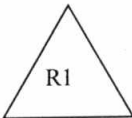
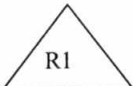
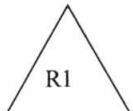




भारत हेवी इलेक्ट्रीकल लिमिटेड
BHARAT HEAVY ELECTRICALS LIMITED
पारेषण व्यापार अभियांत्रिकी प्रबंधन (TBEM)
नोएडा / TBG, NOIDA

DOCUMENT No.	TB-404-316-001	Rev 01	Prepared	Checked	Appd
TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	MM	DKM/	AG/ MK
400 kV , 200kV & 132 KV GAS INSULATED SWITCHGEAR (GIS)		SIGN	[Signature]		
		DATE	05-05-19 25-5-19		
		GROUP	TBEM		
		W.O. No	84004		
CUSTOMER/ CONSULTANT	UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED				

PROJECT	400/22/132 KV GIS s/s at Rasra , Ballia		
<u>Contents:</u>			
Section No.	Description	No of Pages	
SECTION-1 	- SCOPE, SPECIFIC TECHNICAL REQUIREMENTS and QUANTITIES - BOQ (Annexure-1, 2,3) - GAS SLD - DRAWINGS (4 nos.) - ANNEXURE-TR - TECHNICAL QUALIFYING REQUIREMENT - JDU FORMAT	6 9+9+8 3 6 2 02	
SECTION-2	EQUIPMENT SPECIFICATION ANNEXURE-B ANNEXURE-5 ANNEXURE-6 ANNEXURE-A1 CSD SPECIFICATION 	80+3 2 3 15	
SECTION-3	PROJECT DETAILS AND GENERAL SPECIFICATION	27+2	
SECTION-4 	COVER PAGE Annexure C-Compliance Certificate for Technical Specification Annexure D-Deviation/ Change Request for Technical Specification Annexure E-Guaranteed Technical Particulars for GIS & its accessories (to be submitted at contract stage) Annexure F-Technical Checklist (to be submitted with the offer)	1 1 1 6 3	

01	04.05.19	MM	VK	MK	Section 1, Annexure-F revised. Annexure-5,6 , CSD Specification included.
Rev	Date	Altered	Checked	Approved	
Distribution			To		
			Copies		

PROJECT : 400/220/132kV GIS s/s at Rasra , Ballia

CUSTOMER: UTTAR PRADESH TRANSMISSION CORPORATION LTD. (UPPTCL)

Technical Specification of GIS

TB-404-316-001

Section-1: Scope, Specific Technical Requirements & Quantities

REV.01

Section 1: Scope, Technical Requirements and Quantities

1.1 SCOPE

This technical specification covers the requirements of basic to detailed engineering, including system studies like insulation coordination, design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to project site and supervision of erection, testing & commissioning of **400kV, 220kV & 132kV Gas Insulated Switchgear (GIS) with Local Control Cabinet (LCC) and other accessories as per boq**, complete in all respect for efficient & trouble free operation mentioned under this specification.

This section covers the specific technical requirements of **400kV, 220kV & 132kV Gas Insulated Switchgear (GIS) with Local Control Cabinet (LCC)**. This constitutes minimum technical parameters for the above item as specified by the UPPTCL/BHEL. The offered **Gas Insulated Switchgear (GIS) with Local Control Cabinet (LCC)** 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 : Specific technical requirements for the equipment under scope of supplies.
- Section-3 : Project Details and General technical requirements for all equipment under the Project.
- Section-4 : Annexures
 - Annexure-C (Schedule of Technical Deviations)
 - Annexure-D (Compliance Certificate)
 - Annexure-E (Guaranteed Technical Particulars)
 - Annexure-F (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/UPPTCL 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
- o Requirements of other statutory bodies as applicable, e.g. CEA

2. Section-1

3. Section-2

4. Section-3

4. 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/UPPTCL will resolve listed conflicts prior to award. In case of ambiguity, bidder shall inform BHEL/UPPTCL of their interpretation. In case bidder fails to convey the same prior to award, the UPPTCL's 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-C), however bidder shall furnish list of conflicts/ ambiguities/ deviations (Annexure-D), if

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any. Any conflicts/ ambiguities/ deviations mentioned elsewhere in technical offer shall not be reviewed.

The equipment is required for the following project:

Name of the Customer/ UPPTCL	: UTTAR PRADESH TRANSMISSION CORPORATION LTD. (UPPTCL)
Name of Main Contractor	: Bharat Heavy Electricals Limited
Name of the Project	: CONSTRUCTION OF 400/220/132 KV GIS SUBSTATION RASRA, BALLIA

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

1.2 SPECIFIC TECHNICAL REQUIREMENTS

AS PER SECTION 2.

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.

1.3 Drawings Enclosed

Sl. No.	BHEL Drg. No.	Drawing Title
1.	TB-3-404-510-001	SINGLE LINE DIAGRAM OF 400/220/132 KV GIS
2.	TB-0-404-316-002	Overall General Arrangement Drawing of Switchyard for 400/220/132 KV GIS
3.	TB-0-404-316-004	Conceptual drg of 400 kV GIS Building
4.	TB-0-404-316-005	Conceptual drg of 220 kV GIS Building
5.	TB-0-404-316-006	Conceptual drg of 132 kV GIS Building

1.4 OTHER GENERAL REQUIREMENTS

Other general requirements **Gas Insulated Switchgear (GIS) with Local Control Cabinet (LCC)** shall be as follows,

- (i) 400kV GIS (2 main bus scheme, single phase segregated)-
 - 4 nos. line bays,
 - 2 nos. ICT bays,
 - 1 no. Bus reactor bay,
 - 1 no. Bus Coupler
- 220kV GIS (2 main bus scheme, single/three phase encapsulated)-
 - 8 nos. line bays,
 - 4 nos. ICT bays,
 - 1 no. Bus Coupler
- 132kV GIS (2 main bus scheme, single/three phase encapsulated)-
 - 9 nos. line bays,

PROJECT : 400/220/132kV GIS s/s at Rasra , Ballia

CUSTOMER: UTTAR PRADESH TRANSMISSION CORPORATION LTD. (UPPTCL)

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Section-1: Scope, Specific Technical Requirements & Quantities

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2 nos. ICT bays,
1 no. Bus Coupler

- (ii) Bidder shall conduct insulation co-ordination studies for establishing surge arrester rating, quantity and any other requirement for successful operation of GIS.
- (iii) Bidder shall be required to submit 3D OGA Drawing for complete GIS & its accessories.
- (iv) ***"CT & VT details shown in single line diagram are tentative and may change at contract stage. Changes to be incorporated by bidder without any cost and delivery implication to BHEL."***
- (v) 400kV GIS – all bays (line/ICT) shall be terminated with GIB duct
220kV GIS- ICT bays shall be terminated with bus duct and line bays with 220kV terminated cable.
132kV GIS- All bays shall be terminated with 132kV Cable.

GIS shall be suitable for extension in future. Each GIS building will have provision for two future bays.

- (vi) The bidder is to ensure that offered GIS and associated system gets accommodated in the space allocated in GIS Layout including the space required in width for interrupter/other equipment withdrawal for repair/maintenance. R1
BHEL is going ahead with design of GIS building as per enclosed layout (plan & section) drawing, showing building size, column location & crane hook height. Bidder to submit compliance to the same. No deviation at later stage shall be admissible.

Any modification in civil work at later date due to late inputs will be in bidder's account.

- (vii) Bidder shall offer their latest type tested compact model to accommodate the specified & allocated space as per attached layout drawing of GIS Building. Bidder to note that if bidder fails to meet above requirement, its technical offer is liable for non-evaluation.
- (viii) Spares parts of offered GIS shall be available for minimum 10 years.
- (ix) EOT cranes shall be provided in 400kV, 220kV and 132kV GIS buildings for GIS equipment handling during installation, commissioning and maintenance etc.
However, EOT crane for GIS has not been envisaged in bidder's scope.

Crane lifting capacity shall be designed to handle at least two times the maximum weight of the heaviest package of GIS. The crane capacity shall be 10 tonnes (for 400kV & 220KV) and 6 tonnes for 132kV with micro switch arrangement. R1

Maximum size of package to be restricted in line with above.

- (x) 400, 200 & 132kV GIS shall be housed in separate buildings. 400kV building shall be single storied. However, 132 kV & 220 kV GIS building shall be double storied with cable cellar. R1
Building layout enclosed with specification. Bidder to furnish GIS layout accordingly in the offer.

- (xi) Storage shall be provided by BHEL/ its contractor. However, bidder shall provide their

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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 also. Packing shall be suitable for outdoor storage for minimum 6 months. R1

- (xii) Bidder shall submit list of consumables with shelf life of fewer than two years and same shall be dispatched just before the erection and only after specific clearance.
- (xiii) In addition to this, packing of GIS & its accessories shall be suitable for long term storage (minimum 2 years, if required).
- (xiv) 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.
- (xv) 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.
- (xvi) Painting of all structural steel supports provided for installation of all electrical equipment, associated components, cables, earthing etc.
- (xvii) Bidder to submit list of tools, tackle, slings, spanners, gauges, slings and other lifting devices, drills, instruments and appliances necessary for the complete assembly and erection at site of the GIS, required for installation, gas filling, maintenance, site testing of the GIS which shall be arranged by BHEL.

(xviii) **Gas compartmentalization** R1

Separate gas compartment to be provided for Circuit breaker for 400 kV & 220kV GIS. Bidder to meet service continuity requirement as per technical specification/ IEC.

For 400 & 220 kV

- a) During a fault in circuit breaker compartment, no bus bar is permitted out of service during maintenance and repair/ replacement
- b) During a fault in GIS compartment other than CB compartment (including bus bar disconnector), maximum one bus bar and/or one feeder permitted out of service during repair and maintenance.

For 132 kV

- a) During a fault in circuit breaker compartment, only one bus bar is permitted out of service during maintenance and repair/ replacement
- b) During a fault in GIS compartment other than CB compartment (including bus bar disconnector), maximum one bus bar and/or one feeder permitted out of service during repair and maintenance.

(xix) **GIB length** R1

Gas Insulated Bus Duct length shall be measured from the centre line of GIS building wall to SF6 -Air bushing. Quantity given is taken as for 1 phase enclosure for GIB.

PROJECT : 400/220/132kV GIS s/s at Rasra , Ballia

CUSTOMER: UTTAR PRADESH TRANSMISSION CORPORATION LTD. (UPPTCL)

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1.5 Earthing of GIS

R1

Supply of Earthing Material and Supervision of Erection of all Earthing connection for GIS to GIS and GIS to Earth Mesh on Floor shall be in bidder's scope.

The quantity shall be estimated by the bidder, based on their design philosophy. Design philosophy shall be submitted alongwith the bid in line with section 2.

Only supply of earthing materials such as MS Rod (40mm Dia for outdoor below ground earth mat) and GI Flat of 75x12mm or MS Rod as recommended by bidder (for earth mesh on floor) shall be in BHEL's scope and hence any other earthing materials other than mentioned above, if required shall be in bidder's scope of supply.

Erection of earthing materials shall be done by BHEL under supervision of bidder.

In case HF earthing is not required, bidder shall submit necessary calculations and documentation in line with relevant standards including IEEE-80.

1.6 BILL OF QUANTITIES

Quantities for supply and services for shall be as per **Annexure-1,2,3.**

1.7 TYPE TESTING

The offered equipments must have been fully type tested as per relevant ISS/IEC and/or any other specified international standards, during the last 10 years' period to be reckoned from 17.04.18. Type test reports/ certificates must be submitted along with the proposal.

The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.

In case the bidder is not able to submit valid Report of Type Test(s) or in case Type test Reports are not found to be meeting the specification requirements, or not including all specified tests, the contractor shall conduct all such tests under this contract. The costs of such test shall be deemed to be included in the price. The UPPTCL/BHEL shall have right to witness the Type Tests. Waiver of Type Tests will not be entertained in normal circumstances.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

1.8 Drawings and documents

The drawings / documents submitted shall be project and product specific and shall incorporate all project details and title block and numbering scheme of the customer as detailed in Section 2 & 3.

1.9 QUALITY PLAN

The successful bidder shall submit the Quality Plan for BHEL/ UPPTCL approval. In case bidder has reference Quality plan agreed with BHEL/UPPTCL, same can be submitted for specific project after award of contract for BHEL/UPPTCL approval. There shall be no commercial implication to BHEL on account of Quality Plan approval.

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

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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 the bid price.

1.10 FIELD TESTING & COMMISSIONING

- (i) Bidder shall carry out the supervision of installation, field testing and commissioning of GIS including associated system. Submit further appropriate test and commissioning reports and as-built documentation as necessary.
- (ii) Field testing and commissioning of GIS including associated system shall be done by Bidder/OEM only.
- (iii) QAP/SAT/FAT/Type test reports enclosed with the offer of bidder is only for information. Routine, acceptance & Site testing shall be as per UPPTCL approval during detailed engineering. R1
- (iv) Bidder shall also submit site acceptance testing (SAT) procedures and get them approved from BHEL/UPPTCL before carrying out the site testing at site.
- (v) All switchboard protection shall be subject to primary injection test before commissioning.
- (vi) 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.
- (vii) 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 GIS and CRP including associated system.

1.11 PACKING AND DISPATCH

- (i) Biggest packet size to be limited in line with crane capacity as per clause 1.4 (vii)
- (ii) 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.
- (iii) 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.
- (iv) Each individual piece to be shipped, whether crate, container or large unit, shall be marked special notations such as 'Fragile', 'This side up', 'Center of gravity', 'Weight', 'UPPTCL's particulars', 'PO no.' etc., and other details as per purchase order.
- (v) 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.
- (vi) 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.
- (vi) 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.

400 kV GIS - Bill of Materials

Annexure-1

Rev-02

Sl_no	Description	Remarks_Long_Description	Unit	Qty.
4A	400 kV GIS, 50kA for 3 sec, single phase segregated as per enclosed SLD with Double Bus Bar scheme	400 KV, 50kA for 3 sec, single phase segregated SF6 gas insulated switch gear shall have double bus bar arrangement. The SF6 gas insulated switch gear (50 HZ) shall be of the indoor metal-enclosed type, with Partial discharge monitoring sensors comprising of following bay modules:- 1 no. Bus Reactor bay, 2 nos. ICT bay, 4 nos. LINE bay , 1 no. BUS COUPLER bay and, 2 nos. Bus PT bays and scope for extension for future bays (2 nos.) on one side. The bidder shall provide the drawing & design details for future extendibility. The Switchgear shall be complete with all necessary terminal boxes, inspection window, SF6 gas filling arrangements, interconnecting cables/ wirings, grounding connections, gas monitoring equipment and piping, support structures including embedded. The scope of supply shall also include all erection and mounting hardware and interconnecting cables between GIS to LCC and between LCC to LCC including cable tray, glands, lugs, ferrules, earthing material etc. GIS bay modules shall have the provision for offline partial discharge measurement of bay Module.		
4A1	400kV Transformer Bay Module:	400kV, 2000A, 50kA for 3 sec, 3 phase SF6 gas insulated (500MVA, 400/220 kV) Transformer bay module each comprising of following but not limited to: a) one set 3x1-phase SF6 gas insulated circuit breaker (3150A complete with operating mechanism (suitable for 1&3 phase auto reclose) with Control Switching Device(CSD) provision, b) one set 3x1-phase current transformer (3000A) c) two set 3x1-phase group operated bus bar disconnectors (2000A) complete with operating mechanism with safety grounding switch complete d) one set 3x1-phase group operated bus bar disconnectors (2000A) complete with operating mechanism without safety grounding switch e) One set of 3x1-phase, group operated high speed fault make grounding switch, complete with operating mechanisms. f) Gas monitoring devices, pressure switches etc as required. g) Barrier cones, mechanism box and other items as required	set	2
4A2	400kV Bus Reactor Bay Module:	400kV, 2000A, 50kA for 3 sec, 3 phase SF6 gas insulated 125MVAR Bus Reactor bay module each comprising of following but not limited to: a) one set 3x1-phase SF6 gas insulated circuit breaker (3150A) complete with operating mechanism (suitable for 1&3 phase auto reclose) with Control Switching Device(CSD) provision, b) one set 3x1-phase current transformer (3000A), c) one set 3x1-phase voltage transformer, c) two set 3x1-phase , group operated bus bar disconnectors (2000A) complete with operating mechanism with safety grounding switch d) one set 3x1-phase , group operated bus bar disconnectors (2000A) complete with operating mechanism, without safety grounding switch e) One set of 3x1-phase, group operated high speed fault make grounding switch, complete with operating mechanisms. f) Gas monitoring devices, pressure switches etc as required. g) Barrier cones, mechanism box and other items as required.	set	1

400 kV GIS - Bill of Materials

Annexure-1

Rev-02

Sl_no	Description	Remarks_Long_Description	Unit	Qty.
4A3	400kV Line Feeder Bay Module:	400kV, 2000A, 50kA for 3 sec, 3 phase SF6 gas insulated Line feeder bay module each comprising of following but not limited to: a) One set of 3x1-phase,SF6 gas insulated circuit breaker (3150A)complete with operating mechanism (suitable for 1&3 phase auto reclose), b) One set of 3x1-phase,current transformer (3000A), c) two set 3x1-phase , group operated bus bar disconnectors (2000A) complete with operating mechanism, with safety grounding switch d) one set 3x1-phase , group operated bus bar disconnectors (2000A) complete with operating mechanism, without safety grounding switch e) One set of 3x1-phase, group operated high speed fault make grounding switch, complete with operating mechanisms. f) Gas monitoring devices, pressure switches etc as required. g) Barrier cones, mechanism box and other items as required.	set	4
4A4	400kV Bus Bars:	One set of three single phase (isolated), 4000A, 50kA for 3 sec, SF6 gas-insulated metal enclosed bus bars, each comprising of : a) Three individual 4000A bus bars enclosures running across the length of the switchgear to inter connect each of the circuit breaker bay modules b) Gas monitoring systems, pressure switches, telescopic enclosure etc. as required. c) Barriers (communicating , non-communicating types)	set	2
4A5	400kV Voltage Transformer module (for Busbars):	400kV, 50kA for 3 sec, single phase (isolated), SF6 gas insulated bus VT bay module comprising of : a) Three nos. single phase Voltage transformers b) One set of 3x1-phase, 4000A, group operated Disconnector switches complete with operating mechanism , c) One set of 3x1-phase, group operated safety grounding switches, complete with operating mechanisms. (Suitable for Bus Bar Earthing Duty) d) One set of 3x1-phase, high speed fault make grounding switch, complete with operating mechanisms e) Gas monitoring devices, pressure switches etc as required. f) Barrier cones, mechanism box and other items as required.	Set	2
4A6	400kV Bus Coupler Bay Module:	400kV, 4000A, 50kA for 3 sec, 3 phase SF6 gas insulated Bus coupler bay module comprising of following but not limited to: a) One set of 3x1-phase SF6 gas insulated circuit breaker (4000A) complete with operating mechanism , b) One set of 3x1-phase current transformer (3000A), c) two set of 3x1-phase , group operated bus-bar disconnectors (4000A) with safety grounding switches complete with operating mechanism , d) Gas monitoring devices, pressure switches etc as required. e) Barrier cones, mechanism box and other items as required.	Set	1
4A7	First filling of SF6 gas for the equipment supplied plus an additional quantity sufficient for conducting all tests on equipment at site before placing it into successful operation		Lot	1
4A8	First filling of hydraulic fluid, if applicable	First filling of hydraulic fluid plus 10% of total quantity as a spare.	Lot	1
4A9	400kV SF6 to Air Bushing	400kV, 2000A, 50 kA for 3 sec, 25mm/kV creepage, SF6 gas insulated SF6 to Air Bushing for Over head connection of Line/ICT with GIS.	nos.	21
4A10	400kV GIS duct from GIS ICT/Line Bays to SF6 to Air bushing	400kV, 2000A 50kA for 3 sec, SF6 gas insulated GIS duct shall be complete & comprising of:- a) single phase (isolated) SF6 ducts along with all accessories to connect 400kV GIS with 400kV side Lines & ICT. b) Gas monitoring devices, barriers, pressure switches, etc. as required.	Metre	600
4A11	Local Control Cabinet (LCC) for 400kV GIS	Local Control Cabinets shall be used for following bays: 1. 400kV Transformer Bay Module- 2nos. 2. 400kV Bus Reactor Bay Module- 1nos. 3. 400kV Line Feeder Bay Module- 4nos. 4. 400kV Bus Coupler Bay Module- 1nos. 5. 400kV Voltage Transformer module- In adjoining LCC, in case of otherwise, Bidder shall be paid for BOQ qty only.	nos.	8

400 kV GIS - Bill of Materials

Annexure-1

Rev-02

SI_no	Description	Remarks_Long_Description	Unit	Qty.
4A12	Controlled Switching Device for ONE set of 2000A, 3x1-phase, SF6 insulated circuit breaker	Controlled switching device shall be used for following bays: 1. 400kV Transformer Bay Module- 2nos. 2. 400kV Bus Reactor Bay Module- 1nos.	nos.	3
4A13	Supply of structure materials, required for complete installation of 400kV GIS including support structure (foundation bolts/ embedded parts) in floor, walkway platform, structure & bus duct & railing etc including wall sealing & frame for duct crossing in wall. (The civil works will be done based on supplier design & drawings).	Supply of structure material, required for complete installation of GIS including support structure (foundation bolts/ embedded parts) in floor, walkway platform & railing etc including wall sealing & frame for duct crossing in wall shall be in bidder's scope. The civil works shall be done based on bidder's design & drawings.	Lot	1
4A14	Supply of Earthing material for 400kV GIS including High frequency earthing material. The quantity shall be estimated provided by bidder for above floor earthing connection.	Supply of Earthing Material and Supervision of Erection of all Earthing connection for GIS to GIS and GIS to Earth Mesh on Floor shall be in bidder's scope. The quantity shall be estimated by the bidder, based on their design philosophy. Design philosophy shall be submitted alongwith the bid in line with section 2. Only supply of earthing materials such as MS Rod (40mm Dia for outdoor below ground earth mat) and GI Flat of 75x12mm or MS Rod as recommended by bidder (for earth mesh on floor) shall be in BHEL's scope and hence any other earthing materials other than mentioned above, if required shall be in bidder's scope of supply. Erection of earthing materials shall be done by BHEL under supervision of bidder. In case HF earthing is not required, bidder shall submit necessary calculations and documentation in line with relevant standards including IEEE-80.	Lot	1
4A15	Consumables required for 400kV GIS	Consumables required during erection, testing and commissioning for complete package. It shall be supplied just before erection after confirmation from BHEL. However, bidder shall take special permission from BHEL, before supply of consumables having the shelf life less than 6 months.	Lot	1
4A16	Laptop for configuration of CSD	Laptop shall be of reputed make with installed software suitable for configuration of CSD.	nos.	1
4A17	Signal/ Special Cables between Circuit breaker and controlled switching device, other than armoured power and control cables	For signal cables between controlled Switching device (located in relay panel in CRP room of GIS building) and circuit breaker, exact length of cable or no of runs shall be calculated by bidder and shall be supplied as per actual requirement at no extra cost to BHEL.	Lot	1
4A18	Portable ladder & catwalk arrangement for maintenance	Portable ladder shall be of reputed make with wheel arrangement. The ladder platform shall have the arrangement to accommodate emergency tools & tackles and person standing on it should be able to access the remote and highest point of GIS.	set	1
4B	Testing & Maintenance Equipment for GIS			
4B1	SF6 Gas Filling, Evacuating, Filtering, Drying, Pumping & storage Plant with spares for five years operation (including gas sections of bus-bar and all associated equipments) (Any reputed make) - 300 litre capacity, DILO mega series or equivalent	The equipment shall be DILO Make or equivalent reputed make (Mega Series with 300Ltr gas capacity, however make and model shall be subject to customer approval. Equipment cart shall be suitable for movement to different GIS stations.	Set	1
4B1A	SF6 Gas Filling, Evacuating, Filtering, Drying, Pumping & storage Plant with spares for five years operation (including gas sections of bus-bar and all associated equipments) (Any reputed make) - 300 litre capacity, DILO Economy series or equivalent	The equipment shall be DILO Make or equivalent reputed make (Economy Series with 300Ltr gas capacity, however make and model shall be subject to customer approval. Equipment cart shall be suitable for movement to different GIS stations.	Set	1
4B2	Portable type Partial discharge Monitoring kit alongwith sensors and accessories (UHF Type) (Dobel make or equivalent)	The offline portable discharge measurement kit (UHF type) shall be of Dobel or any other equivalent reputed make	Set	1
4B3	SF6 Moisture Content (Dew Point) meter (any reputed make)		Set	1
4B4	Contact resistance meter (any reputed make)	Megger or any other equivalent reputed make	Set	1
4B5	Circuit breaker operational analyzer (any reputed make)	HISAC or any other equivalent reputed make	Set	1
4B6	SF6 gas leakage detector (any reputed make)		Set	2
4B7	Digital Manometer (any reputed make)		Nos.	2
4B8	Micro gas Analyzer (any reputed make)		Set	2
4B9	Gas masks (any reputed make)		Nos.	10

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Sl_no	Description	Remarks_Long_Description	Unit	Qty.
4C	Mandatory spares	These prices shall also be used as a reference price for addition/ deletion /replacement		
4C1.1	400kV GIS spares general - SF6 Gas Pressure Relief Devices, 3 Nos. of each type	1 set=3 no. of each type	Set	2
4C1.2	400kV GIS spares general - SF6 Pressure gauge with coupling device cum switch or density monitors and pressure switch as applicable (1 no. of each type)	1 set=1 no. of each type	Set	1
4C1.3	400kV GIS spares general - Coupling device for pressure gauge cum switch for connecting Gas handling plant	1 set=1 no. of each type	Set	2
4C1.4	400kV GIS spares general - Rubber Gaskets, "O" Rings and Seals for SF6 gas of each type	1 set=1 no. of each type	Set	1
4C1.5	400kV GIS spares general - Molecular filter for SF6 gas with filter bags (20% of total weight)	1 set= 20% of total weight	Set	1
4C1.6	400kV GIS spares general - All types of Control Valves for SF6 gas of each type	1 set=1 no. of each type	Set	2
4C1.7	400kV GIS spares general - SF6 gas (20 % of total gas)	1 Lot= 20% of total gas, to be supplied in non returnable standard cylinders	Lot	1
4C1.8	400kV GIS spares general - All types of coupling for SF6 gas (1 no. of each type)	1 set=1 no. of each type	Set	1
4C1.9	400kV GIS spares general - Pipe length (Copper or Steel as applicable) for SF6 Circuit of each type	1 set=1 no. of each type	Set	1
4C1.10	400kV GIS spares general - Density Monitors for SF6 gas	1 set=1 no. of each type	Set	1
4C1.11	400kV GIS spares general - Enclosures, Insulators & main circuit to replace on each phase, any compartment of Busbar or bay (1 set for 1 (one) bay)	1 set =Quantity sufficient for 1 bay.	Set	1
4C1.12.1	400kV GIS spares general - Covers with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment For 3 phase enclosure if applicable (1 set for 1 (one) bay)	1 set =Quantity sufficient for 1 bay.	Set	2
4C1.12.2	400kV GIS spares general - Covers with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment For 1 phase enclosure if applicable (1 set for 1 (one) bay)	1 set =Quantity sufficient for 1 bay.	Set	3
4C1.13	400kV GIS spares general - Locking device to keep the Dis-connectors (Isolators) and Earthing switches in close or open position in case of removal of the driving Mechanism		Set	1
4C1.14	400kV GIS spares general - Bus support Insulator of each type for single phase/ 3 phase enclosure (5% of population)	1 Lot= 5% of total population	Lot	1
4C1.15	400kV GIS spares general - SF6 to air bushing of each type & rating	1 set=1 no. of each type and rating	Set	1
4C1.16	400kV GIS spares general - Spares for Local control cabinet including MCB, fuses, timers, Aux Relay of each type & rating terminal of each type	1 set=1 no. of each type and rating of each item	Set	1
4C1.17	400kV-GIS spares general—Bushing-for-Dielectric-test-on-Cable	deleted		
4C1.18	400kV-GIS spares general—T&P-for-bushing-erection-including-ladder/-platform-for-Bushing-erection-and-subsequently-during-O&M-for-Transformer	deleted		
4C1.19	400kV-GIS spares general—Cable Termination-Enclosure, if applicable	deleted		
4C2	400 kV Circuit Breaker			
4C2.1	400 kV Circuit Breaker - Complete Circuit Breaker pole of each type & rating complete with interrupter, main circuit, enclosure and Marshalling Box with operating mechanism	1 set=Complete Circuit Breaker pole of each type & rating complete with interrupter, main circuit, enclosure and Marshalling Box with operating mechanism	Set	3
4C2.2	400 kV Circuit Breaker - Fixed, moving and arcing contacts including insulating nozzles - 3 nos. of each type	1 set=3 no. of each type	Set	1

