- 5.6.11 Spring charging motors shall be suitable for 110V DC supply.
- 5.6.12 All feeders/switchboards shall have provision for LOTO implementation. Photographs of LOTO provision in each type of panels shall be submitted during drawing review for approval.
- 5.6.13 All transformer incipient faults signals shall be wired through interposing contactors in the panel to avoid nuisance tripping.
- 5.6.14 4-Pole MCB shall be considered in all the PT panels. 4th pole contact of the MCB shall be used for blocking under voltage protection function. Bi-stable relays shall be considered in PT panels for multiplication of the contact for under voltage blocking function in each feeder.
- 5.6.15 In Control logics / schemes, contacts of vacuum/ SF6 circuit breaker shall be utilized. In case, same is not available, then Bi-stable relays shall be considered for multiplication of Circuit breaker contacts.
- 5.6.16 Wherever failsafe contact concept is used, it shall use mechanical contacts. In case mechanical contacts cannot be provided, failsafe concept shall not be used.
- 5.6.17 The details of all Instrument transformers comprising their full name plate and connection diagram shall be displayed with stickers at an easily accessible location (In addition to Instrument transformer itself), during normal operation.
- 5.6.18 All the CT & PT connection should be through ring type reliable connection/terminations only.
- 5.6.19 Terminal connectors of all other control terminals shall be screwed type only. Separate terminal block shall be provided for further wiring to ECS/ upstream breaker/ Transformer, etc. for tripping/ interlock/ annunciation, etc.
- 5.6.20 All the NO, NC contacts of breaker, Relay DI/DO, RTD inputs, etc. shall be wired upto terminal block, even if the contacts are not used in the scheme.
- 5.6.21 Terminal multiplication to be done, wherever double control cable termination is done, i.e. only one control cable wire shall be connected to one terminal.
- 5.6.22 Additional 2 set of spare CT and PT terminals shall be provided for tapping CT and PT supply for future purpose in Incomers/ bus couplers/ Line PT and Bus PT of all switchboards.
- 5.6.23 It is required to interface EHV, HV and MV switchgears with the ECS Panel for control, monitoring and annunciation purpose. For ECS Interface, typical ECS IO list is attached.

- 5.6.24 In addition to above, terminals as required for interface with upstream and downstream switchgear needs to be provided to fulfil the operational requirements.
- 5.6.25 Hardware, as required, including selector switches, auxiliary relays, etc. during detail engineering to meet the operation requirement shall be supplied by vendor without any time and cost implication.
- 5.6.26 Vendor to note that the control cables used shall be 2.5 sq. mm. twisted pair shielded cables.
- 5.6.27 All signals as per ECS IO List shall be provided for interface with the Electrical control system.
- 5.6.28 Terminals for DCS & ECS, input & output shall be segregated & separate terminal block shall be provided. While wiring these signals from respective feeder module to marshalling, it shall be ensured that separate cables are used for status & commands & same shall be segregated.
- 5.6.29 Current rating for interface contacts shall be 2A, 220V DC or 240V AC.
- 5.6.30 For the DC Control supply to the various breaker panels in EHV GIS, HV IBPS & 415V Switchboards, there shall be one common control switch for all control supply to the panel. Separate fuses for following branch circuit shall be provided:
- 5.6.30.1 Spring charging circuit
- 5.6.30.2 Closing circuit
- 5.6.30.3 Tripping, contact multiplier & digital input circuit
- 5.6.30.4 Indication circuit
- 5.6.30.5 Each Numerical relay supply (incoming of numerical relay supply fuse shall be tapped before the control supply switch)
- 5.6.31 Separate control supply switch shall be provided for differential protection relays.
- 5.6.32 Bus differential scheme shall have dedicated supply from the same bus section.
- 5.6.33 CT Bypassing relay shall be latched type.
- 5.6.34 Bus differential multiplier relay shall be VAJH type only.
- 5.6.35 Common lock key shall be provided for breakers in place of individual lock key for each breaker.
- 5.6.36 Requirements For Online Temperature Monitoring System For HV & MV Switchboards:
- 5.6.36.1 Online Temperature Monitoring System (OTMS) for HV Switchboards at all critical point mentioned below shall be provided for each switchboard and isolating breaker panels. In each vertical, wireless sensors shall be located as per the following:
- Each horizontal bus bar terminal/tap-off connection in busbar compartment.
 - Each cable /bus duct connection points in cable compartment.
 - One sensor per phase of cable connection points shall be considered irrespective of number of runs of cable.
- 5.6.36.2 Online Temperature Monitoring System (OTMS) for MV Switchboards shall conform to the following: In each vertical panel, sensors shall be located as per the following :
- For MV Switchboard (PCC/PMCC/EPMC) having Air circuit breaker panels:
 - Each horizontal bus bar terminal/tap-off connection in busbar compartment.
 - Each bus duct/cable connection points in cable compartment.
 - One sensor per phase of cable connection points shall be considered irrespective of number of runs of cable
 - OTMS is not required for MCC, ASB, LDB & ELDB.
- 5.6.36.3 The temperature sensors installed shall be suitable for wireless, with direct contact to hot point, operating range from -10°C to 125 °C. The accuracy shall be as per the following: $\pm 3^\circ\text{C}$

accuracy for 0°C to 80 °C range. $\pm 4^\circ\text{C}$ accuracy for full range (-10°C to 0°C and 80°C to 125 °C)

- 5.6.36.4 The system shall allow at least 1 configurable threshold (alarm).
- 5.6.36.5 OTMS system shall have the provision to send complete data to SAS/ Owner's ECS for monitoring and investigation. The system shall be online to immediately provide an abnormal temperature alarm (with identification/location of the abnormal temperature) to the owner's operator system.
- 5.6.36.6 Complete data of OTMS shall be accessible in the SAS (through switchboard level Ethernet switches) & associated SAS Laptop/ HMI. The protocol for communication shall be either IEC 61850 or MODBUS TCP/IP or MODBUS RTU or other open protocol and shall be decided by CONTRACTOR. Accordingly, protocol convertors/gateways at suitable locations as required shall be provided by CONTRACTOR for data integration on IEC 61850 protocol from Master Ethernet switch to Owner's ECS system.
- 5.6.36.7 Online temperature monitoring data shall be available in both owner's ECS as well as Substation Automation System (SAS). OTMS shall be integrated with owner's ECS.

5.7 220 kV & 66kV GAS INSULATED SWITCHGEAR

- 5.7.1 220 kV, 2000 Amps, 50 kA (3 Sec) Double Bus Bar GIS Panel & 66kV, 3150A, 40kA (3 Sec) Double Bus Bar GIS Panel shall be as per EIL standard specification 6-51-0066, complete with metering and protection as per datasheet attached with tender. LCC and separate CRP shall be supplied for each bay. Tag number of various equipment shall be as follows:

Tag Number	Item
HV-100103	220kV GIS Switchgear
LCC-100103	LCC of 220kV GIS Switchgear
CRP-100103	Control & Relay Panel of 220kV GIS Switchgear
HV-100111	66kV GIS Switchgear
LCC-100111	LCC of 66kV GIS Switchgear
CRP-100111	Control & Relay Panel of 66kV GIS Switchgear

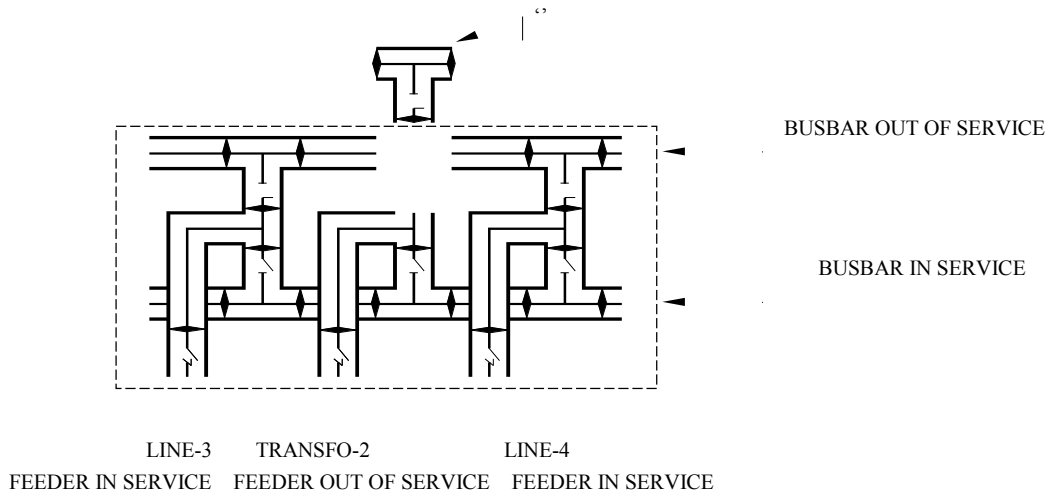
- 5.7.2 The equipment shall be designed for operation in applicable seismic zone for earthquake resistance. The seismic loads are due to the horizontal and vertical acceleration which may be assumed to act on concurrently. Seismic Qualification requirements shall be as per IEC 62271-207 for the design of equipment. To prevent the movement of GIS sub-assemblies i.e. various bay modules during the earthquake, suitable devices shall be provided for fixing the sub-assemblies to the foundation. The contractor shall supply necessary bolts for embedding in the concrete foundation. The fixing of GIS sub-assemblies to the foundation shall be designed to withstand the seismic events. It will also be ensured that the special devices as well as bolts shall not be over stressed. The details of the devices used and the calculations for establishing the adequacy shall be furnished by the supplier and shall be subject to Owner's/ EIL approval.
- 5.7.3 For feeder details and power cable termination kits, refer SLD & feeder detail datasheets attached with tender. Sequence/position of various feeder as shown in the SLD is indicative and same shall be finalised during detailed engineering without any cost and time implication to Owner/EIL.
- 5.7.4 The offered GIS equipment and components shall conform to the type tests as per IEC 62271-203. CONTRACTOR to ensure at the time of order placement that copies of valid type test certificates for tests conducted on identical design of offered equipment is available. In case of non-availability of type test certificates, same shall be conducted without any cost and time

implication to Owner/ EIL. Validity of type test certificate applicable for 220kV, 66kV GIS switchboard & 66kV GIBD shall be considered as 'Till Design Change'. Type test certificate of parent company is also acceptable subject to meeting the tender & statutory requirement.

- 5.7.5 GIS shall be designed in such a way that transfer from one bus isolator to another bus isolator shall be possible in energised condition without any break in supply to the loads.
- 5.7.6 Feeder differential relay (87F) matching with the make/ model as installed in the client's existing upstream 220 kV GIS feeder relay panel shall be supplied under scope of this tender. Testing and commissioning of this relay along with establishing of communication & any other requirement is also included in scope of CONTRACTOR. Make/model of existing relay shall be informed during detailed engineering.
- 5.7.7 Transformer+Feeder differential relay (87T+F) in the GIS CRP for 66 kV incoming feeders (including spare feeders), for installation in client's/other upstream 220kV/66kV panel through future grid shall be supplied loose (free issued by contractor) under scope of this tender.
- 5.7.8 Transformer + Feeder differential relay (87T+F) of same make/ model as installed in the GIS CRP for 66 kV outgoing transformer feeder (including spare feeders), for installation in client's/other downstream 6.6kV incomer panel shall be supplied loose (free issued by contractor) under scope of this tender. Testing and commissioning of loose supply relay is also included in scope of CONTRACTOR.
- 5.7.9 In addition to the requirements specified in 6-51-0066, following clauses shall also be complied:
- 5.7.9.1 The GIS assembly shall consist of separate modular compartments e.g. Circuit Breaker compartment, Bus bar compartment filled with SF6 gas & separated by gas tight partitions so as to minimize risk to human life, allow ease of maintenance and limits the effects of gas leaks failure and internal arcs, etc. These compartments shall be such that maintenance, repair, extension on one feeder may be performed without de-energising the adjacent feeders. These compartments shall be designed to minimize the risk of damage to adjacent sections and protection of personnel in the event of a failure occurring within the compartments. Rupture diaphragms with suitable deflectors shall be provided to prevent uncontrolled bursting pressures developing within the enclosures under worst operating conditions, thus providing controlled pressure relief in the affected compartment.
- 5.7.9.2 The switchgear shall be of modular design and shall have complete phase segregation for the active components (i.e. Isolators, breakers, earth switch, etc.). The conductors and the live parts shall be mounted on high grade epoxy resin insulators. These insulators shall be designed to have high structural strength and electrical dielectric properties and shall be free of any voids and free of partial discharge at a voltage recommended by IEC. These shall be shaped so as to provide uniform field distribution and to minimize the effects of particle deposition either from migration of foreign particles within the enclosures or from the by-products of SF6 breakdown under arcing conditions.
- 5.7.9.3 Gas barrier insulators shall be provided so as to divide the GIS into separate compartments. These shall be suitably located in order to minimize disturbance in case of leakage or dismantling. They shall be designed to withstand any internal fault thereby keeping an internal arc inside the faulty compartment. Due to safety requirement for working on this pressurized equipment, whenever the pressure of the adjacent gas compartment is reduced during maintenance, this compartment shall be designed so that it shall remain in service to perform its intended duty. The gas tight barriers shall be clearly marked on the outside of the enclosures.
- 5.7.9.4 The bus enclosure should be sectionalized in a manner that maintenance, repair or extension work on any bus disconnector (when bus and bus disconnector are enclosed in a single/ three phase enclosure) can be carried out by isolating and evacuating the small effected section and not the entire bus. The design of 220 kV GIS shall be such that in case a circuit breaker/ any other module of a feeder is removed for maintenance, both bus bars shall remain in service. For achieving the above requirements, adequate mechanical support and number of intermediate

gas tight compartments as required, shall be provided to ensure equipment and operating personnel's safety.

- 5.7.9.5 Adequate nos. of gas sectionalizer shall be provided in 220kV GIS & 66kV GIS for ensuring safety, ease of maintenance/repair & lower gas handling requirements during bus faults, regular maintenance/repair activities or extension work. Gas partitions shall be provided in GIS switchboard (220kV & 66kV) as per Fig: F.6 of IEC-62271-203 as a minimum. Typical sketch is as below:



- 5.7.9.6 The material and thickness of the enclosures shall be such as to withstand an internal flash over for a period of 300 mill second at rated short time withstand current.
- 5.7.9.7 Each pressure filled enclosure shall be designed and fabricated to comply with the requirements of the applicable pressure vessel codes to which it is subjected in service (ASME/ CENELEC code for pressure vessel) and based on the design temperature and design pressures as defined in IEC-62271-203.
- 5.7.9.8 The bursting strength of Aluminium castings has to be at least 5 times the design pressure. A bursting pressure test shall be carried out at 5 times the design pressure as a type test on each type of enclosure. Each enclosure has to be tested as a routine test at 1.5 times the design pressure for one minute.
- 5.7.9.9 The thermal rating of all current carrying parts shall be minimum for three second for the rated symmetrical short-circuit current.
- 5.7.9.10 The ladders and walkways shall be provided wherever necessary for access to the equipment. The enclosure and support structure shall be designed that a person of 1780 mm in height and 80 kg in weight is able to climb on the equipment for maintenance.
- 5.7.9.11 In general the contours of energized metal parts of the GIS and any other accessory shall be such, so as to eliminate areas or points of high electrostatic flux concentrations. The surfaces shall be smooth with no projection or irregularities which may cause visible corona. No corona shall be visible in complete darkness when the equipment is subjected to specified test voltage. There shall be no radio interference from the energized switchgear at rated voltage.
- 5.7.9.12 The GIS shall be designed, so as to take care of the Very Fast Transients (VFT) over voltages generated as a result of pre-strikes and re-strikes during isolator operation. Maximum VFT over voltages peak shall not be higher than rated lightning impulse withstand voltage of the equipment. Necessary measures shall be under taken by GIS manufacturer to restrict maximum VFT over voltages lower than the lightning impulse withstand voltage. Manufacturer shall submit the study report of VFTO generated for GIS installation.
- 5.7.9.13 The enclosure shall be of continuous design and shall meet the requirement as specified in clause no. 10 (special considerations for GIS) of IEEE- 80, Year- 2000. The enclosure shall be sized for carrying induced current equal to the rated current of the Bus. The conductor and the

enclosure shall form the concentric pair with effective shielding of the field internal to the enclosure.

- 5.7.9.14 The enclosure shall be designed to practically eliminate the external electromagnetic field and thereby electro-dynamic stresses even under short circuit conditions. The average intensity of electromagnetic field shall not be more than 50 micro –Tesla on the surface of the enclosure. The contractor shall furnish all calculations and documents in support of the above during detailed engineering.
- 5.7.9.15 Alarm circuit shall not respond to faults for momentary conditions. The following indications including those specified elsewhere in the specifications shall be provided in the alarm and indication circuits.

Gas Insulating System

- Loss of Gas Density.
- Loss of Heater power (if required)
- Any other alarm necessary to indicate deterioration of the gas insulating system.

Operating System

- Low operating pressure.
- Loss of Heater power.
- Loss of operating power.
- Loss of control supply.
- Pole Discordance

- 5.7.9.16 Metallic bellows for permitting the movement during expansion and contraction may be of following types:
- Lateral / Vertical mounting units
 - Axial compensators
 - Parallel compensators
 - Tolerance compensators
 - Vibration compensators
- 5.7.9.17 The contractor shall provide suitable measure to mitigate transient enclosure voltage caused by high frequency currents caused by lightning strikes, operation of surge arrestor, phase to earth fault and discharges between contacts during switching operation. The earthing system shall ensure safe touch & step voltages in all the enclosures.
- 5.7.9.18 In order to ensure the security of personnel, equipotential earth mat shall be provided, where the enclosures and fixed accessories are accessible for the floor and manual operation of apparatus or locking system is located.
- 5.7.9.19 Contractor shall provide adequate number of **UHF sensors** in the offered GIS for detection of Partial discharge (of 5 pC and above) as per IEC 60270 through Partial Discharge (PD) monitoring system and the number and location of these sensors shall be subject to approval of Owner/ EIL. Further UHF sensors shall necessarily be provided in close proximity to VT compartments.
- 5.7.9.20 However adequacy of number of sensors and their location shall be verified at site by the contractor as per recommendations of **CIGRE task force TF 15/33.03.05** (Task force on Partial discharge detection system for GIS: Sensitivity verification for the UHF method and the acoustic method). In case during site testing additional UHF sensors are required, the same shall also be supplied & installed to complete the technical requirement without cost and time implication to purchaser.
- 5.7.9.21 The arrangement of gas sections or compartments shall be such as to facilitate future extension of any make without any drilling, cutting or welding on the existing equipment. To add equipment, it shall not be necessary to move or dislocate the existing switchgear bays. Contractor shall make available during detailed engineering stage, the complete design detail of interface module

such as cross section, enclosure material, enclosure dimensions (inner & outer), Flange diameter (inner & outer), conductor connection arrangement, bolt spacing & dimension, rated gas pressure, etc. GIS manufacturer shall furnish all the required details in addition to those mentioned above necessary for design and successful implementation of an interface module during later stage while extending GIS by any other GIS make, without any help of GIS manufacturer who has supplied the GIS equipment in present scope.

5.7.9.22 **Refer clause 5.5.4 of 6-51-0066**, Note that metallic bellows shall be provided for lateral and vertical alignment based on calculation.

5.7.9.23 **Refer clause 5.6 of 6-51-0066, following shall also be complied**

- i. The corona rings/ stress shields for the control of electrical field in the vicinity of the isolation gap shall be provided by the GIS manufacturer.
- ii. The opening for access shall be provided in each phase terminal enclosures as necessary to permit removal of connectors to isolate the XLPE cables to allow carrying out the insulation tests.
- iii. Type test reports of radio interference voltage (RIV) level shall be submitted for approval

5.7.9.24 **Refer clause 5.14.3 (a) and (d) of 6-51-0066**, Note that manual closing and opening of disconnector is not allowed.

5.7.9.25 **Refer clause 6.1.1 of 6-51-0066, following shall also be complied**

The circuit breaker shall be capable of

- i. Interrupting the steady and transient magnetizing current for transformers upto 150 MVA.
- ii. Interrupting line/ cable charging current as per IEC without re-strikes and without use of opening resistors. The breaker shall be able to interrupt the rated line charging current as per IEC-62271-100 with test voltage immediately before opening equal to the product of $U/\sqrt{3}$ and 1.4.
- iii. Breaking 25% the rated fault current at twice the rated voltage under phase opposition condition.
- iv. The breaker shall satisfactorily withstand the high stresses imposed on them during fault clearing, load rejection and re-energization of shunt reactor and/or series capacitor compensated lines with trapped charges.
- v. Withstanding all dielectric stresses imposed on it in open condition at lock out pressure continuously (i.e. shall be designed for 2 p.u. across the breaker continuously, for validation of which a power frequency withstand test conducted for a duration of at least 15 minutes is acceptable).
- vi. Circuit breakers shall be able to switch in and out the shunt reactor of rating upto 100 Ampere with maximum rise of overvoltage limited upto 2.3 p.u.
- vii. **Total Break Time** :The total break time shall not be exceeded under any of the following duties :
 - Test duties T10,T30,T60,T100 (with TRV as per IEC- 62271-100)
 - Short line fault L90, L75 (with TRV as per IEC-62271-100)

The total break time of the breaker shall not be exceeded under any duty conditions specified such as with the combined variation of the trip coil voltage (70-110%), pneumatic/ hydraulic pressure and SF6 gas pressure etc. While furnishing the proof for the total break time of complete circuit breaker, the contractor may specifically bring out the effect of non-simultaneity between poles and show how it is covered in the total break time.

The values guaranteed shall be supported with the type test reports.

5.7.9.26 Refer clause 6.1.5 of 6-51-0066, following shall also be complied

- i. Any device provided for voltage grading to damp oscillations or, to prevent re-strike prior to the complete interruption of the circuit or to limit over voltage on closing, shall have a life expectancy comparable of that of the breaker as a whole.
- ii. Provisions shall be made for attaching an operational analyser to record travel, speed and making measurement of operating timings etc. after installation at site. The contractor shall supply three set of transducer for substation covered under the scope.

5.7.9.27 Refer clause 6.1.6 (b) (viii) of 6-51-0066, clause shall be read as

Densimeter contacts and pressure switch contacts shall be suitable for direct use as permissive in closing and tripping circuits. Separate contacts have to be used for each of tripping and closing circuits.

5.7.9.28 Refer clause 6.1.6 (e) of 6-51-0066, following shall also be complied

- i. As long as power is available to the motor, a continuous sequence of the closing and opening operations shall be possible. The motor shall have adequate thermal rating for this duty.
- ii. After failure of power supply to the motor one close open operation shall be possible with the energy contained in the operating mechanism.
- iii. Breaker operation shall be independent of the motor which shall be used solely for compressing the closing spring. Facility for manual charging of the closing spring shall also be provided. The motor rating shall be such that it requires preferably not more than 90 seconds for full charging of the closing spring.

5.7.9.29 Refer clause 6.1.6 (c) of 6-51-0066, following shall also be complied

- i. The hydraulic oil used shall be fully compatible for the temperature range to be encountered during operation.
- ii. The oil pressure switch controlling the oil pump and pressure in the high pressure reservoir shall have adequate no. of spare contacts, for continuous monitoring of low pressure, high pressure etc. at switchyard control room.
- iii. The mechanism shall be suitable for at-least two close open operations after failure of AC supply to the motor starting at pressure equal to the lowest pressure of auto reclose duty plus pressure drop for one close open operation.
- iv. The mechanism shall be capable of operating the circuit breaker correctly and performing the duty cycle specified under all conditions with the pressure of hydraulic operated fluid in the operating mechanism at the lowest permissible pressure before make up.
- v. Trip lockout shall be provided to prevent operations of the circuit breaker below the minimum specified hydraulic pressure. Alarm contacts for loss of Nitrogen shall also be provided.
- vi. All hydraulic joints shall have no oil leakage under the site conditions and joints shall be tested at factory against oil leakage

5.7.9.30 Refer clause 6.2.1 of 6-51-0066, following shall also be complied

- i. The signalling of the closed position of the Disconnecter shall not take place unless it is certain that the movable contacts will reach a position in which the rated normal current, peak withstand current and short-time withstand current can be carried safely.
- ii. The signalling of the open position of the Disconnecter shall not take place unless the movable contacts have reached such a position that the clearance between the contacts is at least 80 percent of the rated isolating distance.

- iii. Continuous current rating of the Safety earthing switch and high speed make proof earthing switches (not less than 100A) shall be specified by the manufacturer, which can be safely injected for Bay/ Bus equipment testing.

5.7.9.31 Refer clause 6.2.4 of 6-51-0066, following shall also be complied

All portions of the earthing switch and operating mechanism required for earthing shall be connected together utilizing flexible copper conductors having a minimum cross-sectional area of 100 sq. mm.

5.7.9.32 Refer clause 6.2.5 of 6-51-0066, following shall also be complied

Earthing switches located at the beginning of the line/ transformer feeder bay modules shall be of the high speed, make proof type and will be used to discharge the respective charging currents, trapped charge in addition to their safety earthing function. These earthing switches shall be capable of interrupting the inductive and capacitive currents and to withstand the associated TRV. These shall conform to class B and electrical endurance class E1 as per annexure – C of IEC: 62271-102

5.7.9.33 Refer clause 6.3 of 6-51-0066, following shall also be complied

- i. Surge arrestor for GIS shall be installed within the GIS enclosure. Outdoor type surge arrestor are not permitted.
- ii. The contractor shall be fully responsible for complete insulation co-ordination of substation including GIS. Contractor shall carry out detailed studies and design calculations to evolve the required parameters locations, energy capability etc. of surge arrestors such that adequate protective margin is available between peak impulse, surge and power frequency discharge voltages and BIL of the protected equipment. The locations of surge arrestors shown in single line diagram is indicative only. If at some more locations the surge arrestors are required to be provided the same should also be deemed included in the scope of work.
- iii. The contractor shall perform all necessary studies and the report shall detail the limits of all equipment parameters which could affect the insulation co-ordination. The report shall also detail the characteristics of the surge arrestor and shall demonstrate that the selected arrestor's protective and withstand levels, discharge and coordinating currents and arrestor ratings to comply with the requirement of specification.
- iv. The contractor shall also consider in the studies the open circuit breaker condition, fast transients generated by slow operation of disconnecting switches. The study report and design calculations shall be submitted for Owner's approval.
- v. 245 kV class arrester shall be capable of discharging energy equivalent to class 3 of IEC for 245 kV system on two successive operations.
- vi. The reference current of the arresters shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.
- vii. Each arrestor shall be fitted with an online continuous resistive leakage current monitoring system. The system shall be provided with an interface to integrate with the substation automation system.

5.7.9.34 Refer clause 6.4.2 of 6-51-0066, Note that LCC shall be powder coated.

5.7.9.35 Refer clause 6.6 of 6-51-0066, following shall also be complied

- i. Current transformer, characteristics shall be such as to provide satisfactory performance of burdens ranging from 25% to 100% of rated burden over a range of 5% to 120% (or specified rated extended current whichever is higher) of rated current in case of metering CTs and up to the accuracy limit factor/ knee point voltage in case of relaying CTs.

- ii. The instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CTs/reactor are used in the current transformers then all parameters specified shall have to be met treating auxiliary CTs as an integral part of the current transformer. The auxiliary CTs/reactor shall preferably built in construction of the CTs.
- iii. Provisions shall be made for primary injection testing.
- iv. Note that 1.1 kV bushing mentioned in 6.6.4 for taking CT connections to terminal box is not mandatory.

5.7.9.36 Refer clause 6.7 of 6-51-0066, following shall also be complied

- i. VT's for GIS shall be installed within the GIS enclosure. Outdoor type VTs are not permitted.
- ii. The supplier shall ensure that there is no risk of Ferro resonance in inductive type voltage transformers, due to the capacitance of the GIS.

5.7.9.37 Refer clause 6.9.4 of 6-51-0066, following shall also be complied

For SF6 gas site tests for moisture, air content, flash point and dielectric strength to be done during commissioning of GIS. Gas bottles should be tested for leakage during receipt at site. The contractor shall indicate diagnostic test methods for checking the quality of gas in the various sections during service. The method proposed shall, as a minimum check the moisture content & the percentage of purity of the gas on annual basis. The contractor shall also indicate clearly the precise procedure to be adopted by maintenance personnel for handling equipment that are exposed to the products of arcing in SF6 Gas so as to ensure that they are not affected by possible irritants of the skin and respiratory system. Recommendations shall be submitted for suitable protective clothing, method of disposal of cleaning utensils and other relevant matters. The contractor shall also indicate the details and type of filters used in various gas sections, and should also submit the operating experience with such filters.

5.7.9.38 Refer clause 6.10.2 of 6-51-0066, following shall also be complied

For "Compartments except Circuit Breaker" and for "Circuit Breaker" compartment, SF6 low level shall be used to annunciate the need for urgent gas filling. Zone trip level shall also be provided for circuit breaker compartment.

5.7.9.39 Refer clause 6.10 of 6-51-0066, following shall also be complied

The contractor should furnish temperature v/s pressure curves for each setting of density monitor along with details of the monitoring device.

It shall be possible to test all gas monitoring relays/devices without de-energizing the primary equipment & without reducing pressure in the main section. Plugs & sockets shall be used for test purposes. It shall also damp the pressure pulsation while filling the gas in service, so that flickering of the pressure switch contacts does not take place.

In case gas leakage under specified conditions is found to be greater than 0.5% after one year of commissioning, the manufacturer will give additional warranty for FIVE years.

- 5.7.10** It is required to interface the GIS switchboards, LCC and CRP with the ECS Panel for control, monitoring and annunciation purpose. For ECS Interface, typical ECS IO list is attached. All the Bus PTs shall have four stages of under-frequency & df/ dt protection and separate contact for each stage shall be provided for ECS interface. In addition to above, terminals as required for interface with upstream and downstream switchgear needs to be provided to fulfil the operational requirements.

- 5.7.11** For control of GIS switchboards through ECS, One Local/ Remote (L/R) selector switch shall be provided in each individual panel of GIS. Where Local means Operation from panel itself and Remote means ECS.

- When L/ R selector switch is in Local mode, all controls are transferred to GIS switchboard. Following operations shall be possible from the GIS
 - Closing of all incomers and bus coupler breakers in test position only.
 - Closing of all outgoing breakers in test and service position.
 - Tripping of all breakers, irrespective of position of Local/ Remote selector switch.
- 5.7.12 Manufacturer shall furnish the following information for Owner's/ EIL review
 - 5.7.12.1 Details regarding the loosely distributed metallic particles within the GIS encapsulation and calculations of critical field strength for specific particles of defined mass and geometry.
 - 5.7.12.2 Study report of VFTO generated for GIS installation.
 - 5.7.12.3 The methodology and all the equipment for electrical partial discharge (PD) detection.
 - 5.7.12.4 The calculations and documents in support of the average intensity of electromagnetic field on the surface of the enclosure during detailed engineering.
 - 5.7.12.5 The detailed criteria/ design regarding location of pressure relief devices/rupture diaphragms
 - 5.7.12.6 Calculations to show that there is no Ferro resonance due to capacitance of GIS for the voltage transformers
 - 5.7.12.7 Design calculation for simulated parameters for Seismic level as applicable
 - 5.7.12.8 Insulation Coordination studies including studies to recommend for additional surge arrestor
 - 5.7.12.9 Calculation in support of touch & step voltages in all enclosures and earthing of complete GIS installation.
 - 5.7.12.10 Equipotential earth mat drawings along with design calculations.
 - 5.7.12.11 Measures to mitigate transient enclosure voltage by high frequency currents.
- 5.7.13 All transport packages containing critical units viz. Circuit breakers and Voltage transformers shall be provided with sufficient number of electronic impact recorders (on returnable basis) during transportation to measure the magnitude and duration of the impact in all three directions. The acceptance criteria and limits of impact in all three directions which can be withstood by the equipment during transportation and handling shall be submitted by the contractor during detailed engineering. The recording shall commence in the factory and must continue till the units reach site. The data of electronic impact recorders shall be downloaded at site and a soft copy of it shall be handed over to Engineer – in –charge.
- 5.7.14 Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. Either dry nitrogen/ air or dry SF6 gas shall be used and the pressure shall be such as to ensure that, allowing for reasonable leakage, it will always be greater than the atmospheric pressure for all variations in ambient temperature and the atmospheric pressure encountered during shipment to site and calculating the pressure to which the sections shall be filled to ensure positive pressure at all times during shipment. The type of gas, the maximum pressure to which sections will be filled prior to shipment and the minimum allowable pressure during shipment shall be advised prior to dispatch. Necessary arrangement shall be ensured by the contractor to take care of pressure drop of dry air or nitrogen during transit and storage till completion of erection.
- 5.7.15 Following equipments shall be supplied along with GIS (These equipments shall be supplied as Mandatory spare, defined in EDB-1001 & SL-0020 attached with tender/technical amendment)
 - 5.7.15.1 SF6 Gas leakage detector

The detector shall be portable, battery operated with built in battery charger, hand held type and having a minimum SF6 gas leakage sensitivity of 5gm/year. The test kit shall be compatible for EMI/EMC environment as per IEC 1000. The equipment shall have on/off switch & suitable indicating lamps/LEDs, variable pitch audible signal for leakage indication, and a head phone

jack. The equipment shall have automatic zeroing of background signals suitable for detecting SF6 gas leakage in charged substation.

5.7.15.2 Gas filling and evacuating cart

- i. This shall include all the necessary gas cylinders for temporarily storing the evacuated SF6 gas. The capacity of the temporary storage facilities shall be at least be sufficient for storing the maximum quantity of gas that could be removed from at least one phase of one complete Bay (switchgear and associated equipment) or continuous bus section (whichever is higher).
- ii. The minimum capacity of cart will be as under:
 - Vacuum Pump: 60 M³/Hour (Nominal suction pressure)
 - Compressor: 15 M³/Hour (Delivery).

5.7.15.3 SF6 gas analyser

The SF6 gas analyser should be of portable type and instruments shall have following features

- i. In-built calibration facility.
- ii. Sensitivity of the equipment shall not be affected by any atmospheric conditions like dust, humidity, heat, wind etc.
- iii. Equipment shall work on zero gas loss principle i.e. gas should be pumped back to the compartment after measurement without any exposure to the atmosphere.
- iv. Equipment shall be supplied with suitable regulator which can be used to connect SF6 cylinder if required.
- v. Following acidic/impurities products should be detected as per IEC 60480 and IEC 60376
 - SF6 purity – Range: 0-100% & Accuracy: +/- 0.5 %
 - Dew point - Range : -60 to +20 °C & Accuracy: +/- 0.5 °C
 - SO2 - Range : 0-150 ppm & Accuracy : +/- 2 %
 - CF4 – Range : 0-60% volume & Accuracy : +/- 1 %
 - HF - Range : 0-200 ppm & Accuracy : +/- 5 %
- vi. Instrument should work on AC source as well as on rechargeable battery
- vii. Input pressure: upto 10 bar
- viii. It should be housed in a robust IP67 case with wheels

5.7.15.4 Online Partial Discharge(PD) monitoring system for both indoor & outdoor GIS

- i. The equipment shall be used for detecting different types of defects in Gas Insulated Stations (GIS) such as Particles, Loose shields and Partial Discharges as well as for detection of Partial discharges in other types of equipment such as Cable Joints, CTs and PTs.
- ii. It shall be capable for measuring PD in charged GIS environment as EHV which shall have bandwidth in order of 100 MHz–2GHz with possibility to select a wide range of intermediate bandwidths for best measurement results. The principle of operation shall be based on UHF principle of detection. The instrument should also be able to detect partial discharges in cable joints and terminations.
- iii. Detection and measurement of PD and bouncing particles shall be displayed on provided HMI for the system and the measurement shall be stored in the PC for further analysis to locate actual source of PD such as free conducting particles, floating components, voids in spacers, particle on spacer surfaces etc. Software for display and diagnosis of PD signals and an expert software system for accurate interpretation of cause of PD shall also be supplied and installed on the provided HMI by the contractor.
- iv. The equipment shall meet the following requirements

- Measurement shall be possible in noisy environment.
 - Stable reading shall be possible in presence of vibrations within complex GIS assemblies, which can produce signals similar to PD.
 - Equipment should have necessary synchronizing circuits to obtain PD correlation with power cycle and power frequency.
 - The equipment shall be battery operated with built-in-battery charger. It shall also be suitable for 230V AC/ 50 Hz input.
 - Measurement shall be possible in the charged substation/ switchyard in the presence of EMI/EMC. Supplier should have supplied similar detector for GIS application to other utilities. Performance certificate and the list of users shall be furnished for evaluation during detail engineering.
 - Instrument shall be supplied with standard accessories i.e., re-locatable sensors with mounting arrangements, connecting cables (duly screened) to sensors, Laptop PC, diagnostic and expert interpretation software, carrying case, rechargeable battery pack with charger suitable for 230V AC, 50Hz supply connecting cables (duly screened) to view in storage.
- v. The function of software shall be covering the following:
- Data recording, storage and retrieval in computer
 - Data base analysis
 - Template analysis for easy location of fault inside the GIS
 - Evaluation of PD measurement i.e. Amplitude, Phase Synchronization etc.
 - Evaluation of bouncing/loose particles with flight time and estimation on size of particle.
 - Expert software system for accurate interpretation of cause of PD.
 - Report generation.
- vi. To prove the suitability in charged switchyard condition, practical demonstration shall be conducted before acceptance.
- vii. Necessary training may be accorded to personnel to make use of the kit for locating PD sources inside the GIS
- viii. Calibration: The UHF Couplers have to be first calibrated as per CIGRE procedure TF 15/330305 as part of factory acceptance tests to guarantee detection sensitivity of 5pC or better. The GIS of same design shall be used as test specimen during the coupler calibration. The pulse injection level determined through above factory calibration tests shall only be used as reference for site sensitivity checks during commissioning of PDM system. The data sheet/ frequency response characteristics shall be submitted for reference.
- ix. Pulse generator for UHF sensor sensitivity test shall also be supplied as a standard accessory.