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Sl_no	Description	Remarks_Long_Description	Unit	Qty.
4C2.3	400 kV Circuit Breaker - Rubber gaskets, 'O' rings and seals for SF6 gas of each type	1 set=1 no. of each type and rating of each item	Set	1
4C2.4	400 kV Circuit Breaker - Trip coil assembly with resistor as applicable, 3 nos. of each type	1 set=3 no. of each type	Set	2
4C2.5	400 kV Circuit Breaker - Closing coil assembly with resistor as applicable, 3 nos. of each type	1 set=3 no. of each type	Set	2
4C2.6	400 kV Circuit Breaker - Molecular filter for SF6 gas with filter bags (10% of total quantity used)	1 Lot= 10% of total quantity used	Lot	1
4C2.7	400 kV Circuit Breaker - SF6 Pressure gauge cum switch or Density monitors and pressure switch as applicable, 3 nos each type	1 set=3 no. of each type	Set	1
4C2.8	400 kV Circuit Breaker - Coupling device for pressure gauge cum switch for connecting Gas handling plant, 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.9	400 kV Circuit Breaker - Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating	1 set=1 no. of each type and rating of each item	Set	1
4C2.10	400 kV Circuit Breaker - Closing assembly/ valve, 3 nos. of each type	1 set=3 no. of each type	Set	2
4C2.11	400 kV Circuit Breaker - Trip assembly/ valve, 3 nos. of each type	1 set=3 no. of each type	Set	2
4C2.12	400 kV Circuit Breaker - Aux. switch assembly, 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.13	400 kV Circuit Breaker - Operation Counter, 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.14	400 kV Circuit Breaker - Rupture disc, 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.15	400 kV Circuit Breaker - Windscope / Observing window, 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.16	400 kV Circuit Breaker - Spring operating closing mechanism one no of each type, if applicable	1 set=1 no. of each type	Set	1
4C2.17	400 kV Circuit Breaker - Hydraulic operating mechanism, if applicable			
4C2.17.1	400 kV Circuit Breaker - Hydraulic operating mechanism with drive motor , 3 nos of each type if applicable	1 set=3 no. of each type	Set	1
4C2.17.2	400 kV Circuit Breaker - Hydraulic operating mechanism- Ferrules, joints and couplings, 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.17.3	400 kV Circuit Breaker - Hydraulic filter, 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.17.4	400 kV Circuit Breaker - Hydraulic operating mechanism- Hose pipe, 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.17.5	400 kV Circuit Breaker - Hydraulic operating mechanism- N2 Accumulator, 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.17.6	400 kV Circuit Breaker - Hydraulic operating mechanism- Pressure transducer, 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.17.7	400 kV Circuit Breaker - Hydraulic operating mechanism- Valves 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.17.8	400 kV Circuit Breaker - Hydraulic operating mechanism- Pipe length (copper & steel) 3 nos. of each size & type	1 set=3 no. of each type	Set	1
4C2.17.9	400 kV Circuit Breaker - Hydraulic operating mechanism- Pressure switches 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.17.10	400 kV Circuit Breaker - Hydraulic operating mechanism- Pressure gauge with coupling device, 3 nos. of each type	1 set=3 no. of each type	Set	1
4C2.17.11	400 kV Circuit Breaker - Hydraulic oil (20% of total qty. used)	1 set= 20% of total qty. used	Set	1
4C2.17.12	400 kV Circuit Breaker - Hydraulic operating mechanism- Pressure Relief Device, 3 nos. of each type	1 set=3 no. of each type	Set	2
4C3	400 kV Isolators			
4C3.1	400 kV Isolators - Complete set of 3 nos. of single phase / one no. of 3-phase dis-connector including main circuit, enclosure, driving mechanism	1 Set= Complete set of 3 nos. of single phase / one no. of 3-phase dis-connector including main circuit, enclosure, driving mechanism	Set	1
4C3.2	400 kV Isolators - High speed fault making grounding switch operating mechanism complete with all necessary gaskets mounting hardware/operating mechanism complete with all necessary gaskets connecting apparatus,	1 set =operating mechanism for one no. three phase high speed earth	Set	1

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Sl_no	Description	Remarks_Long_Description	Unit	Qty.
4C3.3	400 kV Isolators - 3 no. of single phase / one no of 3 phase Earthing switch including main circuit, enclosure, driving mechanism	1 Set= 3 no. of single phase / one no of 3-phase Earthing switch including main circuit, enclosure, driving mechanism	Set	1
4C3.4	400 kV Isolators - Copper contact fingers for dis-connector male & female contact –for one complete (3 phase) dis-connector of each type and rating	1 set= Copper contact fingers for dis-connector male & female contact –for one complete (3 phase) dis-connector of each type and rating	Set	1
4C3.5	400 kV Isolators - Copper contact fingers for earthing switch male & female contacts- for one complete (3 phase) earthing switch of each type and rating	1 set= Copper contact fingers for earthing switch male & female contacts- for one complete (3 phase) earthing switch of each type and rating	Set	1
4C3.6	400 kV Isolators - Open / Close contactor assembly, timers, key interlock for one complete (3 phase) dis-connector and (3 phase) earthing switch of each type and rating	1 set= Open / Close contactor assembly, timers, key interlock for one complete (3 phase) dis-connector and (3 phase) earthing switch of each type and rating	Set	1
4C3.7	400 kV Isolators - Push button switch, each type, as applicable	1 set= 1 no. of Push button switch of each type	Set	1
4C3.8.1	400 kV Isolators - Limit switches and Aux. Switches for complete 3 phase equipment- For isolator		Set	1
4C3.8.2	400 kV Isolators - Limit switches and Aux. Switches for complete 3 phase equipment For earth switch		Set	1
4C3.9.1	400 kV Isolators - Rotor housing bearing assembly for complete 3 phase equipment For isolator		Set	1
4C3.9.2	400 kV Isolators - Rotor housing bearing assembly for complete 3 phase equipment For earth switch		Set	1
4C3.10.1	400 kV Isolators - Motor with gear assembly for complete 3 phase equipment For isolator		Set	1
4C3.10.2	400 kV Isolators - Motor with gear assembly for complete 3 phase equipment For earth switch		Set	1
4C3.11	400 kV Isolators - Corona shield rings as applicable (1 set for one complete 3-phase isolator)		Set	2
4C3.12.1	400 kV Isolators - Hinge pins for complete 3 phase equipment For isolator		Set	1
4C3.12.2	400 kV Isolators - Hinge pins for complete 3 phase equipment For earth switch		Set	1
4C3.13.1	400 kV Isolators - Bearings for complete 3 phase equipment For isolator		Set	1
4C3.13.2	400 kV Isolators - Bearings for complete 3 phase equipment For earth switch		Set	1
4C3.14	400 kV Isolators - Interlocking coil with resistors, timers, key interlock for complete 3 phase equipment (each type and rating)	1 set= Interlocking coil with resistors, timers, key interlock for complete 3 phase equipment (each type and rating)	Set	1
4C3.15.1	400 kV Isolators - Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For isolator	1 set= Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For isolator	Set	3
4C3.15.2	400 kV Isolators - Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For earth switch	1 set= Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For earth switch	Set	1
4C3.16	400 kV Isolators - Aux. switch assembly (complete) with 10 NO & 10 NC or more contacts for both isolator & earth switch	1 set= Aux. switch assembly (complete) with 10 NO & 10 NC or more contacts for both isolator & earth switch	Set	1
4C4.1	400 KV Current Transformer - Gas Insulated Complete CT of each type and rating with enclosure	1 Set= 1 nos. of GIS CT of each type & rating	Set	3
4C4.2	400 KV Current Transformer - Secondary bushing of each type	1 Set= 1 nos. of Secondary Bushing of each type	Set	3
4C5.1	400KV Voltage Transformer - Gas Insulated Complete PT of each type and rating with enclosure	1 Set= 1 nos. of PT of each type & rating	Set	3
4D	Supply Item – Commissioning spares for testing & commissioning of 400kV GIS till handing over	deleted		

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Sl_no	Description	Remarks_Long_Description	Unit	Qty.
4E	Supply Item - Tools & tackle	Any special tools required is deemed to be included in scope of bidder. 1. Bidder to submit list of general tools & tackles, slings, spanners, gauges and other lifting devices, drills, instruments and appliances necessary for the complete assembly and erection at site of the GIS, required for installation, gas filling, maintenance, site testing of the GIS which shall be arranged by BHEL. Any tool/ (s) which does not fall in the category of general tools shall be arrange by bidder only and in this regard, decision of BHEL shall be final and binding. 2. 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 same shall be considered during evaluation. 3. Bidder shall also provide list of returnable tools and tackles , to complete the assembly and erection at site of the GIS, required for installation, gas filling, maintenance , site testing of the GIS	Lot	1
4F	Services: Supervision of Erection, commissioning & site testing including earthing			
4F1	Insulation co-ordination studies	Outdoor Surge arresters shall be provided by BHEL as indicated in layout. However , Bidder to conduct insulation coordination study including VFTO and in-case additional surge arresters are to be provided, same is in scope of bidder, to be provided inside GIS	Lot	1
4F2	Site visit for unloading & verification of material at store	Store shall be provided by BHEL. Bidder shall provide the details of storage requirement along with storage procedure. Bidder shall ensure proper storage at store after unloading of materials and reconciliation.	Set	1
4F3	Supervision of Erection of GIS	Complete GIS including busbar, ICT bays, Line bays, Tie Line Bays, bus coupler, bus PT etc.	Lot	1
4F4	Supervision of Erection of GIS Duct - GIS to SF6 to Air Bushings		Metre	600
4F5	Supervision of Erection of complete SF6 to Air Bushing		Set	21
4F6	Testing & Commissioning of GIS	Complete GIS including busbar, ICT bays, Line bays, bus coupler, bus PT etc. 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 (UPPTCL). An adequate stock of startup/ commissioning spares shall be made available at the site such that the startup 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.	Lot	1
4F7	Final successful Testing of GIS including HV test kit	HV Test kit including operator shall be arranged by the bidder on returnable basis. (ICT & Lines may be commissioned seperately.) Final testing as per IEC for complete GIS including busbar, ICT bay, Line bays, bus PT, Ducts, SF6 to Air Bushing etc.	Lot	1
4F8	Final Documentation	This includes As Built Drawings, Schematics, Site ITPs & protocols etc. and bidder shall submit the certification from BHEL/ Customer at installation site.	Lot	1
4G	Services: Training			
4G1	Training for GIS of 6 no. Engineers (4 no. customer engineers+2 no. BHEL engineers) for a period of at least one week at Manufacturer's works		Lot	1
4G2	Lodging and boarding of 4 no. customer engineers for a period of at least one week at Manufacturer's works		Lot	1
4G3	To and Fro charges of 4 no. customer engineers for a period of at least one week at Manufacturer's works		Lot	1
4G4	Training for GIS of 12 no. Engineers (10 no. customer engineers+2 no. BHEL engineers) for a period of at least one week at site		Lot	1

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Sl_no	Description	Remarks_Long_Description	Unit	Qty.
4G5	Lodging and boarding of 10 no. customer engineers for a period of at least one week at site		Lot	1
4G6	To and Fro charges of 10 no. customer engineers for a period of at least one week at site		Lot	1
4H	Services: Special type test	deleted		
4I	Any other item required for completion of project		Lot	1
4I1	Supply - Any other item required for completion of project and not covered in A tp E - Complete List to be provided by bidder along with unit prices.	Any other item/ (s) (other than mentioned in BOQ) required for completion of GIS work as per tender scope of work,the same shall be deemed to be included in scope of tender and shall be supplied free of cost by bidder	Lot	1
4I2	Services - Any other item required for completion of project and not covered in F&G - Complete List to be provided by bidder along with unit prices.	Any other service item/ (s) (other than mentioned in BOQ), required to be executed for completion of GIS work as per tender scope of work, the same shall be deemed to be included in scope of tender and shall be provided/ executed free of cost by bidder.	Lot	1
4J	Supply - Unit Prices of Individual Item/Equipment	Unit Prices of Individual Equipment/ item/ Component included here or in mandatory spares shall be used as a reference price for addition/ deletion /replacement due to change in SLD, change in scope of work, additional requirement, damage or theft at site. Vendor shall ensure that the unit prices have a logical relationship with prices of assemblies in main items (Bay, Busbar etc). Quoting for unit prices is mandatory and shall be considered for evaluation. Any item Not Applicable/ Not quoted in technical evaluation is found applicable at any stage and is required due to above mentioned reasons, shall be supplied free of cost till end of contract i.e. till end of guarantee period.		
4J1	Operating Mechanism box for single phase, 400kV Circuit Breaker		No.	1
4J2	Operating Mechanism box for single phase, 400kV disconnecter		No.	1
4J3	Operating mechanism for single phase, 400kV, Maintenance Earthing Switch		No.	1
4J4	Operating Mechanism for single phase, 400kV, High Speed Earthing Switch		No.	1
4J5	Single phase bus bar (Any type)	Complete single phase 400kV, 4000A, 50 kA for 3s bus bar including Conductor, Gas monitoring systems, barriers, pressure switches and any other items required. This item shall be used for buffer gas compartment as per requirements based on the final approved drawings.	Metre	1
4J6	Conductor for Single phase Bus bar/ bus duct (any type)	Conductor for bus bar, bus duct, GIB, Interconnecting conductors of any type with interconnecting parts as required.	Kg	10
4J8	Gas barrier insulators	1 Set= 1 nos. of each type	Set	1
4J9	Density switch	1 Set= 1 nos. of each type	Set	1
4J10	UHF PD sensor along with all accessories	1 Set= 1 nos. of each type	Set	1
4J12	Elbow/ Angle /T-bends	1 Set= 1 nos. of each type	Set	1
4J15	Expansion bellows/ joints	1 Set= 1 nos. of each type	Set	1
4J17	Services of manpower for erection per day (excluding travel time)		Day	1
4J18	Services of manpower for Testing & commissioning per day (excluding travel time)		Day	1
4J19	Hiring charges of HV test kit	Hiring charges of HV test kit including charges of operator, accessories & tools required for completion of HV test (Dielectric Test after installation of GIS). HV test kit charges include HV testing of one or more bay at site.	Lot	1

Notes:

- 1 **Commissioning spares** : It is the responsibility of the contractor to supply all necessary spares as required until the equipment/systems are handed over to the Purchaser (UPPTCL).
An adequate stock of startup spares including SF6 handling kits & other equipment shall be made available at the site such that the startup and commissioning of the equipment /systems, performance testing and handing over the equipment/systems to the Purchaser can be carried out without hindrance or delays.

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Sl_no	Description	Remarks_Long_Description	Unit	Qty.
2	Any item Not Applicable/Not quoted as per bidder's design /confirmation, however, If found applicable later on, the same shall be deemed to be included in the scope of tender and shall be supplied free of cost by bidder.			
3	If any other item (other than mentioned in Item No 4A1 to 4E of BOQ) required for completion of GIS work as per tender scope of work,the same shall be deemed to be included in scope of tender and shall be supplied free of cost by bidder			
4	If any other service item(other than mentioned in Item No 4F1 to 4G6 of BOQ) is required to be executed for completion of GIS work as per tender scope of work,the same shall be deemed to be included in scope of tender and shall be provided/executed free of cost by bidder			
5	Unite rate items- Any item Not Applicable/ Not quoted , is found applicable and is required due to damages , theft, replacement etc. or any other reason as envisaged in clause of NIT, the required quantity shall be supplied free of cost till end of contract i.e. till end of guarantee period.			
6	SF6 Gas handling equipment required during erection, testing & commissioning in bidder's scope.			

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Sl.No.	Description	Remarks_Long_Description	Unit	Qty.
2A	GIS 220 kV, 40kA for 3 sec, single/three phase encapsulated as per enclosed SLD with Double Bus Bar scheme	The 220KV , 40kA for 3s , single/three phase encapsulated SF6 gas insulated switch gear shall have double bus bar arrangement. The SF6 gas insulated switch gear (50 HZ) shall be of the indoor metal- enclosed type, with Partial discharge monitoring sensors comprising of following modules:- 4 nos. ICT bay, 8 nos. LINE bay, 1 no. BUS COUPLER bay and 2 nos. Bus PT bays and scope for extension for future bays on one side(2 nos.). The bidder shall provide the drawing & design details for future extendibility. The Switchgear shall be complete with all necessary terminal boxes, inspection window, SF6 gas filling arrangements, interconnecting cables/ wirings, grounding connections, gas monitoring equipment and piping, support structures including embedded. The scope of supply shall also include all erection and mounting hardware and interconnecting cables between GIS to LCC and between LCC to LCC including cable tray, glands, lugs, ferrules, earthing material etc. GIS bay modules shall have the provision for offline partial discharge measurement of bay Module.		
2A1	220kV Transformer (LV side of 500MVA, 400/220kV) Bay Module:	220kV, 2000A, 40kA, 3 phase SF6 gas insulated ICT(LV side of 500MVA, 400/220kV Transformer) bay module each comprising of following but not limited to: a) one set 3x1-phase SF6 gas insulated circuit breaker (2500A) complete with operating mechanism (suitable for 1&3 phase auto reclose), b) one set 3x1-phase current transformer (2000A), c) two set 3x1-phase group operated bus-bar disconnectors (2000A) complete with operating mechanism, with safety grounding switch , d) one set 3x1-phase group operated line disconnector complete with operating mechanism, without safety grounding switches, e) one set 3x1-phase high speed safety grounding switch complete with operating mechanism, f) Gas monitoring devices, pressure switches etc as required. g) Barrier cones, mechanism box and other items as required.	Set	2
2A2	220kV Transformer (HV side of 160MVA, 220/132kV) Bay Module:	220kV, 2000A, 40kA for 3 s, 3 phase SF6 gas insulated Transformer (160MVA, 220/132 kV) bay module each comprising of following but not limited to: a) one set 3x1-phase SF6 gas insulated circuit breaker (2500A) complete with operating mechanism (suitable for 1&3 phase auto reclose), b) one set 3x1-phase current transformer (2000A), c) two set 3x1-phase bus-bar disconnectors (2000A) complete with operating mechanism, with safety grounding switch, d) one set 3x1-phase bus-bar disconnector (2000A) complete with operating mechanism, without safety grounding switches, e) one set 3x1-phase high speed safety grounding switch complete with operating mechanism, , f) Gas monitoring devices, pressure switches etc as required. g) Barrier cones, mechanism box and other items as required.	Set	2
2A3	220kV Line Feeder Bay Module:	220kV, 2000A, 40kA for 3s , 3 phase SF6 gas Insulated Line feeder bay module each comprising of following but not limited to: a) one set 3x1-phase SF6 gas insulated circuit breaker (2500A) complete with operating mechanism (suitable for 1&3 phase auto reclose), b) one set 3x1-phase current transformer (2000A), c) two set 3x1-phase group operated bus-bar disconnectors (2000A) complete with operating mechanism, with safety grounding switch, d) one set 3x1-phase group operated bus-bar disconnector (2000A) complete with operating mechanism, without safety grounding switches, e) one set 3x1-phase group operated high speed safety grounding switch complete with operating mechanism. , g) Gas monitoring devices, pressure switches etc as required. h) Barrier cones, mechanism box and other items as required.	Set	8

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Sl.No.	Description	Remarks_Long_Description	Unit	Qty.
2A4	220kV Bus Bars:	220kV, 40kA for 3 s, single phase /three phase encapsulated, a) Three SF6 gas insulated, metal enclosed 3000A bus bars in bus enclosures (single/three phase encapsulation) running along the length of the switchgear to interconnect each of circuit breaker bay module. b) Gas monitoring systems, pressure switches, telescopic enclosure etc. as required. c) Barriers (communicating , non-communicating types)	Set	2
2A5	220kV Voltage Transformer module (for Busbars)	220kV, 40kA for 3 sec, single phase (isolated), SF6 gas insulated bus VT bay module comprising of following but not limited to: a) 3x1- phase Voltage transformers b) One set of 3x1-phase, 2000A, group operated Disconnecter switches, c) One set of 3x1-phase, group operated safety grounding switches, complete with operating mechanisms. (Suitable for Bus Bar Earthing Duty) d) One set of 3x1-phase, high speed fault make grounding switch, complete with group operated manual and motor driven operating mechanisms. e) Gas monitoring devices, pressure switches etc as required. f) Barrier cones, mechanism box and other items as required.	Set	2
2A6	220kV Bus Coupler Bay Module:	220kV, 3000A, 40kA for 3 s, SF6 gas insulated Bus coupler bay module comprising of following but not limited to: a) one set 3x1-phase SF6 gas insulated circuit breaker (3000A complete with operating mechanism (suitable for 1&3 phase auto reclose), b) one set 3x1-phase current transformer (2000A), c) two set 3x1-phase group operated bus-bar disconnectors (3000A) complete with operating mechanism, with safety grounding switch d) Gas monitoring devices, pressure switches etc as required. f) Barrier cones, mechanism box and other items as required. g) SF6 gas monitoring system for complete bay etc. as per technical specification.	Set	1
2A7	220kV Gas Insulated Bus Duct	SF6 gas insulated bus duct with all fixing arrangement from transformer GIS module upto and including SF6/Air bushing. (Bus duct is to be terminated through SF6/Air bushing before the HV side of the Transformer and same will be connected to Transformer HV bushing through aluminium pipe via Surge Arresters) to complete transformer bay module as per technical specification.	Metre	240
2A8	220kV SF6 to Air Bushing	220kV, 2000A, 40 kA for 3 sec, 25mm/kV creepage. SF6 gas insulated SF6 to Air Bushing for Over head connection of Line/ICT with GIS.	Nos.	12
2A9	220kV Cable termination module for line bay with isolating link	Gas insulated terminal connection for connecting XLPE cable with cable termination enclosure and other accessories with GIS etc. to complete Line feeder bay module as per technical specification. (1 set for 3 phase) suitable for 1C, 1200 sqmm Cu XLPE Cable including the provision of isolating link for testing	Set	8
2A10	LCC for 220kV GIS	Local Control Cabinets shall be used for following bays: 1. 220kV Transformer Bay Module- 4nos. 2. 220kV Line Feeder Bay Module- 8nos. 3. 220kV Bus Coupler Bay Module- 1nos, 5. 220kV Voltage Transformer module- In adjoining LCC, in case of otherwise, Bidder shall be paid for BOQ qty only	Nos.	13
2A11	First filling of SF6 gas for the equipment supplied plus an additional quantity sufficient for conducting all tests on equipment at site before placing it into successful operation		Lot	1
2A12	First filling of hydraulic fluid, if applicable	First filling of hydraulic fluid plus 10% of total quantity as a spare.	Lot	1

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Sl.No.	Description	Remarks_Long_Description	Unit	Qty.
2A13	Supply of structure materials, required for complete installation of 220kV GIS including support structure (foundation bolts/ embedded parts) in floor, walkway platform, structure & bus duct & railing etc including wall sealing & frame for duct crossing in wall. (The civil works will be done based on supplier design & drawings).	Supply of structure material, required for complete installation of GIS including support structure (foundation bolts/ embedded parts) in floor, walkway platform & railing etc including wall sealing & frame for duct crossing in wall shall be in bidder's scope. The civil works shall be done based on bidder's design & drawings.	Lot	1
2A14	Supply of Earthing material for 220kV GIS including High frequency earthing material. The quantity shall be estimated provided by bidder for above floor earthing connection.	Supply of Earthing Material and Supervision of Erection of all Earthing connection for GIS to GIS and GIS to Earth Mesh on Floor shall be in bidder's scope. The quantity shall be estimated by the bidder, based on their design philosophy. Design philosophy shall be submitted alongwith the bid in line with section 2. Only supply of earthing materials such as MS Rod (40mm Dia for outdoor below ground earth mat) and GI Flat of 75x12mm or MS Rod as recommended by bidder (for earth mesh on floor) shall be in BHEL's scope and hence any other earthing materials other than mentioned above, if required shall be in bidder's scope of supply. Erection of earthing materials shall be done by BHEL under supervision of bidder. In case HF earthing is not required, bidder shall submit necessary calculations and documentation in line with relevant standards including IEEE-80.	Lot	1
2A15	Consumables required for 220kV GIS	Consumables required during erection, testing and commissioning for complete package. It shall be supplied just before erection after confirmation from BHEL. However, bidder shall take special permission from BHEL, before supply of consumables having the shelf life less than 6 months.	Lot	1
2A16	Portable ladder & catwalk arrangement for maintenance	Portable ladder shall be of reputed make with wheel arrangement. The ladder platform shall have the arrangement to accommodate emergency tools & tackles and person stading on it should be able to access the remote and highest point of GIS.	Set	1
2A17	Coupling devices / adapters for testing and maintenance equipment	Maintenance equipment as per technical specification clause 26, section 2	Set	1
2B	Testing & Maintenance Equipment for GIS			
2B1	Portable type PDM kit alongwith sensors and accessories (UHF Type) (Dobel make or equivalent) FOR 220KV GIS	The offline portable discharge measurement kit (UHF type) shall be of Dobel or any other equivalent reputed make	Set	1
2C	Mandatory spares	These prices shall also be used as a reference price for addition/ deletion /replacement		
2C1	General			
2C1.1	220kV GIS spares general -SF6 Gas Pressure Relief Devices, 3 Nos. of each type	1 set=3 no. of each type	Set	2
2C1.2	220kV GIS spares general -SF6 Pressure gauge with coupling device cum switch or density monitors and pressure switch as applicable (1 no. of each type)	1 set=1 no. of each type	Set	1
2C1.3	220kV GIS spares general -Coupling device for pressure gauge cum switch for connecting Gas handling plant	1 set=1 no. of each type	Set	2
2C1.4	220kV GIS spares general -Rubber Gaskets, "O" Rings and Seals for SF6 gas of each type	1 set=1 no. of each type	Set	1
2C1.5	220kV GIS spares general -Molecular filter for SF6 gas with filter bags (20% of total weight)	1 set= 20% of total weight	Set	1
2C1.6	220kV GIS spares general -All types of Control Valves for SF6 gas of each type	1 set=1 no. of each type	Set	2
2C1.7	220kV GIS spares general -SF6 gas (20 % of total gas)	1 Lot= 20% of total gas, to be supplied in non returnable standard cy	Lot	1