5.7.15.5 SF6 topping system.

SF6 topping system shall be provided for 220 kV GIS for filling/ topping up SF6 gas to panel under energized condition manually.

- 5.7.16 DC Control supply change over scheme for the EHV GIS shall be as per hardware datasheet B269-999-16-50-0119 attached with the tender document.
- 5.7.17 Contractor shall finalise the make of 66kV GIS switchboard meeting the criteria indicated in attached Experience Record Proforma (ERP), B269-999-16-50-ERP-0020. Completely filled in ERP sheet along with all supporting documents shall be furnished along with bid.
- 5.7.18 At all 220kV & 66kV feeders (incomer & outgoing) including spares, local breaker back up protection (LBB) shall be considered. Control logic shall be prepared accordingly.

5.7.19 Regarding the busbar differential protection envisaged in 220kV GIS & 66kV GIS, contractor shall note the following:

- Redundant & completely independent scheme shall be provided for main & check zone low impedance distributed differential protection with complete redundancy at both central as well as feeder CT input level for each of the main & check zone protection scheme. Redundancy of bus differential scheme to be ensured with two independent sets central unit each having independent main & check zone protection along with dedicated independent CT input modules for each feeder.
- Bus differential scheme shall have dedicated power supply from same bus section.

5.8 HV ISOLATING BREAKER PANELS

5.8.1 6.6 kV, 800 Amps, 40 kA (1 Sec) AIS Isolating Breaker Panel (1 no.) shall be as per EIL standard specification 6-51-0001. The switchboard shall be complete with metering, protection & control facility as per data sheet attached with tender. Tag number of various equipment shall be as follows.

Tag Number	Item	Hardware Datasheet
HV-100211	6.6 kV, 800 Amps, 40 kA (1 Sec) Isolating Breaker Panel	B269-999-16-50-0074

5.8.2 The switchgear shall be qualified as classification IAC for rated fault current for 0.2 sec. for 6.6kV, according to IEC 62271-200 with regard to its mechanical strength in the event of an internal arc. The test performance shall be in conformity with accessibility type AFLR. The test shall be executed for all separate compartments within the functional unit containing HV equipment, i.e., bus-bar compartment, circuit breaker compartment and cable compartment.

5.8.2.1 In case contractor has considered pressure relief flap/gas duct above switchboard for release of gases due to internal arc, suitable absorbers in the switchboard shall be provided to prevent the release of harmful gases in the switchgear hall. Alternatively duct including all accessories/supporting arrangement/sealing material/bends/ installation material etc. shall be provided for taking the gas outside of substation to a safe location. Substation equipment layout shall be furnished during detailed engineering stage by contractor indicating duct location. This requirement is applicable for 6.6kV switchboard & all isolating breaker panels (6.6kV).

5.8.3 Vendor to note that all HV switchboards shall have Loss of service continuity category as LSC2B with partition class PM as per IEC-62271-200.

5.8.4 Separate earthing carriage/ truck shall be supplied for the IBPs. One set of earthing truck for incoming and outgoing cable side earthing shall be provided for IBPs. Two numbers of Lifting trucks and accessories (if applicable) shall be provided for IBPs for withdrawal of cassette mounted circuit breakers.

5.8.5 The validity requirements for the type test reports for HV switchboards , breakers etc. shall be as below :-

S. No	Type Test	Equipment	Validity
1	Short Circuit Withstand Capacity	Panel	Up to 5 years from the final bid opening date or design change which is earlier
2	Temperature Rise	Panel and breaker	Up to 5 years from the final bid opening date or design change which is earlier
3	Impulse and power frequency withstand	Panel	Till any design change
4	Internal Arc Fault	Panel	Till any design change

S. No	Type Test	Equipment	Validity
5	Degree of protection for panels	Panel	Till any design change
6	Breaker short circuit duty cycle test	Breaker	Till any design change

- 5.8.6 In case the valid type tests on the offered design of Equipment is not available, all type tests shall be conducted by the successful vendor on the offered design after order finalization without any extra cost and delivery impact
- 5.8.7 Surge arrestor shall be provided at both incoming and outgoing of Isolating Breaker Panels. Sizing calculation of surge arrestors shall be furnished during drawing review stage.
- 5.8.8 IBPs shall be with single tier circuit breaker arrangement and shall be provided with online temperature monitoring system.
- 5.8.9 IBPs outgoing and incoming cabling compartment shall be provided with unique castle key rear door interlock such that breaker gets tripped/ does not gets closed, if rear door (through rear door limit switch) of that IBP is opened. In addition to that IBP rear door shall be interlocked with upstream switchboard breaker off contact, so that it shall not be possible to open the rear door, until upstream switchboard breaker is off. Rear door can be opened only when the breaker is switched off and racked out
- 5.8.10 Electrical interlock shall be provided for rear door of IBPs. Further, a mechanical interlock such as a trapped key interlock mechanism that does not permit opening of back cover until cable side earthing of outgoing breakers has been done.
- 5.8.11 Pressure relief ducts above switchboard for release of gases due to internal arc duct shall be considered as per manufacturer's recommendation and type tested design. In case pressure relief ducts are terminated inside switchgear hall, these shall be directed away/ upwards from person standing in the vicinity and shall be provided with absorber at both ends.
- 5.8.12 In each VCB panel, vendor shall ensure that two separate shutters have been provided, one for bus-side and one for cable side.
- 5.8.13 Vendor to note that an indication that defines 'ON', 'OFF', and 'in service position' shall be provided at the back side of all Isolating Breaker panel. Further, additionally, R-, Y-, B- Phase healthy indication shall also be provided.
- 5.8.14 Incoming and outgoing power cables to and from isolating breaker panels shall be as follows:
- **For 6.6kV IBP** : 1 Run 3C x 300 Sq.mm. 6.6 kV (UE), XLPE Insulated, Armoured, and FRLS Aluminium Cables separately for incoming from upstream feeder and to downstream 6.6/0.433kV distribution transformer.
- 5.8.15 The 6.6kV IBP will receive power from upstream 6.6 kV switchboard. Receiving end 87F relay for both the IBPs shall be also free issued to CONTRACTOR as part of this tender. Testing and commissioning of the receiving end relays is also included in CONTRACTOR scope. Optical fiber cable along with HDPE duct (Green conduit with white strip) shall be provided by others, however end termination of OFC including all accessories for receiving end shall be in the scope of this tender.

5.9 HV SWITCHBOARD

- 5.9.1 All requirements shall be considered while sizing the switchboards and feeders, as required, including feeder for free-issues material based on final approved single line diagram, shall be provided with no cost and time implication to owner. 20% spare capacity shall be considered for sizing of Switchboard.
- 5.9.2 HV Switchboard shall be provided with two incomers and two bus coupler. Second bus coupler shall be without any kind of numerical relay and shall be provided with Electro-mechanical type Trip circuit supervision relay. Status of second bus coupler shall be used in interlock of Auto

changeover logic, which shall be implemented in the first bus coupler with numerical relay. There shall not be any feeder in between two bus couplers.

- 5.9.3 All HV Switchgear shall be provided with online wireless temperature monitoring facility. The passive sensor should be wireless, battery less, dielectrically safe, robust to high voltage, high electromagnetic field, and harsh environment. It should take direct measurement on critical point. This facility shall be interfaced with ECS.
- 5.9.4 All feeders of HV Switchboard shall be provided with thermography window at rear side.
- 5.9.5 Transformer + Feeder differential relay (87T+F) of same make/ model as installed in the Upstream 66kV Switchboard at SS-100 shall be free-issued to CONTRACTOR for installation and wiring in 6.6kV Switchboard incomer panels. Testing and commissioning of loose supply relay is included in scope of CONTRACTOR.
- 5.9.6 CONTRACTOR shall supply (loose supply) Feeder differential relay (87F) of same make/ model as installed in the 2 Nos. 6.6kV Outgoing plant feeder for Owner's use for installation and wiring in downstream 6.6kV Switchboard incomer panels. Installation, Testing and commissioning of loose supply relays shall be done by others.
- 5.9.7 Auto changeover between incomers and bus coupler for 6.6 kV system shall be provided. Additionally manual change over through synchro-check relay with momentary paralleling shall also be provided. All necessary hardware shall be included to achieve auto, independent and manual operation of incomers and bus coupler.
- 5.9.8 Only major relays, meters and controls are indicated in the hardware data sheets. Any auxiliary relays, timers, switches, etc, as required while developing the control schematic and felt necessary for safe operation, even if these are not specifically included, shall be supplied by the CONTRACTOR. All logic shall be implemented in the relay itself and not externally. Provision of adequate I/O count in the relays shall be ensured.
- 5.9.9 All relays, metering and control components shall be mounted on the panel front only. Dummy panel and rear extension, as required, for bus trunking / cable terminations shall be provided.
- 5.9.10 Microprocessor based Fast bus transfer system shall be provided between Incomer-1, bus coupler-1 and incomer-2.
- 5.9.11 Auto/Manual Changeover with fast bus transfer scheme for switchboard with two incomers and one bus-coupler breakers shall comply with the logic described briefly as follows. Safety interlocks as deemed necessary shall however be considered during detailed engineering.

Auto/Manual Fast Bus Transfer

The auto/ manual fast bus transfer scheme is described in brief as follows:

Facility to be provided

- a) Auto fast bus changeover between the two incomers and one bus-coupler shall be in such a way that two incomer breakers are 'ON' at a time and bus-coupler breaker is normally open.
- b) Bus-coupler breaker is made 'ON' automatically in case the incoming supply at incomer breaker no. 1 or 2 fails in following modes:
 - i. Fast Transfer
 - ii. Delayed In phase transfer
 - iii. Residual voltage transfer (slow changeovers)
- c) Interlocks shall be continuously checked not limited to the following
 - i. Transfer system healthiness
 - ii. Breaker in service
 - iii. Breaker status & breaker contact integrity
 - iv. Master trip relay lockout condition (86)

- v. Breaker coil healthiness and breaker configuration
 - vi. PT in service and PT MCB condition
 - vii. Other source voltage healthiness
- d) Blocking of auto transfer (i.e., closing of bus-coupler) if any incomer breaker trips due to a fault.
- e) Tripping of incomer on under voltage shall be blocked, if both the incomers simultaneously experience an under voltage.
- f) The auto-change over shall be blocked during load shedding.

Normal operating condition

Incomer no. 1 and 2 breakers are 'ON'. Bus-coupler breaker is 'OFF'.

Fast Transfer

The bus voltage and incoming source voltage shall be monitored on a continuous basis for magnitude and phase angle and it shall be ensured that the same are within the specified limit values at the moment of initiation to ensure that transfer operation is carried out under conditions conducive to fast bus transfer as per high speed sync-check supervision. The open and close commands to the circuit breaker from the high speed transfer device shall be issued synchronously.

In-Phase Transfer

If the synchronized conditions are not present the fast transfer shall be blocked. The supply breaker feeding to the bus opened and the bus-coupler is closed in the first minimum of the difference of healthy and bus bar voltage. The transfer system is able to determine the course of the difference voltage and the point in time of the 1st phase coincidence (first slip cycle synchronization). In order to compensate for the installation specific processing time like system response time, circuit breaker opening time etc. the close command is issued accordingly before the actual first minimum difference voltage occurs.

Residual voltage transfer

When the criteria for a fast transfer operation are not met and in phase transfer is not feasible, the closing of breaker in fast transfer and in phase transfer is not possible, the residual voltage transfer shall be utilized. The closing of the bus coupler shall take place when the voltage of the bus bar has subsided to a preset, permissible safe value (20-30% of rated voltage).

Manual transfer

- a) It is possible to trip incomer no. 1 or 2 after closing the bus-coupler to facilitate maintenance as required.
- b) When supply is again available at incomer breaker after auto changeover has already taken place, it is possible to restore the system to normal operating condition by operating selector switch (meant for tripping incomer no. 1 or 2 or bus-coupler) and by setting auto/ manual switch in 'Manual' mode.
- c) In manual transfer the closing circuit shall be checked through contacts of check synchronizing function during momentary paralleling.
- d) In manual transfer after momentary paralleling if desired breaker does not trip after preset time delay, breaker last closed shall trip.

Independent mode

In addition to the transfer modes, all the incomer and bus-coupler breaker shall be desired to operate independently (ON-OFF operation) on independent mode for dead bus charging & other

maintenance requirement of switchboard. Paralleling of sources shall not be permitted in this mode.

Auto-Manual-independent (A-I-M) selector switch shall be provided in the switchboard for selection of different modes for operation.

Number of binary and analog inputs / outputs shall be adequate for the required system configuration.

FBT (Fast bus transfer) RELAY shall be physically located in Bus coupler panel or in any panel placed in the panel line-up only. All signal interchange between FBT relay & other panels shall be through inter-panel wiring only.

- 5.9.12 CT and PT burden mentioned in data sheets are indicative. CONTRACTOR shall provide the same as required including the burden for transducers provided at transducer panel. CONTRACTOR may consider 1.5 VA per phase per transducer for CT burden and 1.5 VA per phase per transducer for PT burden for analogue input for ECS interface.
- 5.9.13 DC and AC control supply scheme for HV switchboards shall be in line with hardware data sheet attached for HV switchboards.
- 5.9.14 All HV motor feeders schematics shall have provision for auto start and auto re-acceleration with feature to inhibit irrespective of process/licensor's requirement.
- 5.9.15 All HV switchboards shall have provision for positive LOTO implementation. Photographs of LOTO provision in each type of panels shall be submitted during drawing review for approval.
- 5.9.16 All requirements as specified above including ECS interface, shall be applicable for switchboard. Line PT and protection & metering requirements shall be as per Design data sheets and 6.6 kV hardware data sheets as applicable.
- 5.9.17 For interfacing with DCS system, separate Standalone Marshalling panel shall be provided in Substation. Hardwired signals (with minimum requirement specified below) from various feeders of a bus section required for DCS interface shall be wired and terminated in the standalone marshalling panel.
 - i) Breaker/Contactor 'ON' indication
 - ii) Breaker/Contactor 'OFF' indication
 - iii) Local/Remote selection indication
 - iv) Process Trip indication
 - v) Process Start command
 - vi) Process Stop command
 - vii) Process Start permissive command
 - viii) Ammeter (0-1A/4-20mA)
 - ix) Ready to Start signal from feeder
- 5.9.18 Terminals for DCS input & DCS output shall be segregated & separate terminal block shall be provided. While wiring these signals from respective feeder module to marshalling, it shall be ensured that separate cables are used for status & commands & same shall be segregated.
- 5.9.19 Current rating for interface contacts shall be 2A, 110V DC.
- 5.9.20 All the signals available in Numerical relays shall be made available in Laptop & HMI through serial communication.
- 5.9.21 All signals as per ECS data sheet shall be provided for interface with the Electrical control system.

- 5.9.22 Number of analogue / digital IOs shall be worked out by the CONTRACTOR as per the ECS I/Os list attached with the bid package
- 5.9.23 All trip contact should be preferably “NO” contact. Separate NO contact of each such trip should be routed to relay also for event logging or redundant tripping.
- 5.9.24 All the CT connection should be through ring type reliable connection/terminations only.
- 5.9.25 There shall be one common control supply switch for all control supply of feeder. Separate fuses for following branch circuit shall be provided:
- Spring charging circuit
 - Closing circuit
 - Tripping circuit and contactor multiplier circuit & digital input circuit
 - Indication circuit
 - Numerical relay supply (incoming of numerical relay supply fuse shall be tapped before the “control supply switch”.
- 5.9.26 Separate control supply switch shall be provided for differential protection relays.
- 5.9.27 Control supply of each BUS PT of HV switchboard shall have independent control supply switch and sets of fuses tapped from Main DC bus.
- 5.9.28 Installation of surge arrestors to be done after the CTs towards cable termination side.
- 5.9.29 Hard contacts of the breaker shall be used for providing interlocks in the schemes mainly for auto change over, tripping, feedback, closing and process interlocks. In the absence of sufficient hard contacts, latched contactors/ relays to be used for contact multiplication.
- 5.9.30 Critical contacts used for providing process interlocks should be direct hard contacts and these shall not be taken from the multiplying contactors / auxiliary relays, if feasible.
- 5.9.31 Wherever two NO contacts available in Emergency push button & LCS STOP PB of all breaker fed HV Motors, one NO contact shall be wired to trip breaker directly & other shall be wired to binary input of numerical motor protection relay.
- 5.9.32 All rear panel doors of HV panels shall have handle for ease of maintenance.
- 5.9.33 The validity requirements for the type test reports for HV switchboards , breakers etc. shall be as below :-

S. No	Type Test	Equipment	Validity
7	Short Circuit Withstand Capacity	Panel	Up to 5 years from the final bid opening date or design change which is earlier
8	Temperature Rise	Panel and breaker	Up to 5 years from the final bid opening date or design change which is earlier
9	Impulse and power frequency withstand	Panel	Till any design change
10	Internal Arc Fault	Panel	Till any design change
11	Degree of protection for panels	Panel	Till any design change
12	Breaker short circuit duty cycle test	Breaker	Till any design change

In case the valid type tests on the offered design of Equipment is not available, all type tests shall be conducted by the successful vendor on the offered design after order finalization without any extra cost and delivery impact.

- 5.9.34 Contractor shall furnish details of type test certificate in attached format for Type test certificates Doc no. B269-999-16-50-DS-1030 during detailed engineering for review.

5.10 NEUTRAL GROUNDING RESISTOR

- 5.10.1 Neutral grounding resistor shall be supplied as per the EIL specification, 6-51-0043 & attached data sheet.

5.11 EHV CABLE (66KV)

- 5.11.1 66kV cable shall be supplied as per the EIL specification, 6-51-0067 & attached data sheet. Bonding scheme & associated hardware, jointing kit, termination kit, earthing cable etc. as required shall be decided & supplied by contractor.
- 5.11.2 Termination of owner's supplied & laid 66kV cable at outgoing terminal of 66kV GIS switchboard at MRSS-100 is included in contractor's scope. Accordingly, termination kit shall be supplied & commissioned by contractor.
- 5.11.3 Supply, laying & termination of 66kV cable on primary side of 66/6.9kV transformer to be supplied by contractor is included in contractor's scope.

5.12 HV CAPACITOR BANK

- 5.12.1 HV Capacitor shall be as per the enclosed HV capacitor datasheet and EIL standard specification 6-51-0020 attached with the tender.
- 5.12.2 Capacitor banks along with APFCR shall be indoor panel mounted type, installed in switchgear hall. Dry type series reactor, RVT installed inside panel shall be provided with the capacitor banks.
- 5.12.3 Capacitor bank and associated equipment shall be sized to maintain min. 0.95 power factor at the primary of 66/6.9kV transformers.

5.13 MV SWITCHBOARD

- 5.13.1 Refer enclosed hardware data sheets for the details of relay and metering facilities to be provided for each feeder. Only major relays, meters and controls are indicated in the data sheets. Any auxiliary relays, timers, switches, etc., as required while developing the control schematic and felt necessary for safe operation, even if these are not specifically included, shall be supplied by the contractor. All relays, metering and control components shall be mounted on the panel front only. All logic shall be implemented in the relay itself and not externally. Adequate I/O count shall be ensured.
- 5.13.2 The Contractor shall be solely responsible to coordinate the relay characteristics with relay supplier for the proper selection of all CTs with special care to select class PS CTs. The VA burden, knee-point voltage, CT resistance and magnetizing current shall be calculated by the contractor for Owner/ Consultant's review before proceeding with manufacturing.
- 5.13.3 Dummy panels and rear extensions, as required, for cable terminations, mounting of relays, meters, control components etc. shall be supplied as required and dummy/adopter panel for beam shall be considered for as per site requirements. Rear cable chamber provided for the switchboard shall be of height similar to other vertical panels.
- 5.13.4 All MV switchboards in contractor scope shall be of the same make.
- 5.13.5 Limiting maximum rating of PMCC/EPMCC shall be 4000A and fault level limited to 65kA for 1 sec.
- 5.13.6 The rating of MCC & ASB shall be limited to maximum 1250A.
- 5.13.7 All Incomers, Bus couplers and ACB power/motor feeders in MV Switchgear (PCC/PMCC/EPMCC) shall be provided with online wireless temperature monitoring facility. The passive sensor should be wireless, battery less, dielectrically safe, robust to high voltage, high electromagnetic field, and harsh environment. It should take direct measurement on critical point. This facility shall be interfaced with ECS.

- 5.13.8 For PCC/PMCC/EPMCC internal arc protection system shall be provided to sense internal arc and to isolate the fault.
- 5.13.9 For MV Switchboards rated up to 4000A, forced cooling for any of the components e.g. bus bars, air circuit breakers etc. is not acceptable. To achieve the continuous current rating under site conditions at design ambient temperature inside the panel / cubicle, the required de-rating as / if applicable shall be considered by switchboard vendor.
- 5.13.10 MV switchboards shall be provided with facility to conduct test & disconnected operations with door closed position only.
- 5.13.11 All switchboards shall be provided with two incomer and one bus coupler. However, PMCC shall have third incomer for integrating solar photovoltaic system. No. of outgoing feeders shall be decided based on system requirement, spare feeders and feeders for Owner's use as defined elsewhere. However, feeders, as required, based on final approved single line diagram, shall be provided with no cost and time implication to owner. 20% spare outgoing feeder or minimum one of each type, whichever is higher shall be provided in each switchboard.
- 5.13.12 Air circuit breaker/Isolator provided in incomers of PMCC /EPMCC /MCC /ASB /LDB /ELDB shall be of 4-pole type. Isolating links shall be provided in the neutral circuit of all the TPN outgoing feeders
- 5.13.13 All the switchgears shall have rating at least equal to the maximum demand plus a provision for 10% future load growth and 20% spare capacity (i.e. Max. Demand x 1.1 x 1.2). Incomers of switchgear shall be designed to cater to the complete load including 10% margin for future load growth and 20% spare capacity as specified above. Service breaking capacities for all breakers shall be equal to or higher than the maximum value of the short circuit at the point of installation.

5.13.14 Changeover scheme for three incomers and one bus-coupler

PMCC shall be provided with Auto/ Manual Changeover facility. Auto/Manual Changeover scheme for switchboard with two incomers and one bus-coupler breakers shall comply with the logic described briefly as follows. Third Incomer of PMCC (i.e. Incomer from Solar PV system) shall be connected to the bus having emergency supply. Safety interlocks as deemed necessary shall however be considered during detailed engineering.

5.13.14.1 Auto Changeover

- i) Auto changeover between the two incomers and one bus-coupler shall be in such a way that the two-incomer breakers are 'ON' at a time and bus-coupler breaker is normally open.
- ii) Bus-coupler breaker is made 'ON' automatically in case the incoming supply at either of the incomer breaker fails and the respective breaker trips on under voltage.
- iii) Blocking of auto transfer (i.e., closing of bus-coupler) if any incomer breaker trips due to a fault or in case of standby earth fault (51G). Trip due to 64R, 63TX shall allow the transfer.
- iv) Tripping of incomer on under voltage shall be blocked, if both the incomers simultaneously experience an under voltage.

5.13.14.2 Manual Changeover

- i) Both the Incomer breakers are 'ON'. Bus-coupler breaker is 'OFF' Manual closing of bus-coupler with momentary paralleling (interlocked with check synchronizing relay) of the incoming supplies to facilitate taking out any of the incomer breakers for maintenance.
- ii) Trip any of the incomer breakers (pre-selected) after closing of any of the Incomer or coupler to avoid continuous paralleling of incomers.

5.13.14.3 Initiation of auto changeover:

- i) When the incoming supply to any of the breakers fails, the respective incomer is tripped through under voltage relays and a timer. The time delay is in the range of 0.5 to 5 sec. Breaker trip on under voltage is blocked in case of power failure on both the incomers.
- ii) The voltage on healthy bus section has been above the set value of normal voltage for a specified duration (settable through an off delay timer of range 0.5 to 5 sec) and the incomer breaker of healthy bus is closed in service position.
- iii) Bus-coupler is open and in-service position.
- iv) Auto / Manual switch is set for 'AUTO' operation.

5.13.14.4 Closing of bus coupler breaker under auto operation:

- i) One of the incomer breakers has tripped on under voltage.
- ii) The residual voltage on the bus that has lost supply is less than 40% of normal voltage.
- iii) Incoming voltage of healthy incomer has been above 80% of normal voltage for a specific duration (Through timer 0.5 sec to 5.0 sec)
- iv) Auto/ Manual switch is set for 'AUTO' operation.

5.13.14.5 Manual transfer after auto changeover:

- i) When supply is again available at incomer breaker after auto changeover has already taken place, it is possible to restore the system to normal operating condition by operating selector switch (meant for tripping incomer no. 1 or 2 or bus-coupler) and by setting auto/ manual switch in 'Manual' mode.
- ii) In manual transfer the closing circuit shall be interlocked through check synchronizing relay.

5.13.15 For interfacing with OWNER system, separate Standalone Marshalling panel shall be provided in Substation. Hardwired signals (with minimum requirement specified below) from various feeders required for ECS / DCS interface shall be wired and terminated in the standalone marshalling panel.

- i) Breaker/Contactor 'ON' indication
- ii) Breaker/Contactor 'OFF' indication
- iii) Local/Remote selection indication
- iv) Process Trip indication
- v) Process Start command
- vi) Process Stop command
- vii) Process Start permissive command
- viii) Ammeter (0-1A/4-20mA)
- ix) Ready to Start signal from feeder

5.13.16 Number of analogue / digital IOs shall be worked out by the Contractor as per the ECS I/Os list attached with the tender.

5.13.17 Terminals for DCS& ECS, input & output shall be segregated & separate terminal block shall be provided. While wiring these signals from respective feeder module to marshalling, it shall be ensured that separate cables are used for status & commands & same shall be segregated

5.13.18 Current rating for interface contacts shall be 2A, 110V DC or 240V AC.

5.13.19 Indicating lamps shall employ LEDs. LEDs provided for indication shall be cluster type with adequate brightness and minimum 2Nos LEDs chips per light. LEDs shall be connected in parallel and each LED chip having diameter not less than 3mm.

- 5.13.20 All feeders shall have physical lock out provision to facilitate the “lock out tag out” (LOTO) procedure for ensuring safe operation
- 5.13.21 Two numbers ACB breaker handling trolleys shall be provided for the substation.
- 5.13.22 Earth fault relay operated through CBCT provided in PMCC & LDB feeders shall be mounted on draw-out part of the switchboard and shall be suitable for operation at 110V DC or 240V AC supply as available in the respective switchboard.
- 5.13.23 Timer provided in LDB shall be astronomical type smart timer i.e. to take care of weather condition & shall be programmable for full year.
- 5.13.24 For motor feeder rated up to 55kW, following shall be provided :
- R-C circuit shall be provided across the power contactor for all DOL motor starter feeders in PMCC.
 - Low burden auxiliary contactors shall be provided in all DOL motor starter feeders for receiving start/ stop commands from field.
- 5.13.25 All trip contact should be preferably “NO” contact. Separate NO contact of each such trip should be routed to relay also for event logging or redundant tripping.
- 5.13.26 All the CT connection should be through ring type reliable connection/terminations only.
- 5.13.27 There shall be one common control supply switch for all control supply of feeder. Separate fuses for following branch circuit shall be provided:
- Spring charging circuit
 - Closing circuit
 - Tripping circuit, contactor multiplier circuit& digital input circuit
 - Indication circuit
 - Numerical relay supply (incoming of numerical relay supply fuse shall be tapped before the “control supply switch).
- 5.13.28 Separate control supply switch shall be provided for differential protection relays.
- 5.13.29 Control supply of each BUS PT of PCC/EPCC/PMCC/EPMCC shall have independent control supply switch and sets of fuses tapped from Main DC bus.
- 5.13.30 Hard contacts of the breaker shall be used for providing interlocks in the schemes mainly for auto change over, tripping, feedback, closing and process interlocks. In the absence of sufficient hard contacts, latched contactors/ relays to be used for contact multiplication.
- 5.13.31 Critical contacts used for providing process interlocks should be direct hard contacts and these shall not be taken from the multiplying contactors / auxiliary relays, if feasible.
- 5.13.32 Wherever two NO contacts available in Emergency push button & LCS STOP PB of all breaker fed MV Motors, one NO contact shall be wired to trip breaker directly & other shall be wired to binary input of numeric motor protection relay.
- 5.13.33 All rear panel doors of MV panels shall have handle for ease of maintenance
- 5.13.34 Rear cable chamber provided for the switchboard shall be of height similar to other vertical panels and shall have handle for ease of maintenance.
- 5.13.35 All the offered switchboards and breakers shall be type tested. Copies of valid type test certificates for the following tests conducted on identical design of offered equipments required as per data sheets attached with tender specifications shall be furnished post order. The validity requirements for the type test reports for MV switchboards , breakers etc. shall be as below :-

S. No	Type Test	Equipment	Validity
1	Short Circuit Withstand Capacity	Panel and breaker	Up to 5 years from the final bid opening date or design change which is earlier
2	Temperature Rise	Panel and breaker	Up to 5 years from the final bid opening date or design change which is earlier
3	Internal Arc Fault	Panel	Till any design change
4	Degree of protection for panels	Panel	Till any design change
5	Breaker short circuit duty cycle test	Breaker	Till any design change

5.13.36 CONTRACTOR to conduct heat run test on each rating of MV switchboard at vendor's works as part of scope of this tender and no extra payment for the same shall be provided.

5.13.37 For owner supplied items, feeders at 415 V shall be provided by the CONTRACTOR in the PMCC switchboard supplied by them. Number of feeders required for Owner's use are listed below.

S. No.	Description	PMCC	EPMCC	LDB	ELDB	Total Load*
1.	FVNR 30	4	2			PMCC- 60KVA EPMCC – 30KVA
2.	FVNR 100	3	2			PMCC- 125KVA EPMCC – 90KVA
3.	O/G Breaker Feeder with Numerical Relay – 800 Amps	3	6			PMCC-800KVA EPMCC-1200kVA
4.	SFU – 63 Amps with CBCT and ELR, Contactor	4	2			PMCC- 200KVA EPMCC- 100KVA
5.	SFU – 160 Amps with CBCT and ELR, Contactor	3	2			PMCC- 100kVA EPMCC- 100KVA
6.	SFU – 1 x 160 Amps + 4 x 63 Amps with CBCT and ELR, Contactor & timer			2 + 2 (Indoor+ Outdoor)	2 + 2 (Indoor+ Outdoor)	LDB- 25KVA ELDB- 10KVA

* Total Load of 1310 KVA of owner's load shall be considered in Normal distribution transformer sizing. Total load of 1530KVA of Owner's load shall be considered by Contractor for emergency distribution transformer sizing.

5.14 RELAY AND CONTROL PANEL

5.14.1 Relay and control panel shall be as per EIL specification for Relay and control panels/desks, single line diagram and data sheets.

- 5.14.2 Panel shall be free standing, floor mounting, simplex panel with swing frame and protective full glass door in front.
- 5.14.3 Relay and Control panel shall be fed from separate dedicated 415V AC supply feeders, from Auxiliary switch board.
- 5.14.4 Closing and tripping coil of each breaker shall have a dedicated DC feeder.
- 5.14.5 The measuring instruments for Import/ Export purpose shall be taut-band type.
- 5.14.6 The captions to be engraved for various feeders / annunciators shall be finalised during detail engineering. Same shall meet the technical specification of C&R Panels as per HVPNL.
- 5.14.7 Semaphore indicator shall be used for isolator and earth switch, while for breakers, Discrepancy switches shall be used.
- 5.14.8 Testing facility for meters and relays shall be provided. For this purpose, necessary test blocks and test plugs shall be provided.
- 5.14.9 A digital clock suitable for DC supply shall be provided in a suitable position on the complete relay panel assembly.
- 5.14.10 Requirement of ICTs, stabilizing resistance and metrosil shall be decided by the contractor. Calculations to be furnished. For transformer feeders, stabilizing resistor shall be provided in residual earth fault connections to avoid spurious tripping during charging of transformer.
- 5.14.11 Synchronizing panel shall be provided as part of Relay and control panel. Synchronizing facility shall be provided to carry out the synchronizing for the 220 kV & 66kV GIS Incomers, Bus couplers, Bus-sectionalizer and tie breakers. Synchronization shall be from ECS as well as from this panel. Following operations shall be possible from Synchronization panel:
 - 5.14.11.1 Closing of all incomer breakers, bus couplers, bus Sectionalizer breakers, tie breakers (in service position) on dead bus condition (bus coupler/ bus sectionalising breakers dead bus closing to be checked on either side of the breaker).
 - 5.14.11.2 Synchronizing and closing of selected incomer breakers (in service position) and bus couplers/ bus sectionalising breakers/tie breaker (in service position) through check synchronizing.
 - 5.14.11.3 Required interlocks for safe operation shall be provided.
- 5.14.12 All signals as per ECS data sheet shall be provided for interface with the Electrical control system.
- 5.14.13 Number of analogue / digital IOs shall be worked out by the Contractor as per the ECS I/Os list attached with the bid package
- 5.14.14 Power quality meter, disturbance recorder & event logger, Main and back up distance relay, fibre optic transmission system for voice and data communication, cyber security requirements, etc. shall be complied as per requirement of CEA guidelines for grid connectivity and CEA guidelines for communication system. Specific requirement of HVPNL for power quality meters and other equipment listed above shall also be complied by the CONTRACTOR.
- 5.14.15 CONTRACTOR to note that relays, meters and other instruments used in HVPNL feeders shall be as per HVPNL specifications & requirements.
- 5.15 NUMERICAL RELAYS AND SUBSTATION AUTOMATION SYSTEM**
 - 5.15.1 Numerical relays shall be used in 220 kV GIS, 66k kV GIS, 6.6 kV and 415 V switchgear.
 - 5.15.2 All numerical relays shall be digital (microprocessor based) & communicable type as per EIL Standard Specification 6-51-0055 and datasheet for Numerical relay attached with tender.
 - 5.15.3 All relays to the extent possible shall be sourced from same make. All the numerical relays of each switchboard shall be suitable for communication on IEC-61850 protocol and shall be connected serially/LAN topology to Ethernet Switches.

- 5.15.4 All protective relays and meters shall be provided with test terminal blocks for secondary injection testing.
- 5.15.5 All numerical relays shall comply with the prevalent emission and immunity levels.
- 5.15.6 All relays, metering and control components shall be mounted on the panel front only. All panels, relays and components shall be suitable for use in corrosive, humid, sulphurous environment. All relays shall be suitable for flush mounting, and fitted with dust-tight covers. The relay shall have a provision for testing using an external power supply without disconnecting the permanent wiring.
- 5.15.7 Hardwired lockout relay (86), Hand reset (VAJH) type shall be provided. PQ8 relay is not acceptable.
- 5.15.8 Differential relays (87), restricted E/F (64R) relay as asked for in the data sheet shall be separate relay and shall not be combined with the main protection relay.
- 5.15.9 The requirement of numerical relays and integration shall be in compliance with the requirement given in attached data sheet, and specification. Even though data sheets define the requirement in terms of discrete relays (electromechanical type) but numerical relay comprising all required functions shall be provided. Under voltage and Overvoltage relay along with associated timers shall be part of the numerical relay.
- 5.15.10 Numerical relays provided for motor feeders shall use in-built under voltage relay and timer for delayed tripping on bus under voltage.
- 5.15.11 Minimum 4 nos. inputs (DI) and 4 nos. outputs (DO) as spare shall be provided in each numerical relay.
- 5.15.12 Provision of manual bypass of 87B shall be provided in Numerical relays
- 5.15.13 Relay logic shall be ensured to not provide trip in case of DC failure & restoration
- 5.15.14 Scheme of switchboard shall be engineered to achieve the control logic, as required, through relay logic.
- 5.15.15 All relays shall be integrated to ECS for monitoring and control. Provision shall be provided for monitoring & control at HMI also. The relays shall be integrated based on basic system architecture attached with the tender.
- 5.15.16 Conformal coating shall be done for all electronic equipments as per grade 3C3 (Harsh environment) of IEC 60721-3-3. Alternatively, it shall comply with ANSI/ ISA S71.04 class G3 or IEC 60068-2-60 for mixed flow gas test or ASTM B845. Certification for batch of supplied items shall be submitted by vendor for the same.
- 5.15.17 All relays shall have communication port for direct access of data through laptop. One laptop common for all relays shall be provided for the following purposes:
 - 5.15.17.1 Retrieving data from numerical relays.
 - 5.15.17.2 Uploading settings & I/O configuration.
 - 5.15.17.3 Retrieving & viewing disturbance recorder data
- 5.15.18 The Numerical relays shall be provided with suitable hardware, software and communication ports for communication with minimum three different client sources simultaneously.
- 5.15.19 The redundancy in communication hardware shall be provided as per the data sheet attached. In ring topology, the communication shall have no disruption due to loop open circuit or failure of communication port. Also the switch off of DC supply to any or more relay should not affect the communication to rest of the relay. Moreover the ring should not be shared between the switchboards. For LAN where star couplers are used, the communication from star coupler to Ethernet switches shall be dual redundant. Relays of different switchboard should not be connected to the same star coupler. Similar to ring architecture, the failure of one star coupler

or failure of communication port or processor should not affect the communication of other star coupler to Ethernet switches.

- 5.15.20 **Refer Specification for Numerical Relays (Doc no. 6-51-0055)**, 20% spare ports shall be provided in each Ethernet switch provided in switchboard and in SAS.
- 5.15.21 All the data as available in the relay including the status of DI should be considered to be communicated to HMI. The data required for final configuration shall be finalized during engineering. Similarly whether specified or not, serial interface shall have no limitation for data transfer to ECS. However data as required for ECS interface shall be decided during engineering.
- 5.15.22 GPS antenna and hardware shall be provided for time synchronization. The resolution of time synchronization shall be ± 1 millisecond or better throughout the entire system. Suitable ports shall be provided in the GPS for hook up of Owner's switchboard numerical relays for future use.
- 5.15.23 Substation Automation System for switchgears shall be provided. It shall include Ethernet switches, laptop, HMI (Engineering cum operator workstation) and software to be installed for interfacing with Numerical relays over IEC-61850. Following substation automation system shall be in the scope of contractor.

SAS Tag Number	For Equipment	Remarks
SAS-100921	220 kV GIS	
SAS-100922	66 kV GIS	
SAS-100923	6.6 kV IBP and 415V Switchboard	Separate Ethernet Switch in each IBP and MV switchboards shall be provided
Existing	220 kV GIS Extension Bays	Extension of existing system for incorporation new bays to be done.

- 5.15.24 Redundant upper level Ethernet switch shall be provided for each SAS system in wall mounted cabinet.
- 5.15.25 Supply, laying and termination of all interconnecting cables from switch boards to Ethernet switches including cable termination kits and accessories in each substation is in CONTRACTOR's scope. FO cable for connection between switchgear and Ethernet switch shall be supplied and laid in HDPE duct (HDPE ducts shall be black conduit with blue strip for Relay LAN) which is also to be supplied and installed by CONTRACTOR.
- 5.15.26 DC System, UPS etc. shall be interfaced with SAS (Substation Automation System) on MODBUS TCP/IP.
- 5.15.27 Two Laptops are envisaged for the EHV, HV & MV switchboards in the project hence software as required for interface with Numerical relays of EHV switchboard and HV/MV switchboard shall be loaded by the switchboard Vendors in the Laptop provided. Following Laptops shall be in the scope of contractor.
- 5.15.27.1 Laptop for 220 kV GIS & 66kV GIS switchboards. Software if required for interface with GIS SF6 Analyser, PD Monitoring system, etc. shall be loaded in the Laptop provided
- 5.15.27.2 Laptop for 6.6 kV IBP and 415V Switchboards. Software required for interface with Numerical relays of 6.6 kV & 415V switchboards shall be loaded in the Laptop provided.
- 5.15.28 Laptop with Windows-10 or latest tested & compatible windows version and other required licensed software, hardware, accessories (serial data cables, VGA Cables, HDMI Cables, and USB Cables etc.) and materials shall be supplied as defined in the tender. The communication port on laptop shall match as that provided on the front of numerical relay. System configuration

shall be latest proven model and upgradable. The minimum configuration for this project shall be Intel i7 processor, 1 TB HDD, 4 GB RAM, DVD R/W Multi Drive, 15" LED screen, 4 nos. USB Ports (minimum), Ethernet Port, RS-232 Serial Ports, HDMI Port, etc. Further, laptop shall have compatible ports and compatible hardware for interfacing with transformer gas analysis, GIS SG6 analyser, PD Monitoring, etc. systems.

5.15.29 Laptop provided with SAS shall have functionalities specified under clause 6.4.1, 6.4.5 and 6.4.6 of 6-51-0055 attached with tender.

5.15.30 HMI with Windows-10 or latest tested & compatible windows version and other required licensed software, hardware, accessories (serial data cables, VGA Cables, HDMI Cables, and USB Cables etc.) and materials shall be supplied as defined in the tender. System configuration shall be latest proven model and upgradable. The minimum configuration for this project shall be Intel i7 processor, 1 TB HDD, 4 GB RAM, DVD R/W Multi Drive, 21" LED screen, 4 nos. USB Ports (minimum), Ethernet Port, RS-232 Serial Ports, HDMI Port, etc.

5.15.31 Laser printer shall be provided configured for line by line printing

5.15.32 Software for substation automation along with integrating hardware as required shall be supplied as a part of Laptop. Functionality minimum but not limited to the following shall be carried out. Customized software for substation application shall be supplied in non-returnable CD/DVD/USB Drive. Contractor to submit function design specification and screenshots of the various screen for Owner's review.

- Relay parameterization
- Control
- Disturbance record
- Data logging
- Annunciation
- Event/ status monitoring (including DI& DO of relays)
- Feeder status monitoring
- Event recording, motor starting transients, fault analysis etc.
- Analogue signal monitoring and metering
- Self-supervision
- Single Line Diagram
- View of historical data and generating trends
- Preparation of maintenance schedule

5.15.33 HMI shall be provided for disturbance recorder and power quality analyzer. The Power quality meter shall share the recorded data with the electricity regulatory commission. Power quality meters shall have facility to measure and meter the harmonics complying with provision of IEC 61000-3-4 Class A. In addition to harmonics, power quality meter shall have provision to monitor voltage sag, swell, flicker, disruptions, etc. Facility for waveform analysis shall also be provided.

5.15.34 **FACTORY ACCEPTANCE TEST**

FAT shall be conducted for project simulation. FAT procedure shall be prepared and submitted for Owner's review. The methodology shall be mutually agreed to verify the system simulation and intended specification of tender document. All graphics and navigation between different pages shall be configured to Owner's satisfaction and successful commissioning.

5.15.35 **SITE ACCEPTANCE TEST**

SAT shall be conduct to verify the actual simulation and shall be verified for required functionality and the scan time. Any modification as required to meet the tender document requirement and customization modification due to Owner's site engineer in charge shall be carried out with no commercial implication.

5.15.36 For system architecture, refer system architecture drawing attached with tender.

5.16 **DC SYSTEM**

- 5.16.1 The DC system shall be as per EIL standard specification 6-51-0019 and DC System datasheet attached with tender. Battery shall be Medium Discharge type. Minimum temperature for battery sizing shall be 5°C.
- 5.16.2 DC system configuration shall be as per sketch attached with the Design Basis.
- 5.16.3 110V DC system complete with Ni - Cd battery bank, battery charger & DCDB supplied for Switchgear protection and control shall be provided with 2 x 50% battery banks.
- 5.16.4 220V DC system complete with Ni - Cd battery bank, battery charger & DCDB supplied for critical lighting shall be provided with 2 x 50% battery banks.
- 5.16.5 25% spare capacity shall be considered while sizing the battery and battery charger. 20% spare feeders of each type and rating shall be provided in DCDB.
- 5.16.6 3 Pole switch shall be provided for battery isolation purpose. Battery Isolator shall not be located inside battery room.
- 5.16.7 Battery charger shall be SMPS based.
- 5.16.8 DC Earth fault monitoring relay shall be provided on the battery charger.
- 5.16.9 DCDB shall be provided with voltmeter & selector switches which have facility to check DC positive to negative, positive to earth & negative to earth voltage. Annunciation for same shall be provided and indicated to ECS also
- 5.16.10 Busbar to be provided on TOP in DCDB.
- 5.16.11 ECS Interface for each DC System shall be provided as per ECS I/O list.
- 5.16.12 Battery charger output interlocking system shall not be MCCB based.
- 5.16.13 All inter-cell & inter row links shall be of copper with lead coating. Aluminium links are not acceptable.
- 5.16.14 Online battery bank monitoring system shall be provided for 110V DC System battery banks. Provision for individual cell voltage shall be monitored and alarm shall be provided. Battery monitoring system shall have connectivity with ECS system and remote alarm facilities.
- 5.16.15 For the following loads, completely independent redundant feeders from different bus sections of the DCDB shall be provided to the respective loads as minimum :
 - 5.16.15.1 220kV GIS / CRP
 - 5.16.15.2 66kV GIS / CRP
 - 5.16.15.3 6.6kV switchboard
 - 5.16.15.4 Electrical control system (ECS)
 - 5.16.15.5 Online moisture removal system
 - 5.16.15.6 415V PCC/PMCC
 - 5.16.15.7 Substation Automation System Panels
 - 5.16.15.8 Nitrogen Injection Fire Protection System panel
 - 5.16.15.9 Any other equipment based on reliability point of view & client requirement.
- 5.16.16 Battery charger for DC System shall be installed in Air-Conditioned area but it shall be suitable for operation in non-air-conditioned area also. Battery backup time shall be 120 minutes for both DC system.
- 5.16.17 Both DC system shall be kept in Substation switchgear hall. Ni-Cd Batteries for DC system shall be installed in a separate battery room. Both the DC system shall be of same make.
- 5.16.18 Diode droppers for battery charger shall be provided to limit the load voltage to nominal voltage.

- 5.16.19 Battery stand shall be in Double row double tier execution.
- 5.16.20 All cable glands and lugs are in scope of vendor.
- 5.16.21 Current feedback of each battery bank shall be provided to both the rectifiers so that in case of failure of one rectifier, another rectifier can control/ regulate the charging current of both battery banks.
- 5.16.22 The height of DCDB panel shall be same as that of battery charger.
- 5.16.23 Clearance between gland plates to terminating point shall be minimum 300mm in all the electrical equipment
- 5.16.24 Each of battery banks is to be located in a common battery room. CONTRACTOR to furnish number of air changes required to make the battery room safe i.e. non-hazardous. CONTRACTOR to furnish the proposed layout of battery rack in battery room maintaining 750 mm minimum clearance on all sides of battery rack.
- 5.16.25 All electrical equipment installed in battery room must be flameproof type suitable for gas group IIC.
- 5.16.26 DISCHARGE DUTY REQUIREMENTS FOR OWNER'S LOAD:

Load as per below mentioned table shall be considered for Owner's switchgear control supply and critical lighting in respective DC system to be located in Main GIS Substation MRSS-100 in P25 area.

DC System	Nominal DC voltage	Duty cycle		
		First 1 min.	Next 58 min.	Last 1 min.
DC System for switchgear control	110V	60 Amps	40 Amps	50 Amps
DC System for Critical Lighting	110V	15 Amps	15 Amps	15 Amps

5.16.27 FEEDER REQUIREMENTS FOR DCDBs:

DC System	Rating of each outgoing feeders	Number of Outgoing feeders
DC System for switchgear control	Upto 63 Amps	10 Feeders
DC System for Critical Lighting	Upto 32 Amps	6 Feeders

This feeder requirement is over and above the requirement of feeders for items free issued by owner and does not include any spare feeders. Same to be located in Main GIS Substation in P25 area.

5.16.28 **Following clause-wise modifications / additions to standard specifications shall be applicable on Specification for Battery Charger (EIL Spec. 6-51-0019):**

5.16.28.1 Note-2 on Page 13 & 14 of specification

Addition: "Battery isolator (MCCB/Switch Fuse) shall be provided with three pole version to ensure positive isolation of all the three connections of battery".

5.16.28.2 Cl. no. 5.2.1.8 Battery Charger:

Addition : "Perforated sheet/Wire Mesh shall not be provided at the bottom of the charger as over a period of time these gets corroded / damaged resulting in easy access of vermin's. Heat transfer system inside the charger shall be designed considering this aspect"

5.16.28.3 Cl. no. 5.2.2.7 Printed Circuit Board :

Addition: “Battery charger PCB electronic cards shall have conformal coating as per grade 3C3 (harsh environment) of IEC 60721-3-3 and certification for batch of supplied items shall be submitted by vendor for the same.

5.16.28.4 Cl. no. 5.3.1 Construction of Chargers / Distribution Board

Modification: “Each Battery Charger and DC distribution board shall be housed in a separate free standing cubicle with minimum IP-41 degree of protection, with common items for charger-1 & 2 housed in a separate vertical panel.....”

5.17 UPS SYSTEM

- 5.17.1 UPS system shall be as per EIL Specification 6-51-0017 and UPS system datasheet attached with the tender.
- 5.17.2 UPS system configuration shall be Double Parallel redundant with Individual bypass as per sketch attached with the Design Basis. Bypass shall have static or servo controlled voltage stabilizer.
- 5.17.3 230V AC UPS system complete with 2x 100% Ni - Cd battery bank & ACDB shall be provided for Control supply of Thyristor Control Panel, VFD, ECS, LAN system etc.
- 5.17.4 20% spare capacity shall be considered while sizing the battery and UPS. 20% spare feeders of each type and rating shall be provided in ACDB.
- 5.17.5 3 Pole switch shall be provided for battery isolation purpose. Battery Isolator shall not be located inside battery room.
- 5.17.6 UPS system shall be provided with additional separate earth bus for earthing of Isolation transformer. This earth bus shall be separate from earth bus provided for body earthing.
- 5.17.7 Online battery bank monitoring system shall be provided for 110V AC UPS System battery banks. Provision for individual cell voltage shall be monitored and alarm shall be provided. Battery monitoring system shall have connectivity with ECS system and remote alarm facilities.
- 5.17.8 ECS Interface for each UPS System shall be provided as per ECS I/O list.
- 5.17.9 Outgoing feeders with isolation transformer shall be provided with HRC type switch fuse on primary side and semi-conducting type fuse along with switch on secondary side. Outgoing feeders without isolation transformer shall be provided with semi-conducting type fuse.
- 5.17.10 Wherever, isolation transformers are required to be earthed to maintain output voltage in grounded condition, earth bus shall have punched holes for earthing of isolation transformers.
- 5.17.11 DC to DC convertor between UPS charger and battery bank is not acceptable i.e. battery bank float voltage shall be equal to charger float voltage.
- 5.17.12 All inter-cell & inter row links shall be of copper with lead coating. Aluminum links are not acceptable.
- 5.17.13 Disturbance recorder shall have at least two analogue channels with sampling rate of 1ms or better for monitoring of both UPS output at one place. Disturbance recorder shall have minimum features:
 - Capacity to record at least 5 disturbances of 3 second each -
 - Disturbances shall triggered based on settable under voltage level. -
 - Option of settable pre - & post time
 - Shall have facility to take the data to laptop through USB/ suitable communication port.
 - Disturbance should be stored in “first in first out” mode without any manual intervention.

Separate disturbance recorder is not required in case features mentioned at above for disturbance recorder are provided as part of FDU/UPS HMI based controller or voltage monitoring relays on the UPS output is provided with the disturbance recording features.

Regarding requirement of two analogue channels mentioned under "Disturbance Recorder" please note that the same is meant for monitoring the dual redundant UPS output voltages.

5.17.14 Busbar to be provided on TOP in ACDB.

5.17.15 For the following loads, completely independent redundant feeders from different bus sections of the ACDB shall be provided to the respective loads :

5.17.15.1 LAN System Racks

5.17.15.2 Substation Automation System Panels

5.17.15.3 ECS System Panels

5.17.15.4 Any other equipment based on reliability point of view & client requirement.

5.17.16 FEEDER REQUIREMENTS FOR UPS ACDB:

UPS System	Rating of each outgoing feeders	Number of Outgoing feeders
For ECS System	Upto 5kVA	10 Feeders
For EPABX gateway	Upto 500VA	8 Nos.

This feeder requirement is over and above the requirement of feeders for items free issued by owner and does not include any spare feeders. Same to be located in Main GIS Substation MRSS-100 in P25 area.

5.18 FIRE DETECTION AND ALARM SYSTEM

5.18.1 Fire alarm system shall be engineered in line with the specifications attached with the bid document for all areas within battery limit including buildings.

5.18.2 Fire Alarm devices (i.e. DGFAP, detectors, MCP, hooters, HAB, exit sign, input module/ control module) shall be supplied by Owner as free issue items (FIM) and quantities of same are as mentioned elsewhere in the tender. In case quantity required by CONTRACTOR is more than the indicated FIM, contractor shall supply the additional quantity without any time & cost implication. The make of these additional equipment/devices shall be of identical make, type & model no. as that of the free-issued equipment/devices.

5.18.3 Fire alarm system as required for unit/area including buildings within package battery limit shall be engineered by CONTRACTOR. CONTRACTOR will prepare the fire alarm layout for the building. Owner will free issue the FA devices as per the final approved layout within the limits as mentioned elsewhere in the tender.

5.18.4 Installation of all Free Issued Materials for Fire Alarm System and cabling including supply & laying of cables up to DGFAP for all field equipment in line with approved calculations shall be done by contractor. Installation shall be carried out as per installation details/ instruction details/ precautions provided by FA system manufacturer, approved Fire Alarm layouts, specification attached, approved sizing calculations and block diagram.

5.18.5 Interface cabling with air-conditioning system, NIFPS, HVWS and other systems shall be provided by contractor as applicable.

5.18.6 Testing and commissioning, of the Owner supplied fire alarm system will be done by others (Fire Alarm Vendor). However, contractor shall extend all necessary help and manpower to Fire Alarm vendor for executing works such as cable connection, disconnection and reconnection, detector removal, re-installation required during testing and commissioning of the system.

5.18.7 FAJB (Metallic), as required shall be in scope of CONTRACTOR. Fire alarm cabling inside building shall be done using armoured cables. Unarmoured cable will be used as a special case in concealed conduits only subject to Owner's approval.

- 5.18.8 Tinned copper cable lugs for termination of 1.5 sq.mm. multi stranded fire alarm cables in all indoor and outdoor equipments including panels, detectors, BGU, hooters, relay modules, exit signs, JB's, etc. shall be considered by CONTRACTOR. Cable glands with PVC shrouds for all indoor and outdoor equipments including panels, detectors, BGU, hooters, relay modules, exit signs, JB's, etc. shall also be considered by the CONTRACTOR.
- 5.18.9 All hardware used for installation and cable tags shall be of SS 304 grade.
- 5.18.10 CONTRACTOR to furnish the details of control voltage of various systems like NIFPS system & HVAC system for designing of tripping contact by FA system manufacturer. CONTRACTOR to furnish tripping philosophy for HVAC system including tripping of VAM package and AHU package during engineering stage.
- 5.18.11 Maximum number of Fire Alarm system equipments considered in OWNER's scope of supply for installation in MRSS-100 by contractor, shall be as listed below. Any requirement over and above the listed quantities shall be in contractor's scope. The make of these additional equipment/devices shall be of identical make, type & model no. as that of the free-issued equipment/devices. Make & model no. of free-issued fire alarm equipment and fire alarm cable sizes shall be informed to the Contractor during detail engineering
- Data gathering cum fire alarm panel (DGFAP) – 1 no.
 - Intelligent addressable multi sensor detector – 375 Nos.
 - Intrinsic safe intelligent addressable heat detector – 18 Nos.
 - Linear Beam detectors – 12 Nos.
 - Manual call point (MCP) safe area type – 12 Nos.
 - Electronic hooters addressable – 7 Nos.
 - Exit signs addressable (Single faced) – 8 Nos.
 - Exit signs addressable (Double faced) – 4 Nos.
 - Hooter Acknowledgement Box – 4 Nos.
 - Relay Module – 6 Nos.
 - Input module – 16 Nos.
 - Fault Isolator Module – 25 Nos.

5.19 PLANT COMMUNICATION SYSTEM

- 5.19.1 Plant communication system shall be engineered in line with the specifications attached with the bid document for all areas within battery limit including buildings.
- 5.19.2 Plant communication devices (i.e. Master call station, Operator Call station, Field Call Station, Loudspeaker, beacon lamp, etc.) shall be supplied by Owner as free issue items (FIM) and quantities of same are as mentioned elsewhere in the tender. In case quantity required by CONTRACTOR is more than the indicated FIM, contractor shall supply the additional quantity without any time & cost implication. The make of these additional equipment/devices shall be of identical make, type & model no. as that of the free-issued equipment/devices.
- 5.19.3 Plant communication system as required for unit/area including buildings within package battery limit shall be engineered by CONTRACTOR. CONTRACTOR will prepare the plant communication layout for the building. Owner will free issue the devices as per the final approved layout within the limits as mentioned elsewhere in the tender
- 5.19.4 Installation of all Free Issued Materials for Plant Communication System, PAJB and cabling including supply of PAJB and supply & laying of cables up to PAJB for all field equipment in line with approved layouts shall be done by contractor. Installation shall be carried out as per installation details/ instruction details/ precautions provided by Plant Communication system manufacturer, approved layouts, specification attached, approved sizing calculations and block diagram.
- 5.19.5 Testing and commissioning of the Plant Communication system will be done by Owner/others (Plant Communication Vendor). However, contractor shall extend all necessary help and

manpower to Plant communication vendor for executing works such as cable connection, disconnection and reconnection required during testing and commissioning of the system.

- 5.19.6 Weatherproof Junction box (Metallic), shall be considered in 220 kV GIS substation building suitable for 1 run of 50P cable, for receiving incoming cable from Owner's PA System Exchange. Termination and glanding of incoming cable in PAJB is in scope of CONTRACTOR. Contractor to note that minimum 5P cable shall be considered for each FCS and OCS/MCS.
- 5.19.7 Plant Communication cabling from PAJB onwards to the MCS, OCS, FCS, amplifier, loudspeaker, etc. shall be done by CONTRACTOR. Cabling inside building shall be done in concealed conduits using un-armored cables. Tinned copper cable lugs shall be considered for termination of multi stranded cables in all equipments. Cable glands with PVC shrouds for all equipments shall also be considered by the CONTRACTOR
- 5.19.8 All hardware used for installation and cable tags shall be of SS 304 grade.
- 5.19.9 Maximum number of Communication system equipments considered in OWNER's scope of supply shall be as listed below. Any additional requirement over and above the listed quantities shall be in contractor's scope. The make of these additional equipment's shall be of identical make, type & model no. as that of the free-issued equipment's. Make & model no. of free-issued plant communication equipment's and PA communication cable size shall be informed to the Contractor during detail engineering.
- Master Call Station – 1 Nos.
 - Operator Call Station – 2 Nos.
 - Field call station & weatherproof loudspeakers 25W (FCS + Ext loudspeaker) – 6 Nos.

5.20 TELEPHONE SYSTEM

- 5.20.1 Telephone system equipments as specified in scope of work shall be supplied, installed, tested and commissioned as per the specifications of this package.
- 5.20.2 Indoor Telephone Distribution Junction Box (TDJB) suitable for minimum 25 telephones shall be made out of 2.03 mm (14 gauge) sheet steel with Krone type terminals and with hinged lockable door. TDJB shall be provided with one anti-rust coat of primer and two finished coats of epoxy paint.
- 5.20.3 CONTRACTOR to note that incoming cables upto TDJB inside 220 kV GIS substation building shall be supplied and laid by others. However, termination and glanding of cables in TDJB JB is in scope of CONTRACTOR.
- 5.20.4 CONTRACTOR shall supply, install, test and commission flush mounting, plug - in type sockets for telephones including supply of sheet boxes with covers.
- 5.20.5 CONTRACTOR scope includes wiring from TDJB onwards to telephone sockets in concealed conduit.
- 5.20.6 Analog push button telephone handset to be supplied shall have the following functionalities :
- Redial / flash buttons.
 - Ringer volume control.
 - Hands free dialling.
 - Two way speaker phone.
 - Desktop/wall mountable.
 - Caller ID facility.
 - Minimum 99 incoming and 10 outgoing no. storage.
 - Display of real time and date.
 - Programmable flash.
 - Alphanumeric 16 Digit Backlit LCD display without any battery or adopted in put power and shall display date, time, caller number & name at a time.
 - Minimum 50 Names phone book.

- Should have Music on hold.
- Adjustable ringing tone.
- Telephone set should work on both tone & pulse mode.
- Dual mode FSK / DTMF system compatible with auto detection
- Telephone set & Ringer should be compatible with Openscape 4000 V8 type of system
- Telephone Sets should be supplied with battery, rosette, line cord & coil cord.

5.21 LAN SYSTEM

- 5.21.1 CONTRACTOR scope includes supply, installation, testing and commissioning of LAN system comprising of CAT 6A modular UTP jack including all connected material (i.e. face plate, surface mounted box, patch cord, etc.), circuit wiring from Ethernet switch rack to CAT 6A UTP Jack using CAT 6A LSZH UTP cables, CAT 6A modular patch cord.
- 5.21.2 CONTRACTOR to note that minimum three 5A convenience outlets with switch shall be provided along with each LAN UTP Jack.
- 5.21.3 CONTRACTOR to note that connection of LAN system with refinery LAN shall be done by others

5.22 MOTORS

- 5.22.1 MV Motors, if required, shall be energy efficient IE3 type as per IS 12615 and shall meet the requirements as per EIL standard specification 6-51-0064 and datasheet for MV motors attached with tender.
- 5.22.2 Motors installed outdoors shall have canopy (2 mm thick G.I. sheet steel) for additional weather protection.
- 5.22.3 The cable entries of all Terminal Boxes of motors, before dispatch from motor manufacturer works, shall be fitted with suitably sized IP-55 Metallic Sealing Plugs to prevent water entry/ingress in motor windings through openings meant for cable entry in terminal boxes at construction site till the time motors are erected and cable terminations are done. Weatherproof nickel plated brass cable glands shall be supplied loose.
- 5.22.4 In addition to packing requirements specified in EIL standard specification of motors, Vendor to do plastic wrapping for shipping from works to site.
- 5.22.5 All motors shall have provision for double earthing.
- 5.22.6 All glands supplied with motors shall be of thread type 'ET'.

5.23 LOCAL CONTROL STATION

- 5.23.1 Weatherproof control stations (IP-65) for all motors, emergency stop push buttons for transformers, motors and emergency push buttons as required for plant operation and safety etc. shall be provided by the contractor.
- 5.23.2 Each motor shall have a separate push button station for motor start/stop in addition to local/remote, Auto/manual selector switch as per operation requirements. LCS for motors rated 5.5 kW and above shall be provided with ammeter.
- 5.23.3 Dual pushbutton to be provided in the transformer bay shall be wired in series and connected to the trip circuit of the upstream breaker such that pressing of both simultaneous shall trip the transformer circuit breaker. All contact of these push buttons shall be used as close permissive for the transformer circuit breaker. Additionally push buttons shall also be provided with covers and pushbutton shall be stay put type.
- 5.23.4 Each pushbutton provided in LCS shall have two elements / contacts.
- 5.23.5 Local control stations installed in outdoor area shall have GI canopy for additional weather protection.

5.23.6 Local control stations stop push button for transformer shall have 3 NO + 3 NC contacts instead of 2 NO + 2NC specified in EIL standard specification 6-51-0006.

5.23.7 Local Push Button station at each entry of substation floor shall be provided and same shall be wired to LDB for control of normal lighting of switchgear/GIS hall & cable cellar.

5.24 CABLEING

5.24.1 All HV & MV Power cables shall comply with the EIL standard specification 6-51-0051 and datasheet attached with tender.

5.24.2 Power cables used shall be with 3.5/ 4 cores, except for motors, which shall be 3C. The conductor size shall be minimum 4mm². Colour of outer sheath of cables shall be BLACK.

5.24.3 The conductor material for MV power cables shall be copper up to 16 mm² / Aluminium above 16 mm². However in case of cables related to DC system and UPS system all cables from Battery charger & DCDB onwards and from UPS & ACDB onwards shall be with copper conductors irrespective of cable size.

5.24.4 All MV control cables, plant communication cables, telephone system cables and fire alarm cables shall comply with the EIL standard specification 6-51-0052 and datasheet attached with tender. Control cables shall be 2.5 mm², multi stranded copper conductor, twisted pair and overall shielded, XLPE insulated type. Note that type of core insulation for these cables shall be Type A as per IS 5831 and material of Inner sheath shall be ST1.

5.24.5 All cable tags used for cable identification shall be of stainless steel grade SS 304.

5.24.6 For fire alarm system, power cables shall be 2.5 mm², copper conductor, XLPE Insulated armoured with FRLS outer sheath and cables for connecting various fire alarm devices shall be 1.5 mm², copper conductor, twisted pair XLPE Insulated, armoured with FRLS outer sheath. Fire alarm cables shall be multi-stranded type. Colour of outer sheath of fire alarm cables shall be RED. However, power cables for fire alarm shall be BLACK in colour.

5.24.7 For plant communication system, 0.9 mm dia twisted pair solid copper conductor XLPE insulated cables for interconnections between MCS / OCS / FCS & exchange and 1.5 sq. mm twisted pair multi stranded copper cable for connection to the loudspeakers shall be provided. Colour of outer sheath of plant communication cables shall be GREY.

5.24.8 For telephone system, cable from TDJB onwards to telephone sockets shall be 660 V grade, 0.63mm dia. annealed tinned copper conductor and PVC insulated. Colour of outer sheath of telephone cables shall be GREY.

5.24.9 All cables shall be supplied in non-returnable steel drums.

5.24.10 Attached cable datasheet (B269-999-16-50-DS-0200 Rev. A) is applicable for 6.6kV cable.

5.24.11 FIBRE OPTIC CABLES

5.24.11.1 Fibre optic cable shall be supplied along with HDPE duct.

5.24.11.2 The fibre-optic cable shall be of single mode type only with a minimum of 2 spare fibers in each cable. Procedure of data transmission, error control and recovery shall be as per acceptable standards.

5.24.11.3 All lengths shall be joint free single continuous lengths. Coating and the colour of the fiber shall not react with the surrounding jelly. Outer sheath shall be flame retardant low smoke (FRLS) type.

5.24.11.4 Fiber-optic data cable shall be suitable for water-submergence duty and high temperature withstand as per the routing requirements in the plant. All lengths shall be joint-free continuous lengths.

5.24.11.5 Optical fibers shall be coated with UV cured double acrylate resin. It should not have any reaction with cladding or core material.

- 5.24.11.6 The coatings shall be in various colours in order to facilitate fiber identification. Fiber colours shall correspond to latest revision of IEC publication 60793-2 and 60304. The colours shall correspond reasonably with standard colours and shall readily be identifiable and shall be durable. The colours should have good colour fast properties also in the presence of other materials during the lifetime of cable. The coating and the colour shall not react with the surrounding jelly.
- 5.24.11.7 The fiber optic cable shall be protected against damages from termite, rodent, fire, chemicals (such as oil & natural gas, LPG and other petroleum/ petrochemical products), moisture and water over the life time of the cable.
- 5.24.11.8 Moisture barrier – Polymer coated aluminium tape placed longitudinally over the cable core. The tape shall form a close fit around the cable core with a sealed overlap of 6mm minimum. The thickness of each polymer layer shall be 0.04 mm minimum. The thickness of fully annealed aluminium foil shall be 0.15 mm minimum.
- 5.24.11.9 The armouring of the optical fiber cable shall be of corrugated steel (electrolytically chrome plated low carbon steel) tape both side coated with ethylene acrylic copolymer, applied longitudinally with minimum overlap of 6mm. The thickness of the steel tape shall be 0.15 mm minimum. The thickness of each polymer layer shall be minimum 0.04 mm minimum.
- 5.24.11.10 The cable shall have sufficient strength to withstand a load of value $T = 9.81 \times W$ newton, where W = mass of 1 km in kg. The load shall not produce total strain exceeding 0.25% in the fiber.
- 5.24.11.11 The termination enclosures of the optical fiber cable should be dust tight (No dust ingress) and protected against immersion in water (suitable for continuous immersion in water) and should be complete with all accessories including splice cassettes splice protection and all other accessories including accessories for electrical continuity of metallic layers of optical fiber cable and OFC preparation kit along with instruction sheet.
- 5.24.11.12 All fibres (including spare fibers) of a cable shall be terminated in the termination enclosure by pigtails. Subsequent connection shall be by patch chords. Supply and erection of termination enclosure, pigtail, patch chord etc. is in vendor's scope. OTDR analysis/report shall form part of the testing activities of the OFC network.
- 5.24.11.13 Vendor shall furnish past track record for the selected make of the fiber optic cable, preferably for the past EIL projects during drawing review stage.
- 5.24.11.14 HDPE duct shall be permanently solid lubricated/ with spiral groove, UV-protected, fire retardant (Class V2 as per UL-94 and with limited oxygen index of 21 or higher as per ASTM D2863), of 40 mm outer diameter (+5.0/-0.0 mm) minimum thickness 3.7 mm, suitable to withstand load of 6 kg/m².
- 5.24.11.15 All HDPE ducts shall be supplied along with accessories such as push fit coupler, bend and elbow, end plug, simple plug, sonic head, etc. required for blowing cable into HDPE duct by compressed air technology.

5.25 CABLING SYSTEM

- 5.25.1 Cable tray support along with cable trays inside substation cable cellars shall be provided by CONTRACTOR. Cable tray shall be provided on both side of vertical supports in multi-tier arrangement with minimum 6 cable trays uniformly spaced at 300 mm, on each vertical support along the complete length of substation. Vertical support shall be provided for complete height of cable cellar, fixed at cable cellar floor and roof. Span between two consecutive supports shall not exceed 3000 mm.
- 5.25.2 Dedicated cable route shall be provided for 220 kV & 66kV cables. Only 1 trefoil of 220 kV and 2 trefoil of 66kV cable is permitted in each tray. Sufficient space, minimum 500 mm for 220kV cables and 400mm for 66kV cable shall be provided between various tiers for laying cables. For 220 kV&66kV Cables, trays and supports shall be provided to withstand minimum 250 kg/ meter

of uniform weight for cables laid in trefoil arrangement. Sufficient space shall be provided between trays for laying of cables.

- 5.25.3 Supporting structure shall be provided for raising cable trays from cable cellar to switchgear hall for termination in GIS. Cutout provided for raising 220 kV & 66kV cables in switchgear hall for termination shall be closed by chequered plates.
- 5.25.4 Cable tray supports shall be suitable for 750 mm wide cable trays. Engineering for sizing of cable trays based on number and size of cables shall be done by CONTRACTOR.
- 5.25.5 All cable trays as required as per CONTRACTOR scope, shall be GI type with SS hardware and shall be provided by CONTRACTOR. Coupling and connection hardware of cable trays shall be of stainless steel grade SS 304.
- 5.25.6 GI pipes for cable protection above ground, floor sleeves, supports wherever necessary, cable markers, identification tags, GI saddles, saddle bars and associated accessories, all other galvanized hardware like nuts, bolts, washers, grouting bolts as necessary, shall also be provided
- 5.25.7 Modification in requirements specified above, to suit site condition shall be finalized during detail engineering, which shall be taken care by the contractor without any impact on cost and time to Owner/ EIL
- 5.25.8 Wherever trenches/trays within battery limit have interface with the trays and trenches outside battery limit, the details shall be finalized during detailed engineering. Trenches and trays shall be provided up to the battery limits as per the final approved layouts without any impact on cost and time to owner
- 5.25.9 It shall be CONTRACTOR's responsibility to co-ordinate the cable trench/ tray routing from the package battery limit area, control room and substation building etc. with other agencies involved. Trenches and trays shall be provided up to the battery limits as per the final approved layouts without any impact on cost and time to owner.
- 5.25.10 In cable trays/trenches 20% spare space shall be provided. 40% spare shall be considered in Electrical Road Crossings.
- 5.25.11 Lugs to be supplied by the CONTRACTOR shall meet the following requirements for all terminations for the equipments in the scope of CONTRACTOR.
 - Aluminum conductor cable termination on Aluminum bus bar/ terminals (like switchboards) - Aluminum lugs
 - Aluminum conductor cable termination on Copper bus bar/ terminals (like motor) - Bimetallic lugs having Al barrel & tinned Cu palm
 - Copper conductor cable termination on Aluminum bus bar - Bimetallic lugs having tinned Cu barrel & Al palm
 - Copper conductor cable termination on copper bus bar/ terminals - Tinned copper lugs.
 - Lugs provided for termination of HV & MV cables at switchgear end shall be of long barrel type.
- 5.25.12 Glands to be supplied by the CONTRACTOR shall be of nickel-plated brass for all cabling & termination for the equipment in the scope of CONTRACTOR. The cable glands shall be single compression type for indoor equipments & double compression type for outdoor equipments.
- 5.25.13 MV Control cable shall be of Multi-stranded conductor, twisted pair individual & overall shielded, XLPE insulated type.
- 5.25.14 The Cable outer sheath Color for various twisted pair cables shall be as follows:

MV Control Cables	Black base color
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MV Communication Cables	Gray base color
MV Fire Alarm Cables	Red base color
MV Fire Safe Cables	White base color

5.26 EARTHING AND LIGHTNING PROTECTION

- 5.26.1 Earthing system of the entire package shall be designed to meet the statutory requirements and shall be included in contractor's scope including interconnection with owner's earth grid and earthing of all equipment.
- 5.26.2 Earth Resistivity Value shall be measured by CONTRACTOR at minimum five locations before earthing system design calculation.
- 5.26.3 Contractor shall measure the earth resistivity of soil as per Wenner's four electrode method. For determining the earth resistivity, five test locations shall be chosen to cover the whole site as per the site-Engineer-in-charge. This number shall be increased if the test results obtained shows a significant difference. The tests shall be conducted during the dry season
- 5.26.4 Earthing system shall conform to following standards:
 - 5.26.4.1 IEEE-80 Guide for safety in AC substation grounding.
 - 5.26.4.2 IS-3043, Code of practice for earthing.
 - 5.26.4.3 CBIP Tech. report for Earthing System for HV, EHV and UHV Substations.
 - 5.26.4.4 CEA Regulations as amended from time to time and the relevant regulations of the Electricity Supply Authority concerned.
 - 5.26.4.5 The earthing work shall also conform to EIL specification for Installation of earthing system.
- 5.26.5 Lightning protection shall comply with the requirements of IS/ IEC 62305. Contractor to furnish calculation for lightning protection of building. Lightning protection of building and switchyard area shall be separate and shall be designed for LPS 2 as a minimum. Lightning strip size shall be minimum 25 x 3 mm.
- 5.26.6 Cross-section of earthing conductor shall be designed to prevent fusing of conductor and deterioration of joint under most adverse conditions of fault. The same shall be determined as per IS: 3043, and to meet the regulations of CEA Regulations. MS rod shall be used for the buried earth grid in outdoor switchyard. For earthing conductor sizing, duration of earth fault current duration to be considered, shall be minimum one second.
- 5.26.7 The entire installation shall be done in accordance with standards mentioned herein. The contractor shall carry out any changes desired by the electrical inspector or the owner, in order to make the installation conform to CEA Regulations at no extra cost.
- 5.26.8 Earthing system shall be designed to have a low impedance to ground and a current carrying capacity consistent with the fault current. The earth loop impedance to ground shall not be in excess of 1.0 Ω . The main earth loop shall be laid at a depth of minimum 500 mm below grade level. Earth resistance of individual electrode to general mass of earth shall not exceed requirements given in OISD-STD-137.
- 5.26.9 Test disconnect facilities shall be provided for the earth pits to check their earth resistance periodically.
- 5.26.10 The method of earthing has to be considered from the view point of touch and step potentials in the area extended 1 meter outside the substation battery limit and in outdoor switchyard area, so as to ensure that the area in the vicinity of the substation and the switchyard equipments is safe from the viewpoint of touch potential under fault conditions.
- 5.26.11 The attainable and permissible values of the step and touch potential in the design of the earthing grid in substation shall be calculated as per IEEE 80, and it shall be ensured that the

attainable step and touch potential are less than permissible step and touch potential. For step and touch potential, current distribution factor shall be considered as 1 and duration of rated fault current shall be 1 second.