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Sl.No.	Description	Remarks_Long_Description	Unit	Qty.
2C1.8	220kV GIS spares general -All types of coupling for SF6 gas (1 no. of each type)	1 set=1 no. of each type	Set	1
2C1.9	220kV GIS spares general -Pipe length (Copper or Steel as applicable) for SF6 Circuit of each type	1 set=1 no. of each type	Set	1
2C1.10	220kV GIS spares general -Density Monitors for SF6 gas	1 set=1 no. of each type	Nos.	1
2C1.11	220kV GIS spares general -Enclosures, Insulators & main circuit to replace on each phase, any compartment of Busbar or bay (1 set for 1 bay)	1 set =Quantity sufficient for 1 bay.	Set	1
2C1.12	220kV GIS spares general -Covers with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment - For 3 phase enclosure if applicable (1 set for 1 bay)	1 set =Quantity sufficient for 1 bay.	Nos.	2
2C1.13	220kV GIS spares general -Covers with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment - For 1 phase enclosure if applicable (1 set for 1 bay)	1 set =Quantity sufficient for 1 bay.	Nos.	3
2C1.14	220kV GIS spares general -Locking device to keep the Dis-connectors (Isolators) and Earthing switches in close or open position in case of removal of the driving Mechanism		Set	1
2C1.15	220kV GIS spares general -Bus support Insulator of each type for single phase/ 3 phase enclosure (5% of population)	1 set= 5% of population of each type	Set	1
2C1.16	220kV GIS spares general -SF6 to air bushing (220 kV) of each type & rating	1 set=1 no. of each type and rating of each item	Set	1
2C1.17	220kV GIS spares general -Spares for Local control cabinet including MCB, fuses, timers, Aux Relay of each type & rating terminal of each type	1 set=1 no. of each type and rating of each item	Set	1
2C1.18	220kV GIS spares general -Bushing for Dielectric test on Cable		Nos.	1
2C1.19	220kV GIS spares general -T&P for bushing erection including ladder/ platform for Bushing erection and subsequently during Q&M for Transformer	Deleted.		
2C1.20	220kV GIS spares general -Cable Termination Enclosure		Set	1
2C2	220 kV Circuit Breaker			
2C2.1	220 kV Circuit Breaker - Complete Circuit Breaker pole of each type & rating complete with interrupter, main circuit, enclosure and Marshalling Box with operating mechanism	1 set=Complete Circuit Breaker pole of each type & rating complete with interrupter, main circuit, enclosure and Marshalling Box with operating mechanism	Set	3
2C2.2	220 kV Circuit Breaker - Fixed, moving and arcing contacts including insulating nozzles 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.3	220 kV Circuit Breaker - Rubber gaskets, 'O' rings and seals for SF6 gas of each type	1 set=1 no. of each type and rating of each item	Set	1
2C2.4	220 kV Circuit Breaker - Trip coil assembly with resistor as applicable, 3 nos. of each type	1 set=3 no. of each type	Set	2
2C2.5	220 kV Circuit Breaker - Closing coil assembly with resistor as applicable, 3 nos. of each type	1 set=3 no. of each type	Set	2
2C2.6	220 kV Circuit Breaker - Molecular filter for SF6 gas with filter bags (10% of total quantity used)	1 Lot= 10% of total quantity used	Lot	1

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Sl.No.	Description	Remarks_Long_Description	Unit	Qty.
2C2.7	220 kV Circuit Breaker - SF6 Pressure gauge cum switch or Density monitors and pressure switch as applicable, 3 nos each type	1 set=3 no. of each type	Set	1
2C2.8	220 kV Circuit Breaker - Coupling device for pressure gauge cum switch for connecting Gas handling plant, 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.9	220 kV Circuit Breaker - Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating	1 set=1 no. of each type and rating of each item	Set	1
2C2.10	220 kV Circuit Breaker - Closing assembly/ valve, 3 nos. of each type	1 set=3 no. of each type	Set	2
2C2.11	220 kV Circuit Breaker - Trip assembly/ valve, 3 nos. of each type	1 set=3 no. of each type	Set	2
2C2.12	220 kV Circuit Breaker - Aux. switch assembly, 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.13	220 kV Circuit Breaker - Operation Counter, 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.14	Rupture disc, 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.15	220 kV Circuit Breaker - Windoscope / Observing window, 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.16	220 kV Circuit Breaker - Spring operating closing mechanism one no of each type, if applicable	1 set=1 no. of each type	Set	1
	220 kV Circuit Breaker - Hydraulic operating mechanism, if applicable			
2C2.17	220 kV Circuit Breaker - Hydraulic operating mechanism with drive motor , 3 nos of each type if applicable	1 set=3 no. of each type	Set	1
2C2.18	220 kV Circuit Breaker - Ferrules, joints and couplings, 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.19	220 kV Circuit Breaker - Hydraulic filter, 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.20	220 kV Circuit Breaker - Hose pipe, 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.21	220 kV Circuit Breaker - N2 Accumulator, 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.22	220 kV Circuit Breaker - Pressure transducer, 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.23	220 kV Circuit Breaker - Valves 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.24	220 kV Circuit Breaker - Pipe length (copper & steel) 3 nos. of each size & type	1 set=3 no. of each type	Set	1
2C2.25	220 kV Circuit Breaker - Pressure switches 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.26	220 kV Circuit Breaker - Pressure gauge with coupling device, 3 nos. of each type	1 set=3 no. of each type	Set	1
2C2.27	220 kV Circuit Breaker - Hydraulic oil (20% of total qty. used)	1 set= 20% of total qty. used	Set	1
2C2.28	220 kV Circuit Breaker - Pressure Relief Device, 3 nos. of each type	1 set=3 no. of each type	Set	2
2C3	220 kV Isolators			
2C3.1	220 kV Isolators - Complete set of 3 nos. of single phase / one no. of 3-phase dis-connector including main circuit, enclosure, driving mechanism	1 Set= Complete set of 3 nos. of single phase / one no. of 3-phase dis-connector including main circuit, enclosure, driving mechanism	Set	1
2C3.2	220 kV Isolators - Single Phase/Three Phase High speed fault making grounding switch operating mechanism complete with all necessary gaskets mounting hardware/operating mechanism complete with all necessary gaskets connecting apparatus.	1 set =operating mechanism for one no. three phase high speed earth	Set	1
2C3.3	220 kV Isolators - 3 no. of single phase / one no of 3-phase Earthing switch including main circuit, enclosure, driving mechanism	1 Set= 3 no. of single phase / one no of 3-phase Earthing switch including main circuit, enclosure, driving mechanism	Set	1
2C3.4	220 kV Isolators - Copper contact fingers for dis-connector male & female contact –for one complete (3 phase) dis-connector of each type and rating	1 set= Copper contact fingers for dis-connector male & female contact –for one complete (3 phase) dis-connector of each type and rating	Set	1

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Sl.No.	Description	Remarks_Long_Description	Unit	Qty.
2C3.5	220 kV Isolators - Copper contact fingers for earthing switch male & female contacts- for one complete (3 phase) earthing switch of each type and rating	1 set= Copper contact fingers for earthing switch male & female contacts- for one complete (3 phase) earthing switch of each type and rating	Set	1
2C3.6	220 kV Isolators - Open / Close contactor assembly, timers, key interlock for one complete (3 phase) dis-connector and (3 phase) earthing switch of each type and rating	1 set= Open / Close contactor assembly, timers, key interlock for one complete (3 phase) dis-connector and (3 phase) earthing switch of each type and rating	Set	1
2C3.7	220 kV Isolators - Push button switch. each type, as applicable	1 set= 1 no. of Push button switch of each type	Set	1
2C3.8.1	220 kV Isolators -Limit switches and Aux. Switches for complete 3 phase equipment For isolator		Set	1
2C3.8.2	Limit switches and Aux. Switches for complete 3 phase equipment For earth switch		Set	1
2C3.9.1	220 kV Isolators -Rotor housing bearing assembly for complete 3 phase equipment For isolator		Set	1
2C3.9.2	220 kV Isolators -Rotor housing bearing assembly for complete 3 phase equipment For earth switch		Set	1
2C3.10.1	220 kV Isolators - Motor with gear assembly for complete 3 phase equipment For isolator		Set	1
2C3.10.2	220 kV Isolators - Motor with gear assembly for complete 3 phase equipment For earth switch		Set	1
2C3.10.3	220 kV Isolators - Corona shield rings as applicable (1 set for one complete 3-phase isolator)		Set	1
2C3.11.1	220 kV Isolators - Hinge pins for complete 3 phase equipment For isolator		Set	1
2C3.11.2	220 kV Isolators - Hinge pins for complete 3 phase equipment For earth switch		Set	1
2C3.12.1	220 kV Isolators - Bearings for complete 3 phase equipment For isolator		Set	1
2C3.12.2	220 kV Isolators - Bearings for complete 3 phase equipment For earth switch		Set	1
2C3.12.3	220 kV Isolators - Interlocking coil with resistors, timers, key interlock for complete 3 phase equipment (each type and rating)	1 set= Interlocking coil with resistors, timers, key interlock for complete 3 phase equipment (each type and rating)	Set	1
2C3.13.1	220 kV Isolators - Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For isolator	1 set= Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For isolator	Set	3
2C3.13.2	220 kV Isolators - Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For earth switch	1 set= Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For earth switch	Set	1
2C3.13.3	220 kV Isolators - Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) -Aux. switch assembly (complete) with 10 NO & 10 NC or more contacts for both isolator & earth switch	1 set= Aux. switch assembly (complete) with 10 NO & 10 NC or more contacts for both isolator & earth switch	Set	1
2C4.1	220kV Current transformer -Gas Insulated Complete 220kV CT of each type and rating with enclosure	1 Set= 1 nos. of GIS CT of each type & rating	Nos.	3
2C4.2	220kV Current transformer - Secondary bushing of each type	1 Set= 1 nos. of Secondary Bushing of each type	Set	3
2C5.1	Gas Insulated Complete 220kV PT of each type and rating with enclosure	1 Set= 1 nos. of PT of each type & rating	Nos.	3
2D	Supply item - Commissioning spares for testing & commissioning of 220kV GIS till handing over	Deleted		

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Sl.No.	Description	Remarks_Long_Description	Unit	Qty.
2E	Supply Item - Tools & tackle FOR 220 KV GIS	Any special tools required is deemed to be included in scope of bidder. 1. Bidder to submit list of general tools & tackles, slings, spanners, gauges and other lifting devices, drills, instruments and appliances necessary for the complete assembly and erection at site of the GIS, required for installation, gas filling, maintenance, site testing of the GIS which shall be arranged by BHEL. Any tool/ (s) which does not fall in the category of general tools shall be arrange by bidder only and in this regard, decision of BHEL shall be final and binding. 2. 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 same shall be considered during evaluation. 3. Bidder shall also provide list of returnable tools and tackles , to complete the assembly and erection at site of the GIS, required for installation, gas filling, maintenance , site testing of the GIS	Lot	1
2F	Services: Supervision of Erection, commissioning & site testing including earthing			
2F1	Insulation co-ordination studies	Outdoor Surge arresters shall be provided by BHEL as indicated in layout. However , Bidder to conduct insulation coordination study including VFTO and in-case additional surge arresters are to be provided , same is in scope of bidder, to be provided inside GIS	Lot	1
2F2	Site visit for unloading & verification of material at store	Store shall be provided by BHEL	Set	1
2F3	Supervision of Erection of GIS	Complete GIS including busbar, ICT bays, Line bays, Tie Line Bays, bus coupler, bus PT etc.	Lot	1
2F4	Supervision of Erection of GIS Duct - GIS to SF6 to Air Bushings		Metre	240
2F5	Supervision of Erection of 220kV Cable termination module	1 set = 3x 1 phase. Supervision for erection of cable termination shall be done for 4 set only.	Set	4
2F6	Supervision of Erection of complete SF6 to Air Bushing		Set	1
2F7	Testing & Commissioning of GIS	Complete GIS including busbar, ICT bays, Line bays, bus coupler, bus PT etc. 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 (UPPTCL). An adequate stock of startup/ commissioning spares shall be made available at the site such that the startup 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.	Lot	1
2F8	Final successful Testing of GIS including HV test kit	HV Test kit including operator shall be arranged by the bidder on returnable basis. (ICT & Lines may be commissioned separately.) Final testing as per IEC for complete GIS including busbar, ICT bay, Line bays, bus PT, Ducts, SF6 to Air Bushing etc.	Lot	1
2F9	Final Documentation	This includes As Built Drawings, Schematics, Site ITPs & protocols etc. and bidder shall submit the certification from BHEL/ Customer at installation site.	Lot	1
2F10	Testing & Commissioning of GIS for 220kV cable termination	1 set = 3x 1 phase.	Set	4
2G	Services: Training			
2G1	Training for 220kV GIS of 6 no. Engineers (4 no. customer engineers+2 no. BHEL engineers) for a period of at least one week at Manufacturer's works		Lot	1

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Sl.No.	Description	Remarks_Long_Description	Unit	Qty.
2G2	Lodging and boarding of 4 no. customer engineers for a period of at least one week at Manufacturer's works		Lot	1
2G3	To and Fro charges of 4 no. customer engineers for a period of at least one week at Manufacturer's works		Lot	1
2G4	Training for 220kV GIS of 12 no. Engineers (10 no. customer engineers+2 no. BHEL engineers) for a period of at least one week at site		Lot	1
2G5	Lodging and boarding of 10 no. customer engineers for a period of at least one week at site		Lot	1
2G6	To and Fro charges of 10 no. customer engineers for a period of at least one week at site		Lot	1
2H	Services:-Special type test-	Deleted.		
2I	Any other item required for completion of project			
2I1	Supply - Any other item required for completion of project and not covered in A to E- Complete List to be provided by bidder along with unit prices.	If any other item (other than mentioned in Item No 2A1 to 2E of BOQ) required for completion of GIS work as per tender scope of work,the same shall be deemed to be included in scope of tender and shall be supplied free of cost by bidder	Lot	1
2I2	Services - Any other item required for completion of project and not covered in F&G - Complete List to be provided by bidder along with unit prices.	If any other service item(other than mentioned in Item No 2F1 to 2G6 of BOQ) is required to be executed for completion of GIS work as per tender scope of work,the same shall be deemed to be included in scope of tender and shall be provided/executed free of cost by bidder	Lot	1
2J	Supply - Unit Prices of Individual Item/Equipment	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 (Bay, Busbar etc). Quoting for unit prices is mandatory and shall be considered for evaluation. Any item Not Applicable/ Not quoted, is found applicable and is required due to damages , theft, replacement etc. or any other reason as envisaged in clause of NIT, the required quantity shall be supplied free of cost till end of contract i.e. till end of guarantee period.		
2J1	Operating Mechanism box for 220kV , 2000 A Circuit Breaker		No.	1
2J2	Operating Mechanism box for 220kV , 2000 A disconnector		No.	1
2J3	Operating mechanism for 220kV , Maintenance Earthing Switch		No.	1
2J4	Operating Mechanism for 220kV , High Speed Earthing Switch		No.	1
2J5	Single Phase Bus bar (Any type)	Complete single phase 220kV, 3000A, 40 kA for 3s bus bar including Conductor, Gas monitoring systems, barriers, pressure switches and any other items required. This item shall be used for buffer gas compartment as per requirements based on the final approved drawings.	m	1
2J6	Conductor for Single phase Bus bar/ bus duct (any type)	Conductor for bus bar, bus duct, GIB, Interconnecting conductors of any type with interconnecting parts as required.	kg	10
2J7	Gas barrier insulators (of each type and rating)	1 Set= 1 nos. of each type	Set	1
2J8	Density switch	1 Set= 1 nos. of each type	Set	1
2J9	UHF PD sensor along with all accessories	1 Set= 1 nos. of each type	Set	1
2J10	Elbow /Angle / T-bends	1 Set= 1 nos. of each type	Set	1
2J11	Expansion bellows/ joints	1 Set= 1 nos. of each type	Set	1
2J12	Expansion joints / bellows		No.	1
2J13	Services of manpower for erection per day (excl. travel time)		days	1
2J14	Services of manpower for Testing & commissioning per day (excl. travel time)		days	1
2J15	Hiring charges of HV test kit	Hiring charges of HV test kit including charges of operator, accessories & tools required for completion of HV test (Dielectric Test after installation of GIS). HV test kit charges include HV testing of one or more bay at site.	lot	1

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Sl.No.	Description	Remarks_Long_Description	Unit	Qty.
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Notes:

- Commissioning spares** : It is the responsibility of the contractor to supply all necessary spares as required until the equipment/systems are handed over to the Purchaser (UPPTCL).
An adequate stock of startup spares including SF6 handling kits & other equipment shall be made available at the site such that the startup and commissioning of the equipment /systems, performance testing and handing over the equipment/systems to the Purchaser can be carried out without hindrance or delays.
- Any item Not Applicable/Not quoted as per bidder's design /confirmation, however, If found applicable later on, the same shall be deemed to be included in the scope of tender and shall be supplied free of cost by bidder.
- If any other item (other than mentioned in Item No 2A1 to 2E of BOQ) required for completion of GIS work as per tender scope of work, the same shall be deemed to be included in scope of tender and shall be supplied free of cost by bidder
- If any other service item(other than mentioned in Item No 2F1 to 2G6 of BOQ) is required to be executed for completion of GIS work as per tender scope of work,the same shall be deemed to be included in scope of tender and shall be provided/executed free of cost by bidder.
- Unite rate items**- Any item Not Applicable/ Not quoted , is found applicable and is required due to damages , theft, replacement etc. or any other reason as envisaged in clause of NIT, the required quantity shall be supplied free of cost till end of contract i.e. till end of guarantee period.
- SF6 Gas handling equipment required during erection, testing & commissioning in bidder's scope.

SN	DESCRIPTION	Remarks_Long_Description	Unit	Qty.
1A	GIS 132 kV single/three phase encapsulated as per enclosed SLD with Double Bus Bar scheme	The 132 KV, 40kA for 3 s, single/three phase encapsulated SF6 gas insulated switch gear shall have double bus bar arrangement. The SF6 gas insulated switch gear (50 HZ) shall be of the indoor metal- enclosed type, with Partial discharge monitoring sensors , comprising of following modules:- 2 nos. ICT bays, 9 nos. LINE bays, 1 BUS COUPLER bay , 2 nos. Bus PT bays and scope for extension for future bays (2 nos.). The bidder shall provide the drawing & design details for future extendibility. The Switchgear shall be complete with all necessary terminal boxes, inspection window, SF6 gas filling arrangements, interconnecting cables/ wirings, grounding connections, gas monitoring equipment and piping, support structures including embedded. The scope of supply shall also include all erection and mounting hardware and interconnecting cables between GIS to LCC and between LCC to LCC including cable tray, glands, lugs, ferrules, earthing material etc. GIS bay modules shall have the provision for offline partial discharge measurement of bay Module.		
1A1	Transformer (LV side of 160MVA, 220/132kV) Bay Module:	132kV, 1600A, 40kA for 3 s, , SF6 gas insulated Transformer (LV side of 160MVA, 220/132kV) bay module each comprising of but not limited to following: a) SF6 gas insulated circuit breaker (1600A) complete with operating mechanism, , b) one set 3x1-phase current transformer (1600 A), c) two set 3x1-phase, group operated bus-bar disconnectors (1600A) complete with operating mechanism, with safety grounding switch , d) one set 3x1-phase, group operated bus-bar disconnectors (1600A) complete without operating mechanism, without safety grounding switch, f) one set 3x1-phase high speed safety grounding switch complete with operating mechanism, , g) gas insulated terminal connection for connecting XLPE cable with cable termination enclosure and other accessories to connect 132kV GIS with 132kV side of 220/132 kV transformer through XLPE cable to complete transformer bay module as per technical specification. h) Gas monitoring devices, barriers, pressure switches, etc. as required.	Set	2
1A2	132kV Line Feeder Bay Module:	132kV, 1600A, 40kA for 3 s, SF6 gas insulated Line feeder bay module each comprising of but not limited to following: a) SF6 gas insulated circuit breaker (1600A) complete with operating mechanism, b) one set 3x1-phase current transformer (1600A), c) two set 3x1-phase, group operated bus-bar disconnectors (1600A) complete with operating mechanism, with safety grounding switch , d) one set 3x1-phase, group operated bus-bar disconnectors (1600A) complete with operating mechanism, without safety grounding switch , e) one set 3x1-phase high speed safety grounding switch complete with operating mechanism, , g) gas insulated terminal connection for connecting XLPE cable with cable termination enclosure and other accessories to connect 132kV GIS with 132kV line through XLPE cable to complete transformer bay module as per technical specification. h) 3x1-phase Voltage transformers i) Gas monitoring devices, barriers, pressure switches, etc. as required.	Set	9
1A3	132kV Bus Bars:	132kV, 40kA for 3 s, single phase /three phase encapsulated, SF6 gas insulated, metal enclosed 2000A bus bars each enclosed in a) Three SF6 gas insulated, metal enclosed 2000A bus bars in bus enclosures (single/three phase encapsulation) running along the length of the switchgear to interconnect each of circuit breaker bay module. b) Gas monitoring systems, pressure switches, telescopic enclosure etc. as required. c) Barriers (communicating , non-communicating types)	Set	2

SN	DESCRIPTION	Remarks_Long_Description	Unit	Qty.
1A4	132kV Voltage Transformer module (for Busbars)	132kV, 40kA for 3 sec, single phase (isolated), SF6 gas insulated bus VT bay module comprising of but not limited to following: a) 3x1-phase Voltage transformers b) One set of 3x1-phase, 2000A, group operated Disconnecter switches, c) One set of 3x1-phase, group operated safety grounding switches, complete with operating mechanisms. (Suitable for Bus Bar Earthing Duty) d) One set of 3x1-phase, high speed fault make grounding switch, complete with group operated manual and motor driven operating mechanisms, e) Gas monitoring devices, pressure switches etc as required. f) Barrier cones, mechanism box and other items as required.	Set	2
1A5	132kV Bus Coupler Bay Module:	Bus Coupler Bay Module: 132kV, 2000A, 40kA for 3 s, SF6 gas insulated bus coupler bay module comprising of but not limited to following: a) one set 3x1-phase SF6 gas insulated circuit breaker (2500 A) complete with operating mechanism, b) one set 3x1-phase current transformer (1600 A) , c) two set group operated bus-bar disconnectors (1600 A) complete with operating mechanism, each with safety grounding switches, d) Gas monitoring devices, pressure switches etc as required. f) Barrier cones, mechanism box and other items as required.	Set	1
1A6	132kV Cable termination module for line bay with isolating link for testing	Gas insulated terminal connection for connecting XLPE cable with cable termination enclosure and other accessories with GIS etc. to complete Line feeder bay module as per technical specification. (1 set for 3 phase) suitable for single core, Cu. XLPE cable upto 1000 sqmm size	set	9
1A7	132kV Cable termination module for line bay with isolating link for testing	Gas insulated terminal connection for connecting XLPE cable with cable termination enclosure and other accessories with GIS etc. to complete ICT bay module as per technical specification . suitable for single core, Cu, XLPE cable upto 1000 sqmm size	set	2
1A8	LCC for 132kV GIS	Local Control Cabinets shall be used for following bays: 1. 132kV Transformer Bay Module- 2nos. 2. 132kV Line Feeder Bay Module-9nos. 3. 132kV Bus Coupler Bay Module- 1nos. 5. 132kV Voltage Transformer module- In adjoining LCC, in case of otherwise, Bidder shall be paid for BOQ qty only.	nos.	12
1A9	First filling of SF6 gas for the equipment supplied plus an additional quantity sufficient for conducting all tests on equipment at site before placing it into successful operation		Lot	1
1A10	First filling of hydraulic fluid, if applicable	First filling of hydraulic fluid plus 10% of total quantity as a spare.	Lot	1
1A11	Supply of structure material, required for complete installation of 132kV GIS including support structure (foundation bolts/ embedded parts) in floor, walkway platform, structure for bus duct & railing etc. (The civil works will be done based on supplier design & drawings).	Supply of structure material, required for complete installation of GIS including support structure (foundation bolts/ embedded parts) in floor, walkway platform & railing etc including wall sealing & frame for duct crossing in wall shall be in bidder's scope . The civil works shall be done based on bidder's design & drawings.	Lot	1
1A12	Supply of structure materials, required for complete installation of 132kV GIS including support structure (foundation bolts/ embedded parts) in floor, walkway platform, structure & bus duct & railing etc including wall sealing & frame for duct crossing in wall. (The civil works will be done based on supplier design & drawings).	Supply of structure material, required for complete installation of GIS including support structure (foundation bolts/ embedded parts) in floor, walkway platform & railing etc including wall sealing & frame for duct crossing in wall shall be in bidder's scope . The civil works shall be done based on bidder's design & drawings.	Lot	1

SN	DESCRIPTION	Remarks_Long_Description	Unit	Qty.
1A13	Supply of Earthing material for 132kV GIS including High frequency earthing material. The quantity shall be estimated provided by bidder for above floor earthing connection.	Supply of Earthing Material and Supervision of Erection of all Earthing connection for GIS to GIS and GIS to Earth Mesh on Floor shall be in bidder's scope. The quantity shall be estimated by the bidder, based on their design philosophy. Design philosophy shall be submitted alongwith the bid in line with section 2. Only supply of earthing materials such as MS Rod (40mm Dia for outdoor below ground earth mat) and GI Flat of 75x12mm or MS Rod as recommended by bidder (for earth mesh on floor) shall be in BHEL's scope and hence any other earthing materials other than mentioned above, if required shall be in bidder's scope of supply. Erection of earthing materials shall be done by BHEL under supervision of bidder. In case HF earthing is not required, bidder shall submit necessary calculations and documentation in line with relevant standards including IEEE-80.	Lot	1
1A14	Consumables required for 132kV GIS	Consumables required during erection, testing and commissioning for complete package. It shall be supplied just before erection after confirmation from BHEL. However, bidder shall take special permission from BHEL, before supply of consumables having the shelf life less than 6 months.	Lot	1
1A15	Portable ladder & catwalk arrangement for maintenance	Portable ladder shall be of reputed make with wheel arrangement. The ladder platform shall have the arrangement to accommodate emergency tools & tackles and person standing on it should be able to access the remote and highest point of GIS.	Set	1
1A16	Coupling devices / adapters for testing and maintenance equipment	Maintenance equipment as per technical specification clause 26, section 2	Set	1
1B	Testing & Maintenance Equipment for GIS			
1B1	Portable type PDM kit alongwith sensors and accessories (UHF Type) (Dobel make or equivalent) FOR 132KV GIS	The offline portable discharge measurement kit (UHF type) shall be of Dobel or any other equivalent reputed make	Set	1
1C	MANDATORY SPARES	These prices shall also be used as a reference price for addition/ deletion		
1C1.1	132KV GIS spares general - SF6 Gas Pressure Relief Devices, 3 Nos. of each type	1 Set= 3 nos. of each type	Set	2
1C1.2	132KV GIS spares general - SF6 Pressure gauge with coupling device cum switch or density monitors and pressure switch as applicable (1 no. of each type)	1 Set= 1 nos. of each type	Set	1
1C1.3	132KV GIS spares general - Coupling device for pressure gauge cum switch for connecting Gas handling plant	1 set=1 no. of each type	Set	2
1C1.4	132KV GIS spares general - Rubber Gaskets, "O" Rings and Seals for SF6 gas of each type	1 set=1 no. of each type	Set	1
1C1.5	132KV GIS spares general - Molecular filter for SF6 gas with filter bags (20% of total weight)	1 set= 20% of total weight	Set	1
1C1.6	132KV GIS spares general - All types of Control Valves for SF6 gas of each type	1 set= 1 no. of each type	Set	2
1C1.7	132KV GIS spares general - SF6 gas (20 % of total gas)	1 Lot= 20% of total gas, to be supplied in non returnable standard cylinders	Lot	1
1C1.8	132KV GIS spares general - All types of coupling for SF6 gas (1 no. of each type)	1 set= 1 no. of each type	Set	1
1C1.9	132KV GIS spares general - Pipe length (Copper or Steel as applicable) for SF6 Circuit of each type	1 set= 1 no. of each type	Set	1
1C1.10	132KV GIS spares general - Density Monitors for SF6 gas	1 set= 1 no. of each type	No.	1
1C1.11	132KV GIS spares general - Enclosures, insulators & main circuit to replace on each phase, any compartment of Busbar or bay (1 set for bay)	1 set =Quantity sufficient for 1 bay.	Set	1