5.26.12 Contractor shall provide earth grid up to battery limit of the package including provision of earth plate near the battery limit for interconnection of the unit earth grid with the Owner's main plant grid. CONTRACTOR shall extend & connect the plant earthing grid to main earthing grid, at minimum two points.

5.26.13 All earthing hardware (i.e. nut, bolts, etc.) for earth pits, earth plate connection cable trays earthing, etc. shall be of stainless steel grade SS 304.

5.26.14 Contractor to note that separate dedicated earth electrodes shall be provided for lightning protection.

5.26.15 Equipotential Earth mat.

5.26.15.1 When a fault current flows through the earthing connections into the soil, the enclosures, linked to the earthing circuits, will be at the same potential as the earthing mat conductors but this potential is generally different from that on the soil surface.

5.26.15.2 In order to ensure the security of personnel, it is necessary to install an equipotential mat linked to the general earthing mat in the zones where metal enclosures and fixed accessories are accessible from the floor.

5.26.15.3 It is also necessary to provide an equipotential earthing mat in the zones where an emergency mechanical operation or a locking system is accessible from the floor. It is therefore possible to extend the equipotential mat to allow the operator to carry out his maneuvers.

5.26.15.4 In order to ensure a good equipotential surface, each element of the equipotential mat must be connected to the general earthing network by the manufacturer.

5.26.15.5 This mat will be placed on the floor, all around the switchgears. It is not required in front of the control cubicles.

5.26.15.6 If it is an oxidizing material, it should be hot dip galvanized.

5.26.15.7 The manufacturer must design, specify, and provide this equipotential earth mat. The location of the equipotential mat should be defined by the supplier for all the GIS and at places where:

- The enclosures are accessible for the floor.
- Manual operation of apparatus or locking system is located.

5.26.15.8 Equipotential earth mat drawings along with design calculations shall be submitted for approval by the CONTRACTOR along with general arrangement drawings.

5.26.16 All earth pits for earthing and lightning protection shall be maintenance free chemical earth pit with Cu bonded high tensile low carbon steel core electrode.

5.26.17 Earth connections shall be welded at joints, anti-corrosive paint or bitumen and jute covering shall be applied for welded portion.

5.26.18 Separate clean earth system shall be provided for Numerical relays, SAS & ECS in Substation.

5.26.19 Material of connection of equipments to earth plate shall be as per the equipment earthing schedule enclosed with the tender document.

5.26.20 Minimum size of the main earth grid shall be 100 x 12 for Substation. However, Earthing sizing calculation shall be furnished by Contractor for the final GI earth strip selected.

5.26.21 Adequate number of earth plates for taking branch connections shall be provided.

5.27 LIGHTING SYSTEM

- 5.27.1 Normal lighting, Emergency lighting and DC Critical lighting shall be provided as per Electrical Design Philosophy.
- 5.27.2 All lighting fixtures shall be LED type, supplied complete with associated LED lamp and driver
- 5.27.3 25% of total fixtures shall be fed from emergency lighting panel for illumination, in case of failure of normal power supply.
- 5.27.4 During normal operation, both emergency and normal lighting shall be fed by normal power source. On failure of normal supply, emergency lighting load shall be transferred to emergency power supply source. Critical (DC) lighting shall be normally kept 'OFF' and during failure of AC power; DC system shall feed the critical lighting system.
- 5.27.5 All lighting fixtures shall be suitable for the area in which they are installed. All hardware of the lighting fixtures like nuts, bolts, mounting brackets for ceiling & column mounting and adaptors for installation on poles shall be with MOC of SS304.
- 5.27.6 For fixture mounted on pole dedicated standalone junction box shall be provided at bottom for loop-in loop-out.
- 5.27.7 Lighting & Power panels shall be standardized to have 6, 12 or 18 single phase outgoing feeders. The panel shall be provided with 30% spare out goings
- 5.27.8 All lighting poles shall be hot dipped galvanized type with SS hardware.
- 5.27.9 DC critical lighting shall be provided at exit, escape route inside the building/plant area and other strategic locations in package battery limit.
- 5.27.10 All lighting fixtures shall also have independent earth terminal outside the enclosure.
- 5.27.11 Cable from lighting panel onwards to the outdoor lighting fixtures shall be 3Cx2.5mm², Copper conductor, and armored FRLS cable.
- 5.27.12 It is vendor's responsibility to ensure that adequate lighting is maintained within package battery limit with minimum lux level specified as per clause 7.4.12 of 6-51-0099. The same will be measured and demonstrated at site. In case additional lighting fixtures and associated circuit/cabling is required, the same will be provided by vendor without any time/cost implication to owner.
- 5.27.13 415/ 415V Dry type lighting transformer shall be supplied with vector group as Dyn1

5.28 SPECIAL REQUIREMENTS FOR LEDs FIXTURES

5.28.1 TECHNICAL REQUIREMENTS OF LED:

- 5.28.1.1 LED efficacy shall be greater than > 140Lumen/Watt @ 350mA drive current. In respect of LEDs of higher power ratings, drive current greater than 350mA can be accepted if the LED's LM 80 / IS: 16105 test reports support the same.
- 5.28.1.2 LED type shall be SMD (surface mounted device) type LED for all applications. COB type to be considered only for applications such as High bays, Flood Lights & Flameproof Light Fittings.
- 5.28.1.3 Approved makes for different LED technology/types shall be as follows:

LED Technology/ Type	Approved Make
SMD	Nichia, Osram, Lumileds (Erstwhile Philips Lumileds), CREE
C.O.B	Citizen, Bridgelux
Domestic/Decorative Luminaires	Everlight Taiwan, Edison Taiwan, Samsung Korea, Osram Germany along with makes approved for SMD

- 5.28.1.4 Test Report for Ambient Temperature of 55 / 85 / 105 °C at rated and maximum current shall be submitted for SMD type LED. For COB type LED, as soldering temperature is not applicable for COB technology, LM 80 test report shall be submitted.
- 5.28.1.5 TM 21 life projection calculations along with LM80 for all three ambient temperature of 55 / 85 / 105°C as per applicable standard shall be submitted to substantiate that life of LED Chip shall be more than 50000 Hrs for both commercial and Industrial range and 25000 Hrs for LED Bulb, domestic and decorative Range.
- 5.28.1.6 Reported life Span of LEDs used in the Luminaire shall be greater than 50,000 Hrs at the soldering point temperature of 85°C and at the luminaire driving current.
- 5.28.1.7 The LEDs shall comply with Photobiological Safety norms as per IEC 62471 / EN62471 / IS: 16108 and should fall in the exempt group for indoor luminaires and in exempt or low risk group for outdoor LED luminaires.
- 5.28.1.8 View angle : Typical 120°
- 5.28.1.9 The colour temperature of the proposed white colour LED shall be from 5700K (i.e. 5665K±355K) to 6500K for indoor type luminaire Step 5 or Step 3 McAdam, as per ANSI standard C78.377A, & 5700K (i.e. 5665K±355K). For outdoor type luminaires, Step 7 McAdam, as per ANSI standard C78.377A, will be accepted on account of colour consistency.
- 5.28.1.10 The Colour Rendering Index (CRI): CRI should include all colour range from R1 to R15, shall be > 80 for Indoor luminaire and > 70 for Outdoor luminaire.

5.28.2 TECHNICAL REQUIREMENTS FOR LED DRIVER

- 5.28.2.1 Min. efficiency of driver: The minimum efficiency of LED driver shall be 85% for driver power output rating ≤40W and 87% for driver power output rating > 40W.
- 5.28.2.2 Power factor of complete fitting shall be greater than 0.90.
- 5.28.2.3 In-built high voltage cutoff shall be ≥ 290Volt.
- 5.28.2.4 Driver Surge Protection standard: Surge Protection for minimum 2kV for indoor and minimum 3kV for Outdoor LED systems shall be provided. However, if a site is prone to lightning and surge, 10kV surge protection shall be required. In case of outdoor luminaires, the Surge Protection Device (SPD) should be series type with fail safe.
- 5.28.2.5 Total Harmonic Distortion (THD): Less than 10 % for full load for more than 20 W and less than 20% for less than 20W. Not applicable for Domestic/Decorative LED fixtures.
- 5.28.2.6 Isolated driver shall be used. Short circuit protection /Open load protection shall be provided
- 5.28.2.7 For driver power output rating > 50W, potted driver shall be provided.
- 5.28.2.8 The power supply shall be connected to the LED PCBs through proper connectors.
- 5.28.2.9 EMI/ EMC compliance: The driver shall comply to the following EMI/ EMC standards:
- CISPR 15/ 18:6873 (CE, RE, CDN) or compliance to equivalent EN standard.
 - IEC: 61347 (reference standards are listed as follows)
- 5.28.2.10 Driver shall comply with the safety requirements laid down in IEC: 61347 - 2 - 13/ EN: 61347 - 2 - 13/ IS: 15885 - 2 - 13.

5.28.3 TECHNICAL REQUIREMENTS OF ELECTRONIC COMPONENTS USED IN LED LUMINAIRE

The circuit boards and electronic components to be used in the luminaire should be of rating/ type so as to provide reliable functioning. Following shall be ensured during procurement:

- 5.28.3.1 MCPCB is to be used for SMD technology for LED wattage in excess of 0.5. The minimum thickness should be 1.0 mm for indoor and 1.6 mm for outdoor type luminaire. However, the same is not applicable for COB.

- 5.28.3.2 FR4 grade PCBs of min. thickness of 1.6 mm shall be used in driver circuits. The same is not applicable for COB.
- 5.28.4 TECHNICAL REQUIREMENTS OF LED LUMINAIRE
- 5.28.4.1 The luminaire shall have LM-79 / IS: 16106 test report from a NABL accredited laboratory.
- 5.28.4.2 The min. system lumen efficacy of the luminaire shall be 95 lm/W (for luminaire system wattage ≤ 15 W) and 100lm/W for wattage > 15 W.
- 5.28.4.3 Following shall be required in terms of secondary lens/ optics:
- Outdoor industrial luminaire like well glass, flat glass may not have secondary lens/optics.
 - For other Industrial and outdoor fixtures, luminaire must have secondary lens/optics of type PMMA/Borosilicate glass/Polycarbonate.
- 5.28.4.4 Color temperature: 5700K (5665 $\pm$ 355K, as per ANSI standard C78.377A)
- 5.28.4.5 Housing of luminaire: Housing of outdoor and/or FLP shall be Pressure die-cast LM6/ADC12/LM24. For indoor, non-weather proof items like CRCAIPC/Aluminium Extrusion housing can be used.
- 5.28.4.6 Cover type: For outdoor type fittings, cover type shall be Toughened glass or UV stabilized polycarbonate whereas, for indoor and non-weather proof items, UV stabilized Poly Carbonate can be used.
- 5.28.4.7 Minimum Ingress Protection Required for LED Flood Light / Outdoor Industrial is IP 65.
- 5.28.4.8 Impact Resistance: For outdoor fittings minimum impact resistance shall be IK-05 and not applicable for indoor fixtures.
- 5.28.4.9 Temperature rise test: When the luminaire has stabilized thermally, soldering point temperature shall be ≤ 85 °C for SMO type but for COB type the temperature rise test shall not be applicable.
- 5.28.4.10 Temperature rise (above ambient) of heat sink should generally remain within 20°C - relaxation on this account can be granted as long as the soldering point temperature limit of 85°C is not violated and there is no unacceptable outcome.
- 5.28.4.11 BIS Registration: The luminaire shall have BIS approval for surface mounted luminaire as applicable.
- 5.28.4.12 Flameproof tight fittings shall be certified for use in hazardous area as per area classification and the flameproof certificate shall be submitted by the vendor. Explosion proof certificate from PESO shall be submitted before or along with supply of such light fittings.
- 5.28.5 TESTING OF LED LUMINAIRE
- 5.28.5.1 Following acceptance tests shall be carried out / type test & routine test certificates from NABL accredited Labs shall be provided as per relevant standards.
- Visual and dimensional checks
 - Resistance to humidity test
 - Insulation resistance (IR) test
 - High Voltage test
 - Over-voltage protection
 - Surge protection
 - Total harmonic distortion (THD) test
 - Reverse polarity test
 - Temperature rise test

- Ingress protection test

5.28.5.2 Type test report/ certificate as per relevant standards on selected sample including endurance test as per IS10322 & Safety test for Drivers as per IS15885 from NABL accredited lab shall be submitted.

5.28.6 MISCELLANEOUS REQUIREMENTS

5.28.6.1 For LED fixture, integral junction box shall be provided with 3 nos. cable entries for loop-in, loop-out and associated wiring to fixture. Alternatively 2 nos. cable entries for loop-in and loop-out shall be provided with internal wiring for driver and lamp.

5.28.6.2 All lighting fixtures shall be supplied complete with associated LED lamp and driver.

5.28.6.3 All lighting fixtures shall be supplied with fixture mounting nuts and bolts of stainless steel SS-304. Fixture mounting bolts & nuts for mounting the light fittings on already installed clamps/brackets. However, Clamps/brackets mounting bolts & nuts are excluded from vendor's scope.

5.28.6.4 Flameproof LED type lighting fixtures shall fulfill the following requirements:

- LED lamps and Drivers shall be provided with min. 5 years warranty period.
- Lighting fixtures reserved for use in 240 Volt AC Emergency Circuit shall have additional RED Circular ring marking for identification purpose for hazardous area identification. This detail shall be furnished to successful vendor during detailed engineering.
- Vendor shall indicate the following parameters as a minimum in fixture drawings:
 - Fixture Wattage and LED Wattage
 - Actual Consumption of Fixture
 - Driver Consumption
 - Fixture Life time
 - Luminous Efficacy of fixture
 - Lumen Output of Fixture
 - Tolerance for Voltage and wattage rating
 - Power factor of Fixture
 - Beam Angle of Lighting Fixture
 - Weight of Fixture
 - LED LAMP and Driver Warranty Period
 - Driver Surge Protection
 - Compliance to IEC-61347-2-13 for LED Driver
 - BIS Certification no. for Driver
 - Driver Make and Model No.
 - LED Make and Model no.
 - LED type i.e. COB (Chip on Board) or Multichip etc.
 - Quantity of Fixtures
 - No. of Cable entries for Fixture along with quantity of FLP Cable glands and FLP Stopper plug.
 - PESO/CIMFR/BIS License certificates numbers along with dates.
- IES files of all LED lighting fixtures finalized during detail engineering shall be furnished for owner/EIL records.

5.29 FIXED TYPE SPACE HEATER PDB

5.29.1 PDB shall be installed in safe area and shall be suitable for safe area. Ingress protection shall be IP-41.

- 5.29.2 PDB shall be single front, and fixed type, free standing floor mounted type. PDB shall be minimum 415V, 200 Amp, 50Hz, TPN, 25 kA (1 sec.) with two number SFU incomers mechanically interlocked with each other.
- 5.29.3 The switchboard shall be non-compartmentalized type instead of compartmentalized specified in 6-51-0012. However, other requirements of 6-51-0012 shall be complied with.
- 5.29.4 The number of outgoing 240V AC, SPN feeders in the PDB for Owner's use shall be as follows:

Rating	Nos
16A Double Pole MCB	6
32A Double Pole MCB	6
63A Double Pole MCB	6

- 5.29.5 Incomer feeder shall be provided with voltmeter and ammeter. All indicating lamps shall be LED type.
- 5.29.6 Terminals for outgoing feeder's upto 16A shall be suitable for 10 Sq.mm. cable. Terminals for upto 32A and 63A feeders shall be suitable for 25 mm² cable. Supply of lugs and nickel-plated brass cable glands for all cabling & termination in the scope of vendor inclusive of cable glands for incoming cable to PDB. The cable glands shall be single compression type.

5.30 SOLAR ROOFTOP PHOTO VOLTAIC SYSTEM

- 5.30.1 Contractor shall provide grid connected solar power plant units at roof top of main substation MRSS-100 in P25 area on substation switchgear room and transformer bays and feed the generated solar power to the electrical system of the complex. The solar power shall be generated at 415V, TPN, 50 Hz which can support loads at 0.8 pf.
- 5.30.2 The scope of work for contractor includes design, manufacture, supply, erection, testing and commissioning of grid connect interactive solar PV power plants without batteries on substation building roof. Solar power unit shall be connected to the nearest 415V MV switchboard for export of solar power. The solar power systems shall remain synchronized with the grid supply for generation of solar power.
- 5.30.3 Each photovoltaic solar panel shall be divided into small sub arrays to feed into Power Conditioning Units (PCU). The series parallel connection of sub arrays shall be done through panel junction boxes, Array junction boxes and main junction boxes. The AC output of the PCUs shall be collected at the MV switchboard. The detailed scheme for power evacuation shall be worked out by the contractor.
- 5.30.4 PV panels shall be installed on the complete building terrace area which includes roof top of substation switchgear room and transformer & capacitor bays except for personnel movement area and area for other facilities installed on the roof top. Minimum 1 KWp solar panels shall be located in each 12 m² area.
- 5.30.5 The minimum guaranteed supply of energy from the solar power systems shall be 1400 KWh/year for 1 KWp PV panel. The contractor/manufacturer shall furnish the undertaking for guaranteed supply of energy for the solar power systems provided by them.
- 5.30.6 Contractor shall engage the services of a separate specialist agency/manufacturer for execution of solar power plants including design, engineering, sizing, selection & procurement of equipment/material, installation, testing and commissioning of solar power plants. The agency shall be an established manufacturer/supplier of complete SPV power system and shall have adequate experience for carrying out similar SPV based solar power plants. The agency should have designed, supplied, installed and commissioned SPV power plants of cumulative installed capacity of 250 kWp or above, out of which at least one plant should be of 100 kWp capacity

operating satisfactorily for more than one year. The agency shall be approved by PMC/Owner during detail engineering based on details furnished by contractor.

- 5.30.7 The PV solar panels shall be located on roof tops of substation switchgear room and transformer & capacitor bays away from the shadow area. The direction of solar panels shall be as per manufacturer recommendation. The PCU shall be located within the building in Air conditioned room.
- 5.30.8 Complete cabling including supply, laying and termination of cables, cable trays, material, hardware etc. within SPV power plant units and from power plant units to MV switchboards for export of solar power is in contractor scope.
- 5.30.9 For further requirements/details refer Specification for Solar PV System attached with the tender.

5.31 REQUIREMENT FOR AIR CONDITIONING

- 5.31.1 Vendor scope shall include sizing, design, engineering, manufacturing, supply, installation, testing and commissioning, packing and delivery at site of all the electrical equipments including supply of all commissioning spares, special tools and tackles as per the specifications and the datasheets attached or referred. The major electrical equipments for the package includes
 - 5.31.1.1 All MV motors
 - 5.31.1.2 Power distribution board - PDB (As per EIL specification 6-51-0012) for all motors and other load of the package, separate for each building (PDB shall be installed in AC Plant/ Package room, AHU room, as required).
 - 5.31.1.3 Supply, laying and termination of all power and control cabling for all package loads.
 - 5.31.1.4 Cable trays, as required for laying the cables for the motors/ loads.
 - 5.31.1.5 Local control panels/ local push button stations (as required).
 - 5.31.1.6 Earthing material as required for earthing for package equipments.
 - 5.31.1.7 Any other equipment not specifically mentioned above but required for normal operation of the package equipments.
- 5.31.2 PDB shall be single front, compartmentalized, and fixed type. PDB shall be suitable for 415V, 50Hz, TPN, 50 kA (1 sec.) with single bus, two SFU incomers (4 Pole) provided with manual transfer facility and mechanical interlocking between incomers.
- 5.31.3 The number of feeders in the PDB shall be as per the electrical loads of the respective building, where PDB is located. PDB for AC Plant room in shall also include feeders for downstream PDBs located in each AHU Room
- 5.31.4 All PDBs shall be suitable for TOP Cable entry. Minimum clear space of 1000mm shall be maintained in front of PDBs.
- 5.31.5 Incomer feeder shall be provided with voltmeter and ammeter. Incomer SFU shall be 4 Pole type. All motor& other feeders shall be provided with hardware as per the respective datasheets for same attached with the tender, however same shall be in fixed execution. Field ammeter shall be provided in LCS for motors above 55 kW.
- 5.31.6 Providing required interlocking between main PDB & sub PDB of A/C system of a particular building shall be in vendor scope.
- 5.31.7 For Air-conditioning, all blowers shall trip and all "Fire Dampers" shall automatically close on receipt of "Fail-safe FIRE signal" i.e. normally closed but open on Fire condition contact. CONTRACTOR shall take care of this contact in fire alarm system of building. Further distribution of fire signal to each vendor's sub PDB in AHU room (for air-conditioning system) shall be in vendor's scope.

- 5.31.8 All indicating lamps shall be LED type. LED for Space heater 'ON' indication shall be provided for all feeders.
- 5.31.9 20% spare outgoing feeder or minimum one of each type, whichever is higher shall be provided for each PDB
- 5.31.10 Control transformer shall be provided for each outgoing feeder module.
- 5.31.11 Required number of earth plate shall be provided within AC room, AHU room, and pressurization room. Further connection of individual equipments with earthing system shall be done by contractor. For earthing of various equipments upto earth plate, earthing schedule attached with the tender shall be followed
- 5.31.12 All the Electrical work of this package shall be carried-out as per EIL Standard Spec no. 6-51-0093 for package units.
- 5.31.13 Co-ordination required for lighting and fire alarm installation works for areas with false ceiling and/ or air-conditioning ducts is in scope of vendor.

5.32 REQUIREMENT FOR EOT CRANE

- 5.32.1 One EOT Crane for GIS hall of suitable capacity shall be provided for erection & maintenance of largest GIS component/assembly. The crane shall consist of all special requirements & lifting assemblies for erection & maintenance of GIS equipment.
- 5.32.2 The capacity of the crane shall be sized to lift the heaviest GIS switchgear component.
- 5.32.3 The Crane shall be used for the erection and maintenance of the GIS switchgear component and all parts installed in the GIS switchgear room. On completion of erection of the switchgear, the CONTRACTOR shall completely service the crane before the handing over to client.
- 5.32.4 For detailed specifications of EOT crane, refer elsewhere in the tender document.

5.33 FIRE PROOFING SYSTEM

- 5.33.1 The fire-proof sealing system and fire protection coating system are required to prevent the spreading of fire from one place to another (or one zone to another) through the openings in wall / floor, along cables laid in trays / racks and through openings below floor-mounted Electrical Switchgear, MCC, Distribution Boards, Junction boxes, Cabinets and Panels. The systems shall be installed in the specified locations in consultation with the purchaser's engineer after all cables have been laid and terminated.
- 5.33.2 For further requirements/details refer Specification for Fire Proof Sealing System attached with the tender.

5.34 SYNCHRONISATION, CONTROL AND ANNUNCIATION PANEL (SCAP)

- 5.34.1 For the 220kV system covered under the scope of this tender hard wired control, metering and annunciation shall be provided on SCAP which shall be located in Main Substation MRSS-100 in P25 Area and same shall be of mosaic panel type. SCAP shall carry out the control, monitoring and annunciation functions including those of future incomers, which shall include but not be limited to the following
- 5.34.1.1 Control functions
- Control of all breakers (incomers, bus couplers, outgoing).
 - Tap changer control of Grid transformers
 - Auto/Manual synchronization of all incomers and bus couplers.
 - ON/OFF control of all incomers, outgoing feeders and bus couplers including outdoor IBPs in outdoor switchyard.
 - Manual Synchronization subsystem complete with running and incoming voltmeters, frequency meters, ON/OFF switch, check synchronizing and guard relays, switches, lamps and any other hardware as required.

- Manual Changeover of incomers & bus couplers.

5.34.1.2 Monitoring functions

- Voltage of incomers and buses.
- Current of each phase of incomers and bus couplers/section breakers
- Frequency of each incomer
- Power factor of each incomer
- MW, MVAR & MVA of each incomer and outgoing feeder.
- MWH, MVARH of each incomer
- Voltage and frequency recorder for each bus.
- Any other function, which is not mentioned but is essential for operation and safety of equipment and personnel.

5.34.1.3 Audio-visual annunciation Functions

Audio-visual annunciation shall be provided for monitoring the equipment, transformers, switchboard and other electrical equipment as a minimum, but shall not be limited to the following:

- Annunciation of Fault status of Breakers
- Operating and fault status of all protective relays and trip alarm of incomers, buscouplers, etc.
- Complete trip and non-trip alarm annunciation for all transformers including alarm of OLTC.
- Annunciation of all protective relays and trip alarms of all major electrical equipment in the substation
- Hooter and clock.

5.34.1.4 Status on mimic diagram

- ON/OFF/TRIP indications of all breakers
- Semaphore indicators for all circuit breakers, isolators and earth switches

5.34.1.5 Control And Operation Philosophy

- a) Switchboard shall have one local/remote control selector switch. When the switch is selected in local mode, the control will be done from GIS control cubicle.
 - It shall be possible to close any incomer and bus coupler/section breaker of GIS in test condition.
 - It shall be possible to close any of the outgoing breakers of GIS in service condition.
 - When selector switch is selected in remote mode, control shall be transferred to hard wired synchronizing panel (SCAP).
- b) Hard wired synchronizing panel (SCAP) shall be provided with the following selector switches for operation and control:
 - SW-1 3-position selector switch (SCAP/ OFF/ECS)
 - SW-2 4 position selector switches for each breaker to be synchronised (OFF/Dead bus/Manual synchronizing/Auto synchronizing)
 - Incomers selector switches shall be provided on SCAP for selecting the incomers to be sync checked and closed.
 - Contractor, based on the requirements of synchronizing scheme finalized shall decide quantities of these selector switches.

- Following operations shall be possible from SCAP:
 - Closing of all incomer breakers (in service position) and bus couplers/section breakers (in service position) on dead bus condition (bus coupler/ section breakers dead bus closing to be checked on either side).
 - Synchronizing and closing of selected incomer breakers (in service position) and bus couplers/ section breakers (in service position) through check synchronizing & auto synchroniser.
- Required interlocks for safe operation shall be provided.

5.35 ECS INTERFACE

- 5.35.1 All signals as per ECS IO List sheet attached elsewhere shall be provided in respective equipment for interface with the Electrical control system.
- 5.35.2 Number of analogue / digital IOs for ECS interface shall be worked out by the CONTRACTOR as per the ECS I/Os list attached.
- 5.35.3 CONTRACTOR to note that:
- 5.35.3.1 Acquisition of input/output (I/O) signals as hardwired or software:
- All numerical relays shall be connected to a substation automation system. ECS shall communicate with the substation automation system to acquire relay and metering status I/O signals of the relays. These I/O signals have been indicated as “relay and metering LAN” in the typical I/O list.
 - All other I/Os shall be acquired hardwired and have been indicated as “hardwired” in the typical I/O list.
 - In case any of these data cannot be acquired over the relay LAN, these signals have to be provided as hardwired. For requirement of numerical relays, refer Electrical part of contract document.
- 5.35.3.2 The I/O list is indicative only. Any other I/O required to meet the contract requirements shall be identified and provided by CONTRACTOR
- 5.35.3.3 Guidelines for ECS I/O Interface Design

Analogue Input Signals	Signal transducers for hard-wired analogue inputs shall have accuracy class 0.1 for the range 0-120%. All transducers shall be externally-powered types. External power supply shall be 230V AC UPS. For all measurements for I, V, MW, MVAR, Hz, obtained on the relay and metering LAN, maximum possible accuracy shall be ensured
Digital Input Signals	
Alarm (D)	Alarm is a signal which requires operator to be alerted such as VT circuit MCB (closed, open), relays 86 & 95 (operated, reset), auto-changeover (blocked, not blocked), DC control supply (healthy, failed), line voltage (unhealthy, healthy), bus voltage (unhealthy, healthy), motor trip from process, under-voltage trip. This shall be hardwired / on relay LAN as specified. For hardwired signal, potential free contacts of rating 1 A, 110V DC or 240 V AC, make to alarm (NO) preferred. CONTRACTOR shall specifically indicate if NC contact is being provided in place of NO contact. Generally a hardwired alarm point is put under "sequence of event" monitoring
Status (S)	For hardwired signal, potential free contacts of rating 1 A, 110V DC or 240 V AC, make to alarm (NO) required

Digital Output Signals

Command (C)

Hardwired through potential free changeover type contact of interposing relay, contact rating 5 A, 240 V AC and/or 4 A, 110V DC. Coil rating shall be 24 V DC

6 MISCELLANEOUS REQUIREMENTS

- 6.1 Equipment numbering scheme for equipment located in Substation shall be as per Design Basis document. Numbering scheme for other equipments shall be decided during detailed engineering.
- 6.2 Power system study shall be carried out in latest version of ETAP software. Contractor shall furnish the native file of ETAP after carrying out the preliminary study (stage-1), intermediate study (stage-2) & final study (stage-3). Following study shall be done by contractor & report shall be submitted to EIL/owner for review/approval:
 - a. Load flow
 - b. Short circuit
 - c. Motor startup studies (Largest HV and MV motor shall be intimated during detail engineering.
 - d. Transient stability
 - e. Harmonic study
 - f. Relay co-ordination
 - g. Insulation co-ordination (*)
 - h. Transformer inrush current (*)

(*) If the study is not part of ETAP, contractor shall utilize other reputed industry proven software to conduct these studies. Operating & contingency conditions for carrying out power system study shall be informed during detailed engineering.
- 6.3 Wherever switchboards are provided with online temperature monitoring system, thermography window in cable chamber is not required.
- 6.4 CONTRACTOR shall furnish complete relay coordination and relay settings for the complete package including coordination with other EPCC CONTRACTOR/owner, relay settings for the upstream feeders.
- 6.5 Paint shade for indoor electrical equipment shall be RAL 7032, & for outdoor electrical equipment shall be RAL 7031.
- 6.6 Suitability of cable terminal boxes/chambers for the respective cables sizes / runs as per the approved cable schedule shall be ensured by the CONTRACTOR.
- 6.7 All nuts, bolts, washers, spring washers, grouting bolts, anchor fasteners, etc. necessary for completion of job wherever used shall be of stainless steel SS304. External hardware for lighting fixture, junction boxes, 230V receptacles, and lighting panel shall be of stainless steel grade SS304.
- 6.8 All lugs to be supplied shall be heavy duty, long barrel, crimping type and made of tinned copper. Sector shaped/circular barrel lugs shall be provided for making connections for cables having sector shaped/circular geometry of conductors respectively.
- 6.9 Cable tag shall be stainless steel with cable tag engraved. All spare holes at feeder end shall be sealed using metallic plate and GI hardware.
- 6.10 Cable glands shall be of nickel-plated brass. Cable glands shall be single compression type for indoor equipments & double compression type for outdoor equipments.

- 6.11 CONTRACTOR to note that 3D modelling of substation building and equipments shall be done by contractor in line modelling specification attached with tender. PDF/ Hard Copy of GA drawings of Owner's equipments to be installed in the substation shall be provided to CONTRACTOR during detail engineering
- 6.12 Wherever single core cables are to be terminated in switchboard, aluminum gland plates shall be provided.
- 6.13 All Emergency Stop/Stop pushbuttons on LCS/LCP/Switchboard shall be provided with protective covers to avoid accidental operation.
- 6.14 Contractor shall include painting and marking of all buses, individual incomers, all outgoing feeders etc. with detail such as Tag no., feeder rating, sending end source reference etc. for all switchboards.
- 6.15 All switchboards, panels, etc. shall be provided with LED indications and adequate no. of LEDs shall be provided to give required illumination.
- 6.16 All ACB fed motor feeders (>55kW), schematics shall have provision for auto start and auto re-acceleration with feature to inhibit irrespective of process/licensor's requirement. Reacceleration scheme for contactor fed motors (<=55kW) shall be provided by Contractor for all those drives requiring reacceleration as per Process requirements.
- 6.17 For owner supplied items, feeders at 415V/230V AC/ 110V DC/ 230V AC UPS voltage shall be provided by the contractor in the respective switchboard supplied by them. The details for same shall be provided during detailed engineering.
- 6.18 All the critical inputs must be wired in SAS/ECS for proper monitoring.
- 6.19 Armoured cables with double compression glands shall be used inside Battery Rooms along with FLP fittings/equipments.
- 6.20 Contractor / vendor shall comply with the requirements as per Ministry of Power (GoI)'s various orders regarding testing of all equipment, components & parts imported for use in the power supply system for cyber security to check for any kind of embedded malware/Trojans/cyber threat and for adherence to Indian Standards. Necessary testing of their equipment/ components at designated labs & obtaining test certificates in line with MOP orders shall be done by contractor/vendor
- 6.21 Color of HDPE duct for various application shall be as under :

Sr. No.	Application	Colour
1.	Fire Alarm System Data highway OFC cables	Fire Red
2.	Substation Automation system	Black with blue strips
3.	ECS System OFC Cables	Black with red strip for main data highway. Black with blue strip for redundant data highway.
4.	HDPE conduit for LAN line OFC	YELLOW conduit with BLACK strip
5.	HDPE conduit for Feeder differential protection System	GREEN conduit with WHITE strip

6.22 ADDITIONS / DELETIONS / MODIFICATIONS TO STANDARD SPECIFICATION

6.22.1 Specification for Earthing Installation (6-51-0084 Rev.4)

6.22.1.1 The last sentence of clause no.5.1 of 6-51-0084 stands modified as below:

“The Earth electrodes shall be so located such that inter distance/ mutual separation between two electrodes shall not be less than twice the driven depth, however in areas where there is physical limitation to meet the above separation, the mutual spacing can be reduced to a value not less than the driven depth of each electrode”.

6.22.2 Specification for Medium and High Voltage cables & accessories (6-51-0051 Rev.8)

6.22.2.1 Clause No. 5.1.6 (b) shall be read as below:

“Temperature index as per ASTM-D-2863 i.e. to determine at what temperature normal oxygen content of 21% in air will support combustion of FRLS sheath will remain as 250°C”.

6.22.2.2 Refer Cl. 6.3.1 and note that standard cable drum lengths for below mentioned cable sizes stands revised as mentioned below:

- Multi core power cables up to 50 sq.mm. – 2000 m
- Control cable of size up to 7x2.5 sq.mm. – 2000 m

6.22.2.3 The following point is added at the end of specification:

“For screen sizing calculations, final temperature to be considered shall be 200 °C under adiabatic conditions”.

6.22.3 Specification for Communication and Fire Alarm Cables (6-51-0052 Rev. 6)

The following clauses of 6-51-0052 stands modified as below:

6.22.3.1 Cl. 4.3.2 – For XLPE insulated PA/FA/Telephone/Paired Control Cables, insulation thickness (nominal values) shall be as per IS-7098 (Part-1).

6.22.3.2 Cl. No. 6.3 (d) - Temperature index as per ASTM-D-2863 i.e. to determine at what temperature normal oxygen content of 21% in air will support combustion of FRLS sheath shall remain as 250°C.

6.22.3.3 Cl. No. 7.3 – Standard cable drum lengths for below mentioned cable sizes stands revised as mentioned below:

- PA/FA/Signal cable having size up to 6 pair 1.5 & 2.5 sq.mm. – 2000 m
- PA/FA/Signal cable having size up to 10 pair 0.9 mm dia. – 2000 m

6.22.4 Specification for Uninterrupted Power Supply System (6-51-0017 Rev. 7)

6.22.4.1 The following is added at the end of Cl. No. 5.3.9 of specification:

“The efficiency of DC-DC Converter / Buck Boost Amplifier shall be considered in battery sizing calculations as well as rectifier sizing calculations and capacity of battery and rectifier shall be accordingly sized”.

6.22.5 Specification for Battery Charger (6-51-0019 Rev. 6)

6.22.5.1 The following is added at the end of Note-2 on Page 13 & 14 of specification:

“Battery isolator (MCCB/Switch Fuse) shall be provided with three pole version to ensure positive isolation of all the three connections of battery”.

6.22.6 Electrical Installation Standards 7-51-0201 Rev. 5, 7-51-0202 Rev. 5, 7-51-0221 Rev. 5 & 7-51-0233 Rev. 0

50 Dia. GI Pipe and 100 Dia. GI Pipe mentioned wherever in the standards shall be read as 50 NB (Medium Grade) GI Pipe and 100 NB (Medium Grade) GI Pipe respectively.

6.23 CONTRACTOR shall provide separate RCBO & MCB or separate ELCB & MCB for each lighting outgoing circuit at local lighting distribution panel. Common RCBO/ELCB + MCB unit is not acceptable. ELCB/RCBO shall be rated for 30mA in field and 300mA in indoors.

- 6.24 For wiring just above the false ceiling, METSEC channel shall be used. For wiring on true ceiling black enameled surface conduits shall be used.
- 6.25 All Copper Control cables shall be twisted paired (individual shielded and overall shielded) only. Minimum 10% spare pair or minimum 1 spare pair shall be provided.
- 6.26 All Multi-Function Meter (MFM) in HV & MV switchboards shall be communicable type. Complete data of MFM shall be accessible in the SAS (through switchboard level Ethernet switches) & associated SAS Laptop/ HMI. The protocol for communication shall be over RS-485 or fibre optic cable, preferably with IEC protocol. Accordingly, protocol convertors/gateways at suitable locations as required shall be provided by CONTRACTOR for data integration on IEC 61850 protocol from Master Ethernet switch to Owner's ECS system.

7 SPARES

- 7.1 Commissioning spares for all electrical equipments are included in Package Contractor's scope of supply and shall be included in the base price.
- 7.2 Mandatory Electrical spares as per document No. B269-999-16-50-SL-0020, are included in vendor's scope of supply.
- 7.3 Unit rates for two years recommended O&M spares along with list of recommended spares for each equipment provided as a part of this package, shall be provided by CONTRACTOR along with offer
- 7.4 Recommended list of maintenance spares for two years operation shall include the following as a minimum for motors. Vendor shall ensure to quote for the same.
- Bearing for DE/NDE-one set
 - Terminal box cover with screws
 - Fan
 - Terminal block

8 INSTALLATION, FIELD TESTING & COMMISSIONING AT SITE

- 8.1 Contractor shall carry out the installation, field testing and commissioning of all items including installation in field, testing and commissioning of free issue items in accordance with Consultant installation standard & standard specification attached with tender.
- 8.2 Contractor shall coordinate with manufacturers of other equipment wherever required and shall freely and readily supply all technical information for this purpose as and when called for.
- 8.3 Contractor shall comply with the requirements of Mechanical Completion as described in relevant section of Bid document.
- 8.4 Obtaining clearance for energizing the complete electrical facilities covered under this tender and approval of installation / drawings from central electrical inspector and any other concerned approving authority e.g. CCOE (PESO), OISD etc. shall be in the scope of the contractor.
- 8.5 Contractor shall also avail OEM (Original Equipment Manufacturer) services for testing and commissioning of equipment as listed elsewhere in the tender. However for other equipment, contractor shall ensure services of manufacturers' representatives for supervision of installation, testing and commissioning.
- 8.6 Testing and commissioning of all free issue relays for installation in Owner's sending/receiving end switchboard feeders, relay setting for all these feeders at site including supply, installation and testing of application software as required for numerical relays and Owner's laptop/ HMI (of 220 kV, 66kV and 33kV / 6.6 kV / 415V) are included in the scope of vendor. Relay manufacturer shall be solely responsible for numerical relays integration, relay setting etc. for the complete switchboards.

- 8.7 Splicing of FO cable and taking over from cable laying contractor and glanding of same shall be in the scope of CONTRACTOR. OTDR test shall be done mandatorily after taking over from cable laying contractor.
- 8.8 Structural steel support shall be fabricated of rolled MS sections after shot blasting, welding, bolting, riveting, supply of necessary anchor bolts and grouting etc. including supply of paint and applying one coat of anti-rust primer and two finished coats of approved synthetic enamel paint (suitable for highly corrosive environment) as per painting specification attached with tender.
- 8.9 Cable support structure below the GIS shall NOT be fixed to the floor/ wall, instead shall be connected to GIS structure, to avoid this structure coming off the fixing during the short circuit.
- 8.10 Chequered plate shall be painted in accordance with painting specification 6-79-0020 enclosed elsewhere in the bid package.
- 8.11 HV cables being free issued by owner shall be made available at OWNER's warehouse. Transportation of cables from warehouse to site, laying and termination of cables including supply of all cable laying accessories, cable joints, cable termination kits, etc. is in scope of contractor.
- 8.12 Painting/ marking/ numbering of all buses of switchboards and each incoming/ outgoing feeder with details of tag number, feeder rating in front and rear of panel and all other equipments viz. transformers, lighting fixtures, FA devices, junction boxes, motors, welding receptacles, convenience receptacles, local control stations, etc. shall be done as per requirement of Engineer-in-charge at site.

9 INSPECTION AND TESTING AT MANUFACTURER'S WORKS

- 9.1 All major electrical equipment and material shall be subject to inspection by owner/ Consultant or authorized representative at manufacturers' works. Contractor/Vendor/ Sub-Vendor shall furnish all necessary information concerning the supply to owner/ Consultant.
- 9.2 During fabrication, all the equipment shall be subject to inspection by owner/Consultant or by an agency authorized by the owner to assess the progress of work as well as to ascertain that only quality raw material is used.
- 9.3 Type, routine and acceptance tests to be conducted on all equipment shall include all tests as specified in standard specifications & data sheets enclosed with the package.
- 9.4 Contractor shall ensure that the electrical equipment procured have type test certificates.
- 9.5 All routine and acceptance tests as specified by the applicable standards shall be carried out by the contractor/vendor/sub-vendor and these tests shall be witnessed by owner/ Consultant or an agency authorized by owner/ Consultant Any other test and quality assurance requirements as defined elsewhere in the package shall also be complied.
- 9.6 All the equipment offered shall have valid type test certificates of recognized testing house such as CPRI, CMRI, PTB, BASEEFA, UL or equivalent.
- 9.7 Wherever, EIL Inspection and test plan is not available for electrical equipments e.g. Solar rooftop photovoltaic system, etc., CONTRACTOR/ Supplier shall develop QAPs using the specific requirements of Inspection and testing as covered in the tender. The QAPs are required to be reviewed and approved by EIL/Owner.

10 STATUTORY APPROVAL OF WORKS

- 10.1 The contractor shall obtain approvals from the concerned electrical inspectorate for installation drawings and engineering of the electrical system and equipment covered under the contractor's scope. Any modification or additional requirements of the electrical inspectorate shall have to be carried out by the contractor at his own cost without affecting time schedule. Arranging for any other approvals required for the complex, from agencies such as CCOE, CEA etc. are

included in the contractor's scope. For electrical equipment to be installed in hazardous area, statutory approval certificates shall be furnished by the contractor. Any additional testing, if required, shall be carried out by the contractor without affecting project time schedule at no extra cost to Owner.

- 10.2 The inspection and acceptance of the work as above shall not absolve the Contractor from any of his responsibilities under this package. Obtaining clearance for energizing the complete electrical facilities covered under this tender, and approval of installation and drawings from the Chief Electrical Inspectorate/CEA/HVPNL/Power Supply Company shall be the responsibility of the contractor.

11 MAKES OF EQUIPMENT AND COMPONENTS

- 11.1 List of approved vendors for Electrical equipment/components is as mentioned elsewhere in the Master Vendor List, attached with the tender.
- 11.2 All electrical equipment shall be brand new with state of art technology and proven track record. No prototype shall be offered. The make and type of equipment, if not specified in this bid document, shall be subject to approval of owner/ Consultant.
- 11.3 Additional makes of imported items shall be subject to Owner/Consultant's approval during detailed engineering.
- 11.4 Vendor may procure material from any of the listed vendors. However current validity and range of approval as per Consultant enlistment letter, workload, stability and solvency need to be verified by the vendor before placement of order.
- 11.5 Vendor shall ensure the availability of spare parts and maintenance support services for the offered equipment at least for 10 years from the date of supply. Vendor/ sub-vendor shall give a notice of at least one year to the end user of equipment and PMC before phasing out the products/spares to enable the end user for placement of order for spares and services.

इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (भारत सरकार का उपक्रम) (A Govt. of India Undertaking)				220 kV GIS FEEDER DETAIL DATASHEET (HV-100103)										Data sheet No.				
														B269-999-16-50-DS-0034				
														Rev.No. E				
E	18-05-2022	REVISED & REISSUED WITH TA-02						MKM			RAHUL			HK				
D	06-04-2022	REVISED & ISSUED WITH TA-01						MKM			RAHUL			HK				
C	27-09-2021	REVISED AND REISSUED WITH TENDER						AKG			HK			HK				
B	05-07-2021	REVISED AND REISSUED WITH TENDER						AKG			HK			HK				
Rev.	Date							Prepared			Checked			Approved				
Project		P25 PANIPAT				Unit		SUBSTATION				Client			IOCL-PR			
Switchgear No.		HV-100103				Location		Substation-100 (MRSS)				Auto/ Manual Xfr.			Not Applicable			
Voltage		220 kV				Curent		2000 Amps				Fault Level			50 kA (3 Sec)			
Bus Differential		Required				Bus Diff. CT Ratio		2000/1										
S.No.	Feeder Nameplate Inscription				Bus Section			Breaker Rating/ Feeder Designation	CT Primary Rating (A)*				Cable Details			Reference Datasheet		Remarks
	Panel No. @	Feeder No. #	Feeder Description	Rating (MVA)#	Left	Right	Metering		Protection			Run	Core	Size	EIL Hardware Datasheet B269-999-16-50-1	Vendor Scheme No.@		
									O/C,S/C, E/F	Trafo/ Feeder Differential	REF Protection							
1			Incomer-1 from PR 220kV Indoor GIS in S/S-64: Existing Spare feeder of Bus-1 (With Line PT)		1		2000	2000	2000	2000	-	3	1	630	0036		Note-4	
2			Incomer-2 from PR 220kV Indoor GIS in S/S-64: Existing Spare feeder of Bus-2 (With Line PT)		1		2000	2000	2000	2000	-	3	1	630	0036		Note-4	
3			Incomer-3 from PR 220kV Indoor GIS in S/S-64: New extended feeder of Bus-1 (With Line PT)			1	2000	2000	2000	2000	-	3	1	630	0036		Note-4	
4			Incomer-4 from PR 220kV Indoor GIS in S/S-64: New extended feeder of Bus-2 (With Line PT)			1	2000	2000	2000	2000	-	3	1	630	0036		Note-4	
5			Bus Coupler 1A-1B		1		2000	2000	2000	-	-	-	-	-	0038			
6			Bus Coupler 2A-2B			1	2000	2000	2000	-	-	-	-	-	0038			
7			Bus Sectionalizer 1A-2A		1		2000	2000	2000	-	-	-	-	-	0038			
8			Bus Sectionalizer 1B-2B			1	2000	2000	2000	-	-	-	-	-	0038			

 ENGINEERS INDIA LIMITED (भारत सरकार का उपक्रम) (A Govt. of India Undertaking)				220 kV GIS FEEDER DETAIL DATASHEET (HV-100103)										Data sheet No. B269-999-16-50-DS-0034 Rev.No. E				
E	18-05-2022	REVISED & REISSUED WITH TA-02							MKM		RAHUL			HK				
D	06-04-2022	REVISED & ISSUED WITH TA-01							MKM		RAHUL			HK				
C	27-09-2021	REVISED AND REISSUED WITH TENDER							AKG		HK			HK				
B	05-07-2021	REVISED AND REISSUED WITH TENDER							AKG		HK			HK				
Rev.	Date								Prepared		Checked			Approved				
Project		P25 PANIPAT						Unit		SUBSTATION			Client		IOCL-PR			
Switchgear No.		HV-100103						Location		Substation-100 (MRSS)			Auto/ Manual Xfr.		Not Applicable			
Voltage		220 kV						Curent		2000 Amps			Fault Level		50 kA (3 Sec)			
Bus Differential		Required						Bus Diff. CT Ratio		2000/1								
S.No.	Feeder Nameplate Inscription				Bus Section			Breaker Rating/ Feeder Designation	CT Primary Rating (A)*				Cable Details			Reference Datasheet		Remarks
	Panel No. @	Feeder No. #	Feeder Description	Rating (MVA)#	Left	Right	Metering		Protection			Run	Core	Size	EIL Hardware Datasheet B269-999-16-50-1	Vendor Scheme No.@		
									O/C,S/C, E/F	Trafo/ Feeder Differential	REF Protection							
9			Bus PT 1A		1		-	-	-	-	-	-	-	-	-	0039		Note-7
10			Bus PT 1B		1		-	-	-	-	-	-	-	-	-	0039		Note-7
11			Bus PT 2A			1	-	-	-	-	-	-	-	-	-	0039		Note-7
12			Bus PT 2B			1	-	-	-	-	-	-	-	-	-	0039		Note-7
13			Spare Transformer Feeder-1	200	1		1250A	630	630	630	630	3	1	630	0040		Note-4	
14			Spare Transformer Feeder-2	200	1		1250A	630	630	630	630	3	1	630	0040		Note-4	
15			Transformer Feeder (TR-100011)	200	1		1250A	630	630	630	630	3	1	630	0040		Note-4	
16			Transformer Feeder (TR-100013)	200	1		1250A	630	630	630	630	3	1	630	0040		Note-4	
17			Transformer Feeder (TR-100012)	200		1	1250A	630	630	630	630	3	1	630	0040		Note-4	
18			Transformer Feeder (TR-100014)	200		1	1250A	630	630	630	630	3	1	630	0040		Note-4	
19			Transformer Feeder (Spare)-3	200		1	1250A	630	630	630	630	3	1	630	0040		Note-4	
20			Transformer Feeder (Spare)-4	200		1	1250A	630	630	630	630	3	1	630	0040		Note-4	

 ENGINEERS INDIA LIMITED (भारत सरकार का उपक्रम) (A Govt. of India Undertaking)				220 kV GIS FEEDER DETAIL DATASHEET (HV-100103)						Data sheet No. B269-999-16-50-DS-0034																																	
Rev.No. E																																											
E	18-05-2022	REVISED & REISSUED WITH TA-02				MKM		RAHUL		HK																																	
D	06-04-2022	REVISED & ISSUED WITH TA-01				MKM		RAHUL		HK																																	
C	27-09-2021	REVISED AND REISSUED WITH TENDER				AKG		HK		HK																																	
B	05-07-2021	REVISED AND REISSUED WITH TENDER				AKG		HK		HK																																	
Rev.	Date					Prepared		Checked		Approved																																	
<table border="1"> <tr> <td>Project</td> <td>P25 PANIPAT</td> <td>Unit</td> <td colspan="2">SUBSTATION</td> <td>Client</td> <td colspan="2">IOCL-PR</td> </tr> <tr> <td>Switchgear No.</td> <td>HV-100103</td> <td>Location</td> <td colspan="2">Substation-100 (MRSS)</td> <td>Auto/ Manual Xfr.</td> <td colspan="2">Not Applicable</td> </tr> <tr> <td>Voltage</td> <td>220 kV</td> <td>Curent</td> <td colspan="2">2000 Amps</td> <td>Fault Level</td> <td colspan="2">50 kA (3 Sec)</td> </tr> <tr> <td>Bus Differential</td> <td>Required</td> <td>Bus Diff. CT Ratio</td> <td colspan="2">2000/1</td> <td colspan="3"></td> </tr> </table>												Project	P25 PANIPAT	Unit	SUBSTATION		Client	IOCL-PR		Switchgear No.	HV-100103	Location	Substation-100 (MRSS)		Auto/ Manual Xfr.	Not Applicable		Voltage	220 kV	Curent	2000 Amps		Fault Level	50 kA (3 Sec)		Bus Differential	Required	Bus Diff. CT Ratio	2000/1				
Project	P25 PANIPAT	Unit	SUBSTATION		Client	IOCL-PR																																					
Switchgear No.	HV-100103	Location	Substation-100 (MRSS)		Auto/ Manual Xfr.	Not Applicable																																					
Voltage	220 kV	Curent	2000 Amps		Fault Level	50 kA (3 Sec)																																					
Bus Differential	Required	Bus Diff. CT Ratio	2000/1																																								
S.No.	Feeder Nameplate Inscription				Bus Section		Breaker Rating/ Feeder Designation	CT Primary Rating (A)*				Cable Details			Reference Datasheet		Remarks																										
	Panel No. @	Feeder No. #	Feeder Description	Rating (MVA)#	Left	Right		Metering	Protection				Run	Core	Size	EIL Hardware Datasheet B269-999-16-50-		Vendor Scheme No.@																									
									O/C,S/C, E/F	Trafo/ Feeder Differential	REF	Protection																															

Notes :

- CT primary current ratings indicated are tentative and shall be finalised during drawing approval stage without any cost implication. CT secondary shall be 1 Amps for all.
- # These shall be finalised during drawing approval stage and shall not have any cost implication.
- @ Data to be furnished by Vendor.
- Total number of runs collectively for R,Y and B phase are indicated. Cable runs and cable sizes are indicative and actual cable size shall be informed during review of documents post order without any time or cost implication.
- Gas Insulated surge arrestor shall be provided in incomers and all outgoing feeders. Line PT and Bus PT shall also be Gas Insulated Type.
- Bus differential protection and Bus wire check supervision shall be provided for the switchboard including corresponding CTs.
- Independent Bus PT panel shall be provided for all the four buses of the Double Bus GIS switchboard.

 ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)				66 kV GIS FEEDER DETAIL DATASHEET (HV-100111)								Data sheet No. B269-999-16-50-DS-0035 Rev.No. E							
E	18-05-2022	REVISED AND REISSUED WITH TA-02				MKM		RG		HK									
D	06-04-2022	REVISED AND REISSUED WITH TA-01				MKM		RG		HK									
C	27-09-2021	REVISED AND REISSUED WITH TENDER				AKG		HK		HK									
Rev.	Date					Prepared		Checked		Approved									
Project		P25 PANIPAT				Unit		SUBSTATION		Client		IOCL-PR							
Switchgear No.		HV-100111				Location		Substation-100 (MRSS)		Auto/ Manual Xfr.		Not Applicable							
Voltage		66 kV				Curent		3150 Amps		Fault Level		40 kA (3 Sec)							
Bus Differential		Required				Bus Diff. CT Ratio		3150/1											
S.No.	Feeder Nameplate Inscription				Bus Section			Breaker Rating/ Feeder Designation	CT Primary Rating (A)*				Cable Details			Reference Datasheet		Remarks	
	Panel No. @	Feeder No. #	Feeder Description	Rating (MVA)#	Left	Mid	Right		Metering	Protection				Run	Core	Size	EIL Hardware Datasheet B269-999-16-50-		Vendor Scheme No.@
										O/C,S/C, E/F	Trafo/ Feeder Differential	REF	Protection						
1			Incomer from Transformer (With Line PT)	200			3	2000A	2000	2000	2000	-	GIBD			0042		Note-8	
2			Incomer from Transformer (With Line PT)	200	3	2		2000A	2000	2000	2000	-	GIBD			0042		Note-8	
3			Bus Coupler 1A-2A		1			3150A	3150	3150	-	-	-	-	-	0044			
4			Bus Coupler 3A-3B				1	3150A	3150	3150	-	-	-	-	-	0044			
5			Bus Sectionalizer 1A-2A			1		3150A	3150	3150	-	-	-	-	-	0044			
6			Bus Sectionalizer 2A-2B			1		3150A	3150	3150	-	-	-	-	-	0044			
7			Bus Sectionalizer 2A-3A				1	3150A	3150	3150	-	-	-	-	-	0044			
8			Bus Sectionalizer 2B-3B				1	3150A	3150	3150	-	-	-	-	-	0044			
9			Bus PT 1A		1			-	-	-	-	-	-	-	-	0045		Note-7	
10			Bus PT 1B		1			-	-	-	-	-	-	-	-	0045		Note-7	
11			Bus PT 2A			1		-	-	-	-	-	-	-	-	0045		Note-7	
12			Bus PT 2B			1		-	-	-	-	-	-	-	-	0045		Note-7	
13			Bus PT 3A				1	-	-	-	-	-	-	-	-	0045		Note-7	
14			Bus PT 3B				1	-	-	-	-	-	-	-	-	0045		Note-7	
15			Transformer Feeder	12.5		2	2	1000A	120	120	120	-	3	1	300	0046		Note-4	
16			Transformer Feeder	16		1	1	1000A	160	160	160	-	3	1	300	0046		Note-4	

 ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)				66 kV GIS FEEDER DETAIL DATASHEET (HV-100111)						Data sheet No. B269-999-16-50-DS-0035 Rev.No. E								
E	18-05-2022	REVISED AND REISSUED WITH TA-02				MKM		RG		HK								
D	06-04-2022	REVISED AND REISSUED WITH TA-01				MKM		RG		HK								
C	27-09-2021	REVISED AND REISSUED WITH TENDER				AKG		HK		HK								
Rev.	Date					Prepared		Checked		Approved								
Project		P25 PANIPAT				Unit		SUBSTATION		Client		IOCL-PR						
Switchgear No.		HV-100111				Location		Substation-100 (MRSS)		Auto/ Manual Xfr.		Not Applicable						
Voltage		66 kV				Curent		3150 Amps		Fault Level		40 kA (3 Sec)						
Bus Differential		Required				Bus Diff. CT Ratio		3150/1										
S.No.	Feeder Nameplate Inscription				Bus Section			CT Primary Rating (A)*				Cable Details			Reference Datasheet		Remarks	
	Panel No. @	Feeder No. #	Feeder Description	Rating (MVA)#	Left	Mid	Right	Breaker Rating/ Feeder Designation	Metering	Protection			Run	Core	Size	EIL Hardware Datasheet B269-999-16-50		Vendor Scheme No.@
										O/C,S/C, E/F	Trafo/ Feeder Differential	REF Protection						
17			Transformer Feeder	20		1	1	1000A	200	200	200	-	3	1	300	0046		Note-4
18			Transformer Feeder	25	1	4	6	1000A	250	250	250	-	3	1	300	0046		Note-4
19			Transformer Feeder	31.5	2	7	6	1000A	320	320	320	-	3	1	400	0046		Note-4
20			Tie Transformer Feeder - I/C	125	1	1		1250A	1250	1250	1250	1250	6	1	1000	0048		Note-4
21			Tie Transformer Feeder - O/G	125	1	1		1250A	1250	1250	1250	1250	6	1	1000	0047		Note-4
24			Transformer feeder-Spare	20		1	1	1000A	200	200	200	-	3	1	300	0046		Note-4
25			Transformer feeder-Spare	25		1	1	1000A	250	250	250	-	3	1	300	0046		Note-4
26			Transformer feeder-Spare	31.5	1	1	2	1000A	320	320	320	-	3	1	400	0046		Note-4
Notes : 1 `**` CT primary current ratings indicated are tentative and shall be finalised during drawing approval stage without any cost implication. CT secondary shall be 1 Amps for all. 2 `#` These shall be finalised during drawing approval stage and shall not have any cost implication. 3 `@` Data to be furnished by Vendor. 4 Total number of runs collectively for R,Y and B phase are indicated. Cable runs and cable sizes are indicative and actual cable size shall be informed during review of documents post order without any time or cost implication. 5 Gas Insulated surge arrestor shall be provided in incomers and all outgoing feeders. Line PT and Bus PT shall also be Gas Insulated Type. 6 Bus differential protection and Bus wire check supervision shall be provided for the switchboard including corresponding CTs. 7 Independent Bus PT panel shall be provided for all the four buses of the Double Bus GIS switchboard. 8 For two numbers future incomers GIBD/Cable connection shall be finalised post order during detail engineering with any time and cost implication to EIL/Owner.																		

TYPICAL ECS IO LIST

220 KV GIS PACKAGE

TENDER NO. B269-999-16-50-EB-T-0020

PROJECT : PANIPAT REFINERY EXPANSION (P-25) PROJECT

CLIENT : M/s INDIAN OIL CORPORATION LTD

CONSULTANT : ENGINEERS INDIA LTD

EIL JOB NO. : B269

C	13.05.2022	Revised & Reissued with Tender	MKM	RG	HK
B	05.07.2021	Revised and Reissued with tender	AKG	HK	HK
A	11.05.2020	Issued with tender	AKG	HK	HK
Rev.	Date	Subject	By	Checked	Approved
 ENGINEERS INDIA LIMITED		Project : P25 PROJECT Client : M/s IOCL	TYPICAL ECS IO LIST 220 KV GIS PACKAGE	Drawing Number.	Rev
				B269-999-16-50-DS-0054	C