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SN	DESCRIPTION	Remarks_Long_Description	Unit	Qty.
1C1.12	132KV GIS spares general - Covers with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment For 3 phase enclosure if applicable (1 set for bay)	1 set =Quantity sufficient for 1 bay.	Nos.	2
1C1.13	132KV GIS spares general - Covers with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment For 1 phase enclosure if applicable (1 set for bay)	1 set =Quantity sufficient for 1 bay.	Nos.	3
1C1.14	132KV GIS spares general - Locking device to keep the Dis-connectors (Isolators) and Earthing switches in close or open position in case of removal of the driving Mechanism		Set	1
1C1.15	132KV GIS spares general - Bus support Insulator of each type for single phase/ 3 phase enclosure (5% of population)	1 set= 5% of population of each type	No.	1
1C1.16	132KV GIS spares general - Spares for Local control cabinet including MCB, fuses, timers, Aux Relay of each type & rating terminal of each type	1 set=1 no. of each type and rating of each item	Set	1
1C1.17	132KV GIS spares general - Bushing for Dielectric test on Cable		No.	1
1C1.18	132KV GIS spares general - T&P for bushing erection including ladder platform for Bushing erection and subsequently during O&M for Transformer	deleted		
1C1.19	132KV GIS spares general - Cable Termination Enclosure		Set	1
1C2.1	132 kV Circuit Breaker-Complete Circuit Breaker pole of each type & rating complete with interrupter, main circuit, enclosure and Marshalling Box with operating mechanism	1 set=Complete Circuit Breaker pole of each type & rating complete with interrupter, main circuit, enclosure and Marshalling Box with operating mechanism	Set	3
1C2.2	132 kV Circuit Breaker-Fixed, moving and arcing contacts including insulating nozzles 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.3	132 kV Circuit Breaker-Rubber gaskets, 'O' rings and seals for SF6 gas of each type	1 set=1 no. of each type and rating of each item	Set	1
1C2.4	132 kV Circuit Breaker-Trip coil assembly with resistor as applicable, 3 nos. of each type	1 set=3 no. of each type	Set	2
1C2.5	132 kV Circuit Breaker-Closing coil assembly with resistor as applicable, 3 nos. of each type	1 set=3 no. of each type	Set	2
1C2.6	132 kV Circuit Breaker-Molecular filter for SF6 gas with filter bags (10% of total quantity used)	1 Lot= 10% of total quantity used	LS	1
1C2.7	132 kV Circuit Breaker-SF6 Pressure gauge cum switch or Density monitors and pressure switch as applicable, 3 nos each type	1 set=3 no. of each type	Set	1
1C2.8	132 kV Circuit Breaker-Coupling device for pressure gauge cum switch for connecting Gas handling plant, 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.9	132 kV Circuit Breaker-Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating	1 set=1 no. of each type and rating of each item	Set	1
1C2.10	132 kV Circuit Breaker-Closing assembly/ valve, 3 nos. of each type	1 set=3 no. of each type	Set	2
1C2.11	132 kV Circuit Breaker-Trip assembly/ valve, 3 nos. of each type	1 set=3 no. of each type	Set	2
1C2.12	132 kV Circuit Breaker-Aux. switch assembly, 3 nos. of each type	1 set=3 no. of each type	Set	1

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SN	DESCRIPTION	Remarks_Long_Description	Unit	Qty.
1C2.13	132 kV Circuit Breaker-Operation Counter, 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.14	132 kV Circuit Breaker-Rupture disc, 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.15	132 kV Circuit Breaker-Windoscope / Observing window, 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.16	132 kV Circuit Breaker-Spring operating closing mechanism one no of each type, if applicable	1 set=3 no. of each type	Set	1
	132 kV Circuit Breaker-Hydraulic operating mechanism, if applicable			
1C2.17.1	132 kV Circuit Breaker-Hydraulic operating mechanism with drive motor , 3 nos of each type if applicable	1 set=3 no. of each type	Set	1
1C2.17.2	132 kV Circuit Breaker-Ferrules, joints and couplings, 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.17.3	132 kV Circuit Breaker-Hydraulic filter, 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.17.4	132 kV Circuit Breaker-Hose pipe, 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.17.5	132 kV Circuit Breaker-N2 Accumulator, 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.17.6	132 kV Circuit Breaker-Pressure transducer, 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.17.7	132 kV Circuit Breaker-Valves 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.17.8	132 kV Circuit Breaker-Pipe length (copper & steel) 3 nos. of each size &	1 set=3 no. of each type	Set	1
1C2.17.9	132 kV Circuit Breaker-Pressure switches 3 nos. of each type	1 set=3 no. of each type	Set	1
1C2.17.10	132 kV Circuit Breaker-Pressure gauge with coupling device, 3 nos. of each	1 set=3 no. of each type	Set	1
1C2.17.11	132 kV Circuit Breaker-Hydraulic oil (20% of total qty. used)	1 set= 20% of total qty. used	Set	1
1C2.17.12	132 kV Circuit Breaker-Pressure Relief Device, 3 nos. of each type	1 set=3 no. of each type	Set	2
	132 kV Isolators			
1C3.1	132 kV Isolators-Complete set of 3 nos. of single phase / one no. of 3-phase dis-connector including main circuit, enclosure, driving mechanism	1 Set= Complete set of 3 nos. of single phase / one no. of 3-phase dis-connector including main circuit, enclosure, driving mechanism	Set	1
1C3.2	132 kV Isolators-Single Phase/Three Phase High speed fault making grounding switch operating mechanism complete with all necessary gaskets mounting hardware/operating mechanism complete with all necessary gaskets connecting apparatus.	1 set =operating mechanism for one no. three phase high speed earthing switch	Set	1
1C3.3	132 kV Isolators-3 no. of single phase / one no of 3-phase Earthing switch including main circuit, enclosure, driving mechanism	1 Set= 3 no. of single phase / one no of 3-phase Earthing switch including main circuit, enclosure, driving mechanism	Set	1
1C3.4	132 kV Isolators-Copper contact fingers for dis-connector male & female contact -for one complete (3 phase) dis-connector of each type and rating	1 set= Copper contact fingers for dis-connector male & female contact -for one complete (3 phase) dis-connector of each type and rating	Set	1
1C3.5	132 kV Isolators-Copper contact fingers for earthing switch male & female contacts- for one complete (3 phase) earthing switch of each type and rating	1 set= Copper contact fingers for earthing switch male & female contacts- for one complete (3 phase) earthing switch of each type and rating	Set	1
1C3.6	132 kV Isolators-Open / Close contactor assembly, timers, key interlock for one complete (3 phase) dis-connector and (3 phase) earthing switch of each type and rating	1 set= Open / Close contactor assembly, timers, key interlock for one complete (3 phase) dis-connector and (3 phase) earthing switch of each type and rating	Set	1
1C3.7	132 kV Isolators-Push button switch. each type, as applicable	1 set= 1 no. of Push button switch of each type	Set	1
1C3.8	132 kV Isolators-Limit switches and Aux. Switches for complete 3 phase equipment For isolator		Set	1

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SN	DESCRIPTION	Remarks_Long_Description	Unit	Qty.
1C3.9	132 kV Isolators-Limit switches and Aux. Switches for complete 3 phase equipment For earth switch		Set	1
1C3.10	132 kV Isolators-Rotor housing bearing assembly for complete 3 phase equipment For isolator		Set	1
1C3.11	132 kV Isolators-Rotor housing bearing assembly for complete 3 phase equipment For earth switch		Set	1
1C3.12	132 kV Isolators-Motor with gear assembly for complete 3 phase equipment For isolator		Set	1
1C3.13	132 kV Isolators-Motor with gear assembly for complete 3 phase equipment For earth switch		Set	1
1C3.14	132 kV Isolators-Corona shield rings as applicable		Set	1
1C3.15	132 kV Isolators-Hinge pins for complete 3 phase equipment For		Set	1
1C3.16	132 kV Isolators-Hinge pins for complete 3 phase equipment For earth		Set	1
1C3.17	132 kV Isolators-Bearings for complete 3 phase equipment For isolator		Set	1
1C3.18	132 kV Isolators-Bearings for complete 3 phase equipment For earth switch		Set	1
1C3.19	132 kV Isolators-Interlocking coil with resistors, timers, key interlock for complete 3 phase equipment (each type and rating)	1 set= Interlocking coil with resistors, timers, key interlock for complete 3 phase equipment (each type and rating)	Set	1
1C3.20	132 kV Isolators-Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For isolator	1 set= Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For isolator	Set	3
1C3.21	132 kV Isolators-Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For earth switch	1 set= Relays, Power contactors, resistors, fuses, push buttons, timers & MCBs (complete for one 3 phase equipment) For earth switch	Set	1
1C3.22	132 kV Isolators-Aux. switch assembly (complete) with 10 NO & 10 NC or more contacts for both isolator & earth switch	1 set= Aux. switch assembly (complete) with 10 NO & 10 NC or more contacts for both isolator & earth switch	Set	1
	132 KV Current Transformer-			
1C4.1	132 KV Current Transformer-Gas Insulated Complete CT of each type and rating with enclosure	1 Set= 1 nos. of GIS CT of each type & rating	Nos.	3
1C4.2	132 KV Current Transformer-Secondary bushing of each type	1 Set= 1 nos. of Secondary Bushing of each type	Set	3
	132KV Voltage Transformer-			
1C5.1	132KV Voltage Transformer-Gas Insulated Complete PT of each type and rating with enclosure	1 Set= 1 nos. of PT of each type & rating	Nos.	3
1D	Supply Item – Commissioning spares for testing & commissioning of GIS till handing over	deleted		
1E	Supply Item - Special tools and tackles for erection, operation and maintenance of GIS.	Any special tools required is deemed to be included in scope of bidder. 1. Bidder to submit list of general tools & tackles, slings, spanners, gauges and other lifting devices, drills, instruments and appliances necessary for the complete assembly and erection at site of the GIS, required for installation, gas filling, maintenance, site testing of the GIS which shall be arranged by BHEL. Any tool/ (s) which does not fall in the category of general tools shall be arrange by bidder only and in this regard, decision of BHEL shall be final and binding. 2. 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 same shall be considered during evaluation. 3. Bidder shall also provide list of returnable tools and tackles, to complete the assembly and erection at site of the GIS, required for installation, gas filling, maintenance, site testing of the GIS	LOT	1

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SN	DESCRIPTION	Remarks_Long_Description	Unit	Qty.
1F	Services: Supervision of Erection, commissioning & site testing including earthing			
1F1	Insulation co-ordination studies	Outdoor Surge arresters shall be provided by BHEL as indicated in layout. However , Bidder to conduct insulation coordination study including VFTO and in-case additional surge arresters are to be provided , same is in scope of bidder, to be provided inside GIS.	Lot	1
1F2	Site visit for unloading & verification of material at store		Lot	1
1F3	Supervision of Erection of GIS	Complete GIS including busbar, ICT bays, Line bays, Tie Line Bays, bus coupler, bus PT etc.	Lot	1
1F5	Supervision of Erection of 132kV Cable termination	1 set = 3x 1 phase. Supervision for erection of cable termination shall be done for 5 set only.	Set	5
1F6	Testing & Commissioning of GIS	Complete GIS including busbar, ICT bays, Line bays, bus coupler, bus PT etc. 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 (UPPTCL). An adequate stock of startup/ commissioning spares shall be made available at the site such that the startup 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.	Set	1
1F7	Final successful Testing of GIS including HV test kit	HV Test kit including operator shall be arranged by the bidder on returnable basis. (ICT & Lines may be commissioned separately.) Final testing as per IEC for complete GIS including busbar, ICT bay, Line bays, bus PT, Ducts, SF6 to Air Bushing etc.	Lot	1
1F8	Final Documentation	This includes As Built Drawings, Schematics, Site ITPs & protocols etc. and bidder shall submit the certification from BHEL/ Customer at installation site.	Lot	1
1F9	Testing & Commissioning of GIS for 132kV cable termination	1 set = 3x 1 phase.	set	5
1G	Services: Training			
1G1	Training for GIS of 6 no. Engineers (4 no. customer engineers+2 no. BHEL engineers) for a period of at least one week at Manufacturer's works		Lot	1
1G2	Lodging and boarding of 4 no. customer engineers for a period of at least one week at Manufacturer's works		Lot	1
1G3	To and Fro charges of 4 no. customer engineers for a period of at least one week at Manufacturer's works		Lot	1
1G4	Training for GIS of 12 no. Engineers (10 no. customer engineers+2 no. BHEL engineers) for a period of at least one week at site		Lot	1
1G5	Lodging and boarding of 10 no. customer engineers for a period of at least one week at site		Lot	1
1G6	To and Fro charges of 10 no. customer engineers for a period of at least one week at site		Lot	1
1H	Services: Special type test	deleted		
1I	Any other item required for completion of project			
1I1	Supply - Any other item required for completion of project and not covered in A tp E- Complete List to be provided by bidder along with unit prices.	If any other item (other than mentioned in Item No 1A1 to 1E of BOQ) required for completion of GIS work as per tender scope of work,the same shall be deemed to be included in scope of tender and shall be supplied free of cost by bidder	Lot	1
1I2	Services - Any other item required for completion of project and not covered in F&G - Complete List to be provided by bidder along with unit prices.	If any other service item(other than mentioned in Item No 1F1 to 1G6 of BOQ) is required to be executed for completion of GIS work as per tender scope of work,the same shall be deemed to be included in scope of tender and shall be provided/executed free of cost by bidder	Lot	1

SN	DESCRIPTION	Remarks_Long_Description	Unit	Qty.
1J	Supply - Unit Prices of Individual Item/Equipment	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 (Bay, Busbar etc). Quoting for unit prices is mandatory and shall be considered for evaluation. Any item Not Applicable/ Not quoted , is found applicable and is required due to damages , theft, replacement etc. or any other reason as envisaged in clause of NIT, the required quantity shall be supplied free of cost till end of contract i.e. till end of guarantee period.		
1J1	Operating Mechanism box for 132kV, 2000 A Circuit Breaker		No.	1
1J2	Operating Mechanism box for 132kV, 2000 A disconnector		No.	1
1J3	Operating mechanism for 132kV, Maintenance Earthing Switch		No.	1
1J4	Operating Mechanism for 132kV, High Speed Earthing Switch		No.	1
1J5	Single Phase Bus bar (Any type)	Complete single phase 132kV, 2000A, 40 kA for 3s bus bar including Conductor, Gas monitoring systems, barriers, pressure switches and any other items required. This item shall be used for buffer gas compartment as per requirements based on the final approved drawings.	m	1
1J6	Conductor for Single phase Bus bar/ bus duct (any type)	Conductor for bus bar, bus duct, GIB, Interconnecting conductors of any type with interconnecting parts as required.	kg	10
1J8	Gas barrier insulators	1 Set= 1 nos. of each type	Set	1
1J9	Density switch	1 Set= 1 nos. of each type	Set	1
1J10	UHF PD sensor along with all accessories	1 Set= 1 nos. of each type	Set	1
1J11	Elbow/ Angle /T-bends	1 Set= 1 nos. of each type	Set	1
1J12	Expansion bellows/ joints	1 Set= 1 nos. of each type	Set	1
1J13	Services of manpower for erection per day (excluding travel time)		Day	1
1J14	Services of manpower for Testing & commissioning per day (excluding travel time)		Day	1
1J15	Hiring charges of HV test kit	Hiring charges of HV test kit including charges of operator, accessories & tools required for completion of HV test (Dielectric Test after installation of GIS). HV test kit charges include HV testing of one or more bay at site.	Lot	1

Notes:

- Commissioning spares :** It is the responsibility of the contractor to supply all necessary spares as required until the equipment/systems are handed over to the Purchaser (UPPTCL).
An adequate stock of startup spares including SF6 handling kits & other equipment shall be made available at the site such that the startup and commissioning of the equipment /systems, performance testing and handing over the equipment/systems to the Purchaser can be carried out without hindrance or delays.
- Any item Not Applicable/Not quoted as per bidder's design /confirmation, however, If found applicable later on, the same shall be deemed to be included in the scope of tender and shall be supplied free of cost by bidder.
- If any other item (other than mentioned in Item No 1A1 to 1E of BOQ) required for completion of GIS work as per tender scope of work,the same shall be deemed to be included in scope of tender and shall be supplied free of cost by bidder
- If any other service item(other than mentioned in Item No 1F1 to 1G6 of BOQ) is required to be executed for completion of GIS work as per tender scope of work,the same shall be deemed to be included in scope of tender and shall be provided/executed free of cost by bidder
- Unite rate items-** Any item Not Applicable/ Not quoted , is found applicable and is required due to damages , theft, replacement etc. or any other reason as envisaged in clause of NIT, the required quantity shall be supplied free of cost till end of contract i.e. till end of guarantee period.
- SF6 Gas handling equipment required during erection, testing & commissioning in bidder's scope.

TECHNICAL QUALIFYING REQUIREMENT FOR 400, 220 & 132 KV GIS

Sr. No	Description	Supporting Document to be attached
1.1	The Bidder must have manufactured, supplied, supervised erection and tested and commissioned atleast 01(one) no. 400 kV or above rating GIS substation /switchyard anywhere in last seven years, having at least 05(five) nos. circuit breaker bays@ of 400 kV or above voltage rating or 05 nos. circuit breaker bays@ cumulatively in more than one substation/switchyard and 40kA short circuit level or higher and the same should have been in successful operation for at least 02(two) years as on 17.04.18. For 220kV and 132kV GIS also , the bidder should have the qualification of 400kV or above level GIS.	1. Records as proof of supply & supervision of ETC of 400kV or above GIS substation (01 no.) from the manufacturer. (Purchase order, commissioning certificate, completion report etc.) 2. Performance certificate/ MOM / Letter issued by customer without any adverse remark, clearly showing the date of commissioning, date of performance certificate, no of bays ETC. 3. List of past supplies of 400kV or above GIS in last seven years and documents for proof of supply, supervision of erection & testing & commissioning.
1.2	The GIS modules should have been type tested earlier in any internationally recognized Test House (accredited laboratories) duly furnishing Credentials of the Test House. The type tests should have been conducted after 17.04.08.	Valid type test reports and also a list giving : 1. Name of test 2. Lab where test is conducted 3. Date of test
1.3	The GIS modules should be offered from <u>manufacturer/its Indian subsidiary/ Indian arm</u>, who have designed and supplied <u>minimum 06 (six) nos. 400kV GIS circuit breaker bays@ anywhere</u> <u>The Manufacturer or its Indian subsidiary company should have a well-equipped repair and maintenance & testing (routine & acceptance tests) facility for GIS in India.</u> For 220kV and 132kV GIS also , the bidder should have the qualification of 400kV or above level GIS.	1. Supply records for supply (PO/ dispatch clearance) of 400kV or above GIS (06 nos. bays) from the manufacturer 2. Documents for repair , maintenance and testing (routine & acceptance tests for 400kV GIS) facility in India 3. Confirmation/ undertaking from GIS Bidder / OEM for well equipped repair and maintenance & testing facility in india
1.4	The Indian bidders, who are not meeting prequalifying conditions as mentioned in 1.1 & 1.2 above, but have established Manufacturing and testing facilities in india for 400kV or above voltage level GIS, can bid on the basis of the qualification of their parent company , can also be considered provided: (i) The parent company* meets the qualifying requirements stipulated under clause 1.1 & 1.2 above. (ii) Bidder meets the qualifying requirement as per clause 1.3 above (iii) The bidder furnishes a legally enforceable undertaking (Jointly with the Parent company) to guarantee quality, timely supply, performance and Warranty obligations as specified for the equipment(s)	1. Documents as per clause 1.3 above 2. Documents for parent company as per clause 1.1 & clause 1.2 above. 3. A legally enforceable undertaking (Jointly with the Parent company) to guarantee quality, timely supply, performance and Warranty obligations as specified for the equipment(s) as per JDU Format enclosed.

TECHNICAL QUALIFYING REQUIREMENT FOR 400, 220 & 132 KV GIS

Sr. No	Description	Supporting Document to be attached
	Notes:	
1	Bidder shall be a GIS Manufacturer.	
2	@ for the purpose of qualifying requirement, one no. Circuit breaker bay shall be considered as a bay used for controlling a line or a transformer or bus reactor or a bus section or a bus coupler comprising of atleast one circuit breaker, one disconnector and three nos. of single phase CTs/ Bushing CTs .	
3	* Parent Company refers to a GIS OEM established outside India and who is doing business through its Indian Arm (facility) / subsidiary in India.	

1. in shape

2. in shape

M. J. 7.5.19
- GM (TDS - Engineering)

**FORM OF JOINT DEED OF UNDERTAKING TO BE EXECUTED BY THE PARENT
COMPANY (FORIGEN GIS MANUFACTURING COMPANY) ALONGWITH THE ITS INDIAN
SUBSIDERY (INDIAN GIS MANUFACTURING COMPANY)**

THIS DEED OF UNDERTAKING executed on this <date> by <parent company>, a company incorporated under the laws of <country>, with registered office <address> hereinafter called the " Parent Company "(which expression shall include its successors, administrators, executors and permitted assigns), the party of First Part

And

<bidder> a Company incorporated under the laws of the India and having its registered office at <address> (hereinafter called the Indian GIS Manufacturing Company (which expression shall include its successors, administrators, executors and permitted assigns) the parties of Second Part

Undertakes and executes this undertaking in favour of **Bharat Heavy Electricals Ltd**, having its office at **Transmission Business Group, Tower A, 5TH FLOOR, ADVANT NAVIS IT Business Park, Plot-7, Sector-142, Noida Expressway, Noida, Dist. G. B. Nagar, U. P. — 201305**

(hereinafter called the "Employer" which expression shall include its successors, executors and permitted assigns)

WHEREAS THE OWNER invited bids as per its Enquiry No.: _____; for **400KV/220KV/132KV GIS FOR UPPTCL RASARA (BALIA) PROJECT**

AND WHEREAS Bidding Documents inter-alia stipulates that the Bidder/Indian GIS Company along with its Parent Company must fulfil the Qualifying Requirements for the 400/220/132kV GIS (400/220/132 kV SF6 Gas Insulated Switchgear) Package and be jointly and severally bound and responsible to guarantee quality, timely supply, performance and Warranty obligations as specified for the equipment(s) of the 400/220/132 kV GIS (400/220/132 kV SF6 Gas Insulated Switchgear) offered in the event the Bid submitted by the Bidder is accepted by the Employer resulting in a Contract.

NOW THEREFORE THIS UNDERTAKING WITNESSETH as under:

1. In consideration of the award of Contract by the Employer to the Bidder (hereinafter referred to as the "Contract") we, the Parent Company and the Bidder/Indian GIS Manufacturer do hereby declare that we shall be jointly and severally bound unto the Employer Company



i.e. **Bharat Heavy Electricals Ltd (BHEL)** for the successful performance of the 400/220/132 kV GIS and shall be fully responsible jointly and severally bound and responsible to guarantee quality, timely supply, performance and Warranty obligations as specified for the equipment(s) in accordance with the Contract Specifications.

2. Without in any way affecting the generality and total responsibility in terms of this Deed of Undertaking, the Parent Company to ensure:

- (i) A valid technology transfer agreement including license to manufacture and supply in India, between the Parent Company (the technology provider) and the Indian GIS Manufacturer covering the type, size and rating of the 400/220/132 kV GIS sets specified, valid minimum up to the end of the defect liability period of the contract. The technology transfer agreement necessarily covers transfer of technological know-how for 400/220/132 kV GIS in the form of complete transfer of design dossier, design software's, drawings and documentation, quality system manuals and imparting relevant training to the personnel of the Bidder/Contractor.
- (ii) Design of the Equipments manufactured in India shall be identical to the design of equipments manufactured and supplied by the Parent Company.

3. We, the Parent Company and Indian GIS Manufacturer agree that this Undertaking shall be irrevocable and shall form an integral part of the Contract and further agree that this Undertaking shall continue to be enforceable till the Employer discharges it. It shall become operative from the effective date of Contract.

IN WITNESS WHEREOF the Parent Company and the Indian GIS Manufacturer have through their Authorized Representatives executed these presents and affixed Common seals of their respective Companies, on the day, month and year first above mentioned.