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	INCOMER	AI	MEASURING	R-Phase Current			HARDWIRED	FROM MEASURING CT CORES TO TRANSDUCERS IN ECS TRANSDUCER PANEL
220 & 66 kV DBB GIS	INCOMER	AI	MEASURING	Y-Phase Current			HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	AI	MEASURING	B-Phase Current			HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	AI	MEASURING	Three Phase Real Power (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	AI	MEASURING	Three Phase Reactive Power (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	AI	MEASURING	Power Factor			HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	CB in Service and	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	CB in Service and	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Bus Side Isolator 1	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Bus Side Isolator 1	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Bus Side Isolator 1 Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Bus Side Isolator 1 Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Bus Side Isolator 2	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Bus Side Isolator 2	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Line Side Isolator 1	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Line Side Isolator 1	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Line Side Isolator 1 Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Line Side Isolator 1 Earth Switch	Open	Closed	HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	High Speed Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	High Speed Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Feeder Differential	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Relay 86 - Lock Out Relay	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Gas Pressure Low	Operated=1		HARDWIRED	Separate for each compartment
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	No Voltage Signal from Cap. Voltage Detector	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Local Remote Selector Switch	Local		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Local Remote Selector Switch	Remote		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	CB Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	Trip form ECS (TC-1)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	Trip from ECS (TC-2)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	Close Inhibit (From ECS)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	Bus Side Isolator 1 Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	Bus Side Isolator 1 Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	Bus Side Isolator 1 Earth Switch Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	Bus Side Isolator 1 Earth Switch Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	Bus Side Isolator 2 Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	Bus Side Isolator 2 Close Command	Activated=1		HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	Line Side Isolator Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DO	COMMAND	Line Side Isolator Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Pole Discordance	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Relay 95 - Trip Circuit - 1 Supervision	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Relay 95 - Trip Circuit - 2 Supervision	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Relay 80	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Tripped on Undervoltage	Activated=1		RELAY LAN	
220 & 66 kV DBB GIS	INCOMER	DI	STATUS	Numerical Relay	Unhealthy=1		RELAY LAN	For each type of Relay
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	AI	MEASURING	R-Phase Current			HARDWIRED	FROM MEASURING CT CORES TO TRANSDUCERS IN ECS TRANSDUCER PANEL
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	AI	MEASURING	Y-Phase Current			HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	AI	MEASURING	B-Phase Current			HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	AI	MEASURING	Three Phase Real Power (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	AI	MEASURING	Three Phase Reactive Power (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	AI	MEASURING	Power Factor			HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	CB in Service and	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	CB in Service and	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Cable Side Isolator 1	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Cable Side Isolator 1	Open	Closed	HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Cable Side Isolator 1 Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Cable Side Isolator 1 Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Outgoing Cable Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Outgoing Cable Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Line Side Isolator 1	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Line Side Isolator 1	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Line Side Isolator 1 Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Line Side Isolator 1 Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	High Speed Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	High Speed Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Feeder Differential for Cable	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Feeder Differential for Line	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Relay 86 - Lock Out Relay	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Gas Pressure Low	Operated=1		HARDWIRED	Separate for each compartment
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	No Voltage Signal from Cap. Voltage Detector	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Local Remote Selector Switch	Local		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Local Remote Selector Switch	Remote		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	CB Close Command	Activated=1		HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	Trip form ECS (TC-1)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	Trip from ECS (TC-2)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	Close Inhibit (From ECS)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	Bus Side Isolator 1 Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	Bus Side Isolator 1 Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	Bus Side Isolator 1 Earth Switch Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	Bus Side Isolator 1 Earth Switch Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	Bus Side Isolator 2 Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	Bus Side Isolator 2 Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	Line Side Isolator Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DO	COMMAND	Line Side Isolator Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Pole Discordance	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Relay 95 - Trip Circuit - 1 Supervision	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Relay 95 - Trip Circuit - 2 Supervision	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Relay 80	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Tripped on Undervoltage	Activated=1		RELAY LAN	
220 & 66 kV DBB GIS	ISOLATING BREAKER PANEL	DI	STATUS	Numerical Relay	Unhealthy=1		RELAY LAN	For each type of Relay
220 & 66 kV DBB GIS	LINE PT	AI	MEASURING	R-Y Line Voltage			HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	LINE PT	AI	MEASURING	Y-B Line Voltage			HARDWIRED	FROM PT TO TRANSDUCERS IN ECS TRANSDUCER PANEL
220 & 66 kV DBB GIS	LINE PT	AI	MEASURING	R-B Line Voltage			HARDWIRED	
220 & 66 kV DBB GIS	LINE PT	AI	MEASURING	Line Frequency			HARDWIRED	
220 & 66 kV DBB GIS	LINE PT	DI	STATUS	Line PT Primary Side Disconnecter	OPEN		HARDWIRED	
220 & 66 kV DBB GIS	LINE PT	DI	STATUS	Line PT Primary Side Disconnecter	CLOSED		HARDWIRED	
220 & 66 kV DBB GIS	LINE PT	DI	STATUS	Line PT Primary Side Disconnecter	EARTHED		HARDWIRED	
220 & 66 kV DBB GIS	LINE PT	DI	STATUS	Line PT Secondary MCB	Tripped=1		HARDWIRED	
220 & 66 kV DBB GIS	LINE PT	DI	STATUS	Line	Dead = 1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	AI	MEASURING	R-Phase Current			HARDWIRED	FROM MEASURING CT / PT CORES TO TRANSDUCERS IN ECS TRANSDUCER PANEL
220 & 66 kV DBB GIS	PLANT FDR	AI	MEASURING	Y-Phase Current			HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	AI	MEASURING	B-Phase Current			HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	AI	MEASURING	Three Phase Real Power (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	AI	MEASURING	Three Phase Reactive Power (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	AI	MEASURING	Power Factor			HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	CB in Service and	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	CB in Service and	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Bus Side Isolator 1	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Bus Side Isolator 1	Open	Closed	HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Bus Side Isolator 1 Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Bus Side Isolator 1 Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Bus Side Isolator 2	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Bus Side Isolator 2	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Line Side Isolator 1	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Line Side Isolator 1	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Line Side Isolator 1 Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Line Side Isolator 1 Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	High Speed Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	High Speed Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Feeder Differential	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Relay 86 - Lock Out Relay	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Gas Pressure Low	Operated=1		HARDWIRED	Separate for each compartment
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	No Voltage Signal from Cap. Voltage Detector	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Local Remote Selector Switch	Local		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Local Remote Selector Switch	Remote		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	CB Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	Trip form ECS (TC-1)	Activated=1		HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	Trip from ECS (TC-2)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	Close Inhibit (From ECS)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	Bus Side Isolator 1 Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	Bus Side Isolator 1 Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	Bus Side Isolator 1 Earth Switch Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	Bus Side Isolator 1 Earth Switch Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	Bus Side Isolator 2 Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	Bus Side Isolator 2 Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	Line Side Isolator Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DO	COMMAND	Line Side Isolator Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Pole Discordance	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Relay 95 - Trip Circuit - 1 Supervision	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Relay 95 - Trip Circuit - 2 Supervision	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Relay 80	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	PLANT FDR	DI	STATUS	Numerical Relay	Unhealthy=1		RELAY LAN	For each type of Relay
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	AI	MEASURING	R-Phase Current (Bi-directional)			HARDWIRED	FROM MEASURING CT / PT CORES TO TRANSDUCERS IN
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	AI	MEASURING	Y-Phase Current (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	AI	MEASURING	B-Phase Current (Bi-directional)			HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	AI	MEASURING	Three Phase Real Power (Bi-directional)			HARDWIRED	CONNECTED TO TRANSDUCCERS IN ECS TRANSDUCER PANEL
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	AI	MEASURING	Three Phase Reactive Power (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	AI	MEASURING	Power Factor			HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	CB in Service and	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	CB in Service and	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Bus Side Isolator 1	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Bus Side Isolator 1	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Bus Side Isolator 1 Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Bus Side Isolator 1 Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Bus Side Isolator 2	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Bus Side Isolator 2	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Line Side Isolator 1	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Line Side Isolator 1	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Line Side Isolator 1 Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Line Side Isolator 1 Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	High Speed Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	High Speed Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Restricted Earth Fault	Operated=1		HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Transformer Differential	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Relay 86 - Lock Out Relay	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Gas Pressure Low	Operated=1		HARDWIRED	Separate for each compartment
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	No Voltage Signal from Cap. Voltage Detector	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Local Remote Selector Switch	Local		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Local Remote Selector Switch	Remote		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	CB Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	Trip form ECS (TC-1)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	Trip from ECS (TC-2)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	Close Inhibit (From ECS)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	Bus Side Isolator 1 Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	Bus Side Isolator 1 Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	Bus Side Isolator 1 Earth Switch Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	Bus Side Isolator 1 Earth Switch Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	Bus Side Isolator 2 Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	Bus Side Isolator 2 Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	Line Side Isolator Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DO	COMMAND	Line Side Isolator Close Command	Activated=1		HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Pole Discordance	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Relay 95 - Trip Circuit - 1 Supervision	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Relay 95 - Trip Circuit - 2 Supervision	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Relay 80	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Numerical Relay	Unhealthy=1		RELAY LAN	For each type of Relay
220 & 66 kV DBB GIS	TRANSFORMER / TIE FDR	DI	STATUS	Transformer Trouble	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	GRID TRANSFORMER	AI	MEASURING	Oil Temperature			HARDWIRED	4-20mA THROUGH TRAFO MBOX
220 & 66 kV DBB GIS	GRID TRANSFORMER	AI	MEASURING	Winding Temperature			HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC L/R Selector Switch	Local	Not Local	HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC L/R Selector Switch	Remote	Not Remote	HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	ECS/ RTCC Selector Switch	ECS	Not ECS	HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	ECS/ RTCC Selector Switch	RTCC	Not RTCC	HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC I/A Selector Switch	Independent	Not Indepen.	HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC I/A Selector Switch	Auto	Not Auto	HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Run Mode	Master	Not Master	HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Run Mode	Follower	Not Follower	HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	Tap Changer In Progress	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	Tap Changer Stuck	Activated=1		HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	GRID TRANSFORMER	DO	COMMAND	Tap Raise Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DO	COMMAND	Tap Lower Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 1	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 2	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 3	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 4	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 5	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 6	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 7	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 8	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 9	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 10	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 11	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 12	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 13	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 14	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 15	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 16	Activated=1		HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	OLTC Tap at Position 17	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	TCIV Closed	Activated=1		HARDWIRED	From NIFPS
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	Fire Detector Tripped	Activated=1		HARDWIRED	From NIFPS
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	Oil Drain Valve Open	Activated=1		HARDWIRED	From NIFPS
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	Extinction in Progress	Activated=1		HARDWIRED	From NIFPS
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	Cylinder Pressure Low	Activated=1		HARDWIRED	From NIFPS
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	System Out of Service	Activated=1		HARDWIRED	From NIFPS
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	NIFPS not in Auto	Activated=1		HARDWIRED	From NIFPS
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	DC Supply to NIFPS Fail	Activated=1		HARDWIRED	From NIFPS
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	Fire Detector Tripped	Activated=1		HARDWIRED	From HVWS
220 & 66 kV DBB GIS	GRID TRANSFORMER	DI	STATUS	Online Moisture Removal System	Healthy		HARDWIRED	From system panel
220 & 66 kV DBB GIS	BUSPT	AI	MEASURING	R-Y Line Voltage			HARDWIRED	FROM PT TO TRANSDUCERS IN ECS TRANSDUCER PANEL
220 & 66 kV DBB GIS	BUSPT	AI	MEASURING	Y-B Line Voltage			HARDWIRED	
220 & 66 kV DBB GIS	BUSPT	AI	MEASURING	R-B Line Voltage			HARDWIRED	
220 & 66 kV DBB GIS	BUSPT	AI	MEASURING	Bus Frequency			HARDWIRED	
220 & 66 kV DBB GIS	BUSPT	DI	MEASURING	Bus PT Primary Side Disconnecter	OPEN		HARDWIRED	
220 & 66 kV DBB GIS	BUSPT	DI	MEASURING	Bus PT Primary Side Disconnecter	CLOSED		HARDWIRED	
220 & 66 kV DBB GIS	BUSPT	DI	MEASURING	Bus PT Primary Side Disconnecter	EARTHED		HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	BUSPT	DI	STATUS	Bus PT Secondary MCB	Tripped=1		HARDWIRED	
220 & 66 kV DBB GIS	BUSPT	DI	STATUS	STAGE 1 UFLS Operated	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUSPT	DI	STATUS	STAGE 2 UFLS Operated	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUSPT	DI	STATUS	STAGE 3 UFLS Operated	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUSPT	DI	STATUS	STAGE 4 UFLS Operated	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUSPT	DI	STATUS	Check Supervision for Bus Differential	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	BUSPT	DI	STATUS	Differential Protection for Bus	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	AI	MEASURING	R-Phase Current (Bi-directional)			HARDWIRED	THROUGH MEASURING CT CORES TO TRANSDUCERS IN ECS TRANSDUCER PANEL
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	AI	MEASURING	Y-Phase Current (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	AI	MEASURING	B-Phase Current (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	AI	MEASURING	Three Phase Real Power (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	AI	MEASURING	Three Phase Reactive Power (Bi-directional)			HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	AI	MEASURING	Power Factor			HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	CB in Service and	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	CB in Service and	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Isolator 1	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Isolator 1	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Isolator 1 Earth Switch	Closed	Open	HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Isolator 1 Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Isolator 2	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Isolator 2	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Isolator 2 Earth Switch	Closed	Open	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Isolator 2 Earth Switch	Open	Closed	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Bus Bar Differential	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Relay 95B	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Relay 86 - Lock Out Relay	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Gas Pressure Low	Operated=1		HARDWIRED	Separate for each compartment
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	No Voltage Signal from Cap. Voltage Detector - 1	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	No Voltage Signal from Cap. Voltage Detector - 2	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Local Remote Selector Switch	Local		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Local Remote Selector Switch	Remote		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	CB Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	Trip form ECS (TC-1)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	Trip from ECS (TC-2)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	Close Inhibit (From ECS)	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	Isolator 1 Open Command	Activated=1		HARDWIRED	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	Isolator 1 Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	Isolator 1 Earth Switch Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	Isolator 1 Earth Switch Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	Isolator 2 Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	Isolator 2 Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	Isolator 2 Earth Switch Open Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DO	COMMAND	Isolator 2 Earth Switch Close Command	Activated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Pole Discordance	Operated=1		HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Relay 95 - Trip Circuit - 1 Supervision	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Relay 95 - Trip Circuit - 2 Supervision	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Relay 80	Operated=1		RELAY LAN	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	Numerical Relay	Unhealthy=1		RELAY LAN	For each type of Relay
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	AI	MEASURING	MW Value from relay	Activated=1		RELAY LAN	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	AC Control Supply 1	Failed	Healthy	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	AC Control Supply 2	Failed	Healthy	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	DC Control Supply 1	Failed	Healthy	HARDWIRED	
220 & 66 kV DBB GIS	BUS COUPLER / SECTIONALISER	DI	STATUS	DC Control Supply 2	Failed	Healthy	HARDWIRED	
6.6 KV AIS	ISOLATING BKR PNL	AI	W	3-Phase Real Power			RELAY LAN	
6.6 KV AIS	ISOLATING BKR PNL	AI	R	3-Phase Reactive Power			RELAY LAN	
6.6 KV AIS	ISOLATING BKR PNL	AI		Power Factor			RELAY LAN	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
6.6 KV AIS	ISOLATING BKR PNL	DI	D	Line PT Secondary MCB	Tripped=1		HARDWIRED	
6.6 KV AIS	ISOLATING BKR PNL	DI	S	CB in service &	Closed	Not closed	HARDWIRED	
6.6 KV AIS	ISOLATING BKR PNL	DI	S	CB in service &	Open	Not open	HARDWIRED	
6.6 KV AIS	ISOLATING BKR PNL	DI	D	Relay 86	Operated	Reset	HARDWIRED	
6.6 KV AIS	ISOLATING BKR PNL	DI	D	Relay 95	Operated	Reset	RELAY LAN	
6.6 KV AIS	ISOLATING BKR PNL	DI	D	Trip on under voltage	Activated	Reset	RELAY LAN	
6.6 KV AIS	ISOLATING BKR PNL	DI	D	Numerical Relay	Unhealthy	Healthy	RELAY LAN	
6.6 KV AIS	ISOLATING BKR PNL	DO	C	Trip from ECS	Activated	Reset	HARDWIRED	
6.6 KV AIS	ISOLATING BKR PNL	DO	COMMAND	Close Inhibit (From ECS)	Activated=1		HARDWIRED	
6.6 KV AIS	ISOLATING BKR PNL	DI	D	Feeder Differential	Operated=1		RELAY LAN	
6.6 KV AIS	ISOLATING BKR PNL	DI	D	Transformer Trouble	Operated=1		RELAY LAN	63TX, 51G, 64R
6.6 KV AIS	ISOLATING BKR PNL	DI	D	Trafo Trouble Alarm (Buch., OTI, WTI)	Operated=1		RELAY LAN	
6.6 KV AIS	ISOLATING BKR PNL	DI	D	Trafo Trouble Trip (Buch., OTI, WTI)	Operated=1		RELAY LAN	
6.6 KV AIS	ISOLATING BKR PNL	DI	STATUS	AC Control Supply	Failed	Healthy	HARDWIRED	
6.6 KV AIS	ISOLATING BKR PNL	DI	STATUS	DC Control Supply	Failed	Healthy	HARDWIRED	
415V SWBD	Incomer (from trafo)	AI	A	R phase current			RELAY LAN	
415V SWBD	Incomer (from trafo)	AI	A	Y phase current			RELAY LAN	
415V SWBD	Incomer (from trafo)	AI	A	B phase current			RELAY LAN	
415V SWBD	Incomer (from trafo)	AI	W	3-phase real power			RELAY LAN	
415V SWBD	Incomer (from trafo)	AI	R	3-phase reactive power			RELAY LAN	
415V SWBD	Incomer (from trafo)	AI		Power factor			RELAY LAN	
415V SWBD	Incomer (from trafo)	DI	S	CB in service & Closed	Closed	Not closed	Hardwired	
415V SWBD	Incomer (from trafo)	DI	S	CB in service & Open	Open	Not open	Hardwired	
415V SWBD	Incomer (from trafo)	DO	C	Trip from ECS	Activated	Reset	Hardwired	
415V SWBD	Incomer (from trafo)	DO	C	Close Inhibit (From ECS)	Operated	Reset	Hardwired	
415V SWBD	Incomer (from trafo)	DI	D	Relay 95	Operated	Reset	RELAY LAN	
415V SWBD	Incomer (from trafo)	DI	D	Trip on under-voltage	Activated	Reset	RELAY LAN	
415V SWBD	Incomer (from trafo)	DI	D	Numerical Relays	Unhealthy	Healthy	RELAY LAN	
415V SWBD	Incomer (from trafo)	DI	S	Transformer trouble	Activated	Reset	RELAY LAN	
415V SWBD	Incomer (from trafo)	DI	D	Relay 86	Operated	Reset	Hardwired	
415V SWBD	Incomer (from trafo)	DI	D	Over Temperature monitoring system	Operated	Reset	Hardwired	
415V SWBD	Line PT I/O signals	AI	V	R-Y line voltage			RELAY LAN	
415V SWBD	Line PT I/O signals	AI	V	Y-B line voltage			RELAY LAN	
415V SWBD	Line PT I/O signals	AI	V	B-R line voltage			RELAY LAN	
415V SWBD	Line PT I/O signals	DI	D	Line VT MCB	Open	Closed	Hardwired	
415V SWBD	Incomer (other SWBD)	AI	A	R phase current			RELAY LAN	
415V SWBD	Incomer (other SWBD)	AI	A	Y phase current			RELAY LAN	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
415V SWBD	Incomer (other SWBD)	AI	A	B phase current			RELAY LAN	
415V SWBD	Incomer (other SWBD)	AI	W	3-phase real power			RELAY LAN	
415V SWBD	Incomer (other SWBD)	AI	R	3-phase reactive power			RELAY LAN	
415V SWBD	Incomer (other SWBD)	AI		Power factor			RELAY LAN	
415V SWBD	Incomer (other SWBD)	DI	S	CB in service & Closed	Closed	Not closed	Hardwired	
415V SWBD	Incomer (other SWBD)	DI	S	CB in service & Open	Open	Not open	Hardwired	
415V SWBD	Incomer (other SWBD)	DO	C	Trip from ECS	Activated	Reset	Hardwired	
415V SWBD	Incomer (other SWBD)	DO	C	Close Inhibit (From ECS)	Operated	Reset	Hardwired	
415V SWBD	Incomer (other SWBD)	DI	D	Relay 95	Operated	Reset	RELAY LAN	
415V SWBD	Incomer (other SWBD)	DI	D	Trip on under-voltage	Activated	Reset	RELAY LAN	
415V SWBD	Incomer (other SWBD)	DI	D	Numerical Relay	Unhealthy	Healthy	RELAY LAN	
415V SWBD	Incomer (other SWBD)	DI	D	Relay 86	Operated	Reset	Hardwired	
415V SWBD	Incomer (other SWBD)	DI	D	Over Temperature monitoring system	Operated	Reset	Hardwired	
415V SWBD	Bus coupler	AI	A	R phase current			RELAY LAN	
415V SWBD	Bus coupler	AI	A	Y phase current			RELAY LAN	
415V SWBD	Bus coupler	AI	A	B phase current			RELAY LAN	
415V SWBD	Bus coupler	AI	W	3-phase Real power			RELAY LAN	
415V SWBD	Bus coupler	AI	R	3-phase Reactive power			RELAY LAN	
415V SWBD	Bus coupler	AI		Power factor			RELAY LAN	
415V SWBD	Bus coupler	DI	S	CB in service & Closed	Closed	Not closed	Hardwired	
415V SWBD	Bus coupler	DI	S	CB in service & Open	Open	Not open	Hardwired	
415V SWBD	Bus coupler	DO	C	Trip from ECS	Activated	Reset	Hardwired	
415V SWBD	Bus coupler	DO	C	Close Inhibit (From ECS)	Operated	Reset	Hardwired	
415V SWBD	Bus coupler	DI	D	Relay 95	Operated	Reset	RELAY LAN	
415V SWBD	Bus coupler	DI	D	Auto-changeover	Blocked	Not blocked	RELAY LAN	
415V SWBD	Bus coupler	DI	D	Numerical Relay	Unhealthy	Healthy	RELAY LAN	
415V SWBD	Bus coupler	DI	D	Trip from under voltage	Activated	Reset	RELAY LAN	
415V SWBD	Bus coupler	DI	S	Switchboard (A-I-M selector switch)	In auto mode	Not in auto mode	Hardwired	
415V SWBD	Bus coupler	DI	S	Switchboard (A-I-M selector switch)	In independent mode	Not in indep mode	Hardwired	
415V SWBD	Bus coupler	DI	S	Switchboard (A-I-M selector switch)	In manual mode	Not in manual mode	Hardwired	
415V SWBD	Bus coupler	DI	D	DC control supply #1	Failed	Healthy	Hardwired	
415V SWBD	Bus coupler	DI	D	DC control supply #2	Failed	Healthy	Hardwired	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
415V SWBD	Bus coupler	DI	D	AC space heater supply #1	Failed	Healthy	Hardwired	
415V SWBD	Bus coupler	DI	D	AC space heater supply #2	Failed	Healthy	Hardwired	
415V SWBD	Bus coupler	DI	D	Relay 86	Operated	Reset	Hardwired	
415V SWBD	Bus PT	AI	V	R-Y bus voltage			RELAY LAN	
415V SWBD	Bus PT	AI	V	Y-B bus voltage			RELAY LAN	
415V SWBD	Bus PT	AI	V	B-R bus voltage			RELAY LAN	
415V SWBD	Bus PT	DI	D	Bus PT MCB	Open	Closed	Hardwired	
415V SWBD	Bus PT	DI	D	UF & df/dt Signal	Open	Closed	Hardwired	4 Stages
415V SWBD	Outgoing ACB feeder	AI	A	R phase current			RELAY LAN	
415V SWBD	Outgoing ACB feeder	AI	A	Y phase current			RELAY LAN	
415V SWBD	Outgoing ACB feeder	AI	A	B phase current			RELAY LAN	
415V SWBD	Outgoing ACB feeder	AI	W	Real power			RELAY LAN	
415V SWBD	Outgoing ACB feeder	AI	R	Reactive Power			RELAY LAN	
415V SWBD	Outgoing ACB feeder	AI		Power factor			RELAY LAN	
415V SWBD	Outgoing ACB feeder	DI	S	CB in service & Closed	Closed	Not closed	Hardwired	
415V SWBD	Outgoing ACB feeder	DI	S	CB in service & Open	Open	Not open	Hardwired	
415V SWBD	Outgoing ACB feeder	DI	C	Trip from ECS	Activated	Reset	Hardwired	
415V SWBD	Outgoing ACB feeder	DO	C	Close Inhibit (From ECS)	Operated	Reset	Hardwired	
415V SWBD	Outgoing ACB feeder	DI	D	Relay 95	Operated	Reset	RELAY LAN	
415V SWBD	Outgoing ACB feeder	DI	D	Numerical Relay	Unhealthy	Healthy	RELAY LAN	
415V SWBD	Outgoing ACB feeder	DI	D	Trip from under voltage	Activated	Reset	RELAY LAN	
415V SWBD	Outgoing ACB feeder	DI	D	Relay 86	Operated	Reset	Hardwired	
415V SWBD	Outgoing ACB motor	AI	A	R phase current			RELAY LAN	
415V SWBD	Outgoing ACB motor	AI	A	Y phase current			RELAY LAN	
415V SWBD	Outgoing ACB motor	AI	A	B phase current			RELAY LAN	
415V SWBD	Outgoing ACB motor	AI	W	Real power			RELAY LAN	
415V SWBD	Outgoing ACB motor	AI	R	Reactive Power			RELAY LAN	
415V SWBD	Outgoing ACB motor	AI		Power factor			RELAY LAN	
415V SWBD	Outgoing ACB motor	DI	S	Ready To Close			RELAY LAN	
415V SWBD	Outgoing ACB motor	DI	S	49T/50/50LR			RELAY LAN	
415V SWBD	Outgoing ACB motor	DI	S	Earth Fault			RELAY LAN	
415V SWBD	Outgoing ACB motor	DI	S	Unbalance			RELAY LAN	
415V SWBD	Outgoing ACB motor	DI	S	Under voltage Trip			RELAY LAN	
415V SWBD	Outgoing ACB motor	DI	S	Re-Acceleration			RELAY LAN	
415V SWBD	Outgoing ACB motor	DI	S	Reverse Blocking activated			RELAY LAN	
415V SWBD	Outgoing ACB motor	DI	S	Process Trip	Operated	Reset	RELAY LAN	
415V SWBD	Outgoing ACB motor	DI	S	CB in service & Closed	Closed	Not closed	Hardwired	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
415V SWBD	Outgoing ACB motor	DI	S	CB in service & Open	Open	Not open	Hardwired	
415V SWBD	Outgoing ACB motor	DI	S	Motor Trip from Process	Operated=1		Hardwired	
415V SWBD	Outgoing ACB motor	DO	C	Trip from ECS	Activated	Reset	Hardwired	
415V SWBD	Outgoing ACB motor	DO	C	Close Inhibit (From ECS)	Operated	Reset	Hardwired	
415V SWBD	Outgoing ACB motor	DI	D	Relay 86	Operated	Reset	Hardwired	
UPS System	UPS System	DI	D	UPS Charger – 1/1	Failure	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Inverter – 1/1	Failure	Normal	Hardwired	
UPS System	UPS System	DI	S	UPS load on Invertor – 1/1	Operated	Reset	Hardwired	
UPS System	UPS System	DI	D	UPS Fan Failure - 1/1	Fault	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Fault – 1/1	Fault	Normal	Hardwired	
UPS System	UPS System	AI	A	UPS Current – 1/1			Hardwired	4-20mA through transducers in UPS
UPS System	UPS System	AI	V	UPS Voltage – 1/1			Hardwired	
UPS System	UPS System	DI	D	UPS Charger – 1/2	Failure	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Inverter – 1/2	Failure	Normal	Hardwired	
UPS System	UPS System	DI	S	UPS load on Invertor – 1/2	Operated	Reset	Hardwired	
UPS System	UPS System	DI	D	UPS Fan Failure - 1/2	Fault	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Fault – 1/2	Fault	Normal	Hardwired	
UPS System	UPS System	AI	A	UPS Current – 1/2			Hardwired	4-20mA through transducers in UPS
UPS System	UPS System	AI	V	UPS Voltage – 1/2			Hardwired	
UPS System	UPS System	DI	S	UPS load on bypass supply – 1	Operated	Reset	Hardwired	
UPS System	UPS System	DI	D	UPS Battery – 1	Discharged	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Battery – 1	Isolated	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Battery Bank Monitoring System Alarm – 1	Operated	Reset	Hardwired	
UPS System	UPS System	DI	D	UPS Charger – 2/1	Failure	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Inverter – 2/1	Failure	Normal	Hardwired	
UPS System	UPS System	DI	S	UPS load on Invertor – 2/1	Operated	Reset	Hardwired	
UPS System	UPS System	DI	D	UPS Fan Failure - 2/1	Fault	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Fault – 2/1	Fault	Normal	Hardwired	
UPS System	UPS System	AI	A	UPS Current – 2/1			Hardwired	4-20mA through transducers in UPS
UPS System	UPS System	AI	V	UPS Voltage – 2/1			Hardwired	
UPS System	UPS System	DI	D	UPS Charger – 2/2	Failure	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Inverter – 2/2	Failure	Normal	Hardwired	
UPS System	UPS System	DI	S	UPS load on Invertor – 2/2	Operated	Reset	Hardwired	
UPS System	UPS System	DI	D	UPS Fan Failure – 2/2	Fault	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Fault – 2/2	Fault	Normal	Hardwired	
UPS System	UPS System	AI	A	UPS Current – 2/2			Hardwired	4-20mA through transducers in

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
UPS System	UPS System	AI	V	UPS Voltage – 2/2			Hardwired	UPS
UPS System	UPS System	DI	S	UPS load on bypass supply – 2	Operated	Reset	Hardwired	
UPS System	UPS System	DI	D	UPS Battery – 2	Discharged	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Battery – 2	Isolated	Normal	Hardwired	
UPS System	UPS System	DI	D	UPS Battery Bank Monitoring System Alarm – 2	Operated	Reset	Hardwired	
DC System	DC System	DI	D	DC supply Charger – 1	Failure	Normal	Hardwired	
DC System	DC System	DI	D	Battery discharged – 1	Discharged	Charged	Hardwired	
DC System	DC System	DI	D	Battery set Isolated – 1	Isolated	Connected	Hardwired	
DC System	DC System	DI	D	Charger Boost Charging – 1	Boost charging	Float Charging	Hardwired	
DC System	DC System	DI	D	DC Battery Bank Monitoring System Alarm – 1	Operated	Reset	Hardwired	
DC System	DC System	DI	D	DC Earth Fault relay DCDB Bus – 1	Failure	Normal	Hardwired	
DC System	DC System	DI	D	DC supply Charger – 2	Failure	Normal	Hardwired	
DC System	DC System	DI	D	Battery discharged – 2	Discharged	Charged	Hardwired	
DC System	DC System	DI	D	Battery set Isolated – 2	Isolated	Connected	Hardwired	
DC System	DC System	DI	D	Charger Boost Charging – 2	Boost charging	Float Charging	Hardwired	
DC System	DC System	DI	D	DC Battery Bank Monitoring System Alarm – 2	Operated	Reset	Hardwired	
DC System	DC System	DI	D	DC Earth Fault relay DCDB Bus – 2	Failure	Normal	Hardwired	
Distribution Transformer	Distribution Transformer	AI	MEASURING	Oil Temperature			HARDWIRED	4-20mA THROUGH TRAFO MBOX
Distribution Transformer	Distribution Transformer	AI	MEASURING	Winding Temperature			HARDWIRED	
MISC.	SOLAR PV	DI	D	Building Solar PV System Common Alarm	Operated	Reset	Hardwired	
MISC.	SOLAR PV	AI	A	R phase current			Serial	
MISC.	SOLAR PV	AI	A	Y phase current			Serial	
MISC.	SOLAR PV	AI	A	B phase current			Serial	
MISC.	SOLAR PV	AI	W	3-Phase Real Power			Serial	
MISC.	SOLAR PV	AI	R	3-Phase Reactive Power			Serial	
MISC.	MISCELLANEOUS	DO	COMMAND	Lighting feeder ' ON'	Activated	Reset	HARDWIRED	
MISC.	MISCELLANEOUS	DO	COMMAND	Lighting feeder ' OFF'	Activated	Reset	HARDWIRED	
MISC.	MISCELLANEOUS	DO	COMMAND	Load Shedding	Operated	Reset	HARDWIRED	
MISC.	MISCELLANEOUS	DI	STATUS	SAS Ethernet Switch Power Supply Fail	Failure	Normal	HARDWIRED	
MISC.	HVAC	DI	D	Building VAM System Common Alarm	Operated	Reset	Hardwired	

EQUIPMENT DESCRIPTION	FEEDER TYPE	INFORMATION TYPE	NATURE OF INFORMATION	INFORMATION DESCRIPTION	SET CONDITION	RESET CONDITION	INTERFACE	REMARKS
MISC.	HVAC	AI	T	Switchgear Hall / Battery Charger Room / UPS Room / VFD Room Temperature individually			Hardwired	4-20mA through transducers/ transmitter

MANDATORY SPARE LIST (ELECTRICAL) FOR 220kV GIS PACKAGE (TENDER NO. B269-999-16-50-EB-T-0020)

PROJECT : P25 PROJECT
OWNER : M/s INDIAN OIL CORPORATION LTD.
EPMC : ENGINEERS INDIA LTD.
JOB NO. : B269

F	13.05.2022	REVISED & REISSUED WITH TENDER	MKM	RG	HK
E	07.04.2022	REVISED AND REISSUED WITH TENDER	MKM	RG	HK
D	01.04.2022	REVISED AND REISSUED WITH TENDER	MKM	RG	HK
C	27.09.2021	REVISED AND REISSUED WITH TENDER	AKG	HK	HK
B	05.07.2021	REVISED AND REISSUED WITH TENDER	AKG	HK	HK

Mandatory spares for applicable items shall be as per Clause 6.1 of Engineering Design Basis (Electrical), B269-999-16-50-EDB-1001 attached with the tender document.

In addition to the above following mandatory spare shall also be supplied:

As per bid price
schedule

Sr. No	PART DESCRIPTION	QUANTITY REQUIRED
1.	EHV GIS with LCP and CRP	One set of spare for each GIS, LCP and CRP (Separate, wherever applicable)
1.1.	SF ₆ Gas Leakage Detector	1 Nos. ** (Note-8)
1.2.	SF ₆ Gas Analyzer	1 Nos. ** (Note-8)
1.3.	Portable Partial Discharge Monitoring System	1 Nos. ** (Note-8)
1.4.	Online Partial Discharge(PD) monitoring system for indoor & outdoor GIS	1 Nos. * (Note-7)
1.5.	SF6 online topping system / Online SF6 Gas filling system	1 Nos. ** (Note-8)
1.6.	Gas Filling and Evacuation Cart	1 Nos. ** (Note-8)
2.	Power Transformer	One set of spare for all power transformer
2.1.	Dissolved Gas Analysis kit	2 Nos. — Refer clause 5.1.11 of electrical job specification
2.2.	Online Moisture Removal System— Filters	10% or minimum 2 Nos. of each type & rating
2.3.	Online Moisture Removal System— Cartridges	10% or minimum 2 Nos. of each type & rating
3.	6.6kV Air Insulated Switchboard (AIS)	One set of spare common for AIS IBPs
3.1.	Ethernet Switch for 6.6 kV AIS IBP	1 Nos. (Each type)
4.	415V PMCC/ MV Switchboard	One set of spare for each switchboard
4.1.	Ethernet switch for 415V PMCC	1 Nos.
5.	Relay control Panel	One set of spare each for 220 kV GIS Relay & Control panel and 66 kV GIS Relay & Control panel
5.1.	Ethernet switch for GIS Control and Relay Panel	1 Nos.
6.	Solar Photovoltaic System	One set of spare for each system
6.1.	Power Thyristor / Transistors / IGBT / IGCT	1 No. of each rating & type
6.2.	Control cards	1 No. of each type

Sr. No	PART DESCRIPTION	QUANTITY REQUIRED
6-3.	Power supply cards	1 No. of each rating and type
6-4.	Cable connectors	10% or minimum 2 Nos. of each type
7.	415V Fixed Type PDBs	One set of spare for each switchboard
7-1.	Control fuses	10 Nos. each rating & type
7-2.	Indicating lamps covers	5 Nos. of each colour
7-3.	Indicating lamps	20% or 3 Nos. (min.), whichever is more

NOTES:

1. The word 'TYPE' means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable.
2. The terminology used under 'Item Description' is the commonly used name of the part and may vary from manufacturer to manufacturer.
3. Wherever % age is identified, Contractor shall supply next rounded figure.
4. Mandatory spares as indicated above do not cover commissioning spares.
5. Mandatory spares as indicated above do not cover two year O&M spares.
6. Mandatory spares shall be applicable for electrical items of sub-packages as per mandatory spares philosophy specified elsewhere in the bid document.
7. * 1 no. of each item for each EHV GIS i.e. separate set for 220kV indoor GIS, & 66kV indoor GIS.
8. ** 1 no. of each item for MRSS-100 (i.e. common set for 220kV & 66kV Indoor GIS)

GENERAL NOTES FOR CABLING SYSTEM

PROJECT : PANIPAT REFINERY EXPANSION (P-25) PROJECT

CLIENT : M/s IOCL

LOCATION : PANIPAT, HARYANA, INDIA

CONSULTANT : ENGINEERS INDIA LIMITED

JOB NO. : B269

0	20.04.2022	ISSUED FOR CONSTRUCTION	AK	MK	HK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

GENERAL NOTES: CABLING SYSTEM

1. The cabling system shall be executed in accordance with the requirements laid down in EIL Specification 6-51-0082, respective installation standards, cable schedules, General Notes Lighting, General Notes Earthing & Lightning Protection, applicable BIS codes & standards, CEA Regulations and other statutory regulations, specific job requirement indicated in this document and the respective cable layout drawings.
2. In case of any contradiction between various referred standards / documents / statutory regulations the following order of priority shall govern
 - Statutory regulations
 - Cable layout drawing(s)
 - This specification
 - Installation standards
 - Standard specification
 - Codes and standardsHowever, concurrence of Engineer-in Charge shall always be obtained, before taking a final decision in any such matter.
3. It shall be Contractor's responsibility to coordinate with other agencies associated with project for smooth execution of work.
4. All cable trays shall be supported @ 3 m / @ 2m intervals along straight run (as specified in layout drawing) & vertical dropping of trays shall be supported generally @2m intervals. For exact location/ elevation of the electrical cable tray supports, refer respective structural drawings.
5. Electrical contractor shall provide cable tray supports (both vertical and horizontal) inside the substation cellar. Vertical supports shall be welded to MS insert plates provided by structural contractor. Wherever these insert plates are not available, electrical contractor shall provide required insert plates, insert angles, using anchor fasteners.
6. All cable tray supports on pipe rack/cable rack shall be provided by structural contractor as per respective structural drawings.
7. In general, HV cables and MV Power & control cables shall be laid in separate trays, unless otherwise indicated in the drawing. Wherever HV & MV cables are laid in the same tray, suitable barrier plates shall be provided between HV & MV cables with minimum spacing of 300 mm between HV & MV cables.
8. Plant communication, fire alarm & telephone cables and Optical Fibre Cables (OFC) in HDPE conduit, shall be laid in instrumentation overhead cable duct / instrumentation trenches as far possible. In other areas, these cables shall be laid in electrical routes, along berm of the roads, or separately in a suitable polyolefin injection moulded underground cable duct/ pre-cast RCC trench.
9. All tray bends shall have uniform bending radius of 1000/ 1600/ 2000mm (as specified in the layout drawings). At any particular location all vertical outside/ inside bends shall have uniform bending radius i.e. 1000/ 1600/ 2000mm based on bending radius governed by if 66kV cable tray at that route.
10. After completion of laying of cables, all cables/ cable tray entries in substation/ other buildings (except process control room/ rack rooms) shall be suitably sealed with weatherproof compound to prevent water and entry of rodent/ creepers. MCTs shall be provided for cable entries to process control room/ rack room and shall have 20% spare provision for future use.
11. Cable trays, racks and trenches shall be sized to allow for 20 % space for future cables.

12. Jointing of prefabricated ladder type cable trays and their fittings shall be done by using splice plates. Splice plates shall be provided, one on inside face and one on outside face, of each side runner of cable tray, at each joint.
13. RCC cable trenches other than those of 220kV cable trenches shall be filled with stone dust / fine river sand.
14. No cable trays/racks to be provided in RCC lined trenches other than those of 220kV cables trenches.
15. In case of vehicular traffic over the RCC cable trench, the same shall be of heavy duty construction suitable for vehicular movement.
16. Street lighting cables shall not be laid along with fire alarm, communication and telephone cables. These cables shall be laid in separate buried cable trench in road berm or in suitable polyolefin injection moulded underground cable duct.
17. Perforated trays shall be used to run power cable of welding receptacles from the nearest main tray/ G.I. sleeves.
18. Perforated trays shall be used to run lighting cables. Routing of the same shall be decided suitably at site.
19. Walkways shall be provided on either side of overhead cable trays on pipe racks (with ladders at regular intervals) to facilitate movement of people while pulling cable
20. Cable trays shall be Hot dip Galvanized(HDG) prefabricated.
21. Underground Road crossings where large number of cables cross the roads, shall be provided using Cable culverts. At road crossings where few cables cross the roads, Electrical road crossings (ERC) using 160mm PVC/RCC pipes may be provided. The ERC shall have minimum 30% spare pipes. The pipes shall be embedded in concrete. Minimum 6 nos. 160mm pipes shall be provided in ERC at any road crossing.
22. Overhead Road crossings shall be provided with overhead cable bridge.
23. All single core cables (220kV, 66kV & 33kV) shall be laid in trefoil formation except for short run of cables within substations. Single core cables pertaining to 3-phase circuits shall be laid together & separated from multi-core cables as per requirements specified in IS-1255. Trefoil formation shall be braced by suitable clamps including necessary hardware for fixing the cables at a distance not exceeding 3m for 33kV cables and 800mm for 66kV & 220kV Cables.
24. For 220kV & 66kV Single core cables, bonding arrangement (single point/ midpoint/ cross) shall be as per respective cable manufacturer recommendation which shall be provided during detail engineering. Surge voltage limiters (SVLs) shall also be installed as per respective cable manufacturer recommendation.
25. For 33kV Single core cables, bonding of armour and screen shall be as per cable manufacturer recommendation which shall be finalised during detail engineering.
26. Cutouts on both sides of panels (for future use) shall be covered by 6.0 mm thick chequered plates.
27. MS angle cleats shall be welded to the horizontal support at the end of the cable trays.
28. Cables in general shall be laid in RCC trench, stone dust/ sand filled in Process area. Cable laying in offsite area shall be through above ground cable tray on sleeper for paved area and through above ground cable tray/ RCC cable trench and directly buried & laid in underground duct/ pre-cast RCC trench for unpaved area.
29. No process pipe shall pass through cable trench. If unavoidable, min. 300mm clearance to be provided between pipe and cables. In this case, either pipe or cable trench shall be taken through RCC congregate.
30. Care to be taken so that no hydrocarbon seepage in the cable trench takes place. Also the precast RCC cover should be such that no oil/ seepage is allowed into the trench.
31. Cables, before and after upto a length of 2m from the GI kick pipe entry in process area & pump houses shall be provided with fire proof coating as per IEC-60331.

32. All power cables inside battery room from battery charger onwards shall be provided with fire proof coating as per IEC-60331.
33. Fire proof sealing system as per IEC-60332 shall be provided below the switchboards in substations and above ground entry points of cables to substations.
34. Sealing compound shall be used for sealing metallic kick pipes
35. Trenches shall be marked at all direction changes, intersections and straight runs.
36. All hardware used for joining cable trays shall be of SS material.
37. Cables shall not pass through area where high temperature lines, steam vents / drains etc are provided. However, adequate precautions shall be taken if un-avoidable in some cases.
38. Electrical cable layout drawing gives indicative route of trays/ trenches. For exact coordinates of these, Piping / General Civil area drawings of respective area shall be referred.
39. Unless otherwise specified, tray levels given in the drawing shall correspond to the bottom level of tray.
40. For co-ordinates of directly buried trenches/ underground duct, RCC trenches, ERCs, CTCs & SCRCs etc. respective General Civil / piping area drawings shall be referred.
41. The dimensions shown for the cable trenches on the respective cable layout drawings are the clear dimensions. Details of trenches (i.e. thickness of wall/ bricks/ slab) shall be as per respective Structural Standards.
42. Exact termination / layout of G.I. Pipes (for protection of cables) shall be suitably decided at site depending upon the location of respective terminal block of the electrical equipment.
43. The G.I./ PVC sleeves shall be adjusted suitably at site during installation to avoid fouling with any underground equipments, pipes, foundations, etc.
44. Edges of cable trenches and cover slabs shall be provided with structured steel angles for nosing protection.
45. Where fire proofing columns/ structures are encountered, socket, receptacle, cable trays, lighting fixtures, etc. shall be installed on a suitable deep legged angle iron frame/ distance bracket.

GENERAL NOTES

FOR

EARTHING AND LIGHTNING PROTECTION SYSTEM

PROJECT : PANIPAT REFINERY EXPANSION (P-25) PROJECT

CLIENT : M/s IOCL

LOCATION : PANIPAT

CONSULTANT : ENGINEERS INDIA LIMITED

JOB NO. : B269

0	04.04.2022	ISSUED FOR CONSTRUCTION	AK	MK	HK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

GENERAL NOTES: EARTHING AND LIGHTNING PROTECTION SYSTEM

1. Earthing and lightning protection system works shall be executed in accordance with EIL Specification 6-51-0084, EIL standard 7-51-0116 for equipment earthing schedule, EIL installation standards referred in the layout drawings, specific job requirement indicated in this document and the respective earthing and lightning protection layout drawings.
2. In case of any contradiction between various referred standards / documents / statutory regulations the following order of priority shall govern
 - Statutory regulations
 - Earthing & Lighting Protection drawing(s)
 - This specification
 - Installation standards
 - Standard specification
 - Codes and standards

However, concurrence of Engineer-in Charge shall always be obtained, before taking a decision in any such matter.

3. It shall be Contractor's responsibility to coordinate with other agencies associated with project for smooth execution of work.
4. All panels/cabinets, steel frames, field control box, junction box, special instruments etc. will be connected to the earth, the connection shall be according to respective layout drawings and standards, job specification for earthing.
5. Earth bonding to the ladder, any metal parts and staircase shall be according to respective layout drawings and standards, job specification for earthing.
6. All earth pits (both earthing & lightning protection) shall be maintenance free chemical earth pits with Cu bonded high tensile low carbon steel core electrode
7. Unless otherwise specified, 100 X 12 mm G.I. earth strip shall be used for substations/ SRR/ CR/ MCR and 50 X 6 mm G.I. earth strip shall be used in process units and offsite area as main earth grid conductor.
8. Street lighting poles / high masts shall be earthed to the main earth grid, wherever available nearby, else separate 50 x 6 mm GI strip will be run for the street lighting system and shall be connected to main grid at minimum two points.
9. All lighting fixtures and single phase sockets shall be earthed using the third core of the feeding cable or third wire in circuit wiring as per respective lighting layout drawing.
10. The KW rating of motors, wherever indicated in the layout drawing is for guidance only. Selection of earthing conductor shall be done based on exact rating as per respective motor's nameplate.
11. In hazardous areas, all process equipment shall be connected to the earth grid at minimum two points. Pipelines shall be earthed at entry and exit of battery limit of process units as per EIL standard 7-51-0112. The earthing conductors shall be as per earthing layout drawings/ equipment earthing schedule 7-51-0116.
12. Reinforcement bars of pipe rack concrete column / pavement shall be connected to the main earth grid by using 50 x 6 mm GI strip at interval of not more than 24 m.
13. Tall columns as per layout drawing having continuous metallic structure shall be earthed at minimum 2 points at its bottom and shall be directly connected to individual earth electrodes for lightning protection.

14. Technological structure, vessels, columns shall be earthed minimum at two points, preferably diagonally opposite. The earthing conductors shall be as per earthing layout drawings/ equipment earthing schedule 7-51-0116.
15. Earth strip, wherever shown on platforms, shall be cleated below the platform.
16. Tappings from main grid upto the earth plate shall generally be of the same size as the main earth grid.
17. Reinforcement bars of extreme columns of sub-station building, reinforcement bars in ground and first floor slab of sub-station building shall be effectively earthed using 100 x 12 mm GI strip.
18. Lightning protection grid for buildings and sheds (wherever indicated) shall be formed by using 25x3mm G.I. strip suitably cleated along parapet wall / roof.
19. Earthing of transformer neutrals shall be done using two independent earth electrodes, as per standard / job specification, CEA guidelines. Their electrodes shall be interconnected to main earth grid.
20. Clean earth system for instrumentation shall be separate from electrical earthing grid.
21. Common clean earth shall be provided for relays, VFD PLC, Thyristor & SAS separate from substation earthing system
22. All equipment shall be earthed using GI wire ropes/ G.I. earth strip. The conductor size/type to be used for earth connection of various equipments shall be as per the equipment earthing schedule (EIL Standard No. 7-51-0116).
23. Earth pit cover shall be of chequered plate.