(For Parent Company)
PARTY OF FIRST PART

WITNESS

Signature

Name

Office Address

(Signature of the authorized representative)

Name :-

Designation :-

Common Seal of Company

WITNESS

Signature

Name

Office Address

(For Indian GIS Manufacturing company)
PARTY OF SECOND PART

(Signature of the authorized representative)

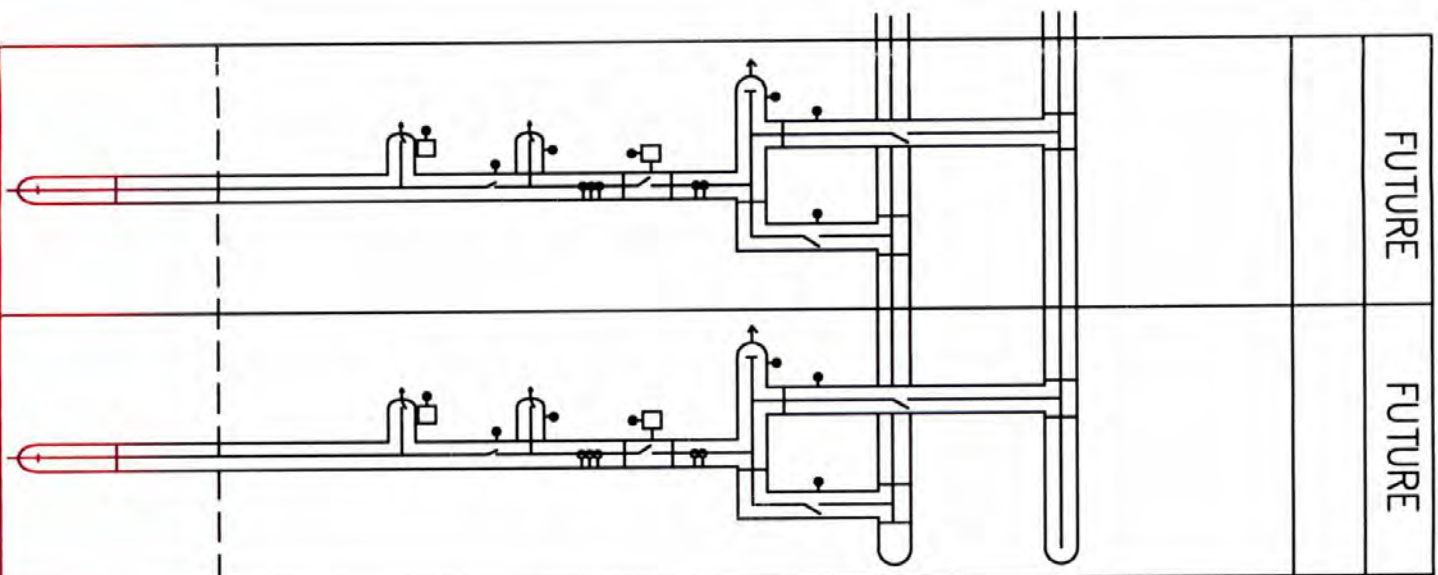
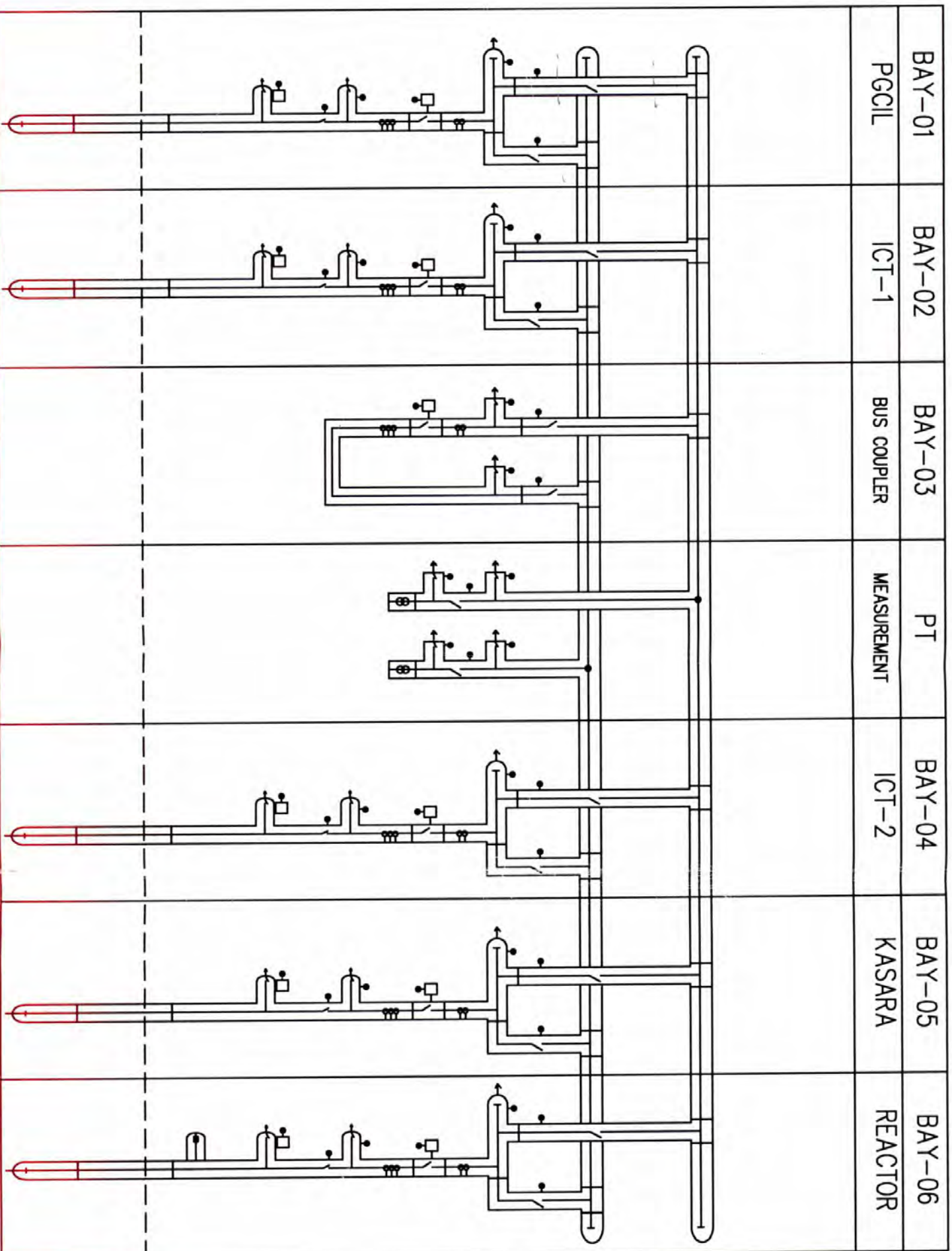
Name :-

Designation :-

Common Seal of Compan

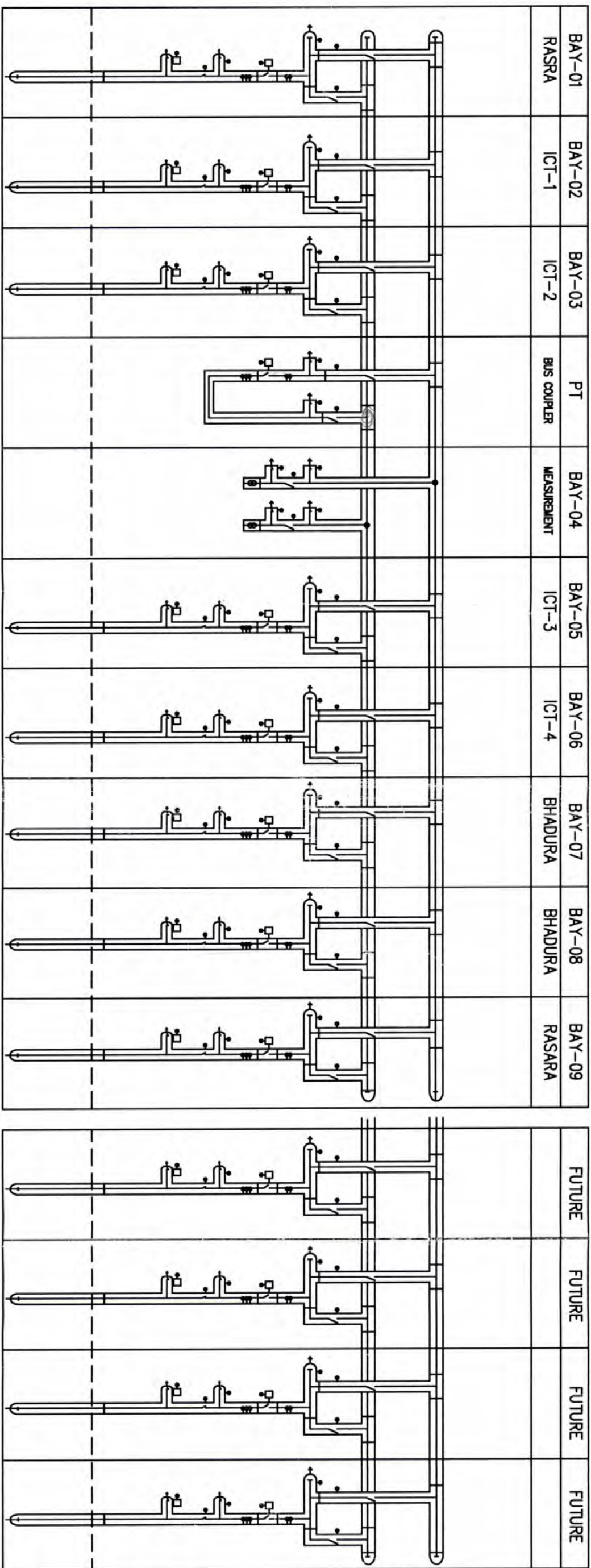
Amal K. Pillai

400KV EGS – RASARA



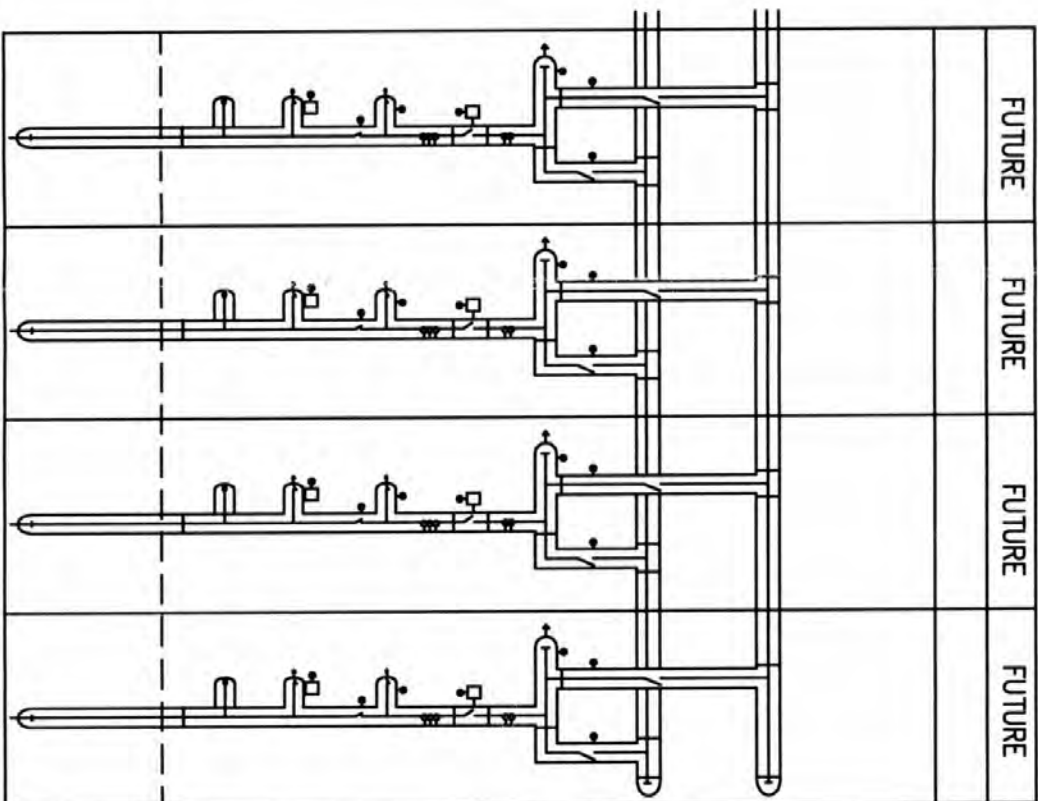
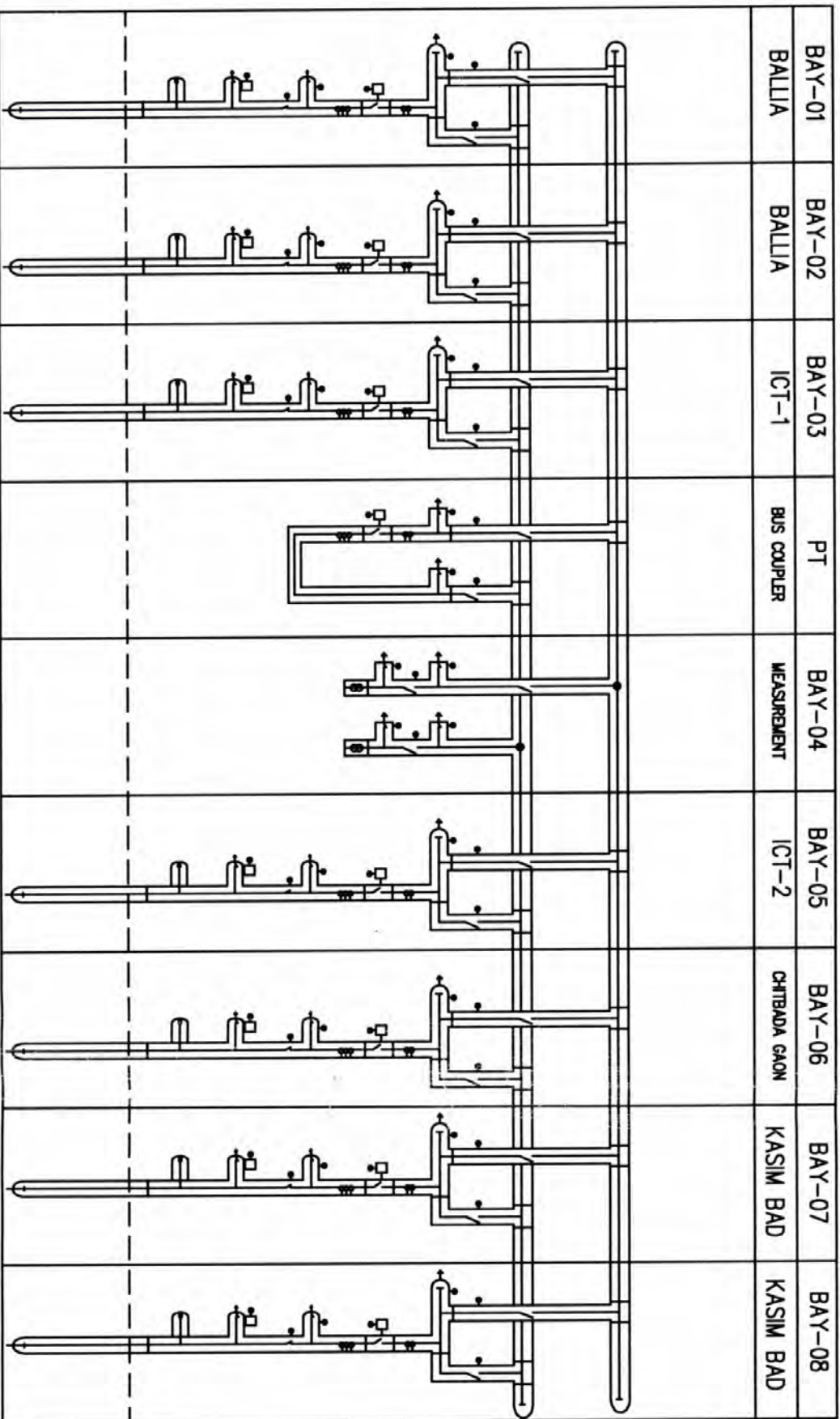
FOR TENDER PURPOSE ONLY

220KV EGS – RASARA



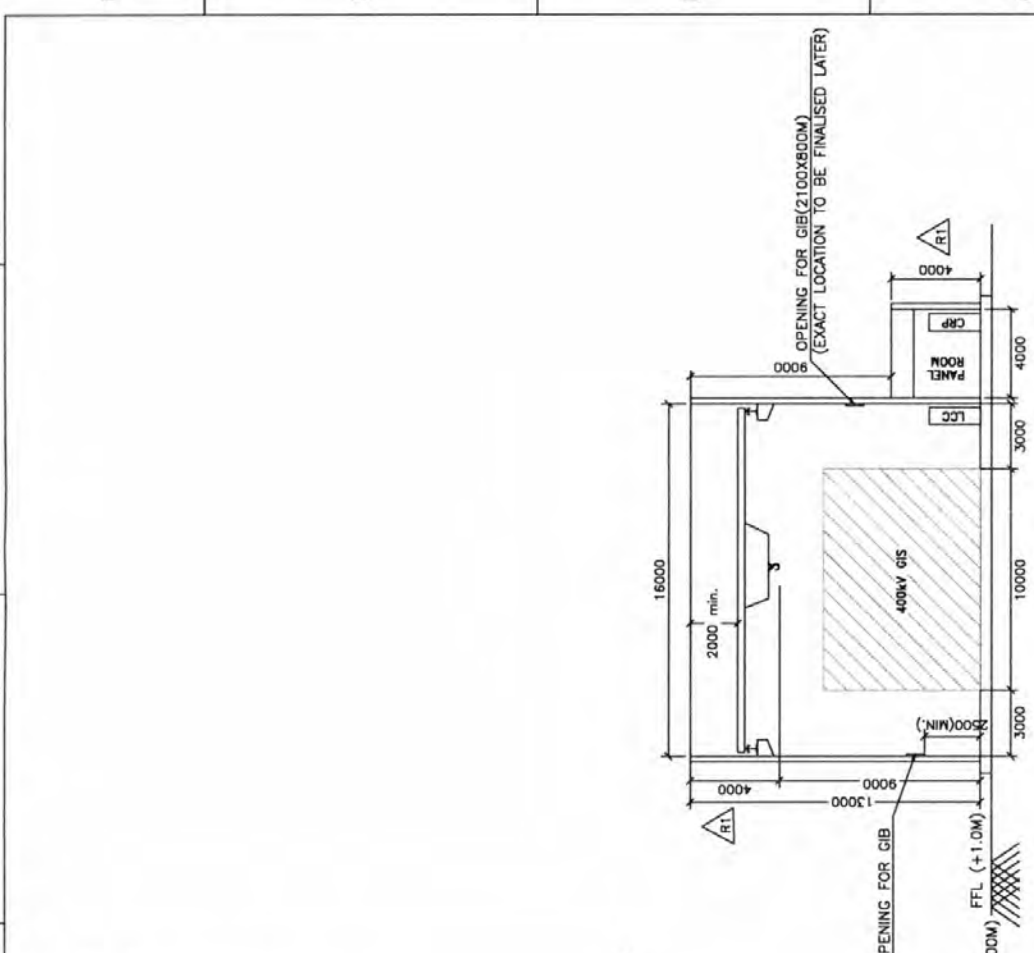
FOR TENDER PURPOSE ONLY

132KV EGS – RASARA

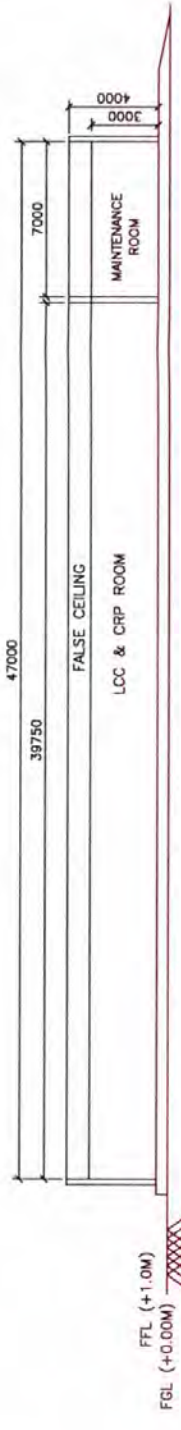


FOR TENDER PURPOSE ONLY

1



SECTION B-B



NOTE:-

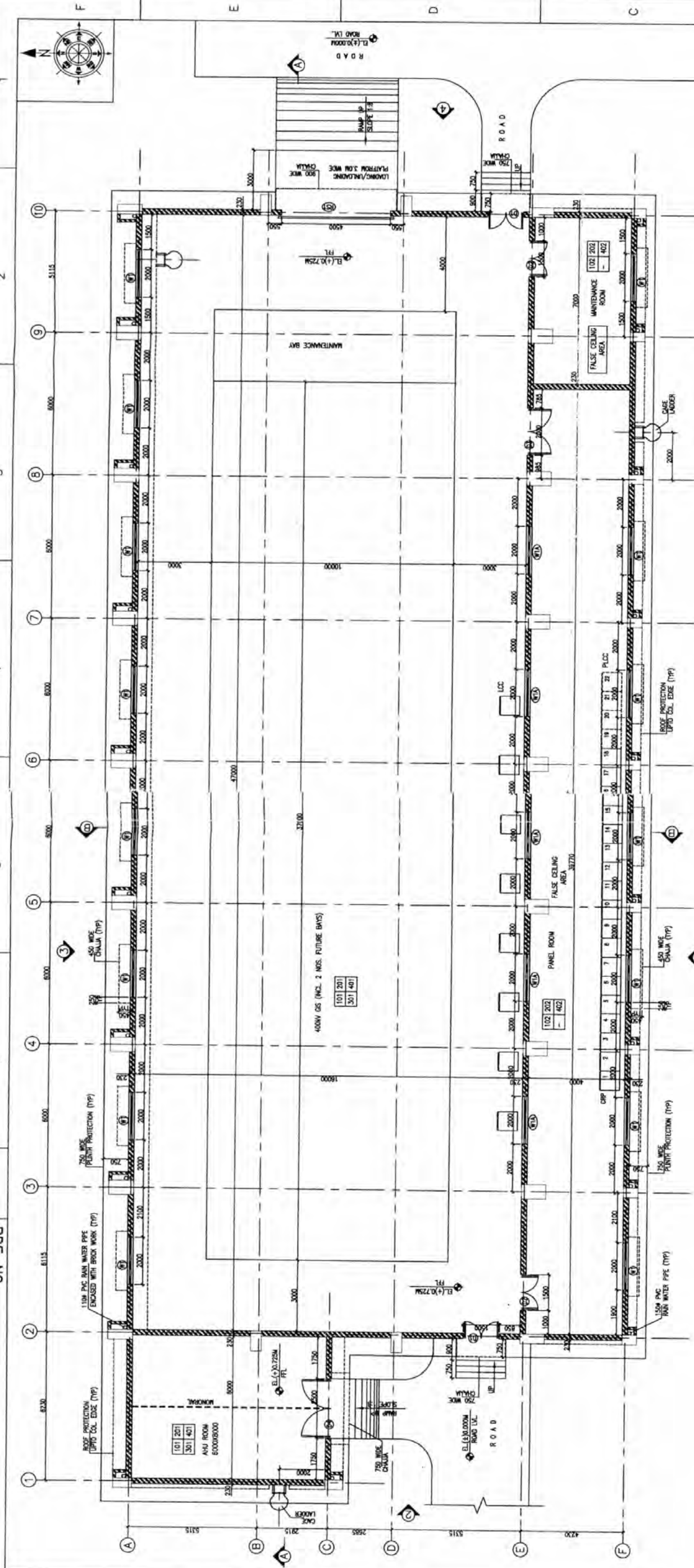
1. ALL DIMENSIONS ARE IN MM AND MINIMUM CLEAR DIMENSIONS.
2. GIN ROOM SHALL BE PROVIDED WITH DUCTED VENTILATION .
3. FINAL LOCATION OF CABLE TRENCH ENTRY SHALL BE AS PER APPROVED TRENCH LAYOUT.
4. DOOR SHALL BE 2500(H)X1500(W) IN SIZE.
5. ROLLING SHUTTER SHALL BE 5500(H)X4500(W) IN SIZE.
6. CAPACITY OF EOT CRANE - 10T

1. OVERALL GENERAL ARRANGEMENT DRAWING : TB-0-375-316-002

SECTION C-C

REV	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	MV
		CHD/APPD			CHD/APPD			CHD/APPD	PK	19.11.18	CHD/APPD	DKM/AG
ZONE			ZONE			ZONE			ZONE			DRG REVISED FOR CHANGE IN DIMENSIONS OF G5 HALL

A



GROUND FLOOR PLAN

Approved and released for cont.

S.1
FOTC, Prayagraj

ILLUSTRATION OF FINISHES.				FINISHES OF SCHEDULE										
<table><tr><th>WALL SERIES</th><th>FLOORING SERIES</th><th>CEILING SERIES</th><th>SKIRTING/DOOR SERIES</th></tr><tr><td>100</td><td>300</td><td>300</td><td>400</td></tr></table>				WALL SERIES	FLOORING SERIES	CEILING SERIES	SKIRTING/DOOR SERIES	100	300	300	400	WALL FINISHES-		
				WALL SERIES	FLOORING SERIES	CEILING SERIES	SKIRTING/DOOR SERIES							
				100	300	300	400							
				SERIAL NO.	CODE NO.	DESCRIPTION								
				1.	101	ARTIC DISTEMPER								
2.	102	ARTIC EMULSION PAINT												
				FLOORING FINISHES										
<table><tr><th>SKIRTING/DOOR SERIES</th></tr><tr><td>401</td></tr><tr><td>402</td></tr></table>				SKIRTING/DOOR SERIES	401	402	CEILING FINISHES							
				SKIRTING/DOOR SERIES										
				401										
				402										
				1.	401	CEMENT PLASTER SKIRTING 150 MM HIGH								
2.	402	VITRIFIED TILES												
				CEILING FINISHES										
				1.	301	ARTIC DISTEMPER								
				2.	302	ARTIC EMULSION PAINT								

REFERENCE DRAWING:-

- ! OVERALL GENERAL ARRANGEMENT DRAWING - TB-0-375-316-002
! CONCEPTUAL DRAWING FOR 400KV GAS BUILDING - TB-3-404-316-004

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2. ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(4.0.00) CORRESPONDS TO TOP LEVEL OF ROAD.
5. FINAL LOCATION OF CABLE TRENCHES REFER APPROVED ELECTRICAL DRAWINGS.

WATER PROOFING ON ROOF

[illegible]

PLASTER:

INTERNAL:
12mm THK. PLASTER (1:6 CEMENT : SAND)

EXTERNAL:
18mm THK. PLAIN PLASTER (1:6 CEMENT : SAND)
12mm 1ST LAYER 1:6 C&S, 6mm 2ND LAYER 1:4 C&S

CEILING EXCEPT FOR WHERE FALSE CEILING WILL BE PROVIDED,
6mm THK. PLAIN PLASTER (1:4 CEMENT : SAND)

LEGEND:-

- | | |
|---|--------------------------|
|  | SIDE HUNG OPENABLE PANEL |
|  | FIXED GLASS PANEL |
| FTL | = FINISH FLOOR LEVEL |
| FGL | = FINISH GRADE LEVEL |
| H.P. | = HIGH POINT |
| L.P. | = LOWER POINT |
| T.O.C. | = TOP OF CONCRETE |
| FFL | = FINISH FLOOR LEVEL |
| FGL | = FINISH GRADE LEVEL |

PROJECT:

400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)

CUSTOMER: _____

भारत भारत भारत
UTTAR PRADESH POWER TRANSMISSION CORPORATION LTD.
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS -

RDA CIVIL ENGINEERING SYSTEM PVT. LTD.
N-43, SRINIWASPURI NEW DELHI -65
PH. 011 26846126, FAX 011 26313478

DEPT. TOD	UNTOOL DIMS.	SCALE	WEIGHT

	IBU	GR. 9/11/17		N.T.S.	N.A.
	CODE				

TITLE					
-------	--	--	--	--	--

400KV GIS BUILDING
ARCHITECTURAL GROUND FLOOR PLAN &

FINISHES SCHEDULE

2	
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100

FIRST ANGLE PROJECTION

DRG. NO.

1

2

3

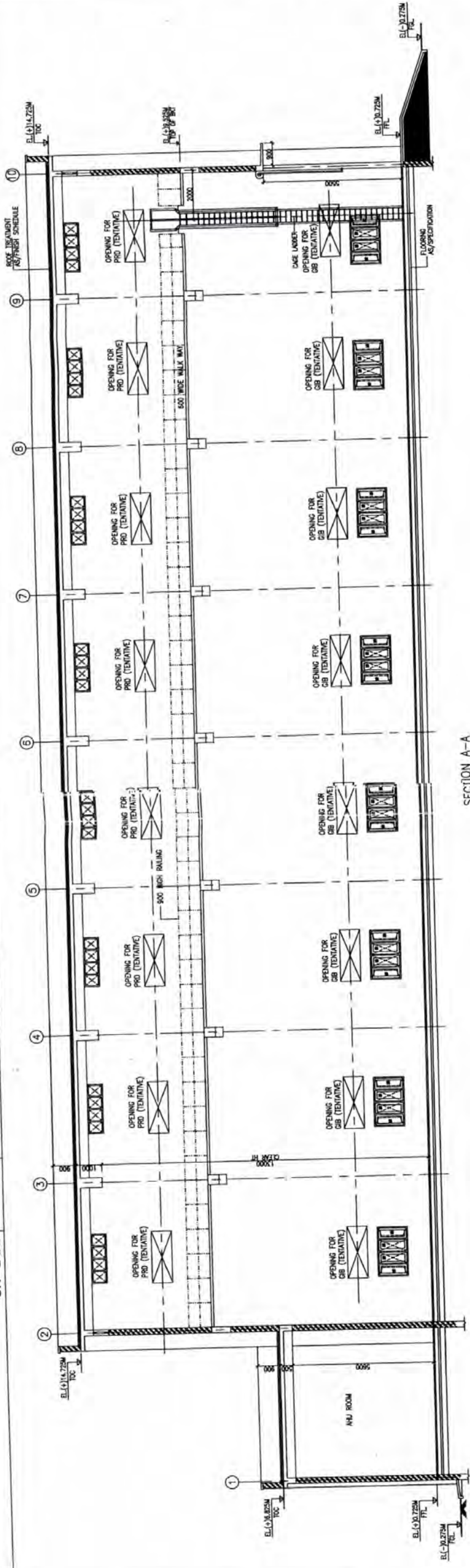
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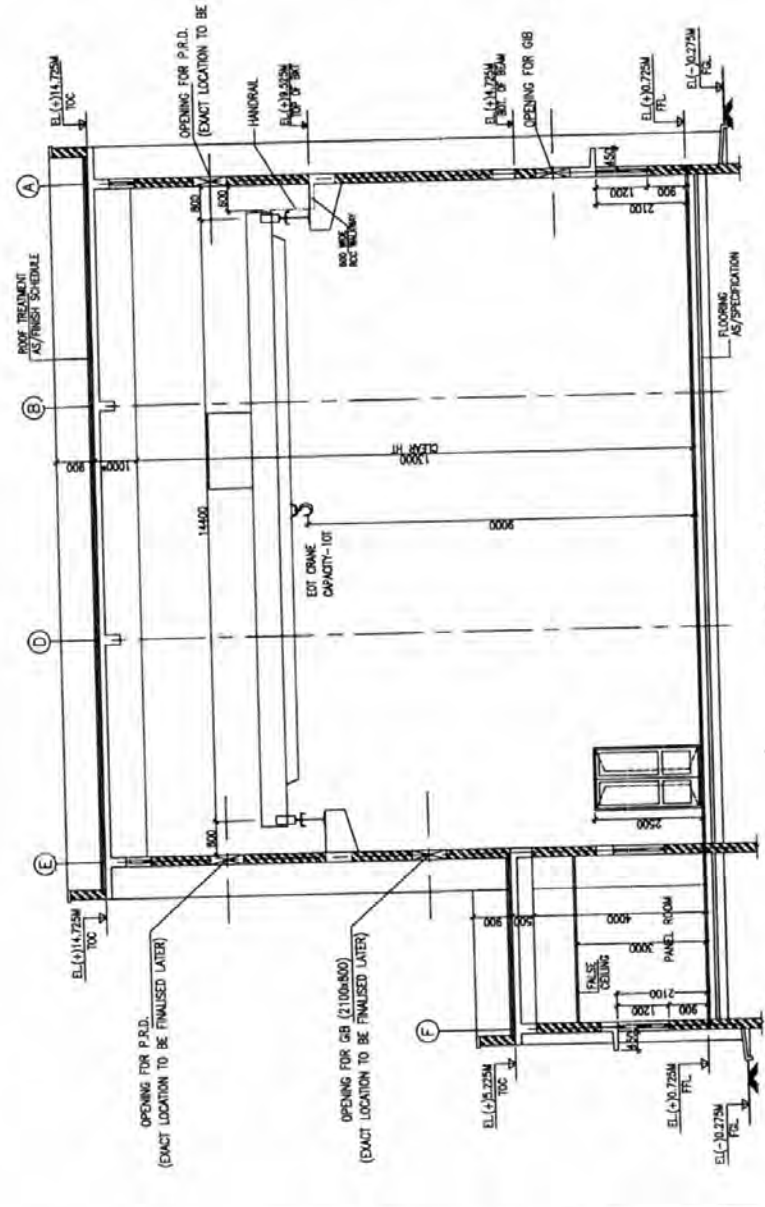
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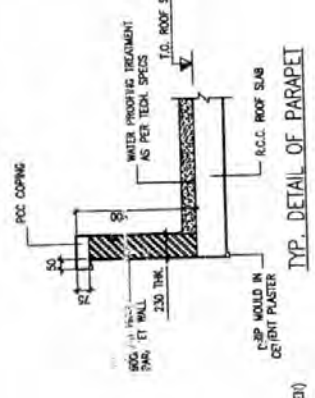
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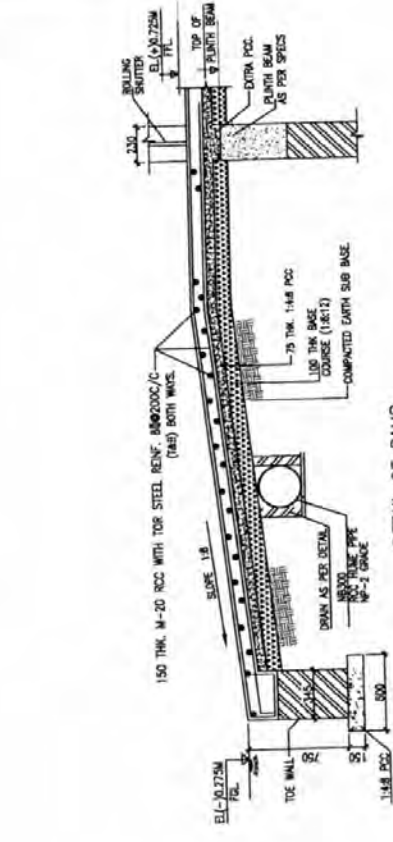
SECTION A-A



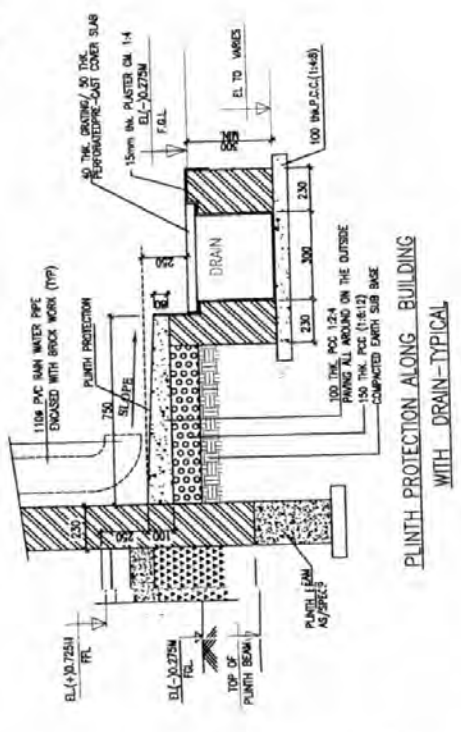
SECTION B-B



TYP. DETAIL OF PARAPET



DETAIL OF RAMP



PLINTH PROTECTION ALONG BUILDING WITH DRAIN-TYPICAL

Approved and released for con.

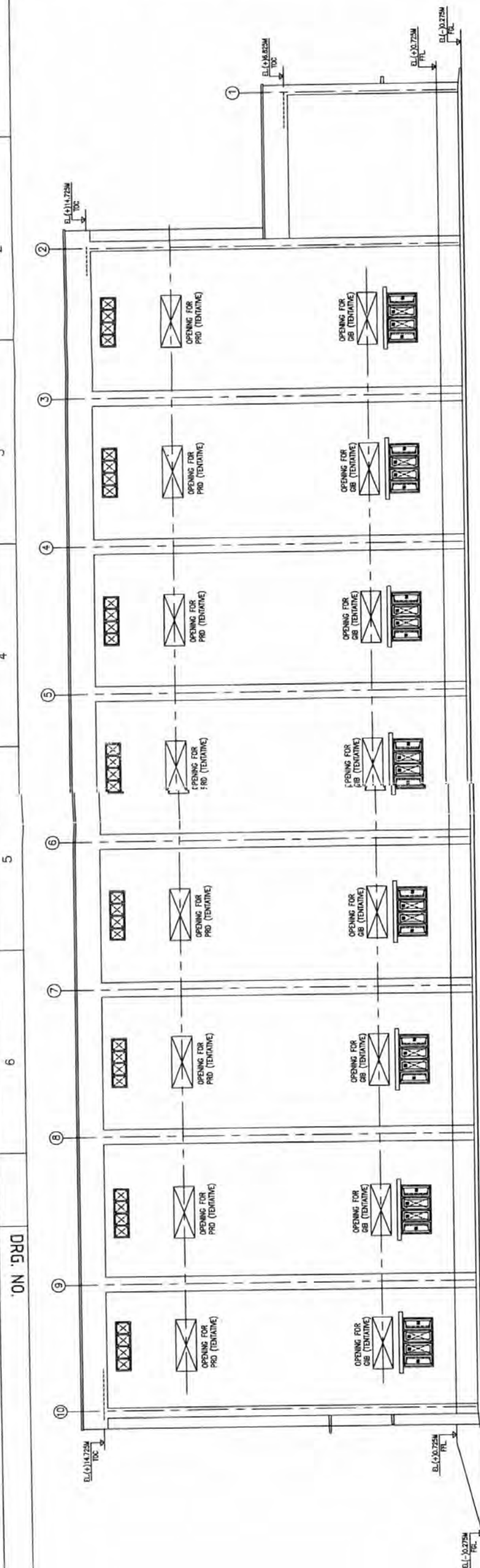
S. E.
ECTC, Prayagraj

PROJECT:
400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)
CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LTD.

BEHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:-		NAME		SIGN.		DATE		NO. OF	
RDA CIVIL ENGINEERING SYSTEM PVT. LTD.		DRN.		TMR		15.01.19		VAR.	
N-43, SEKTAWAPURI NEW DELHI - 65		CHO.		AWALESH		15.01.19		N.A.	
P.R. 011 26645128, FAX 011 26313478		APPD.		DKU		15.01.19		N.A.	
DEPT. TBC		SCALE		WEIGHT (KG)		REF. TO ASSY. DRG.		NO. OF	
CODE		N.T.S		N.A.		N.A.		ITEM NO.	
TITLE		400KV GIS BUILDING		CARD		NO. 01		REV.	
		ARCHITECTURAL SECTIONS		CODE		TB-1-404-607-661-2		NO. OF	
				SHT. No 01		NO. OF		SHT. 01	
								1	
								2	
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								4	
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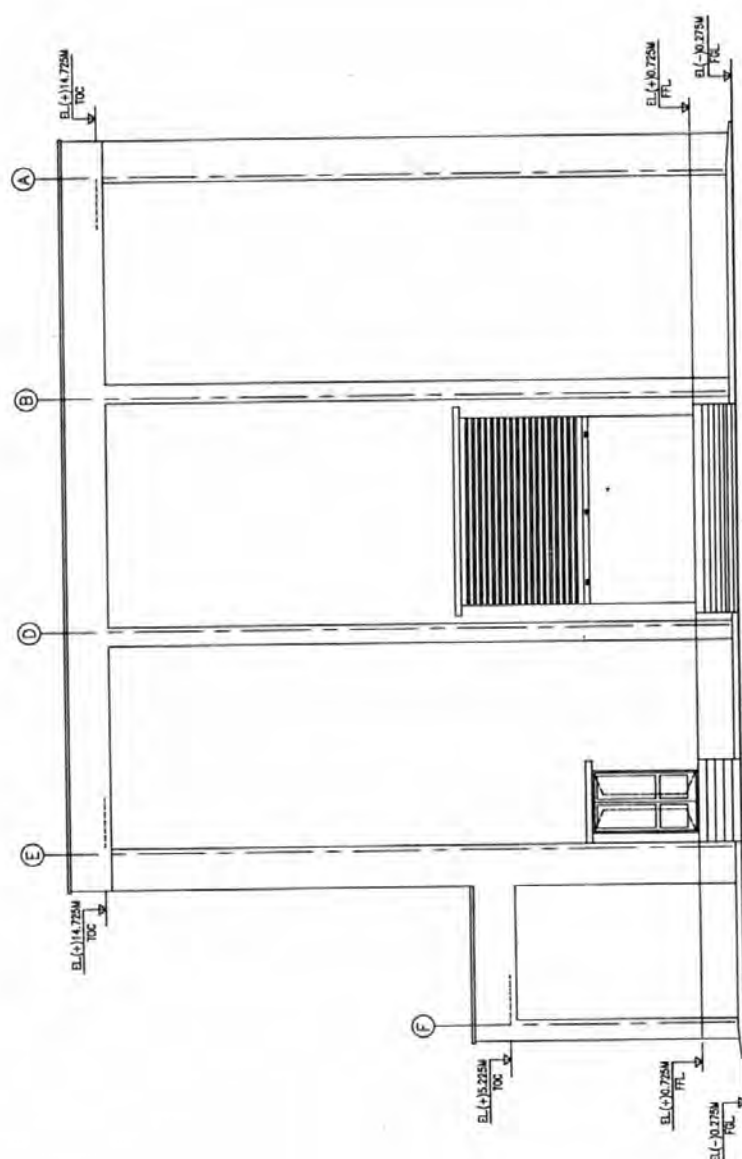
- NOTES:-
1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
 2. ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
 3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
 4. EL (+10.00M) CORRESPONDS TO TOP LEVEL OF ROAD.
 5. FINAL LOCATION OF CABLE TRENCHES REFER APPROVED ELECTRICAL DRAWINGS.



ELEVATION-3

Approved and released for const.

18/11/13
8.11
DIRECTOR, Prayagraj



ELEVATION-4

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2. ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE INS DRILL
3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. ELEVATION CORRESPONDS TO TOP LEVEL OF ROAD.
5. FINAL LOCATION OF CABLE TRENCHES REFER APPROVED ELECTRICAL DRAWINGS.

PROJECT:		400kV/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)	
CUSTOMER:		UTTAR PRADESH POWER TRANSMISSION CORPORATION LTD.	
		BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP NOIDA	
STRUCTURAL CONSULTANTS:- RDA CIVIL ENGINEERING SYSTEM PVT. LTD. N-43, SERPENTASPURI NEW DELHI -65 PH. 011 26646128, FAX 011 26313478			
DEPT. T.B.C CODE	UNTLT. DIMS. GR. g/m ²	 SCALE N.T.S	WEIGHT (KGS) N.A. REF. TO ASST. DRG. N.A. DRG. NO. TB-1-404-607-661-3
TITLE		REV	
400KV GIS BUILDING ARCHITECTURAL ELEVATIONS		00	
		NO. OF SHT. 02	
		SIZE-A	

NOTES:--									
1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.									
2. ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.									
3. ALL DOOR-WINDOW, ETC HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.									
4. ELEVATION CORRESPONDS TO TOP LEVEL OF ROAD.									
5. FINAL LOCATION OF CABLE TRENCHES REFER APPROVED ELECTRICAL DRAWINGS.									

(ALL DIMENSIONS ARE IN mm)

FIRST ANGLE PROJECTION

DRG. NO.

900-018-404-S-BL

1

2

3

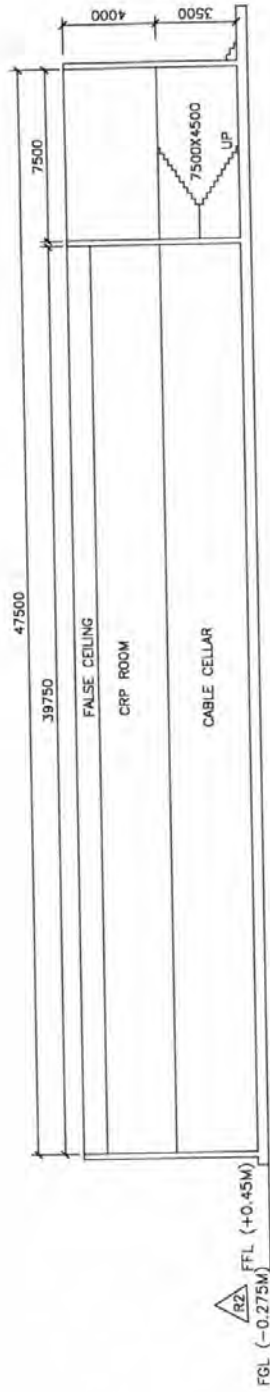
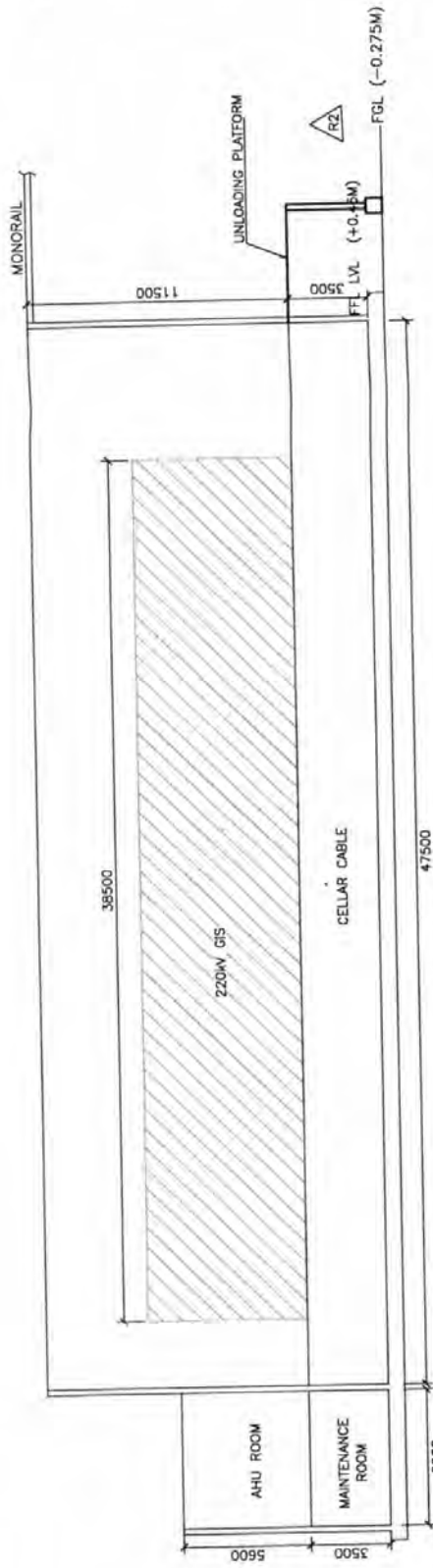
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- NOTE:-
1. ALL DIMENSIONS ARE IN MM AND MINIMUM CLEAR DIMENSIONS.
 2. GIS ROOM SHALL BE PROVIDED WITH DUCTED VENTILATION.
 3. FINAL LOCATION OF CABLE TRENCH ENTRY SHALL BE AS PER APPROVED TRENCH LAYOUT.
 4. DOOR SHALL BE 2500(H)X1500(W) IN SIZE.
 5. ROLLING SHUTTER FOR GIS ROOM SHALL BE 5500(H)X4500(W) IN SIZE.
 6. CAPACITY OF EOT CRANE - 10T.
 7. DETAILS OF STAIRS AS PER CIVIL DRG.
 8. DOOR FOR AHU ROOM SHALL BE 3300(H)X2200(W) IN SIZE.
- REFERENCE:-
1. LAYOUT PLAN AND SECTION DRAWING : TB-0-375-316-002

REFERENCE DRG.:- TENDER SINGLE LINE DIAGRAM 400/220/132kV GIS S/S

PROJECT: 400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)

CUSTOMER: UTTAR PRADESH TRANSMISSION CORPORATION LIMITED

REV.	DATE	ALTERED	DATE	REV.	DATE	ALTERED	DATE	REV.	DATE	ALTERED	DATE	REV.	DATE	ALTERED	DATE	REV.	DATE	ALTERED	DATE
02	08.01.19	CHD/APPD	08.01.19	02	08.01.19	CHD/APPD	08.01.19	02	08.01.19	CHD/APPD	08.01.19	02	08.01.19	CHD/APPD	08.01.19	02	08.01.19	CHD/APPD	08.01.19
ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18
ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18	CABLE CELLAR PROVIDED ON GROUND FLOOR	ZONE	15.12.18

CONCEPTUAL DRAWING FOR 220kV GIS BUILDING

TB-3-404-316-005

REV. 02

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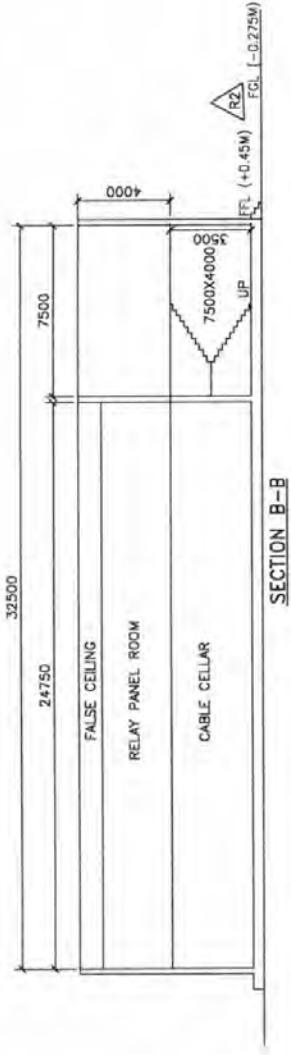
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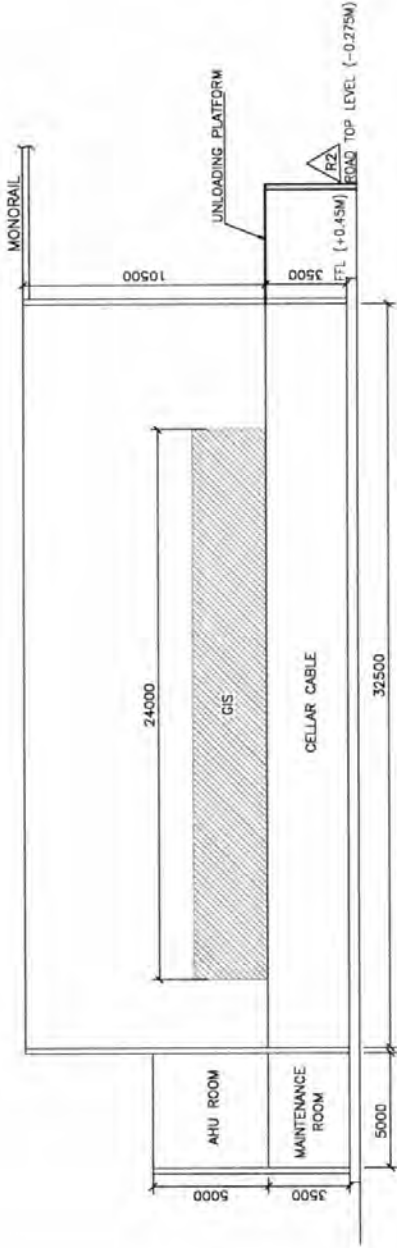
SIZE-A3



SECTION B-B



SECTION A-A



SECTION C-C

- NOTE:-
1. ALL DIMENSIONS ARE IN MM AND MINIMUM CLEAR DIMENSIONS.
 2. GIS ROOM SHALL BE PROVIDED WITH DUCTED VENTILATION.
 3. FINAL LOCATION OF CABLE TRENCH ENTRY SHALL BE AS PER APPROVED TRENCH LAYOUT.
 4. DOOR SHALL BE 2500(H)x1500(W) IN SIZE.
 5. ROLLING SHUTTER FOR SHALL BE 5500(H)x4500(W) IN SIZE.
 6. CAPACITY OF EOT CRANE - 6T
 7. DETAILS OF STAIRS AS PER CIVIL DRG.
 8. DOOR FOR AHU ROOM SHALL BE 3300(H)x2200(W) IN SIZE.

REFERENCE:-

1. LAYOUT PLAN AND SECTION DRAWING : TB-0-375-316-002

REFERENCE DRG :- TENDER SINGLE LINE DIAGRAM 400/220/132kV GIS S/S

PROJECT: 400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)

CUSTOMER: UTTAR PRADESH TRANSMISSION CORPORATION LIMITED

UTAR PRADESH TRANSMISSION CORPORATION LIMITED

	DEPT. TBG CODE	UNTD. DIMS. GR or g/n/y		SCALE	N.T.S	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO	N.A.	NO. OF ITEMS	N.A.	REV	02
BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP NOIDA													
NAME PK MM/DKM AG													
SIGN. DRN. CHD. APPD.													
DATE 21.09.18													
NO. OF VAR. N.A.													
TITLE													
CONCEPTUAL DRAWING FOR 132KV GIS BUILDING													
CARD CODE NA													
SHT. No 02													
NO. OF SHT. 02													
TB-3-404-316-006													

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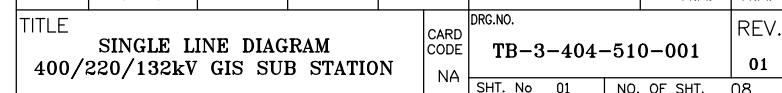
INDEX

SHEET NO.	DESCRIPTION
1	SINGLE LINE DIAGRAM - 400KV GIS S/S
2	SINGLE LINE DIAGRAM - 220KV GIS S/S
3	SINGLE LINE DIAGRAM - 132 KV GIS S/S
4	BQ FOR 400KV GIS S/S
5	BQ FOR 220KV GIS S/S
6	BQ FOR 132KV GIS S/S
7	CT-VT DETAILS FOR 400, 220 , 132 KV GIS S/S
8	72.5/36KV SLD

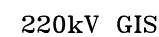
REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED						
		CHD/APPD			CHD/APPD			CHD/APPD	01	01.09.18	CHD/APPD						
ZONE						ZONE						ZONE	DRG. REVISED IN LINE WITH DISCUSSION DATED 01.09.18				
8			7			6			5			4			3		

REFERENCE DRG.: - TENDER SINGLE LINE DIAGRAM 400/220/132kV GIS S/S									
PROJECT:									
400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)									
CUSTOMER:									
UTTAR PRADESH TRANSMISSION CORPORATION LIMITED									
									
BHARAT HEAVY ELECTRICALS LTD.					NAME	SIGN.	DATE	NO. OF	
TRANSMISSION BUSINESS GROUP					DRN.	PK		VAR.	
NOIDA					CHD.	AK/RD		N.A.	
					APPD.	DKM			
DEPT.	T.BG	UNTOL.	DIMS.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE	GR.	g/m/y	N.T.S						
TITLE					CARD	NO.	REV.		
SINGLE LINE DIAGRAM					CODE	TB-3-404-510-001	01		
400/220/132kV GIS SUB STATION					NA	SHT. No	A	NO. OF SHT.	08
					2		1	SIZE-A3	

1



SIZE-A3



220kV GIS BUS I
3000A, 40kA FDR 3s
220kV GIS BUS II
3000A, 40kA FDR 3s

DRG.NO.	TB-3-404-510-001	REV.	01
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SIZE-A3

1



132kV GIS

132kV GIS BUS I
2000A, 40kA FDR 3s

132kV GIS BUS II
2000A, 40kA FDR 3s

BUS COUPLER

SF6/XLPE CABLE TERMINATION

2. IN BAY NOS. 109, 110, 111 & 112 ONLY GIS MODULES UPTO SF6/XLPE CABLE TERMINATION SHALL BE IN BHEL SCOPE
OUTDOOR TYPE LA & 132KV CABLE SHALL NOT BE IN BHEL SCOPE.

SINGLE LINE DIAGRAM- 132kV GIS s/s

REFERENCE DRG.: - TENDER SINGLE LINE DIAGRAM 400/220/132kV GIS S/S															
PROJECT: 400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)															
CUSTOMER: UTTAR PRADESH TRANSMISSION CORPORATION LIMITED															
BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP NOIDA				NAME		SIGN.		DATE		NO.OF VAR.					
		DRN.		PK						N.A.					
		CHD.		AK/RD						N.A.					
		APPD.		DKM						N.A.					
DEPT. TBG CODE		UNTOL. DIMS. GR. 9/11/17				SCALE N.T.S		WEIGHT (KG) N.A.		REF. TO ASSY. DRG. N.A.		ITEM NO. N.A.		NO.OF ITEMS N.A.	
TITLE SINGLE LINE DIAGRAM 400/220/132kV GIS SUB STATION						DRG.NO. TB-3-404-510-001				REV. 01					
						CARD CODE NA				SHT. No 03 NO. OF SHT. 08					

	N.A.	A
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SIZE-A3

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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

TB-3-404-510-001

DRG. NO.