TECHNICAL AMENDMENT NO: 01

TO

TENDER:B269-999-16-50-EB-T-0020FOR 220KV GIS PACKAGE

(PROJECT:P-25,M/s IOCL-PANIPAT)

17.05.22	Issued for tender	SS	GJK	SD
DATE	PURPOSE	BY	CHECKED	APPROVED

TECHNICAL AMENDMENT NO.01
TO
220KV GIS PACKAGE

DOCUMENT No.
B269-999-81-46-TA-0020-01 Rev.0
PAGE 2 OF 2

SUBJECT : Technical Amendment No.: 01
TENDER NO. : B269-999-16-50-EB-T-0020

The terms, conditions and specifications of Bidding Document stand modified to the extent indicated under column "MODIFICATIONS/ADDITION/DELETION". Corresponding implications of the same, else-where in the bid package shall be taken care appropriately. All other terms & conditions, stipulations and specifications of Bidding Document shall remain unaltered.

S.No	Section No./ Document No.	Clause No./ Item No.	Subject	Modifications / Additions/Deletions/ Clarification
1.	B269-000-81-41-02406	Clause no 4, S. NO. B " CIVIL/ STRUCTURAL/ ARCHITECTURAL " of MASTER LIST OF DOCUMENTS	Substation – 220 KV GIS – Ground Floor Plan	The drawing no. "B269-000-81-41-02406 Revision B " Shall be REPLACED with attached drawing no. "B269-000-81-41-02406 Revision C ".
2.	B269-000-81-41-02407	- DO -	Substation – 220 KV GIS – First Floor Plan & Section	The drawing no. "B269-000-81-41-02407 Revision B " Shall be REPLACED with attached drawing no. "B269-000-81-41-02407 Revision C ".
3.	B269-000-81-41-02408	- DO -	Substation – 220 KV GIS – Second Floor Plan & Section	The drawing no. "B269-000-81-41-02408 Revision B " Shall be REPLACED with attached drawing no. "B269-000-81-41-02408 Revision C ".
4.	B269-000-81-41-02511	- DO -	Switchyard Substation – Plan & Section	The drawing no. "B269-000-81-41-02511 Revision A " Shall STAND DELETED.
5.	PART-A(ARCHITECTURAL) / B269-999-81-41-SOW-0020 (Rev B)	Clause no. 1.1.1 (b)/ DETAILED SCOPE OF WORK	Switch Yard Substation	"Switch Yard Substation in existing Panipat Refinery " Shall STAND DELETED.

(SIGNATURE AND STAMP OF BIDDER)

SUBJECT: 220kv GIS Package

BIDDING DOCUMENT NO.: B269-999-16-50-EB-T-0020

The terms, conditions of Bidding Documents and modified to the extent indicated under column "MODIFICATIONS/ADDITIONS/ DELETIONS". All other terms & conditions etc. of bidding Document issued earlier shall remain unaltered.

B. STRUCTURAL

S.No	Section (Document No)	Subject/Clause No	Modifications/Additions/Deletions
1	B269-999-81-41-SOW-0020 Rev.B Clause No.1.0, Page No.7 of 16	The Scope of Civil and Structural works under this contract shall include design, detailing, supply and construction of all relevant civil and steel works required for successful completion of works for 220kV Gas Insulated Substation (GIS) building and Switchyard as per specifications enclosed with the Bid document.	Modifications:- The Scope of Civil and Structural works under this contract shall include design, detailing, supply and construction of all relevant civil and steel works required for successful completion of works for 220kV Gas Insulated Substation (GIS) building as per specifications enclosed with the Bid document.
2	B269-999-81-41-SOW-0020 Rev.B Clause No.1.0, S.no. a. v, Page No.7 of 16	Foundation & Super-structure of All Switch Yard Structures (Gantry Tower, Lightning Arrestors, Cable Termination, Bus Post Insulators etc.), Equipment and support structure for GIS Bus, Operating and Maintenance Platform, Architectural sheeting & Ventilation works whatsoever required within Battery Limit area.	Modifications:- Foundation & Super-structure of Equipment and support structure for GIS Bus, Operating and Maintenance Platform, Architectural sheeting & Ventilation works, Foundations for Power and Distribution Transformer etc. whatsoever required within Battery Limit area.

A	11.05.2022	ISSUED FOR BIDS	MK	KML	PM
Rev.No	Date	Purpose	Prepared by	Checked by	Approved by

S.No	Section (Document No)	Subject/Clause No	Modifications/Additions/Deletions
3.	B269-999-81-41-SOW-0020 Rev.B Clause No.2.0, S.no. i, Page No.9 of 16	Min. thickness of various structural steel components for transmission tower and switchyard structures shall be as per IS:802	Modifications:- This clause stands deleted.

We accept all the modifications, additions, deletions of Technical amendment 02 in totality and our quoted price is inclusive of above

Name of Bidder:

Seal / Stamp:

A	11.05.2022	ISSUED FOR BIDS	MK	KML	PM
Rev.No	Date	Purpose	Prepared by	Checked by	Approved by

TECHNICAL AMENDMENT
(Static & Machinery Equipment)
FOR
220 kV GIS PACKAGE

TECHNICAL AMENDMENT No. 2

ITEM DESCRIPTION:

220 kV GIS PACKAGE

TENDER NO. :

B269-999-16-50-EB-T-0020

0	11/05/2022	ISSUED AS AMENDMENT TO TENDER	BKD	AK/AN	SPC
Rev. No.	Date	Purpose	Prepared By	Checked By	Approved By

TECHNICAL AMENDMENT
(Static & Machinery Equipment)
FOR
220 kV GIS PACKAGE

The terms, conditions and specifications of Bidding Document stand modified to the extent indicated under column "MODIFICATIONS/ADDITION/DELETION". All other terms & conditions, stipulations and specifications of bidding document shall remain unaltered.

S. No.	Part No/ Vol. No	Page No/ Document No.	Document Title	Section/ Clause No.	Subject	Clarification/Modifications / Additions / Deletion
1.	Technical	Page no.: 3 of 6 / B269-999-80-43-SOW-0020 Rev 2	Scope of Work / Supply (Static & Machinery equipment)	Cl. No. 1.2	Scope of Work /Supply	Deletion : Clause no.1.2 related to Package AC system for Sub-station (switchyard) stands deleted.
2.	Technical	Page no.: 4 of 6 / B269-999-80-43-SOW-0020 Rev 2	Scope of Work / Supply (Static & Machinery equipment)	Cl. No. 3.2	Scope of Work /Supply	Deletion : Clause no.3.2 related to Chain Pulley Block for loading/ unloading of switch gear panels from first floor of Sub-station (Switchyard) stands deleted.
3.	Technical	Page no. 4 of 21/ B269-999-80-43-SP-0020 Rev 2	Job Specification (Static & Machinery equipment)	Cl. No. 3.1.5.1	Job Specification	Deletion : Clause no. 3.1.5.1, outdoor(fresh air) requirement for switchgear room (switchyard) stands deleted.
4.	Technical	Page no. 5 of 21/ B269-999-80-43-SP-0020 Rev 2	Job Specification (Static & Machinery equipment)	Cl. No. 3.1.5.2	Job Specification	Deletion : Clause no. 3.1.5.2, equipment load, occupancy details given on this page for Sub-station (switchyard) stands deleted.
5.	Technical	Page no. 6 of 21/ B269-999-80-43-SP-0020 Rev 2	Job Specification (Static & Machinery equipment)	Cl. No. 3.1.7	Job Specification	Deletion : Clause no. 3.1.7. (ii).b i "water cooled package AC for substation (switch yard) building" stands deleted.
6.	Technical	Page no. 8 of 21/ B269-999-80-43-SP-0020 Rev 2	Job Specification (Static & Machinery equipment)	Cl. No. 3.1.9	Job Specification	Deletion : Clause no. 3.1.9 i "Configuration of Air conditioning system with water cooled package AC" stands deleted.

TECHNICAL AMENDMENT
(Static & Machinery Equipment)
FOR
220 kV GIS PACKAGE

S. No.	Part No/ Vol. No	Page No/ Document No.	Document Title	Section/ Clause No.	Subject	Clarification/Modifications / Additions / Deletion
7.	Technical	Page no. 11 of 21/ B269-999-80-43-SP-0020 Rev 2	Job Specification (Static & Machinery equipment)	Cl. No. 3.1.10	Job Specification	Deletion : Clauseno.3.1.10i The words "SUBSTATION(SWITCHYARD)" stands deleted.
8.	Technical	B269-999-80-42-DS-0020-10 Rev 0	Data Sheet for Water/ Cooled Packaged Unit (For AC System)	-	Data Sheet of Water Cooled Package Air-Conditioner	Deletion: Data Sheet of Water Cooled Package Air-Conditioner stand deleted.
9.	Technical	B269-999-80-43-SP-0020 Rev 2	Job Specification (Static & Machinery equipment)	Cl. 3.1.1, 3.2.1 & 3.3.1	Sub vendor list	Addition: Sub vendor list for HVAC-Central air conditioning, EOT Crane (safe area) and CP block is enclosed.

Enclosure:

1. Sub Vendor list for HVAC-Central air conditioning, EOT Crane (safe area) and CP block (Doc. no. B269-999-80-42-VL-0020)

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 06AA		Description : HVAC SYSTEM- CENTRAL AIR CONDITIONING		
Approved Suppliers				
1	3678	ROOTS COOLING SYSTEMS PVT. LTD.	INDIA	
2	B029	BLUE STAR LTD	INDIA	
3	E178	VERTIV ENERGY PRIVATE LIMITED	INDIA	
4	A336	ADVANCE VENTILATION PVT. LTD	INDIA	
5	3962	ANEMO PROJECTS PVT LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 07AC		Description : CRANE- E.O.T (SAFE AREA)		
Approved Suppliers				
1	G183	GRIP ENGINEERS PVT.LTD	INDIA	
2	C035	CONSOLIDATED HOISTS PVT LTD.	INDIA	
3	T222	TATA STEEL GROWTH SHOP	INDIA	
4	3875	MEEKA MACHINERY PVT LTD	INDIA	
5	3622	UNIQUE INDUSTRIAL HANDLERS PVT. LTD.	INDIA	
6	3619	TECHNO INDUSTRIES	INDIA	
7	3620	TECHNO INDUSTRIES	INDIA	
8	E227	ELECTROMECH MATERIAL HANDLING SYSTEMS (I) PVT. LTD.	INDIA	
9	A266	ANUPAM INDUSTRIES LIMITED (ANAND)	INDIA	
10	W005	BRADY & MORRIS ENGINEERING CO. LTD.	INDIA	
11	S138	SAFEX ENERGY PVT LTD	INDIA	
12	H012	HEAVY ENGINEERING CORPORATION LTD	INDIA	
13	M248	MEEKA MACHINERY PVT LTD	INDIA	
14	E072	EDDY CRANES ENGRS (P) LTD	INDIA	
15	F023	FURNACE AND FOUNDRY EQUIPMENT CO.	INDIA	
16	S377	SAFEX ELECTROMECH PVT LTD	INDIA	
17	S853	STAHL CRANE SYSTEMS GMBH	GERMANY	
18	W013	KONECRANES AND DEMAG PRIVATE LIMITED	INDIA	

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 07AH		Description : CHAIN PULLEY BLOCK		
Approved Suppliers				
1	3921	BAKELITE ELECTRICAL MFG CO.PVT LTD	INDIA	
2	W005	BRADY & MORRIS ENGINEERING CO. LTD.	INDIA	
3	H129	HERCULES HOISTS LTD	INDIA	



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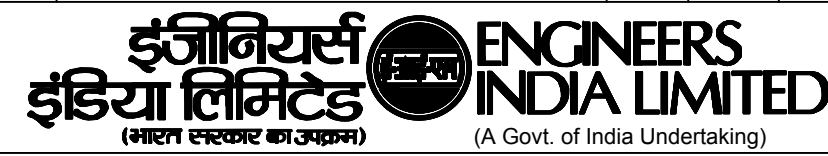
REF. DWG. NO.	REFERENCE DRAWING TITLE
B259-000-01-41-02407	SUBSTATION-100: FIRST FLOOR PLAN & SECTION
B259-000-01-41-02408	SUBSTATION-100: SECOND FLOOR PLAN & SECTION
NOTES :- 1. ALL DIMENSIONS ARE IN MILLIMETRES. 2. ALL LEVELS ARE IN METRES. 3. LEVEL 100.00 INDICATES FINISHED APPROACH ROAD LEVEL NEAR THE BUILDING. 4. UNDERNEATH INSULATION SHALL BE PROVIDED UNDER THE ROOF OF ALL A/C AREAS AND A.H.U. ROOM. 5. ALL OUTSIDE SURFACES SHALL BE FINISHED WITH 18MM THK. PLAIN CEMENT PLASTER ON BRICK SURFACES & 6MM THK. PLAIN CEMENT PLASTER ON R.C.C. SURFACES, EXCEPT WHERE SAND FACE PLASTER IS MENTIONED. 6. ALL INTERNAL WALLS SHALL BE FINISHED WITH 12MM THK. PLAIN CEMENT PLASTER ON R.C.C. WALLS & 12MM/15MM THK. PLAIN CEM. PLASTER ON EITHER SIDE OF INTERNAL WALLS. 6MM THK. PLAIN CEMENT PLASTER SHALL BE PROVIDED ON ROOF SURFACES. 7. ALL CUTOUTS IN FLOOR, WALLS FOR CABLE ENTRIES ETC. TO BE KEPT AS/REQUIREMENT OF RESPECTIVE DEPT'S. 8. 1000 MDD PLINTH PROTECTION WITH BUILDING DRAIN SHALL BE PROVIDED ALL AROUND. 9. ALL SUNSHADE, CLANOPY & ROOF PROJECTIONS SHALL HAVE Drip Mould GROOVES UNDERNEATH ALL ALONG THE PERIPHERIES. 10. SUITABLE SLOPE IN FLOOR SLAB FOR CABLE CELLAR AND A/C PACKAGE ROOM SHALL BE PROVIDED TOWARDS FLOOR TRAPS LOCATIONS AS SHOWN IN THE D.R. FOR DRAINAGE OF WATER. 11. SUBSTATION SWITCHGEAR HALL SHALL BE AIR- CONDITIONED. 12. SUBSTATION SWITCHGEAR HALL SHALL HAVE CLEAR HEIGHT OF 4.5M. 13. ALL DOORS REQUIRED IN AC AREAS SHALL BE AIR – TIGHT. 14. FOR INTERNAL & EXTERNAL FINISHES, ENGINEERING DESIGN SHALL BE REFERRED. 15. PROVISION FOR SEPARATE MALE FEMALE TOILET IS REQUIRED DURING DETAILED ENGINEERING. 16. THE SIZE OF BUILDING AND ROOMS SHOWN ARE THE MINIMUM AND INDICATIVE. THEY SHALL BE FINALIZED AND INCREASED AS PER REQUIREMENT DURING DETAILED ENGINEERING.	

TYPE	OPENING SIZE	FRAME SIZE	LINTEL LEVEL	NOTES
RS1	3000x350	-	3500	STD. STEEL ROLLING SHUTTER, ELECTRICALLY OPERATED
RS2	3000x350	-	3000	STD. STEEL ROLLING SHUTTER, PARTY GRILL TYPE, ELECTRICALLY OPERATED
R1	1000x2100	0980x2090	2100	35 TH FULLY PANELLED DOOR SINGLE SHUTTER AS/EL STD. 7.75-0004
FD1	2000x2700	1980x2690	2700	2. HR FIRE RATED, GLAZED DOOR AS PER MANUFACTURER'S SPECIFICATION.
FD2	1500x2500	1480x2490	2500	2. HR FIRE RATED, GLAZED DOOR AS PER MANUFACTURER'S SPECIFICATION.
FD3	1200x2100	1180x2090	2100	2. HR FIRE RATED, GLAZED DOOR AS PER MANUFACTURER'S SPECIFICATION.
AL1	1480x2500	1480x2500	2500	POWDER COATED ALUM. GLAZED DOOR WITH 6mm TIK TOUGHENED GLASS, DOUBLE LEAF STD. 7.75-0014
AL2	1200x2100	1180x2090	2100	SAME AS AL1 BUT SINGLE LEAF WITH AIR TIGHT
S1	1500x2500	1480x2490	2500	PRESSED STEEL DOOR WITH PRESSED STEEL FRAME, DOUBLE SHUTTER AS/EL STD. 7.75-0071
SD1A	1500x2500	1480x2490	2500	SAME AS SD1 BUT AIR TIGHT
SD2	1200x2100	1180x2090	2100	PRESSED STEEL DOOR WITH PRESSED STEEL FRAME, SINGLE SHUTTER AS/EL STD. 7.75-0070
SD3	1200x2100	1180x2090	2100	SAME AS SD2 BUT WITH LQUVERS AT BOTTOM.
W1	1200x1800	1180x1790	2700	ALUM. GLAZED WINDOW POWDER COATED WITH 6 mm TIK TOUGHENED GLASS, PARTLY FIXED/ OPENABLE TYPE
V1	2000x600	1980x590	BEAM BOTTOM	ALUM. GLAZED VENTILATOR POWDER COATED WITH 6 mm TIK TOUGHENED GLASS, PARTLY OPENABLE & PARTLY FIX TYPE.
V1A	2000x600	1980x590	BEAM BOTTOM	ALUM. GLAZED VENTILATOR POWDER COATED WITH 6 mm TIK TOUGHENED GLASS, FIX TYPE WITH AIR TIGHT.
V2	3000x600	2980x590	BEAM BOTTOM	ALUM. GLAZED VENTILATOR POWDER COATED WITH 6 mm TIK TOUGHENED GLASS, PARTLY FIXED/ OPENABLE TYPE WITH EXHAUST FAN.
V2A	3000x600	2980x590	4500	ALUM. GLAZED VENTILATOR POWDER COATED WITH 6 mm TIK TOUGHENED GLASS, FIX TYPE WITH AIR TIGHT.
V3	2000x600	2580x590	BEAM BOTTOM	SAME AS V2 WITH 2 EXHAUST FAN.
V4	1500x600	1480x590	3000	SAME AS V2.

F.R.L. - FINISHED ROAD LEVEL
F.F.L. - FINISHED FLOOR LEVE

FC	AC	FC = FALSE CEILING AC = AIR CONDITIONED
FF		FF = FALSE FLOORING

C	13.05.22	REVISED ISSUED WITH TENDER			SM	GJK	SD		
B	15.07.21	REVISED ISSUED WITH TENDER			SM	GJK	JS		
A	29.04.20	ISSUED WITH TENDER			SM	GJK	JS		
REV	DATE	REVISIONS			BY	CHKD	APPD	PENCL	



इंडियन आउयल कॉर्पोरेशन लिमिटेड
INDIAN OIL CORPORATION LTD.

पी२५ प्रोजेक्ट
पानीपत रिफाईनरी

P25 PROJECT
PANIPAT REFINERY

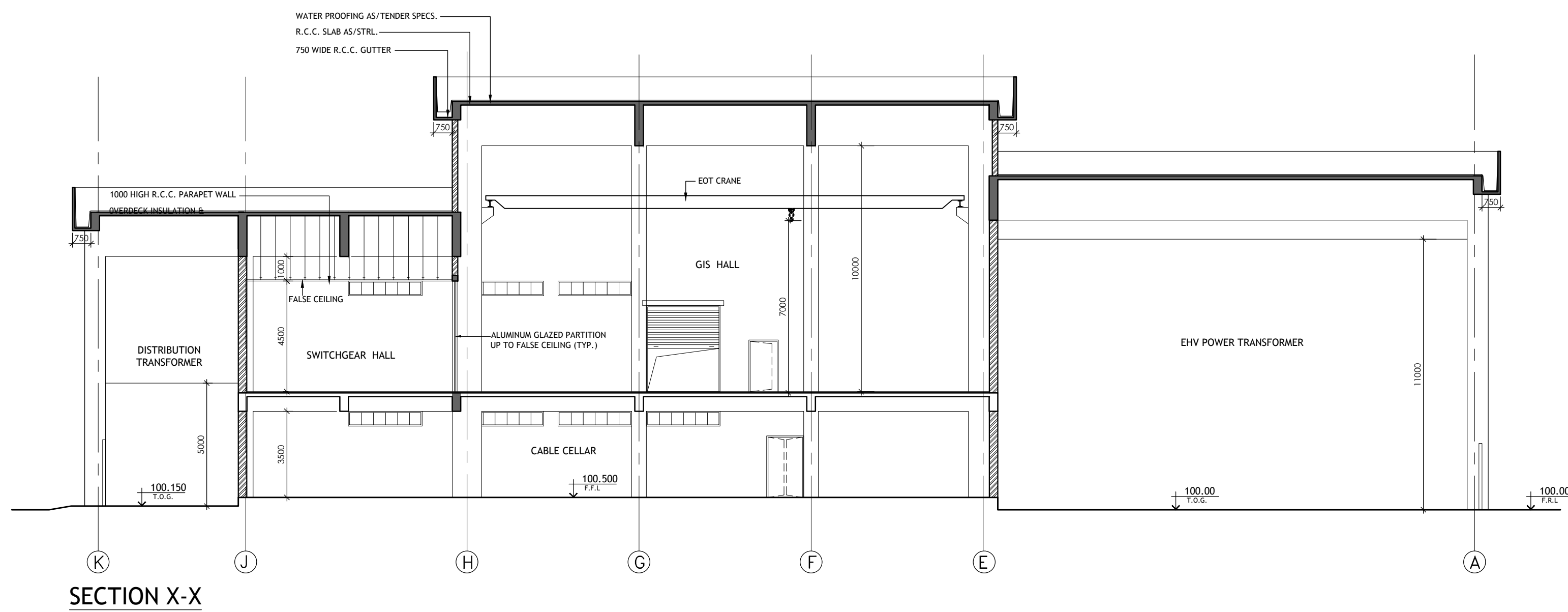
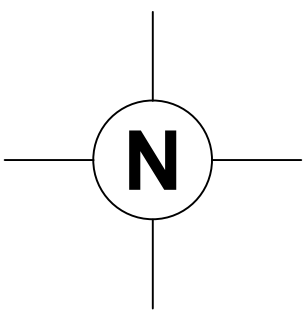
सब स्टेशन 100
भूगल का प्लान

SUBSTATION-100
(MAIN RECEIVING SUBSTATION)
GROUND FLOOR PLAN

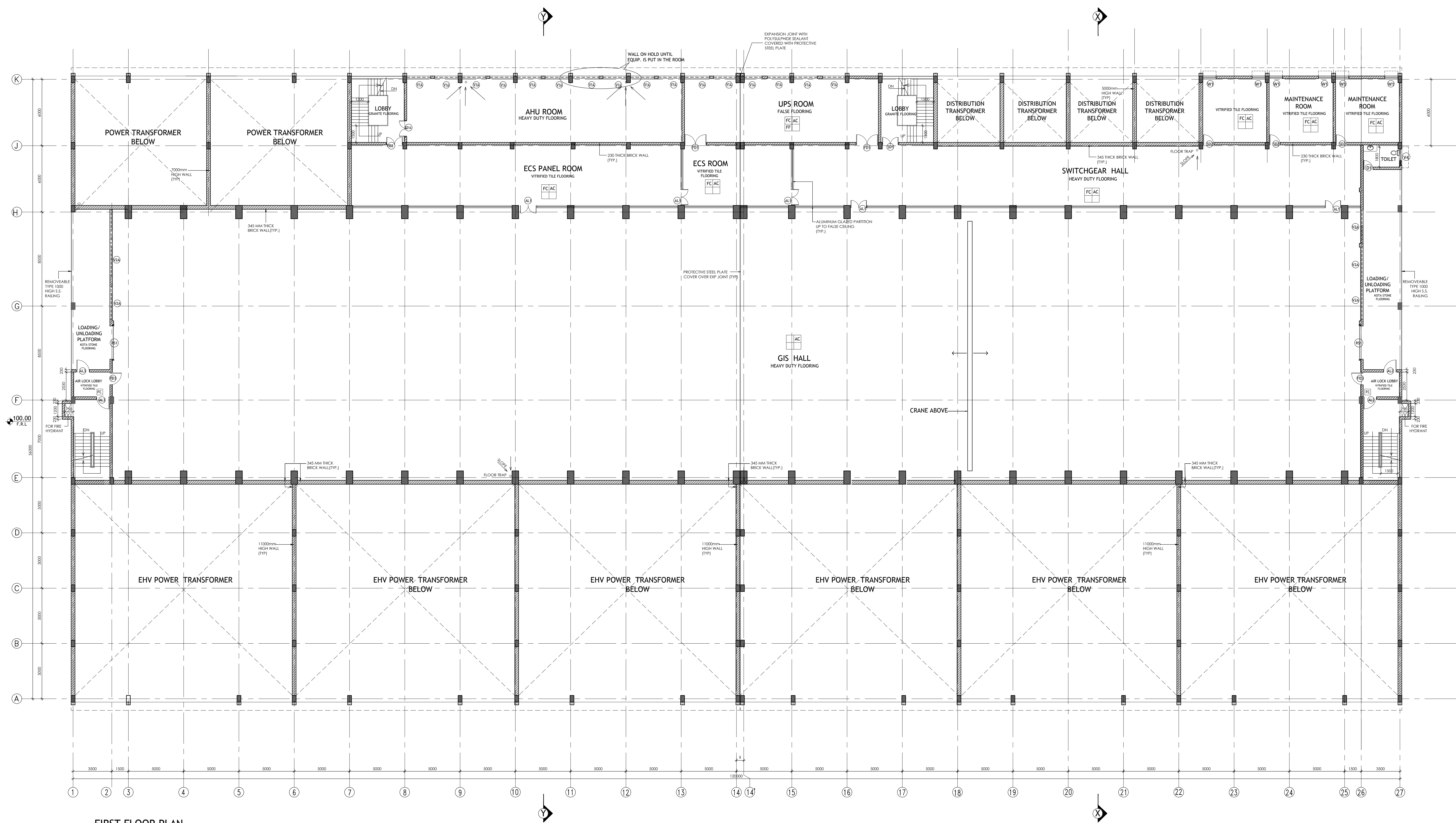
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प्रत्येक अंशधर को इसमें निहित डिवाइडेंड इन्वील्वमेंट ईस्टीमेटिड की संतुष्टि है, जो मात्र उधार प्राप्त हुए हैं और उधारकर्ता ने यह वादा संतुष्टि किया है कि वे तो उधार प्राप्त: मुद्रित किया जाएगा, न सकार की जायगी, उधार देने वाले, न प्रचुरीत किए जायेंगे और वे सीमा और निम्नी श्रेणी के ग्राहकों के अंतर्गत आते हैं।

B269-000-81-41-02407



SECTION X-X



FIRST FLOOR PLAN

REF. DWG. NO.	REFERENCE DRAWING TITLE
B269-000-81-41-02406	SUBSTATION-100: GROUND FLOOR PLAN
B269-000-81-41-02408	SUBSTATION-100: SECOND FLOOR PLAN & SECTION

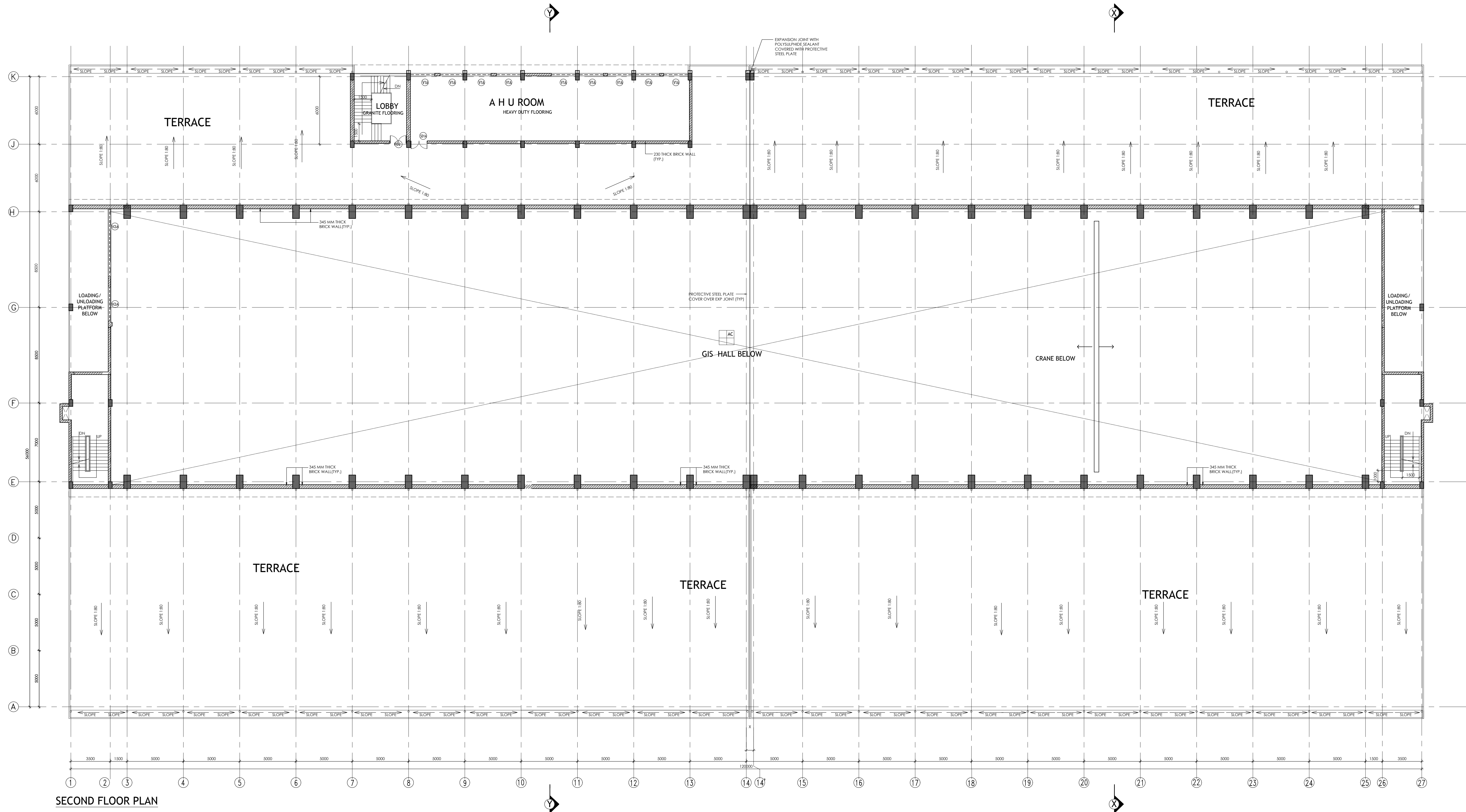
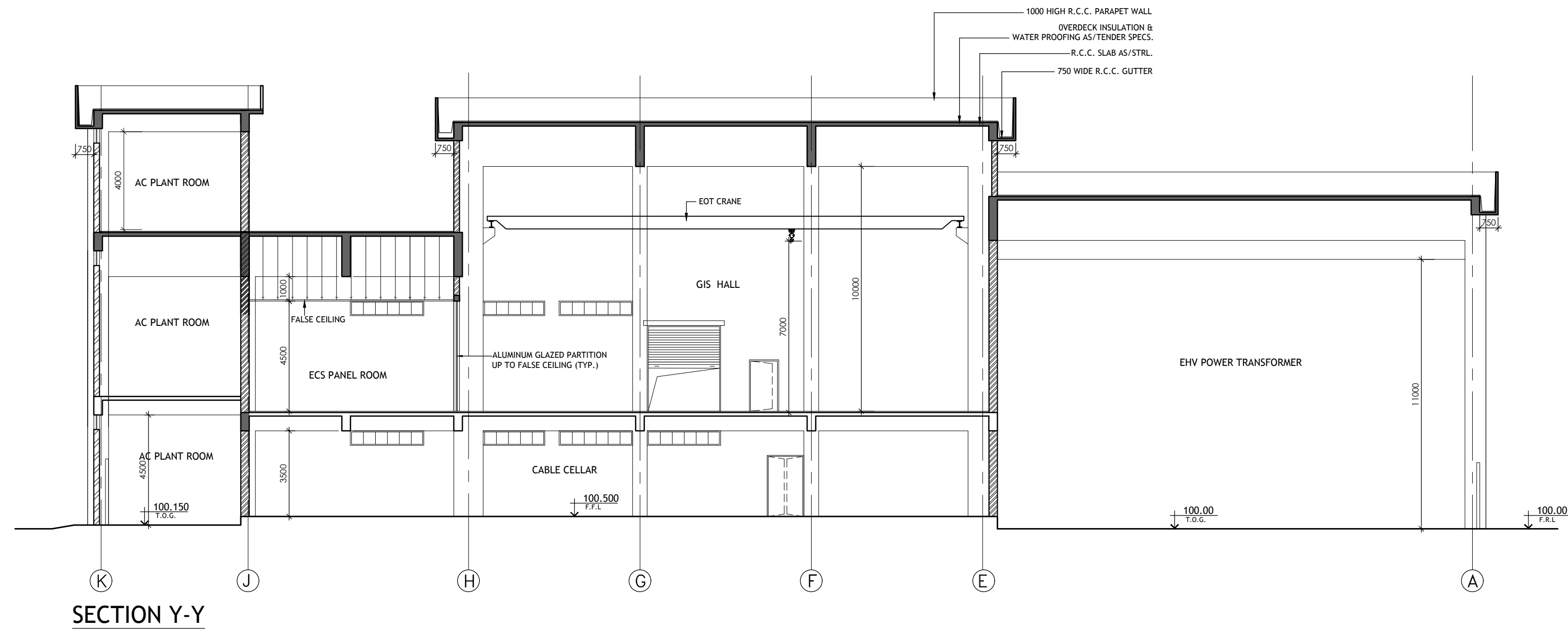
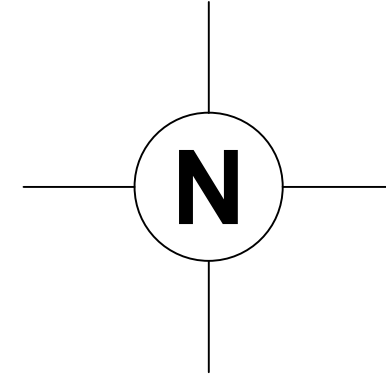
NOTES :-
1. FOR ALL NOTES, REFER DWG. NO. B269-000-81-46-02406.

LEGEND :-
F.R.L. - FINISHED ROAD LEVEL
F.F.L. - FINISHED FLOOR LEVEL
FC/AC - FALSE CEILING
AC - AIR CONDITIONED
FF - FALSE FLOORING

C	13.05.22	REVISED ISSUED WITH TENDER	SM	GJK	SD
B	15.07.21	REVISED ISSUED WITH TENDER	SM	GJK	JS
A	29.04.20	ISSUED WITH TENDER	SM	GJK	JS
REV	DATE	REVISIONS	BY	CHKD	APPD/PMPC
इंडियन ऑइल कॉर्पोरेशन लिमिटेड INDIAN OIL CORPORATION LTD. ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)					
प्री25 प्रोजेक्ट पानीपत रिफाईनरी			P25 PROJECT PANIPAT REFINERY		
सब स्टेशन 100			SUBSTATION-100 (MAIN RECEIVING SUBSTATION)		
प्लान एवम काट			FIRST FLOOR PLAN & SECTION		
SCALE	JOB NO.	UNIT	DIVN.	DEPT.	DWG. NO. REV.
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प्रस्तावित आरक्षण एवं इसमें निर्मित विद्युत इंजीनियरिंग इकायों का संपत्ति है। ये आरक्षण इकायों के निर्माण के लिए हैं और इकायों में यह स्पष्ट समझौता किया है कि न तो उन्हें पुनः मुद्रित किया जाएगा, न मूलों को खारिज, न उधार दिए जाएंगे, न प्रतिलिपि दिए जाएंगे और न ही सीमा और किसी प्रकार के अनाधिकारिक प्रकाशनों का निर्माण रूप में या यह संपत्ति से होगा ।
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B269-000-81-41-02408



REF. DWG. NO. SUBSTATION-100- GROUND FLOOR PLAN
B269-000-81-41-02406

REFERENCE DRAWING TITLE
SUBSTATION-100- FIRST FLOOR PLAN & SECTION

NOTES :-
1. FOR ALL NOTES, REFER DWG. NO. B269-000-81-46-02406.

LEGEND :-
F.R.L. - FINISHED ROAD LEVEL
F.F.L. - FINISHED FLOOR LEVEL
FC AC FC = FALSE CEILING
AC = AIR CONDITIONED
FF FF = FALSE FLOORING

C	13.05.22	REVISED ISSUED WITH TENDER	SM	GJK	SD
B	15.07.21	REVISED ISSUED WITH TENDER	SM	GJK	JS
A	13.05.20	ISSUED WITH TENDER	SM	GJK	JS

REV. DATE REVISIONS BY CHKD APPD PEMPIC

ENGINEERS INDIA LIMITED
(A Govt. of India Undertaking)

इंडियन आइल कॉर्पोरेशन लिमिटेड
INDIAN OIL CORPORATION LTD.