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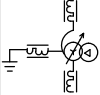
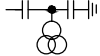
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A. 400 kV OUTDOOR EQUIPMENT: –

S.N.	DESCRIPTION	SYMBOLS	LEGEND	BAY NO/LOCATION	UNIT	QTY
1.	500MVA, 400/220/33KV, YNa0d11, DFAF, 3-PH ICT		ICT	402, 405	NDS	02
2.	400kV, 125MVA, 3-PH BUS REACTOR		BR	407	NDS	01
3.	400kV, 1-PH, 8800pF CAPACITIVE VOLTAGE TRANSFORMER		CVT	401, 406	NDS	06
4.	390kV, 20kA, CLASS-IV, 1-PH, LIGHTNING ARRESTER		LA	401, 402, 405, 406, 407	NDS	15
5.	400kV, 3150A, 1.0mH, 1-PH, PEDESTAL TYPE WAVE TRAP *		WT	401, 406	NDS	04

*' WAVE TRAPS WOULD BE IN TWO PHASES OF LINES ONLY. CUSTOMER SHALL CONFIRM THOSE PHASES.

B. 400 kV INDOOR GIS: –

S.N.	DESCRIPTION	SYMBOLS	LEGEND	BAY NO/LOCATION	UNIT	QTY
1.	400kV, 4000A, 50kA FOR 3 SEC., 3-PH. CIRCUIT BREAKER		52	403	SETS	01
2.	400kV, 3150A, 50kA FOR 3 SEC., 3-PH. CIRCUIT BREAKER		52	401, 406, 409, 410	SETS	04
3.	400kV, 3150A, 50kA FOR 3 SEC., 3-PH. CIRCUIT BREAKER WITH CSD		52	402, 405, 407	SETS	03
4.	400kV, 4000A, 50kA FOR 3 SEC., 3-PH., GROUP OPERATED DISCONNECTING SWITCH		89A 89B	403 403	SETS	02
5.	400kV, 3150A, 50kA FOR 3 SEC., 3-PH., GROUP OPERATED DISCONNECTING SWITCH		89A 89B 89L	401, 406, 408, 409 401, 406, 408, 409 401, 406, 408, 409	SETS	12
6.	400kV, 2000A, 50kA FOR 3 SEC., 3-PH. GROUP OPERATED DISCONNECTING SWITCH		89 89A 89B 89L	404A, 404B 402, 405, 407 402, 405, 407 402, 405, 407	SETS	11
7.	EARTH SWITCH, 3-PH, GROUP OPERATED		89E2 89AE 89BE 89LE1	404A, 404B 401, 402, 403, 405, 406, 407, 408, 409 403 401, 402, 405, 406, 407, 408, 409	SETS	18
8.	HIGH SPEED EARTHING SWITCH, 3-PH, GROUP OPERATED		89E1 89LE2	404A, 404B 401, 402, 405, 406, 407, 408, 409	SETS	09
9.	400kV, 3000A, 50kA FOR 3 SEC, 1-PH., 5-CORE CURRENT TRANSFORMER WITH 120% EXTENDED CURRENT RATING		CT	401, 402, 403, 405, 406, 407, 408, 409.	NDS.	24
10.	400kV, 1-PH. VOLTAGE TRANSFORMER		VT	404A, 404B, 407	NDS.	09

400 kV SYSTEM PARAMETERS: –

S.N.	SYSTEM PARAMETERS	400kV
1.	NOMINAL VOLTAGE	400kV
2.	HIGHEST SYSTEM VOLTAGE	420kV
3.	RATED FREQUENCY	50Hz
4.	RATED SHORT TIME CURRENT	50kA for 3sec.
5.	POWER FREQUENCY WITHSTAND VOLTAGE	650kV (rms)
6.	LIGHTNING IMPULSE WITHSTAND VOLTAGE	±1425 kV peak
7.	SWITCHING IMPULSE WITHSTAND VOLTAGE	±1050 kV peak
8.	CREEPAGE	25mm/kV (10500 mm)
9.	GROUNDING	Effectively earthed

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD	01	01.09.18	CHD/APPD
ZONE			ZONE			ZONE			ZONE		DRG. REVISED IN LINE WITH DISCUSSION DATED 01.09.18

REFERENCE DRG.: – TENDER SINGLE LINE DIAGRAM 400/220/132kV GIS S/S																											
PROJECT: 400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)																											
CUSTOMER: UTTAR PRADESH TRANSMISSION CORPORATION LIMITED																											
BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP NOIDA <table><tr><td>NAME</td><td>SIGN.</td><td>DATE</td><td>NO.OF VAR.</td></tr><tr><td>DRN. PK</td><td></td><td></td><td></td></tr><tr><td>CHD. AK/RD</td><td></td><td></td><td>N.A.</td></tr><tr><td>APPD. DKM</td><td></td><td></td><td></td></tr></table>												NAME	SIGN.	DATE	NO.OF VAR.	DRN. PK				CHD. AK/RD			N.A.	APPD. DKM			
NAME	SIGN.	DATE	NO.OF VAR.																								
DRN. PK																											
CHD. AK/RD			N.A.																								
APPD. DKM																											
DEPT. TBG CODE	UNTOL. DIMS. CR. 9/M/Y		SCALE N.T.S	WEIGHT (KG) N.A.	REF. TO ASSY. DRG. N.A.	ITEM NO. N.A.	NO.OF ITEMS N.A.																				
TITLE SINGLE LINE DIAGRAM 400/220/132kV GIS SUB STATION				CARD CODE NA	DRG.NO. TB-3-404-510-001		REV. 01																				
SHT. No 04				NO. OF SHT. 08																							

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SIZE-A3

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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

TB-3-404-510-001

DRG. NO.

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A. 220 kV OUTDOOR EQUIPMENT: –

S.N.	DESCRIPTION	SYMBOLS	LEGEND	BAY NO/LOCATION	UNIT	QTY
1.	160MVA, 220/132/11KV, YNa0d11, DFAF, 3-PH ICT		ICT	206, 207	NDS	02
2.	220kV, 1-PH, 4400pF CAPACITIVE VOLTAGE TRANSFORMER		CVT	201, 208, 209, 210	NDS	12
3.	216kV, 10kA, CLASS-III, 1-PH, LIGHTNING ARRESTER		LA	201, 208, 209, 210	NDS	12
4.	198kV, 10kA, CLASS-III, 1-PH, LIGHTNING ARRESTER		LA	202, 203, 206, 207	NDS	12
5.	220kV, 1600A, 0.5mH, 1-PH, PEDESTAL TYPE WAVE TRAP *		WT	201, 208, 209, 210	NDS	08

*' WAVE TRAPS WOULD BE IN TWO PHASES OF LINES ONLY. CUSTOMER SHALL CONFIRM THOSE PHASES.

220 kV SYSTEM PARAMETERS: –

S.N.	SYSTEM PARAMETERS	220kV
1.	NOMINAL VOLTAGE	220kV
2.	HIGHEST SYSTEM VOLTAGE	245kV
3.	RATED FREQUENCY	50Hz
4.	RATED SHORT TIME CURRENT	40kA for 3sec.
5.	POWER FREQUENCY WITHSTAND VOLTAGE	460kV (rms)
6.	LIGHTNING IMPULSE WITHSTAND VOLTAGE	±1050 kV peak
7.	SWITCHING IMPULSE WITHSTAND VOLTAGE	N.A.
8.	CREEPAGE	25mm/kV (6125 mm)
9.	GROUNDING	Effectively earthed

B. 220 kV INDOOR GIS: –

S.N.	DESCRIPTION	SYMBOLS	LEGEND	BAY NO/LOCATION	UNIT	QTY
1.	220kV, 3000A, 40kA FOR 3 SEC., 3-PH. CIRCUIT BREAKER		52	204	SETS	01
2.	220kV, 2500A, 40kA FOR 3 SEC., 3-PH. CIRCUIT BREAKER		52	201, 202, 203, 206, 207, 208, 209, 210, 211, 212, 213, 214	SETS	12
3.	220kV, 3000A, 40kA FOR 3 SEC., 3 PH., GROUP OPERATED DISCONNECTING SWITCH		89A 89B	204 204	SETS	02
4.	220kV, 2000A, 40kA FOR 3 SEC., 3 PH. GROUP OPERATED DISCONNECTING SWITCH		89 89A 89B 89L	205A, 205B 201, 202, 203, 206, 207, 208, 209, 210, 211, 212, 213, 214 201, 202, 203, 206, 207, 208, 209, 210, 211, 212, 213, 214 201, 202, 203, 206, 207, 208, 209, 210, 211, 212, 213, 214	SETS	38
5.	EARTH SWITCH, 3-PH		89E2 89AE 89BE 89LE1	205A, 205B 201, 202, 203, 204, 206, 207, 208, 209, 210, 211, 212, 213, 214 204 201, 202, 203, 206, 207, 208, 209, 210, 211, 212, 213, 214	SETS	28
6.	HIGH SPEED EARTHING SWITCH, 3-PH		89E1 89LE2	205A, 205B 201, 202, 203, 206, 207, 208, 209, 210, 211, 212, 213, 214	SETS	14
7.	220kV, 2000A, 40kA FOR 1 SEC, 1-PH., 5-CORE CURRENT TRANSFORMER WITH 120% EXTENDED CURRENT RATING		CT	201, 202, 203, 204, 206, 207, 208, 209, 210, 211, 212, 213, 214	NDS.	39
8.	220kV, 1-PH. VOLTAGE TRANSFORMER		VT	205A, 205B	NDS.	06

REFERENCE DRG.: – TENDER SINGLE LINE DIAGRAM 400/220/132kV GIS S/S

PROJECT:
400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)

CUSTOMER:
UTTAR PRADESH TRANSMISSION CORPORATION LIMITED

		BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP NOIDA			NAME		SIGN.		DATE		NO.OF VAR.		
					DRN. PK						N.A.		
					CHD. AK/RD								
					APPD. DKM								
DEPT. TBG		UNTOL. DIMS. GR. 9"/m/f			SCALE N.T.S	WEIGHT (KG) N.A.	REF. TO ASSY. DRG. N.A.		ITEM NO. N.A.		NO.OF ITEMS N.A.		
CODE													
TITLE SINGLE LINE DIAGRAM 400/220/132kV GIS SUB STATION						CARD CODE NA		DRG.NO. TB-3-404-510-001				REV. 01	
						SHT. No 05		NO. OF SHT. 08					

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD	01	01.09.18	CHD/APPD
ZONE			ZONE			ZONE			ZONE		DRG. REVISED IN LINE WITH DISCUSSION DATED 01.09.18

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1 SIZE-A3

132 kV SYSTEM PARAMETERS: –

S.N.	SYSTEM PARAMETERS	132kV
1.	NOMINAL VOLTAGE	132kV
2.	HIGHEST SYSTEM VOLTAGE	145kV
3.	RATED FREQUENCY	50Hz
4.	RATED SHORT TIME CURRENT	40kA for 3 sec.
5.	POWER FREQUENCY WITHSTAND VOLTAGE	275kV (rms)
6.	LIGHTNING IMPULSE WITHSTAND VOLTAGE	±650 kV peak
7.	SWITCHING IMPULSE WITHSTAND VOLTAGE	N.A.
8.	CREEPAGE	25mm/kV (3625 mm)
9.	GROUNDING	Effectively earthed

S.N.	DESCRIPTION	SYMBOLS	LEGEND	BAY NO/LOCATION	UNIT	QTY
1.	132kV, 2500A, 40kA FOR 1 SEC., 3-PH. CIRCUIT BREAKER		52	104	SETS	01
2.	132kV, 1600A, 40kA FOR 1 SEC., 3-PH. CIRCUIT BREAKER		52	101, 102, 103, 106, 107, 108, 109, 110, 111, 112, 113	SETS	11
3.	132kV, 1600A, 40kA FOR 1 SEC., 3-PH. DISCONNECTING SWITCH		89 89A 89B 89L	105A, 105B 101, 102, 103, 104, 106, 107, 108, 109, 110, 111, 112, 113 101, 102, 103, 104, 106, 107, 108, 109, 110, 111, 112, 113 101, 102, 103, 106, 107, 108, 109, 110, 111, 112, 113	SETS	37
4.	EARTH SWITCH, 3-PH		89E2 89AE 89BE 89LE1	105A, 105B 101, 102, 103, 104, 106, 107, 108, 109, 110, 111, 112, 113 104 101, 102, 103, 106, 107, 108, 109, 110, 111, 112, 113	SETS	26
5.	HIGH SPEED EARTHING SWITCH, 3-PH		89E1 89LE2	105A, 105B 101, 102, 103, 106, 107, 108, 109, 110, 111, 112, 113	SETS	13
6.	132kV, 1600A, 40kA FOR 1 SEC, 1-PH., 5-CORE CURRENT TRANSFORMER WITH 120% EXTENDED CURRENT RATING		CT	101, 102, 103, 104, 106, 107, 108, 109, 110, 111, 112, 113	NDS.	36
7.	132kV, 1-PH. VOLTAGE TRANSFORMER		VT	105A, 105B	NDS.	06

REFERENCE DRG.: - TENDER SINGLE LINE DIAGRAM 400/220/132kV GIS S/S											
PROJECT:											
400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)											
CUSTOMER:											
UTTAR PRADESH TRANSMISSION CORPORATION LIMITED											
 BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP NOIDA											
				NAME		SIGN.		DATE		NO.OF VAR.	
DRN.		PK								N.A.	
CHD.		AK/RD								N.A.	
APPD.		DKM								N.A.	
DEPT. TBG		UNTO. DIMS. GR.		SCALE		WEIGHT (KG)		REF. TO ASSY. DRG.		ITEM NO.	
CODE		9/M/f		N.T.S		N.A.		N.A.		NO.OF ITEMS	
											
TITLE						DRG.NO.			REV.		
SINGLE LINE DIAGRAM						CARD CODE			TB-3-404-510-001		
400/220/132kV GIS SUB STATION						NA			01		
						SHT. No			06		
						NO. OF SHT.			08		

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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

TB-3-404-510-001

DRG. NO.

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400kV GIS CT DETAILS

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	3000-2000-1000/1 A	-	3000-2000-1000	20-30-60	15-10-5	PS	Protection
2	3000-2000-1000/1 A	-	3000-2000-1000	20-30-60	15-10-5	PS	Protection
3	3000-2000-1000-500/1 A	20	-	-	-	0.2s, ISF ≤ 5	Metering
4	3000-2000-1000-500/1 A	-	6000-4000-2000-1000	20-30-60-120	15-10-5-2.5	PS	Protection
5	3000-2000-1000-500/1 A	-	6000-4000-2000-1000	20-30-60-120	15-10-5-2.5	PS	Protection

400kV GIS VT DETAILS

Winding No.	Ratio	Accuracy Class	Rated Burden (VA)	Purpose
1	(400 kV/√3) / (110V/√3)	3P	50	Protection
2	(400 kV/√3) / (110V/√3)	3P	50	Protection
3	(400 kV/√3) / (110V/√3)	0.2	50	Metering

400kV, 8800pF (+10%, -5%) OUTDOOR CVT DETAILS

Winding No.	Ratio	Accuracy Class	Rated Burden (VA)	Purpose
1	(400 kV/√3) / (110V/√3)	3P	50	Protection
2	(400 kV/√3) / (110V/√3)	3P	50	Protection
3	(400 kV/√3) / (110V/√3)	0.2	50	Metering

220kV GIS CT DETAILS

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	2000-1000-500/1 A	-	2000-1000-500	30-60-120	10-5-2.5	PS	Protection
2	2000-1000-500/1 A	-	2000-1000-500	30-60-120	10-5-2.5	PS	Protection
3	2000-1000-500/1 A	20	-	-	-	0.2s, ISF ≤ 5	Metering
4	2000-1000-500/1 A	-	2000-1000-500	30-60-120	10-5-2.5	PS	Protection
5	2000-1000-500/1 A	-	2000-1000-500	30-60-120	10-5-2.5	PS	Protection

220kV GIS VT DETAILS

Winding No.	Ratio	Accuracy Class	Rated Burden (VA)	Purpose
1	(220 kV/√3) / (110V/√3)	3P	50	Protection
2	(220 kV/√3) / (110V/√3)	3P	50	Protection
3	(220 kV/√3) / (110V/√3)	0.2	50	Metering

220kV, 4400pF (+10%, -5%) OUTDOOR CVT DETAILS

Winding No.	Ratio	Accuracy Class	Rated Burden (VA)	Purpose
1	(220 kV/√3) / (110V/√3)	3P	50	Protection
2	(220 kV/√3) / (110V/√3)	3P	50	Protection
3	(220 kV/√3) / (110V/√3)	0.2	50	Metering

500 MVA, 400/220/33kV ICT BUSHING CT DETAILS

400kV SIDE BUSHING CT

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	1600/1 A	-	1600	25	4	PS	REF
2	1000/1 A	30	-	-	-	0.2, ISF ≤ 5	Metering

220kV SIDE BUSHING CT

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	1600/1 A	-	1600	25	4	PS	REF
2	1600/1 A	30	-	-	-	0.2, ISF ≤ 5	Metering

NEUTRAL SIDE BUSHING CT

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	1600/1 A	-	1600	25	4	PS	REF

125MVAR, 400kV SHUNT REACTOR BUSHING CT DETAILS

400kV SHUNT REACTOR (LINE SIDE)

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV/2	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	200/1 A	-	200	100	1	PS	REACTOR DIFF
2	200/1 A	-	200	100	1	PS	REF
3	200/1 A	15	-	-	-	5P20	REACTOR BACK-UP

400kV SHUNT REACTOR (NEUTRAL SIDE)

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV/2	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	200/1 A	-	200	100	1	PS	REACTOR DIFF
2	200/1 A	-	200	100	1	PS	REF
3	500/1 A	10	-	-	-	0.2, ISF ≤ 5	METERING
4	172/2.2-2.0-1.8-1.6 A	10	-	-	-	5	WTI CT (Y-PH ONLY)

160 MVA, 220/132/11 kV ICT BUSHING CT DETAILS

220kV SIDE BUSHING CT

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV/2	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	1000/1 A	-	1000	40	5	PS	REF

132kV SIDE BUSHING CT

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV/2	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	1000/1 A	-	1000	40	5	PS	REF

NEUTRAL SIDE BUSHING CT

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV/2	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	1000/1 A	-	1000	40	5	PS	REF

11kV TERTIARY BUSHING CT

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV/4	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	2500/1 A	-	600	30	5	PS	DIFF
2	2500/1 A	-	300	40	5	PS	SPARE
3	2500/1 A	30	-	-	5	1	METERING

132kV GIS CT DETAILS

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	1600-800-400/1 A	-	1600-800-400	25-50-100	8-4-2	PS	Protection
2	1600-800-400/1 A	-	1600-800-400	25-50-100	8-4-2	PS	Protection
3	1600-800-400/1 A	20	-	-	-	0.2s, ISF ≤ 5	Metering
4	1600-800-400/1 A	-	1600-800-400	25-50-100	8-4-2	PS	Protection
5	1600-800-400/1 A	-	1600-800-400	25-50-100	8-4-2	PS	Protection

132kV GIS VT DETAILS

Winding No.	Ratio	Accuracy Class	Rated Burden (VA)	Purpose
1	(132 kV/√3) / (110V/√3)	3P	50	Protection
2	(132 kV/√3) / (110V/√3)	3P	50	Protection
3	(132 kV/√3) / (110V/√3)	0.2	50	Metering

REFERENCE DRG.: - TENDER SINGLE LINE DIAGRAM 400/220/132kV GIS S/S

PROJECT:

400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)

CUSTOMER:

UTTAR PRADESH TRANSMISSION CORPORATION LIMITED



BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	PK			
CHD.	AK/RD			N.A.
APPD.	DKM			

DEPT. TBG CODE

UNTOOL. DIMS. CR. 9/M/Y



SCALE N.T.S

WEIGHT (KG) N.A.

REF. TO ASSY. DRG. N.A.

ITEM NO. N.A. NO.OF ITEMS N.A.

TITLE
SINGLE LINE DIAGRAM
400/220/132kV GIS SUB STATION

CARD CODE NA

DRG.NO.
TB-3-404-510-001

REV.
01

SHT. No 07 NO. OF SHT. 08

REV.	DATE	ALTERED
		CHD/APPD

REV.	DATE	ALTERED
		CHD/APPD

REV.	DATE	ALTERED
		CHD/APPD

REV.	DATE	ALTERED
01	01.09.18	CHD/APPD

DRG. REVISED IN LINE WITH DISCUSSION DATED 01.09.18

ZONE

ZONE

ZONE

ZONE

8

7

6

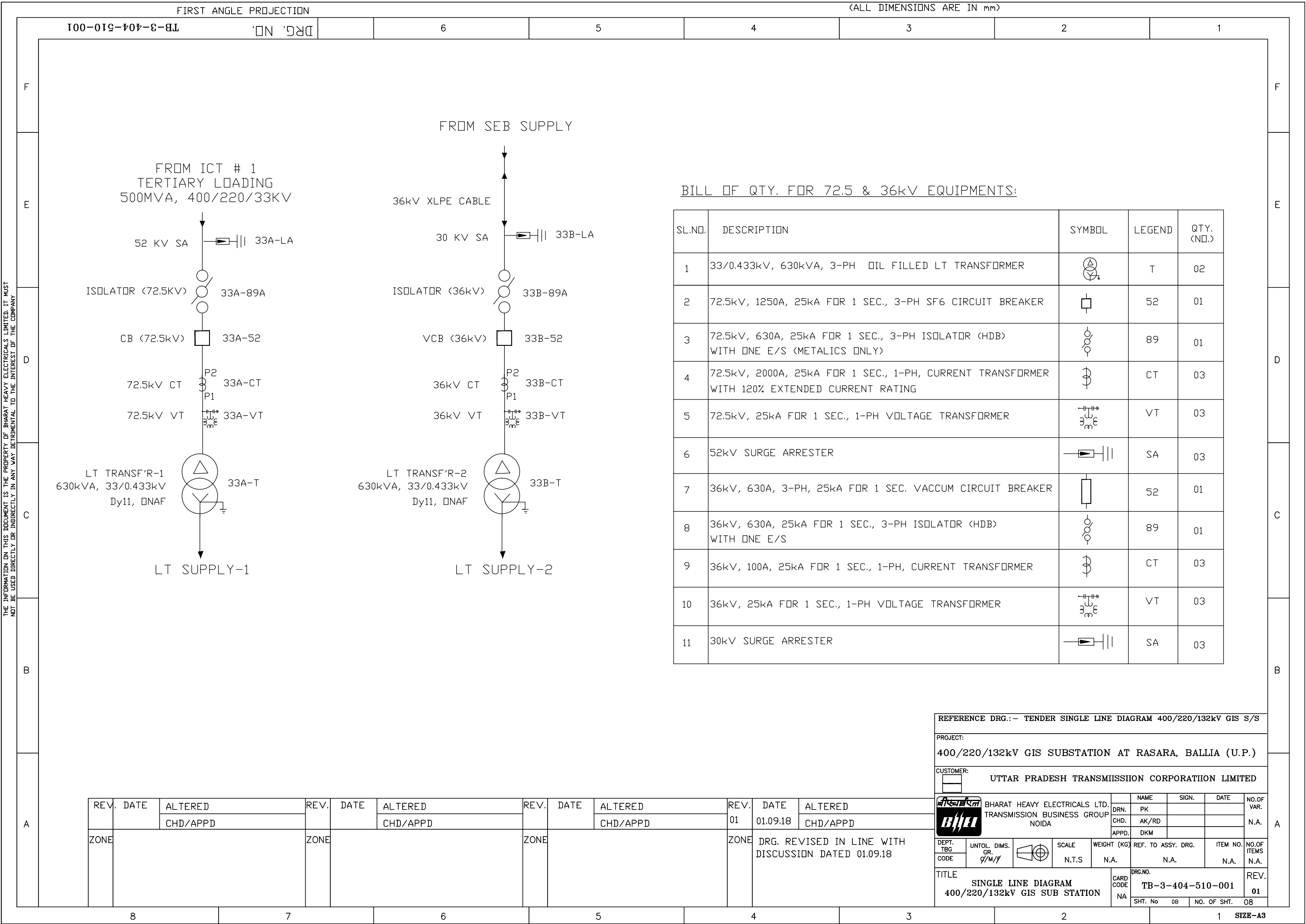
5

4

3

2

1 SIZE-A3



BILL OF QTY. FOR 72.5 & 36KV EQUIPMENTS:

SL.NO.	DESCRIPTION	SYMBOL	LEGEND	QTY. (NO.)
1	33/0.433kV, 630kVA, 3-PH OIL FILLED LT TRANSFORMER		T	02
2	72.5kV, 1250A, 25kA FOR 1 SEC., 3-PH SF6 CIRCUIT BREAKER		52	01
3	72.5kV, 630A, 25kA FOR 1 SEC., 3-PH ISOLATOR (HDB) WITH ONE E/S (METALICS ONLY)		89	01
4	72.5kV, 2000A, 25kA FOR 1 SEC., 1-PH, CURRENT TRANSFORMER WITH 120% EXTENDED CURRENT RATING		CT	03
5	72.5kV, 25kA FOR 1 SEC., 1-PH VOLTAGE TRANSFORMER		VT	03
6	52kV SURGE ARRESTER		SA	03
7	36kV, 630A, 3-PH, 25kA FOR 1 SEC. VACCUM CIRCUIT BREAKER		52	01
8	36kV, 630A, 25kA FOR 1 SEC., 3-PH ISOLATOR (HDB) WITH ONE E/S		89	01
9	36kV, 100A, 25kA FOR 1 SEC., 1-PH, CURRENT TRANSFORMER		CT	03
10	36kV, 25kA FOR 1 SEC., 1-PH VOLTAGE TRANSFORMER		VT	03
11	30kV SURGE ARRESTER		SA	03

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD	01	01.09.18	CHD/APPD
ZONE			ZONE			ZONE			ZONE		DRG. REVISED IN LINE WITH DISCUSSION DATED 01.09.18

REFERENCE DRG.: - TENDER SINGLE LINE DIAGRAM 400/220/132kV GIS S/S

PROJECT:
400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)

CUSTOMER:
UTTAR PRADESH TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

NAME	SIGN.	DATE	NO.OF VAR.
DRN. PK			
CHD. AK/RD			N.A.
APPD. DKM			

DEPT. TBG CODE	UNTOL. DIMS. CR. 9/M/f		SCALE N.T.S	WEIGHT (KG) N.A.	REF. TO ASSY. DRG. N.A.	ITEM NO. N.A.	NO.OF ITEMS N.A.
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TITLE SINGLE LINE DIAGRAM 400/220/132kV GIS SUB STATION	DRG.NO. TB-3-404-510-001	REV. 01
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CARD CODE NA	SHT. No 08	NO. OF SHT. 08
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S.NO.	DESCRIPTION	SYMBOL	QUANTITY (NOS.)
1	420 kV INDOOR GIS		01
2	420 KV, 1-ph SF6 TO AIR BUSHING		21
3	420KV, 1-ph CVT		06
4	360KV, 1-ph SURGE ARRESTER		15
5	420KV, 8 kN, 1-ph, BUS POST INSULATOR		24
6	420KV, 1mH, 1-ph, WT		04

S.NO.	DESCRIPTION	SYMBOL	QUANTITY (NOS.)
1	420 kV INDOOR GIS		01
2	420 KV, 1-ph SF6 TO AIR BUSHING		21
3	420KV, 1-ph CVT		06
4	360KV, 1-ph SURGE ARRESTER		15
5	420KV, 8 kN, 1-ph, BUS POST INSULATOR		24
6	420KV, 1mH, 1-ph, WT		04

S.NO.	DESCRIPTION	SYMBOL	QUANTITY (NOS.)
1	132 kv INDOOR GIS		01
2	120kV, 1-ph SURGE ARRESTER		21
3	132kV, 6 kN , 1-ph, BUS POST INSULATOR		24
4	XLPE CABLE TERMINATION (CABLE SEALING END)		24

<u>CONDUCTOR SIZE DETAILS</u>		
EQUIPMENT INTERCONNECTION	400 KV	TWIN 'MOOSE' CONDUCTOR
JACK BUS & JUMPERS	400 KV	TWIN 'MOOSE' CONDUCTOR

CONDUCTOR SIZE DETAILS		
EQUIPMENT INTERCONNECTION	220 KV	TWIN 'ZEBRA' CONDUCTOR
JACK BUS & JUMPERS	220 KV	TWIN 'ZEBRA' CONDUCTOR

CONDUCTOR SIZE DETAILS		
EQUIPMENT INTERCONNECTION	132 KV	TWIN 'PANTHER' CONDUCTOR
JACK BUS & JUMPERS	132 KV	TWIN 'PANTHER' CONDUCTOR

<u>MINIMUM CLEARANCE TABLE</u>	<u>400kV</u>	<u>220kV</u>	<u>132kV</u>	<u>33kV</u>
PHASE TO PHASE (PP) (mm)	4000	2100	1300	320
PHASE TO EARTH (PE) (mm)	3500	2100	1300	320
SECTION CLEARANCE (SC) (mm)	6500	5000	4000	3000
HEIGHT OF CONDUCTOR CENTRE LINE OF FIRST LEVEL (MN.) MM. (FROM PLINTH LEVEL)	8000	5500	4500	3600
GROUND CLEARANCE TO NEAREST PART NOT AT EARTH POTENTIAL OF AN INSULATOR SUPPORTING LIVE CONDUCTOR	2550	2500	2500	2500
CREEPAGE DISTANCE (mm/kV)	25	25	25	25

	TENSION INSULATOR
	TWIN MOOSE ACSR CONDUCTOR
	SHIELD WIRE
	FENCE
	400kV SUSPENSION INSULATOR
	CONNECTION TO TWIN ACSR MOOSE CONDUCTOR
	PROPOSED SCOPE
	EXISTING/FUTURE SCOPE
	GIB (GAS INSULATED BUS DUCT)
	TOWER WITH PEAK
	LM (LIGHTNING MAST)

REV.	DATE	ALTERED (CHECKED APPROVED)	REV.	DATE	ALTERED (CHECKED APPROVED)	REV.	DATE	ALTERED (CHECKED APPROVED)	REV.	DATE	ALTERED (CHECKED APPROVED)	REV.	DATE	ALTERED (CHECKED APPROVED)	REV.	DATE	ALTERED (CHECKED APPROVED)	REV.	DATE	ALTERED (CHECKED APPROVED)	REV.	DATE	ALTERED (CHECKED APPROVED)	REV.	DATE	ALTERED (CHECKED APPROVED)	REV.	DATE	ALTERED (CHECKED APPROVED)	PK MM/DDMM AG	
ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE	02 20.12.18 DRAWING REVISED AS PER UPTCL COMMENTS DATED 15.12.18

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SECTION 2

Equipment specification

- ANNEXURE-B – CLARIFICATIONS TO SPECIFICATION (2 pages)
- ANNEXURE- A1 – COORIGENDUM TO TECHNICAL PARAMETRS (15 pages)
- ANNEXURE-5 - COORIGENDUM TO TECHNICAL PARAMETRS
- ANNEXURE-6- CLARIFICATIONS
- UPPTCL SPECIFICATION FOR GIS (80 pages)

CONTROLLED SWITCHING REQUIREMENTS

400 kV Circuit Breaker shall be equipped with controlled switching with consequent optimization of switching behaviour, when used in:

- . Switching of transformer
- . Switching of shunt reactor

The controller shall be provided in Circuit breaker of switchable line reactor and in Main & The circuit breakers of Transformer, line with non-switchable line reactors and Bus reactors.