प्री25 प्रोजेक्ट
पानीपत रिफाइनरी

P25 PROJECT
PANIPAT REFINERY

सब स्टेशन 100
खान एवं काट

SUBSTATION-100
(MAIN RECEIVING SUBSTATION)
SECOND FLOOR PLAN & SECTION

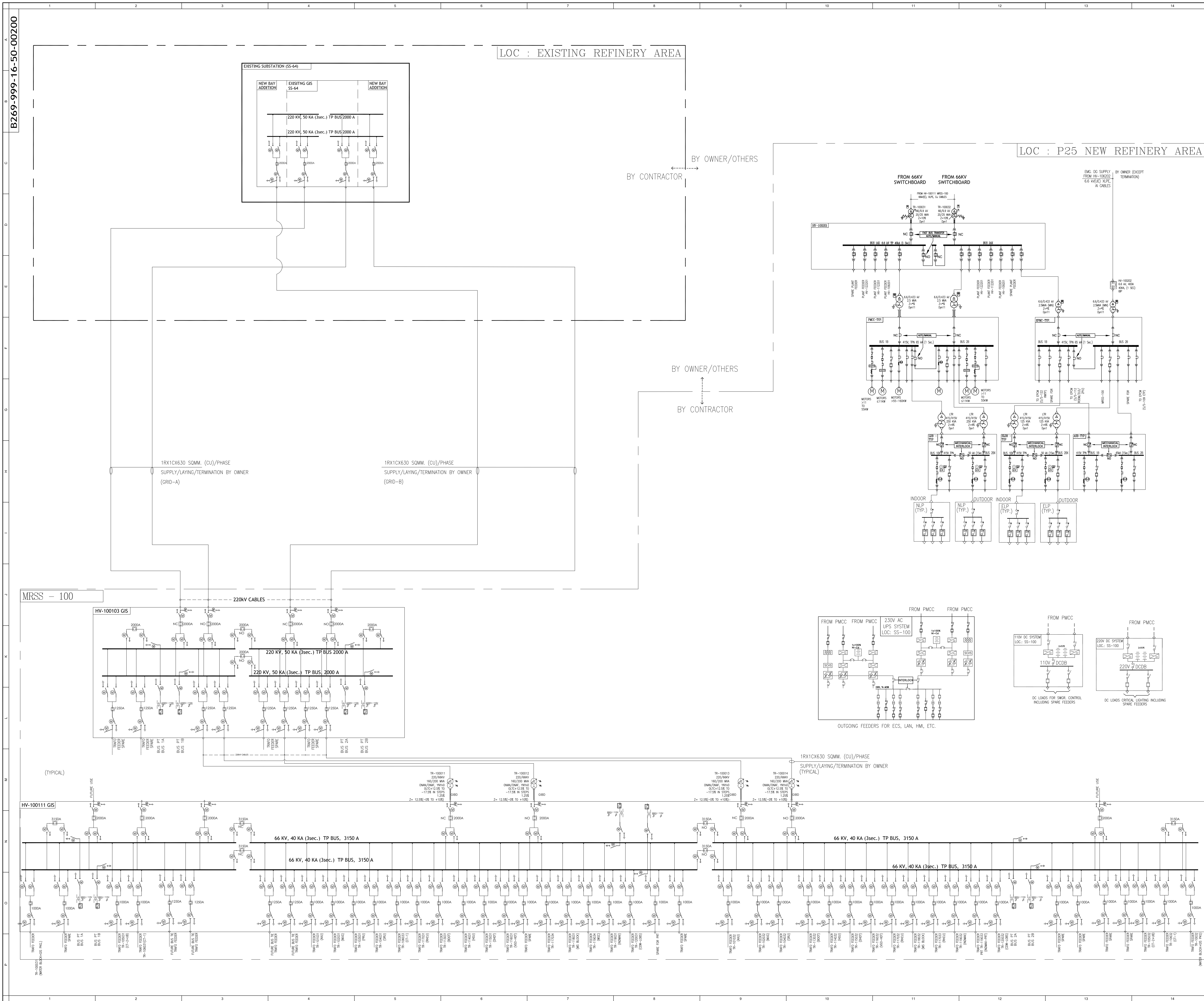
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	Description	UOM	QTY Rev.1	Detailed Description of Scope
1.01	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - BUS BARS	LOT	1	Please refer revised Bay numbers. This covers complete GIS System under this technical specification (TB-PBT-316-PN1) excluding the following BOQ line items. In the event of changes in present scope, payment shall be made on pro-rata basis of number of circuit breaker bays.
1.02	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - TRANSFORMER GIS BAY MODULE (EXTN. TO EXISTING GIS)	SET	0	Extension by addition of transformer feeder bays in existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear (one set each on both side). Feeder details similar to Sr. nos. 1 / 2 (Incomer from PR 220kV GIS with Line PT) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module & Line PT Module which is covered in separate BOQ item)
1.03	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM -DOUBLE MAIN BUS SCHEME - GIS EXTENSION MODULE	SET	0	Bus extension module for interfacing of transformer feeder bays (of present scope) with existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear (one set equals complete extension module for one side of existing GIS). Bidder shall consider the modules including the bellows/ compensators like lateral mounting units, Axial compensators, Parallel compensators, tolerance compensators and vibration compensators etc as applicable. Please note, such extension shall be required on both side of GIS Bays.
1.04	SUPPLY- GIS : 220KV, 50KA FOR 3S, OUTDOOR GIS ISOLATING BREAKER BAY	SET	0	Please refer Sr. nos. 1 / 2 (220kV GIS Outdoor IBP with Line PT) of the document: 220 kV ICOG FEEDER DETAIL DATASHEET (HV-100101/HV-100102), Nos: B269-999-16-50-DS-0033. (Excluding SF6 to air bushing, Surge Arrester Module, Line PT Module, Gas Insulated Bus Duct which are covered in separate BOQ items)
1.05	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A - SF6 TO AIR BUSHING	SET	0	Single phase 220kV , 2000A SF6 to Air Bushing for the air termination of the GIS shall be as per IEC. (a) Single phase, termination module for terminating GIS SF6 bus duct (b) Scope of supply shall be as per latest version of IEC . (c) Gas monitoring system, pressure relief device, busbar, insulator, expansion joint/ flexible connection etc. as required. (d) Barrier cones, mechanism box and other items as required. (e) Any other item required to complete the system in all respects but not limited to above.
1.06	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - LINE GIS BAY	SET	2	Incomer from Panipat Refinery 220kV GIS. Please refer Sr. nos. 1 / 2 (Incomer from PR 220kV GIS with Line PT) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module & Line PT Module which are covered in separate BOQ item)
1.07	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - LINE GIS BAY (TYPE 2)	SET	2	Incomer from Panipat Refinery Isolating Breaker Panel. Please refer Sr. nos. 3 / 4 (Incomer from PR IBP with Line PT) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module & Line PT Module which are covered in separate BOQ item)
1.08	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - BUS COUPLER GIS BAY	SET	2	Please refer Sr. nos. 5 / 6 (Bus Coupler 1A-2A & Bus Coupler 1B-2B) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D
1.09	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - BUS SECTIONALISER BAY MODULE	SET	2	Please refer Sr. nos. 7 / 8 (Bus Coupler 1A-1B & Bus Coupler 2A-2B) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D
1.10	SUPPLY- GIS : 220KV, 50KA FOR 3S, DOUBLE MAIN BUS SCHEME - BUS MEASUREMENT GIS BAY/ VOLTAGE TRANSFORMER BAY	SET	4	Please refer Sr. nos. 9 / 10 / 11 / 12 (Bus PT 1A, 1B, 2A & 2B) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D Complete including Isolator & Bus earth swith.

	Description	UOM	QTY Rev.1	Detailed Description of Scope
1.11	SUPPLY- GIS : 220KV, 50KA FOR 3S, MAIN ITEM - DOUBLE MAIN BUS SCHEME - TRANSFORMER GIS BAY	SET	6	Please refer Sr. nos. 13 / 14 / 15 / 16 / 17 / 18 (Transformer Feeder) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module which is covered in separate BOQ item)
1.12	SUPPLY- GIS : 220KV, 50KA FOR 3S, GIS DOUBLE MAIN BUS SCHEME - SPARE TRANSFORMER GIS BAY MODULE	SET	2	Please refer Sr. nos. 19 / 20 (Transformer Feeder Spare) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module which is covered in separate BOQ item)
1.13	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - SF6 TO EHV CABLE GIS CONNECTION MODULE	SET	0	SF6 to EHV cable GIS connection module suitable upto 1600 Sqmm (above 630 Sqmm) and as per technical requirement mentioned in specification, 1 phase Cable, shall be as follows, but not limited to, (a) It shall be of the plug-in type with dry-type or fluid-filled terminations. The interfaces conform to IEC standards. A removable link, which disconnects and isolates the GIS from the cable during high-voltage test for convenience and ease of operations shall also be provided. (b) Termination kit for fixing of cable shall also be provided in line with IEC62271-209. (c) PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, insulators etc. as required. (d) Any other item required to complete the system in all respects but not limited to above. (e) 1 Set equals to supplies required for one Phase
1.14	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - SF6 TO EHV CABLE GIS CONNECTION MODULE (TYPE 2)	SET	42	SF6 to EHV cable GIS connection module suitable upto 630 Sqmm and as per technical requirement mentioned in specification, 1 phase Cable, shall be as follows, but not limited to, (a) It shall be of the plug-in type with dry-type or fluid-filled terminations. The interfaces conform to IEC standards. A removable link, which disconnects and isolates the GIS from the cable during high-voltage test for convenience and ease of operations shall also be provided. (b) Termination kit for fixing of cable shall also be provided in line with IEC62271-209. (c) PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, insulators etc. as required. (d) Any other item required to complete the system in all respects but not limited to above. (e) (e) 1 Set equals to supplies required for one Phase
1.15	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - GAS INSULATED BUS DUCT	MTR	0	GIB length of 1-phase busduct outside the GIS BAY MODULE shall be considered for mode of measurement. This including SF6 Gas, structure, Earthing, foundation bolt, PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, compensator, insulators etc. Complete in all respect.
1.16	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - BUS EARTH SWITCH GIS BAY	SET	0	220kV, 50kA for 3 second, 2000A GIS double main bus scheme bus earth switch bay GIS bay, each set comprising of following but not limited to, (a) 2 set- 1x3 phase high speed make proof grounding switch, complete with operating mechanism. (b) PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, insulators etc. as required. (c) Any other item required to complete the system in all respects but not limited to above.
1.17	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - GIS SURGE ARRESTER MODULE WITH SURGE COUNTER	SET	42	1 Set equals 1 Phase surge arrestor. Necessary surge counter for every 3 numbers of surge arrestor is inclusive in the scope.
1.18	SUPPLY- GIS : 220KV, LOCAL CONTROL CUBICLE	SET	16	Bidder shall meet the requirement of LCC for the complete GIS System, mode of measurement shall be nos. of Bays with Circuit Breaker. LCC requirements other than Circuit Breaker Bays i.e. Bus PT, Bus earthswitch etc shall be deemed inclusive of bidders scope of supply with respective main item.

	Description	UOM	QTY Rev.1	Detailed Description of Scope
1.19	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - SF6 GAS REQUIRED FOR PLACING GIS INTO SUCCESSFUL OPERATION	LOT	1	(1.) First filling of SF6 gas for the equipment supplied plus (2.) an additional quantity sufficient for conducting all the tests on equipment at site before placing it into successful operation plus (3.) 10% extra quantity of first filling as Quality of spare gas. (4.) In the event of changes in present scope, payment shall be made on pro-rata basis of number of circuit breaker bays.
1.20	SUPPLY- GIS : STRUCTURE MATERIALS FOR SUPPORT OF GIS, BUS DUCTS, SF6 TO OIL BUSHING/ CONNECTION AND SF6 TO AIR BUSHING/ CONNECTION INCLUDING FOUNDATION BOLTS, EMBEDDED ITEMS, RAILS AND/ OR OTHER ITEMS STRUCTURAL ITEMS REQUIRED	LOT	1	Structure Materials for support of GIS, SF6 to oil bushing/ connection and SF6 to air bushing/ connection including Foundation Bolts, Embedded Items, Rails and/ or other items structural items required. All steel structure members shall be hot-dip galvanized after fabrication. Unless otherwise specified, minimum mass of zinc coating for Galvanizing shall be 610 gm/square meter. All field assembly joints shall be bolted. Field welding shall not be acceptable. Noncorrosive metal or plated steel shall be used for bolts and nuts throughout the work. Manufacturer shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts, nuts and washers shall be provided to fasten the switchgear base frames to the foundation channels. In addition to above, supports, platforms, foundation bolts, embedded parts in floors etc., are also included in the scope as per the specification, but not limited to the following, (a) Base Plate, Channel, Metallic / Structural Member for seating of GIS system (b) Lattice / Pipe structure required for GIS bay, GIB, SF6 to oil bushing/ connection and SF6 to air bushing/ connection. (c) Foundation bolt / Anchor Fastening bolts for GIS system, if required. (d) Equipment fixing hardware. (e) Cable tray arrangement (mounted on structures of) GIS bay, GIB, SF6 to oil bushing/ connection and SF6 to air bushing/ connection. (f) Any other structural item required to complete the system in all respects but not limited to above. (Excluding structure for GIB which covered with main GIB item itself) (g) In the event of changes in present scope, payment shall be made on pro-rata basis of number of circuit breaker bays.
1.21	SUPPLY- GIS : EARTHING MATERIALS INCLUDING HIGH FREQUENCY EARTHING, IF APPLICABLE	LOT	1	Earthing Materials, except 40mm MS rod, 75x12mm / 50x6 / 100X12 GI Flat, which shall be provided by BHEL as free issue item (FIM), however, exact requirement shall be intimated by bidder based on the earthing philosophy approved, and Supervision of erection of all earthing connection for GIS to Earth Mesh on Floor shall be scope including any special requirements including high frequency earthing. In case, high frequency earthing is not required, necessary design and calculations shall be submitted by bidder. In the event of changes in present scope, payment shall be made on pro-rata basis of number of circuit breaker bays.
1.22	SUPPLY- GIS : 220KV, CONSUMABLES FOR GIS	LOT	1	All consumables including grouting material and chemicals for the chemical anchors bolts etc., if applicable for GIS system shall be provided by bidder, however, in case of consumables with shelf life less than six months shall be supplied with special permission and intimation from BHEL.
1.23	SUPPLY- GIS : 220KV, MAIN ITEM - LINE PT MODULE	SET	18	1 Set equals 1 Phase of line PT module complete in all respect. Please note, this shall be part of main bay & separate BOQ item is created for billing break-up purpose.
2.01	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - ONLINE PARTIAL DISCHARGE (PD) MONITORING SYSTEM	LOT	1	Please refer clause: 5.7.15.4 Online Partial Discharge(PD) monitoring system for (a) 220kV indoor GIS, ~~(b) 220kV outdoor GIS & (c) 220kV GIS extension.~~ Please refer clause: 5.7.15.4 Online Partial Discharge(PD) monitoring system for ~~both indoor & outdoor~~ GIS of document: B269-999-16-50-SP-0020. Following online PD monitoring system shall be provided: (1.) Online PD monitoring system for offered GIS. ~~(2.) One PD monitoring system at Outdoor Switchyard substation (3.) Modification/Integration of existing PD monitoring system to include 2 nos. GIS bay extension.~~

	Description	UOM	QTY Rev.1	Detailed Description of Scope
2.02	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - ONLINE SF6 GAS FILLING / TOPPING-UP SYSTEM	SET	1	Please refer clause:5.7.15.5 SF6 topping system of document: B269-999-16-50-SP-0020. SF6 topping system shall be provided for 220 kV GIS for filling / topping up SF6 gas to panel under energized condition manually. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).-
2.03	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - PORTABLE PD (PARTIAL DISCHARGE) ANALYZER/ MEASUREMENT KIT SUITABLE FOR GIS ALONG WITH REQUIRED ACCESSORIES	SET	1	(Remark: 1 Set of each item for each location i.e. separate set for MRSS-100 (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).-).
2.04	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS LEAKAGE DETECTOR	SET	1	Please refer clause: 5.7.15.1 SF6 Gas leakage detector of document: B269-999-16-50-SP-0020. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).-
2.05	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS FILLING, EVACUATING, FILTERING, DRYING, PUMPING & STORAGE PLANT	SET	1	Please refer clause: 5.7.15.2 Gas filling and evacuating plant of document: B269-999-16-50-SP-0020. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).-
2.06	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS ANALYZER	SET	1	Please refer clause: 5.7.15.3 SF6 gas analyser of document: B269-999-16-50-SP-0020. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).-
2.07	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 Gas Handling Unit / Service Cart	SET	1	Please refer clause: 6.11 of document: 6-51-0066, Document title: SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR
2.08	SPARES- GIS : 220KV, MANDATORY SPARES AS PER TECHNICAL SPECIFICATION	LOT	1	Please refer Clause 6.1 of Engineering Design Basis (Electrical), B269-999-16-50-EDB-1001 inclusive of the followings. (2.1 is covered in separate BOQ item) 2.2 Handle for disconnecter switch drive 4 Nos. 2.3 Handle for earthing switch drive 4 Nos. 2.4 Pre selection key for three position switch 1 No. 2.5 Power cable termination kit 2 sets 2.6 Tripping coil 2 No. 2.7 Closing coil 2 No. 2.8 Capacitive type voltage detectors 1 Set 2.9 Control fuses / MCB 10 Nos. of each rating & type 2.10 Density monitoring device 2 Nos of each type 2.11 Pressure Gauge 2 Nos of each type 2.12 Indicating lamps covers 5 nos. of each colour 2.13 Indicating lamps 20% or 3 nos. (min.), whichever is more
2.09	SUPPLY- GIS : RECOMMENDED OPERATION AND MAINTENANCE SPARES	LOT	0	Price Break-up are to be submitted with technical bid for information only.
2.10	SPARES- GIS : PORTABLE GAS FILLING EQUIPMENT / SF6 GAS CART	SET	1	

	Description	UOM	QTY Rev.1	Detailed Description of Scope
2.11	SUPPLY- GIS : CONTROLLED SWITCHING DEVICE (CSD)	Set	8	CSD: controlled switching device/synchronous switching device in each of the 220kV outgoing transformer feeders (including at all spare feeders) at 220kV GIS substation (MRSS-100) to limit voltage dip during closing of transformer incomer breaker. Bidder to carry out transformer inrush current study for all EHV transformer under various operating conditions including charging through existing CPP SS-28 interconnected with SS-64.
3.01	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GIS BAYS INCLUDING LCC	LOT	1	Site service activities shall be carried out at in stages as per requirement or front availability at site, and hence multiple visits for completion of work are envisaged. Site visit for supervision of unloading & verification of materials for proper storage and up-keeping at site includes following activities but not limited to, (a) Supervision of safe unloading of GIS & its accessories at site. (b) Reconciliation, storage & up keeping of materials, with due instructions/ training to site persons for long storage. Supervision of complete GIS System (as per scope of supply) along with all bay Equipments, indoor & outdoor (excluding Bus duct and SF6 to air bushing covered separate BOQ line item) such as and not limited to GIS extension module, GIS bus extension module, surge arrester, voltage transformer, LCC including structure, cabling, earthing & other associated activities shall be included in the scope. (Excluding the Services item covered in separate BOQ items)
3.02	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GAS INSULATED BUS DUCT	MTR	0	GIB length of 1-phase busduct outside the <u>GIS BAY MODULE</u> shall be considered for mode of measurement.
3.03	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF SF6 TO AIR BUSHING	SET	0	Complete in all respect
3.04	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GIS	LOT	1	Complete in all respect (excluding Bus duct and SF6 to air bushing covered separate BOQ line item)
3.05	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GAS INSULATED BUS DUCT	MTR	0	Complete in all respect
3.06	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF SF6 TO AIR BUSHING	SET	0	Complete in all respect
3.07	SERVICES- GIS : 220KV, FINAL SUCCESSFUL HV/ POWER FREQUENCY TESTING OF GIS INCLUDING ARRANGING OF HV TEST KIT ALONG WITH OPERATOR	LOT	1	Complete in all respect
3.08	SERVICES- GIS : INSULATION CO-ORDINATION & VFT STUDIES FOR GIS SYSTEM	LOT	1	Complete in all respect
SPARES- GIS : REFERENCE UNIT PRICE FOR ADDITION / DELETION OF SUPPLY ITEMS (Unit Prices of Individual Equipment included here or in manadatory spares are required for any Addition/ Deletion of Equipment and replacement of damaged items. Vendor to ensure that the unit prices have a logical relationship with prices of assemblies in main items. Quoting for unit prices is mandatory and shall be considered for evaluation)				
4.01	SPARES- GIS : SINGLE PHASE BUS BAR WITHOUT ENCLOUSER	MTR	1	Complete in all respect.
4.02	SPARES- GIS : GIS METALLIC ENCLOSURE	KG	50	
4.03	SPARES- GIS : EXPANSION BELLOWS/ JOINTS	Set	1	For Single Phase of any type and any rating.
4.04	SPARES- GIS : TEE BEND	Set	1	For Single Phase of any type and any rating.
4.05	SPARES- GIS : ANGLE BEND (135°)	Set	1	For Single Phase of any type and any rating.

	Description	UOM	QTY Rev.1	Detailed Description of Scope
4.06	SPARES- GIS : L-BEND	Set	1	For Single Phase of any type and any rating.
4.07	220KV GIS- SINGLE PHASE AND SINGLE CORE OF CURRENT TRANSFORMER EXCLUDING ASSOCIATED ENCLOSURE AND PRIMARY CONDUCTOR	SET	1	For Single Phase and core of any type and any rating.
4.08	SPARES- GIS : TRIP COIL ASSEMBLY WITH RESISTOR FOR GIS CIRCUIT BREAKER (AS APPLICABLE)	SET	3	
4.09	SPARES- GIS : CLOSING COIL ASSEMBLY WITH RESISTOR FOR GIS CIRCUIT BREAKER (AS APPLICABLE)	SET	3	
4.10	SPARES- GIS : RELAYS, POWER CONTACTORS, PUSH BUTTONS, TIMERS & MCBS ETC. (AS APPLICABLE) OF EACH TYPE FOR GIS CIRCUIT BREAKER	SET	1	
4.11	SPARES- GIS : SINGLE PHASE DISCONNECTOR SWITCH INCLUDING MAINCIRCUIT, ENCLOSURE AND SUPPORT INSULATOR ETC., COMPLETE INALL RESPECT	SET	1	
4.12	SPARES- GIS : SINGLE PHASE MAINTENANCE EARTHING SWITCH INCLUDING MAINCIRCUIT, ENCLOSURE AND SUPPORT INSULATOR ETC.,COMPLETE IN ALL RESPECT	SET	1	
4.13	SPARES- GIS : SINGLE PHASE FAST EARTHING SWITCH INCLUDING MAIN CIRCUIT,ENCLOSURE AND SUPPORT INSULATOR ETC., COMPLETE INALL RESPECT	SET	1	
4.14	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS CIRCUIT BREAKER	SET	1	
4.15	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS DISCONNECTOR SWITCH	SET	1	
4.16	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS MAINTENANCE EARTH SWITCH	SET	1	
4.17	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS FAST EARTHING SWITCH	SET	1	
4.17	SPARES- GIS : GIS-SF6 GAS	Kg	50	

	Description	UOM	QTY Rev.1	Detailed Description of Scope
4.21	SPARES- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - SF6 TO EHV CABLE GIS CONNECTION MODULE	SET	1	SF6 to EHV cable GIS connection module suitable upto 1600 Sqmm (above 630 Sqmm) and as per technical requirement mentioned in specification, 1 phase Cable, shall be as follows, but not limited to, (a) It shall be of the plug-in type with dry-type or fluid-filled terminations. The interfaces conform to IEC standards. A removable link, which disconnects and isolates the GIS from the cable during high-voltage test for convenience and ease of operations shall also be provided. (b) Termination kit for fixing of cable shall also be provided in line with IEC62271-209. (c) PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, insulators etc. as required. (d) Any other item required to complete the system in all respects but not limited to above. (e) 1 Set equals to supplies required for one Phase
SERVICES- GIS : REFERENCE UNIT PRICE FOR ADDITION / DELETION OF SERVICES (Unit Prices of Individual services included here are required for any Addition/ Deletion of Equipment and replacement of damaged items. Vendor to ensure that the unit prices have a logical relationship with prices of assemblies in main items. Quoting for unit prices is mandatory and shall be considered for evaluation)				
5.01	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR SUPERVISION OF ERECTION OF GIS	MANDAY	10	Charges for repetition of services - (if required due to reasons not attributed to the contractor) This item will be executed only if repetition of services is required by BHEL.
5.02	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR TESTING & COMMISSIONING OF GIS	MANDAY	10	Charges for repetition of services - (if required due to reasons not attributed to the contractor) This item will be executed only if repetition of services is required by BHEL.
5.03	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - HIRING CHARGES OF HV TEST KIT WITH OPERATOR	LOT	1	Additional HV test kit charges including charges of operator, HV test kit, accessories & tools required for completion of HV test (Dielectric Test after installation of GIS). This item is executed only if repetition/ additional HV Test is required by BHEL i.e. post successful commissioning of GIS. (if required due to reasons not attributed to the contractor)
5.04	SERVICES- GIS : TRAINING FOR GIS AT SITE	DAY	6	Training for TEN number OWNER' s Engineers at Site for GIS with LCC & its Accessories including Partial Discharge Monitoring system
5.05	SERVICES- GIS : TRAINING FOR GIS AT MANUFACTURER WORKS	DAY	1	

Tender Inviting Authority: BHEL TBG NOIDA

Name of Work: 220 KV GIS FOR IOCL Panipat PROJECT

Enquiry/NIT No: NIT63119_61G2200211 dated 16.02.2022

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1	2	3	4	5	13	14	15	16	20	21	51	53	54	55
1.01	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - BUS BARS	item1	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only
1.02	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - TRANSFORMER GIS BAY MODULE (EXTN. TO EXISTING GIS)	item2	0	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.03	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM -DOUBLE MAIN BUS SCHEME - GIS EXTENSION MODULE	item3	0	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.04	SUPPLY- GIS : 220KV, 50KA FOR 3S, OUTDOOR GIS ISOLATING BREAKER BAY	item4	0	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.05	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A - SF6 TO AIR BUSHING	item5	0	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.06	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - LINE GIS BAY	item6	2	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.07	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - LINE GIS BAY (TYPE 2)	item7	2	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.08	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - BUS COUPLER GIS BAY	item8	2	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.09	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - BUS SECTIONALISER BAY MODULE	item9	2	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.1	SUPPLY- GIS : 220KV, 50KA FOR 3S, DOUBLE MAIN BUS SCHEME - BUS MEASUREMENT GIS BAY/ VOLTAGE TRANSFORMER BAY	item10	4	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.11	SUPPLY- GIS : 220KV, 50KA FOR 3S, MAIN ITEM - DOUBLE MAIN BUS SCHEME - TRANSFORMER GIS BAY	item11	6	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.12	SUPPLY- GIS : 220KV, 50KA FOR 3S, GIS DOUBLE MAIN BUS SCHEME - SPARE TRANSFORMER GIS BAY MODULE	item12	2	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.13	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - SF6 TO EHV CABLE GIS CONNECTION MODULE	item13	0	SET			0.00			0.00		0.000	0.000	INR Zero Only
1.14	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - SF6 TO EHV CABLE GIS CONNECTION MODULE (TYPE 2)	item14	42	SET			0.00			0.00		0.000	0.000	INR Zero Only

Tender Inviting Authority: BHEL TBG NOIDA

Name of Work: 220 KV GIS FOR IOCL Panipat PROJECT

Enquiry/NIT No: NIT63119_61G2200211 dated 16.02.2022

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1	2	3	4	5	13	14	15	16	20	21	51	53	54	55	
1.15	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - GAS INSULATED BUS DUCT	item15	0	MTR			0.00			0.00		0.000	0.000	INR Zero Only	
1.16	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - BUS EARTH SWITCH GIS BAY	item16	0	SET			0.00			0.00		0.000	0.000	INR Zero Only	
1.17	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - GIS SURGE ARRESTER MODULE WITH SURGE COUNTER	item17	42	SET			0.00			0.00		0.000	0.000	INR Zero Only	
1.18	SUPPLY- GIS : 220KV, LOCAL CONTROL CUBICLE	item18	16	SET			0.00			0.00		0.000	0.000	INR Zero Only	
1.19	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - SF6 GAS REQUIRED FOR PLACING GIS INTO SUCCESSFUL OPERATION	item19	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only	
1.2	SUPPLY- GIS : STRUCTURE MATERIALS FOR SUPPORT OF GIS, BUS DUCTS, SF6 TO OIL BUSHING/ CONNECTION AND SF6 TO AIR BUSHING/ CONNECTION INCLUDING FOUNDATION BOLTS, EMBEDDED ITEMS, RAILS AND/ OR OTHER ITEMS STRUCTURAL ITEMS REQUIRED	item20	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only	
1.21	SUPPLY- GIS : EARTHING MATERIALS INCLUDING HIGH FREQUENCY EARTHING, IF APPLICABLE	item21	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only	
1.22	SUPPLY- GIS : 220KV, CONSUMABLES FOR GIS	item22	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only	
1.23	SUPPLY- GIS : 220KV, MAIN ITEM - LINE PT MODULE	item23	18	SET			0.00			0.00		0.000	0.000	INR Zero Only	
2.01	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - ONLINE PARTIAL DISCHARGE (PD) MONITORING SYSTEM	item24	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only	
2.02	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - ONLINE SF6 GAS FILLING / TOPPING-UP SYSTEM	item25	1	SET			0.00			0.00		0.000	0.000	INR Zero Only	
2.03	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - PORTABLE PD (PARTIAL DISCHARGE) ANALYZER/ MEASUREMENT KIT SUITABLE FOR GIS ALONG WITH REQUIRED ACCESSORIES	item26	1	SET			0.00			0.00		0.000	0.000	INR Zero Only	
2.04	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS LEAKAGE DETECTOR	item27	1	SET			0.00			0.00		0.000	0.000	INR Zero Only	

Tender Inviting Authority: BHEL TBG NOIDA

Name of Work: 220 KV GIS FOR IOCL Panipat PROJECT

Enquiry/NIT No: NIT63119_61G2200211 dated 16.02.2022

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1	2	3	4	5	13	14	15	16	20	21	51	53	54	55
2.05	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS FILLING, EVACUATING, FILTERING, DRYING, PUMPING & STORAGE PLANT	item28	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
2.06	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS ANALYZER	item29	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
2.07	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 Gas Handling Unit / Service Cart	item30	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
2.08	SPARES- GIS : 220KV, MANDATORY SPARES AS PER TECHNICAL SPECIFICATION	item31	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only
2.09	SUPPLY- GIS : RECOMMENDED OPERATION AND MAINTENANCE SPARES	item32	0	LOT			0.00			0.00		0.000	0.000	INR Zero Only
2.10	SPARES- GIS : PORTABLE GAS FILLING EQUIPMENT / SF6 GAS CART	item32	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
2.11	SUPPLY- GIS : CONTROLLED SWITCHING DEVICE (CSD)	item32	8	Set			0.00			0.00		0.000	0.000	INR Zero Only
3.01	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GIS BAYS INCLUDING LCC	item33	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only
3.02	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GAS INSULATED BUS DUCT	item34	0	MTR			0.00			0.00		0.000	0.000	INR Zero Only
3.03	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF SF6 TO AIR BUSHING	item35	0	SET			0.00			0.00		0.000	0.000	INR Zero Only
3.04	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GIS	item36	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only
3.05	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GAS INSULATED BUS DUCT	item37	0	MTR			0.00			0.00		0.000	0.000	INR Zero Only
3.06	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF SF6 TO AIR BUSHING	item38	0	SET			0.00			0.00		0.000	0.000	INR Zero Only
3.07	SERVICES- GIS : 220KV, FINAL SUCCESSFUL HV/ POWER FREQUENCY TESTING OF GIS INCLUDING ARRANGING OF HV TEST KIT ALONG WITH OPERATOR	item39	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only

Tender Inviting Authority: BHEL TBG NOIDA

Name of Work: 220 KV GIS FOR IOCL Panipat PROJECT

Enquiry/NIT No: NIT63119_61G2200211 dated 16.02.2022

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3.08	SERVICES- GIS : INSULATION CO-ORDINATION & VFT STUDIES FOR GIS SYSTEM	item40	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only
4.01	SPARES- GIS : SINGLE PHASE BUS BAR WITHOUT ENCLOUSER	item41	1	MTR			0.00			0.00		0.000	0.000	INR Zero Only
4.02	SPARES- GIS : GIS METALLIC ENCLOSURE	item42	50	KG			0.00			0.00		0.000	0.000	INR Zero Only
4.03	SPARES- GIS : EXPANSION BELLOWS/ JOINTS	item43	1	Set			0.00			0.00		0.000	0.000	INR Zero Only
4.04	SPARES- GIS : TEE BEND	item44	1	Set			0.00			0.00		0.000	0.000	INR Zero Only
4.05	SPARES- GIS : ANGLE BEND (135°)	item45	1	Set			0.00			0.00		0.000	0.000	INR Zero Only
4.06	SPARES- GIS : L-BEND	item46	1	Set			0.00			0.00		0.000	0.000	INR Zero Only
4.07	220KV GIS- SINGLE PHASE AND SINGLE CORE OF CURRENT TRANSFORMER EXCLUDING ASSOCIATED ENCLOSURE AND PRIMARY CONDUCTOR	item47	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
4.08	SPARES- GIS : TRIP COIL ASSEMBLY WITH RESISTOR FOR GIS CIRCUIT BREAKER (AS APPLICABLE)	item41	3	SET			0.00			0.00		0.000	0.000	INR Zero Only
4.09	SPARES- GIS : CLOSING COIL ASSEMBLY WITH RESISTOR FOR GIS CIRCUIT BREAKER (AS APPLICABLE)	item42	3	SET			0.00			0.00		0.000	0.000	INR Zero Only
4.10	SPARES- GIS : RELAYS, POWER CONTACTORS, PUSH BUTTONS, TIMERS & MCBS ETC. (AS APPLICABLE) OF EACH TYPE FOR GIS CIRCUIT BREAKER	item43	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
4.11	SPARES- GIS : SINGLE PHASE DISCONNECTOR SWITCH INCLUDING MAINCIRCUIT, ENCLOSURE AND SUPPORT INSULATOR ETC., COMPLETE INALL RESPECT	item44	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
4.12	SPARES- GIS : SINGLE PHASE MAINTENANCE EARTHING SWITCH INCLUDING MAINCIRCUIT, ENCLOSURE AND SUPPORT INSULATOR ETC.,COMPLETE IN ALL RESPECT	item45	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
4.13	SPARES- GIS : SINGLE PHASE FAST EARTHING SWITCH INCLUDING MAIN CIRCUIT,ENCLOSURE AND SUPPORT INSULATOR ETC., COMPLETE INALL RESPECT	item46	1	SET			0.00			0.00		0.000	0.000	INR Zero Only

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Tender Inviting Authority: BHEL TBG NOIDA

Name of Work: 220 kV GIS FOR IOCL Panipat PROJECT

Enquiry/NIT No: NIT63119_61G2200211 dated 16.02.2022

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NUMBER #	TEXT #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Item Code / Make	Quantity	Units	Unit RATE In Figures To be entered by the Bidder in Rs. P	GST (in Percentage)	GST Amount (Unit Rate*Quantity* GST) Rs. P	Unit Freight & Insurance Charges in Rs. P	GST (in Percentage)	GST Amount on F&I (Unit Rate*Quantity*GST) Rs. P	HSN / SAC Code	TOTAL Ex-Works + F & I AMOUNT excluding GST in Rs. P	TOTAL Ex-Works + F & I AMOUNT including GST in Rs. P	TOTAL AMOUNT In Words
1	2	3	4	5	13	14	15	16	20	21	51	53	54	55
4.14	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS CIRCUIT BREAKER	item47	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
4.15	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS DISCONNECTOR SWITCH	item44	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
4.16	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS MAINTENANCE EARTH SWITCH	item45	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
4.17	SPARES- GIS : DRIVE MECHANISM BOX FOR GIS FAST EARTHING SWITCH	item46	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
4.18	SPARES- GIS : GIS-SF6 GAS	item47	50	Kg			0.00			0.00		0.000	0.000	INR Zero Only
4.19	SPARES- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - SF6 TO EHV CABLE GIS CONNECTION MODULE	item46	1	SET			0.00			0.00		0.000	0.000	INR Zero Only
5.01	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR SUPERVISION OF ERECTION OF GIS	item48	10	MANDAY			0.00			0.00		0.000	0.000	INR Zero Only
5.02	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR TESTING & COMMISSIONING OF GIS	item49	10	MANDAY			0.00			0.00		0.000	0.000	INR Zero Only
5.03	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - HIRING CHARGES OF HV TEST KIT WITH OPERATOR	item50	1	LOT			0.00			0.00		0.000	0.000	INR Zero Only
5.04	SERVICES- GIS : TRAINING FOR GIS AT SITE	item51	6	DAY			0.00			0.00		0.000	0.000	INR Zero Only
5.05	SERVICES- GIS : TRAINING FOR GIS AT MANUFACTURER WORKS	item52	1	DAY			0.00			0.00		0.000	0.000	INR Zero Only
Total in Figures												0.000	0.000	Zero Only
Total Rate in Words		INR Zero Only												