The controlling relay shall also record and monitor the switching operations and make adjustments to the switching instants to optimize the switching behaviour as necessary. It shall provide self diagnostic facilities, signalling of alarms and enable downloading of data captured from the switching events.

1. Technical Requirement for controlled switching device.
 - a) The controller shall be designed to operate at the correctly and satisfactorily with the excursion of auxiliary A/C & DC voltages and frequency as specified in section - GTR.
 - b) The controller shall meet the requirements of IEC-60255-4 Appendix 'E' Class III regarding HF disturbance test, and fast transient test shall be as per IEC-61000-4 level III and insulation test as per 60255-5.
 - b) The controller shall have functions for switching ON & OFF the circuit breakers.
 - c) The controller shall get command to operate the breakers manually or through auto re-close relay at random. The controller shall be able to analyze the current and voltage waves available through the signals from secondary of CTs & CVTs for the purpose of calculation of optimum moment of the switching the circuit breaker and issue command to circuit breaker to operate.
 - d) The controller shall also have an adaptive control feature to consider the next operating time of the breaker in calculation of optimum time of issuing the switching command. In calculation of next operating time of the breaker the controller must consider all factors that may affect the operating time of the breaker such as, but not limited to, ambient temperature, hydraulic/pneumatic pressure of the operating mechanism, control voltage variation, SF6 gas density variations etc. Schematic drawing for this purpose shall be provided by the controller shall be better than + 0.5 ms.
 - e) The controller should have display facility at the front for the settings and measured values.
 - f) The controller should be PC compatible for the setting of various parameters and down loading of the settings and measured values date time of switching etc. Window based software for this purpose shall be supplied by the contractor to be used on the owner's PC.
 - g) The controller shall have self-monitoring facility.
 - h) The controller shall be suitable for current input of 1 amp from the secondary of the CTs. And 110V (Ph to Ph) from the CVTs. The controller shall also take care of transient and dynamic state values of the current from the secondary of the CTs and CVTs.
 - j) The controller shall have time setting resolution of 0.1 ms or better.
 - k) The controller shall have sufficient number of output/input potential free contacts for connecting the monitoring equipment and annunciation system available in the control room. Necessary details shall be worked out during engineering the scheme.
 - l) The provision for bypassing the Controlled switching device shall be provided through BCU and SCADA both. Further, in case of any non-operation of the controlled switching device after receiving a close/trip command after a predetermined time delay, the controlled switching device should automatically be bypassed so as to ensure that the trip and close commands are extended to the Trip/close coils.
 - m) The point-on-wave switching is to be applied to both the trip coils and one closing coil with the facility to bypass this equipment as per requirement.

Section 2: AMENDMENT/ CLARIFICATIONS

REFERENCE DOC. Volume/ Cl. No./ Pg No.	EXISTING CLAUSE	CLARIFICATION/ CONFIRMATION REQUIRED	UPPTCL Comments
Cl. No. 3.4 (V) Sl. No. 6/ Tech Specs for GIS	One-minute power frequency withstand voltage between sec Terminal & earth - 5kVrms	We would like to inform you that, one-minute power frequency withstand voltage between secondary terminal & earth of CT shall be 3kVrms. Please accept the same.	As per ISS/IEC
Cl. No. 3.4 (X) / Tech Specs for GIS	Cable Head	Applicable only for 132kV GIS. Cable box enclosures as per IEC 62271-209 shall be provided. The quantity of cable enclosures shall be as per BOQ. Please confirm.	confirmed
Cl. No. 5.7 / Tech Specs for GIS	The material and thickness of the enclosures shall be such as to withstand an internal flash over without burn through for a period of 300 ms at rated short time withstand current.	We would like to inform you that, the offered GIS enclosures can withstand internal flash over without burn though as per IEC 62271-203. Please accept the same.	Accepted
Cl. No. 14.1.2 / Tech Specs for GIS	The circuit breakers shall be designed for high speed single and three phase reclosing with an operating sequence and timing as specified.	Offered 132kV CB is three phases encapsulated with one operating mechanism for all 3 poles. Only three phase reclosing is possible with this arrangement. Please confirm.	Auto-Reclosing on 132kV is not required.
Cl. No. 14.6.4 / Tech Specs for GIS	The gap between the open contacts shall be such that it can withstand at least the rated phase to ground voltage for eight hours at zero pressure above atmospheric level of SF6 gas due to its leakage	According to cl.no: 25.1(2. C) , pg 277/1201 of the specification "Circuit breaker : Zone Trip level : This is the minimum level at which the manufacturer will guarantee the insulation rating of the assembly." As per Cl. No. 14.6.4 of specification, eight (8) hours at atmosphere pressure is not specified by any IEC standards. Request you to please clarify.	As per IEC specification
Cl. No. 17.1 / Tech Specs for GIS	Disconnectors shall be of the single-pole, group operated type, installed	In 132kV GIS, disconnectors shall be 3 pole, group operated type. Please confirm your acceptance to same.	Confirmed
Cl. No. 19.2 / Tech Specs for GIS	Single phase switches shall be provided with operating mechanism suitable for operation from	The proposed high speed earthing switches are single pole gang operated with common operating mechanism for 245kV	Confirmed

PROJECT : 400/220/132kV GIS at Rasra , Ballia
CUSTOMER: UTTAR PRADESH TRANSMISSION CORPORATION LTD. (UPPTCL)
Technical Specification of GIS
Section-2: equipment specification

TB-404-316-001
REV.00
ANNEXURE-B

	a 220V DC.		and 420kV. For 132kV, it is three phase encapsulated with common operating mechanism. Please confirm your acceptance to same.	
Cl. No. 20.1.1 D) a) b)/ Tech Specs for GIS	The current transformers incorporated into the GIS will be used for protective relaying..... Each current transformer shall be equipped with a marshalling box with terminals...		CT secondary shall be outside the HV enclosure. Inbuilt terminal box shall be provided for each current transformer. Marshalling box is not applicable to GIS. Please confirm your acceptance to same.	Confirmed with the condition that the design is type tested
Cl. No. 20.3/ Tech Specs for GIS	Condenser type bushings will be preferred but alternative types can also be considered.		We offer composite type SF6/Air bushing for 420kV and 220kV. Please confirm your acceptance to same.	Confirmed
Cl. No. 3.1.1/ Tech Specs for GIS	132kV GIS : (a) (ii), D(iii) Three, inductive potential transformers, complete with isolator switch (b) (ii), C(ii), D) ii), Three 5 core-multi ratio, single phase current transformers.		As we offer three phase encapsulated design for 132kV GIS, one, three phase inductive potential transformer shall be considered. As above, current transformers. (CT) shall be one 5 core-multi ratio, three phase CTs. Please confirm your acceptance to same.	Confirmed

Amendment for 400/220/132 kV GIS for UPPTCL Rasra, Ballia

Sl No	Reference clause	Extract from specification	Amendment
1	CI - 7.0 (c)	Any other alarm necessary to indicate deterioration of the gas insulating system.	Deterioration of gas quality shall be checked by independent sampling and testing by SF6 gas analyser
2	CI- 5.31.1	Gas Monitoring kiosk - Separate control cubicle including gas monitoring kiosk shall be provided for each bay	Gas density monitor shall be provided for each gas tight compartment for monitoring of pressure and alarms will be provided in LCC. Same shall be wired upto BCU. Bidder to provide sufficient NO-NC contacts for the same.
3	CI-3.0, 18	Maximum break time at rating breaking capacity For 132 kV : 40 ms For 220 kV : 40 ms For 400kV : 40 ms	Below 300kV, total break time is 3 cycles i.e. 60 ms
4	CI-38.1.3	Special Type test : Internal Arc test Thermal Stability test Operation tests at limit temperature Gas tightness test	Valid type test reports will be submitted. In case type test reports are not acceptable during approval stage, same shall be conducted without cost and delivery implication to BHEL.
5	CI-3.0, 18	For all kV Levels: Line charging current - 50 Arms Cable charging current - 120 Arms Small inductive breaking current- 10 Arms	For all kV levels, line charging, cable charging and inductive breaking current shall be as per IEC.
6	cl 21.2 €	Rated lightning impulse voltage- Across the open contacts- for 400kV - 1200 or 240 kV	For 400 kV , Lightning impulse withstand voltage across the open contacts shall be 1425 or -240 kV as per IEC
7	cl 14.3 (iv)	The circuit breaker shall be capable of Breaking 25% the rated fault current at twice the rated voltage under phase opposition condition.	Out of phase breaking current shall be as per IEC.

Amendment for 400/220/132 kV GIS for UPPTCL Rasra, Ballia

Sl No	Reference clause	Extract from specification	Amendment
8	Cl 5.7	The material and thickness of the enclosures shall be such as to withstand an internal flash over without burn through for a period of 300 ms at rated short time withstand current. The material shall be such that it has no effect of environment as well as from the by-products of SF6 breakdown under arcing condition.	As per IEC 622171-203, for rated short circuit current $\geq 40\text{kA}$, for duration $\leq 0.3\text{s}$, No fragmentation (burn through is acceptable)
9	GAS SLD	Gas compartmentalization	Separate gas compartment to be provided for Circuit breaker for 400 kV & 220kV GIS. Bidder to meet service continuity requirement as per technical specification/ IEC. For 400 & 220 kV a) During a fault in circuit breaker compartment, no bus bar is permitted out of service during maintenance and repair/ replacement b) During a fault in GIS compartment other than CB compartment (including bus bar disconnector), maximum one bus bar and/or one feeder permitted out of service during repair and maintenance. For 132 kV a) During a fault in circuit breaker compartment, only one bus bar is permitted out of service during maintenance and repair/ replacement b) During a fault in GIS compartment other than CB compartment (including bus bar disconnector), maximum one bus bar and/or one feeder permitted out of service during repair and maintenance.

Amendment for 400/220/132 kV GIS for UPPTCL Rasra, Ballia

Sl No	Reference clause	Extract from specification	Amendment
10	GAS SLD	Placement of Cores	As per UPPTCL Gas SLD, GIS CT Core-4 and 5 to be placed in Bus-1 side of Circuit Breaker and Core-1, 2 and 3 to be placed in the other side of Circuit Breaker for 400, 220 and 132kV GIS.
12	Section 1	GIB length	Gas Insulated bus Duct length shall be measured from the centre line of GIS building wall to SF6 -Air bushing. Quantity given is taken as for 1 phase enclosure for GIB. Please refer revised quantity in Annexure-1,2,3

Clarification to bidders for 400/220/132 kV GIS for Rastra, Ballia

S.No	Reference Document	Reference Clause/Doc No.	Technical Issue	Technical Specification	Bidder's Remarks	Clarification
1	TS	Table-I A-I/ Annexure A1	Bus reactor CT Data	N/A	<i>CT data for reactor is not provided. We have considered CT data same as transformer bay.</i>	Project SLD to be followed for CT parameters
2	132kV EGS-RASARA	GSLD (132kV)	CB & CT compartment		<i>Bidder's Remarks:</i> As per GSLD attached with TS, customer has asked for separate compartment for CB and CT. As per our design concept we provide CT & CB in the same compartment. We like to inform you that gas compartment are sectionalized considering the best maintenance possibility. Kindly accept the same.	ACCEPTED for 132kV only
3	132kV EGS-RASARA	GSLD (132kV)	Bus Side DS & ES		<i>Bidder's Remarks:</i> As our 132kV is 3 phase encapsulated design we provide DS & ES in same enclosure (3PDS) which is mechanically not possible to separate. Thus, it is in same gas compartment. The earth switch is common for both the bus. However we assure you that this design concept shall fulfill the technical requirements of the customer. Kindly accept our proposal.	ACCEPTED
4	Annexure-A1	-	PIR		We would like to inform you that as per BOQ & SLD, there is no requirement of PIR in line feeder of 400kV. Kindly confirm the same.	No PIR required in 400kV CB
5	TS	5.31.1	Gas monitoring kiosk	Separate control cubicle including gas monitoring kiosk shall be provided for each bay	<i>Bidder's Remarks:</i> As per our design concept, we have provided separate gas density monitor for each gas tight compartment for monitoring of gas pressure, therefore in this reference no separate gas monitoring kiosk is required for monitoring of gas. Kindly consider our proposal.	Gas density monitor shall be provided for each gas tight compartment for monitoring of pressure and alarms will be provided in LCC. Same can be wired upto BCU.
6	TS	8.0	Pole Discrepancy	Pole Discrepancy	<i>For</i> 3-phase common operating box for 145kV CB, pole disordance is not valid. Kindly accept the same.	ACCEPTED
7	Un-priced bid- Ind bidd 400KV		Clarity Required in scope of works	4D, 2D, 1D- Supply Item - Commissioning spares for testing & commissioning of 400kV GIS till handing over	We envisage special tools for the description mentioned in 4 D, 2D, 1D. Kindly confirm.	Refer "Remarks_Long Description" column for 4D, 2D, 1D in revised BOQ (Annexure-1.2.3) in amendment
8	Un-priced bid- Ind bidd 400KV		Clarity Required in scope of works	4E, 2E, 1E - Supply Item - Tools & tackle	Please confirm whether Erection tools to be provided against 4E & whether it will permanent supply or on returnable basis. Kindly confirm.	Refer "Remarks_Long Description" column for 4E in revised BOQ (Annexure-1.2.3) in amendment
9	Un-priced bid- Ind bidd 400KV		Clarity Required in scope of works	4J16, 2J19, 1J19- Services of manpower for erection per day (excl. travel time)	Please help us to understand that whether its supervision manpower charges of Erection or actual erection manpower per day charges. Kindly clarify.	Supervision charges only to be considered for erection
10	Un-priced bid- Ind bidd 400KV		Clarity Required in scope of works	4J17, 2J20, 1J20 - Services of manpower for Testing & commissioning per day (excl. travel time)	Please help us to understand that whether its supervision manpower charges of Testing & Commissioning or actual Testing & Commissioning manpower per day charges. Kindly clarify.	Actual testing and commissioning charges to be considered

Clarification to bidders for 400/220/132 kV GIS for Rastra, Ballia

S.No	Reference Document	Reference Clause/DocNo.	Technical Issue	Technical Specification	Bidder's Remarks	Clarification
11	Page 58 of 187 (Annexure-A1)		Section 2	(V) Current Transformer (CT) 8. Rated insulation level	We wish to inform you that as the offered CT is ring type CT, hence the said clause is not applicable. Please confirm	Pl. follow TS
12	Page 58 of 187 (Annexure-A1)		Section 2	(V) Current Transformer (CT) 14. Rated dynamic withstand current	We wish to inform you that the rated dynamic current of the CTs shall be as per relevant IEC. Please confirm.	Pl. follow TS
13	Page 84 of 187		Section 2	5.5 Due to safety requirement for working on pressurized equipment, whenever the pressure of the adjacent gas compartment is reduced, it should be ensured by the bidder that adjacent compartment would remain in service with reduced pressure.	From safety point of view, we will not recommend to work on the 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. Please confirm.	As per Annexure- F of IEC 62271-203
14	Page 89 of 187		Section 2	5.39 a) Calculations of critical field strength for specific particles of defined mass and geometry.	These data's are intellectual property of the company. It is protected under relevant laws.	Calculation to be submitted as per Technical Specification
15	Page 90 of 187		Section 2	8.0 Operating System: Loss of Heater power.	As per the manufacturer standard design, Loss of heater power is not applicable. Please confirm.	Bidder to comply by providing suitable NO/ NC contacts and control circuit
16	Page 92 of 187		Section 2	13.0 GROUNDING The GIS supplier must supply the entire material for grounding bus of GIS viz conductor, clamps, joints, operating and safety platforms etc. The GIS supplier is also required to supply all the earthing conductors and associated hardware material for the following: 1) Connecting all GIS equipment, bus ducts, enclosures, control cabinets, supporting structure etc. to the ground bus of GIS 2) Grounding of transformer and other outdoor switchyard equipments/ structures etc.		Scope of supply for earthing material as per Technical Specification-SECTION 1
17	Page 95 of 187		Section 2	14.7 Operating Mechanism e) An operation counter shall also be provided in the central control cabinet.	As per manufacturer design standard, the operation counter shall be placed near the mechanism box. Please confirm.	ACCEPTED
18	Page 97 of 187		Section 2	14.7.3 Spring operated Mechanism a) Spring Operated Mechanism shall be complete with Motor in accordance with Section GTR.	As per manufacturer design standard, DC motors runs on control voltage 220V DC shall be used to operate the circuit breaker mechanism. Please confirm.	NOTED
19	Page 98 of 187		Section 2	15.0 Additional Data to be Furnished a) Drawing showing Contacts in CLOSE, Arc Initiation, Full Arcing, Arc Extinction and OPEN Position.	These data's are intellectual property of the company. It is protected under relevant laws.	Data to be provided in O&M manual
20	Page 101 of 187		Section 2	19.0 HIGH SPEED MAKE PROOF GROUNDING SWITCHES 19.2 Single phase switches shall be provided with operating mechanism suitable for operation from a 220V DC.	We wish to inform you that the High speed make proof grounding switches shall be three phase for 145kV GIS. Please confirm.	NOTED

Clarification to bidders for 400/220/132 kV GIS for Rasra, Ballia

S.No	Reference Document	Reference Clause/DocNo.	Technical Issue	Technical Specification	Bidder's Remarks	Clarification
21	Page 102 of 187		Section 2	20.0 INSTRUMENT TRANSFORMERS (1)Current transformer. Specification regarding	There exists a difference in CT specification furnished in BOQ and technical specification. We are considering CT parameters as per revised BOQ. However, we understand that the current transformer data provided in the technical specification are tentative and shall be finalized during detail engineering. Please confirm.	For CT secondary parameters, pl refer project SLD
22	Page 103 of 187		Section 2	D)Constructional Details of Voltage Transformers e) Voltage transformers secondaries shall be protected by HRC cartridge type fuses for all the windings.	We recommend to use MCB instead of fuses for VT secondaries. The MCBs shall be placed in the LCC. Please confirm.	Noted
23	Page 106 of 187		Section 2	21.0 Surge Arrestors 21.1.1 Insulation Co-ordination and selection of surge arrestor	We understand that Insulation Co-ordination is in main contractors scope. Please confirm.	Outdoor Surge arresters shall be provided by BHEL as indicated in layout. However, Bidder to conduct insulation coordination study including VFTO and in-case additional surge arresters are to be provided, same is in scope of bidder, to be provided inside GIS without any price & delivery implication.
24	Page 113 of 187		Section 2	Circuit Breaker e) Zone Trip Level	SF6 gas monitoring devices and alarm circuits- As per manufacturer design standard 2 stages of alarms are provided in Gas circuit breaker and all other compartments. 1)Refill Level 6.7bar(abs) for GCB compartment 6.7bar (abs) for all other compartments 2)SF6 low level 6.4bar (abs) for GCB compartment(Lockout stage) 6.4bar (abs) for all other compartments for all voltage class. Please confirm.	Pl. follow Technical Specification
25	Page 126 of 187		Section 2	38.1 Type Tests 15. Electromagnetic Compatibility Test (EMC)	15. This is a type test on materials of sub-assemblies which are carried out at sub-supplier premises	Bidder to provide test reports of sub-vendor during inspection as per MQP
26	General				CT and VT parameters in DWG No.TB-3-404-510-001 and Section III Table IA-1 & Table I-B are not the same. We understand that parameters mentioned in Section-III are to be considered Kindly confirm.	For CT & VT secondary parameters, pl refer project SLD
27	SLD			As per UPPPTCL 132kV GIS SLD, Metering bay is having two earth switch (One is Bus-side & other is VT side), Isolating device and VT.	We wish to inform you that, VT with integrated isolating device shall be provided along with one number of earth switch on busbar shall suffice the technical requirement. Please confirm.	Pl. follow SLD
28	Gas SLD			Gas compartmentalization	The GIS assembly shall consist of modular compartments filled with SF6 Gas and separated by gas tight partitions as per the manufacturer standard design. Please confirm.	Bidder to meet requirement of service continuity as per Technical specification.
29	Page 5 of 6			Section 1 1.11 Packing and Dispatch	Packing shall be as per the requirement/instructions. We recommend you to consider indoor storage for long duration. For long duration storage of packed material, inspection may be required after a defined period.	Outdoor storage period will be 6 months minimum. Suitable packing should be provided Refer amendment.

Clarification to bidders for 400/220/132 kV GIS for Rasra, Ballia

S.No	Reference Document	Reference Clause/Doc.No.	Technical Issue	Technical Specification	Bidder's Remarks	Clarification
30				Schedule-Q1 : Length of GI bus deul(3-ph); B. 400kV GIS Equipment [item no: 1.1, 2.1 & 3.1] C. 220kV GIS Equipment [item no: 1.1 & 2.1]	As per the revised price schedule format, we understand that we are to quote for GIS portions for the items mentioned in the price schedule. In this regard, we request you to confirm the following: 1) Mode of Measurement of the quantity: The quantity mentioned is measurable from the centre line of the exiting wall of GIS building till the Gas to Air bushing [or] from the end of the bay module inside the GIS hall till the Gas-Air bushing. Please clarify/confirm. 2) Where the quantity is mentioned against item description of three phase(3-phase), in case of manufacturer's configuration of being single phase(- phase), please confirm if total single phase(1-phase) length to be quoted is 3 times the quantity specified or 1/3rd of the quantity specified.	Duct length shall be measured from the centre line of GIS building wall to SF6 -Air bushing. Quantity given is taken as for 1 phase enclosure for GIS. Refer amendment.
31				Spares for 400/220/132kV GIS		Bidder to quote for all applicable items in boq Else if required during detailed engineering, same will be provided free of cost
32					Kindly confirm whether requirement of partial discharge system, Online or portable	Portable Partial discharge monitoring kit alongwith sensors is required
33					Hiring charges of HV testing KIT, whether during charging commissioning. Kindly confirm if it needs to be quoted in man days	To be quoted in Lot as per detailed description
34					Reactor bay CT data will be provided	As per SLD
35				Technical Specification Page 58, Item 14	Rated dynamic withstand current:NHVS is 0.3ms, not 1ms. Please confirm acceptance	Please follow technical specification.
36					Qualification report publish By BHEL under Annexure-2 seen to be different from the original QR published by UPTCL. kindly provide the confirmation for the same.	Please Follow QR in BHEL enquiry
37					Against clause no 2 kindly confirm the same that having international standard GB (equivalent to IEC) are applicable to participate for this tender	Pl. follow TS
38	4C1.11	BOQ		400kV GIS spares general - Enclosures, Insulators & main circuit to replace on each phase, any compartment of Busbar or bay	We understand that "any compartment" means any one compartment. But we are confused which compartment we should consider. And also, for the busbar or bay, which one should be considered.	to be quoted for Circuit breaker compartment
39	2C1.11	BOQ		220kV GIS spares general -Enclosures, Insulators & main circuit to replace on each phase, any compartment of Busbar or bay		
40	1C1.11	BOQ		132kV GIS spares general - Enclosures, Insulators & main circuit to replace on each phase, any compartment of Busbar or bay		
41	4F7	BOQ		Final successful. Testing of GIS including HV test kit	We understand that we just consider the HV test kit on returnable. Please clarify.	HV test kit will be on returnable basis

Clarification to bidders for 400/220/132 kV GIS for Rastra, Ballia

S.No	Reference Document	Reference Clause/DocNo.	Technical Issue	Technical Specification	Bidder's Remarks	Clarification
42	4J18	BOQ		Hiring charges of HV test kit		to be quoted as per BOQ
43	/	150, 149, 148, 142, 141, 140		Drawing in Technical Specification Drawing No. TB-3-404-510-0D1, Rev 01	For 400/220/132kV GIS, CT is single side of CB in the SLD. But in the GAS SLD, the CT is double side of CB. Please clarify which one is correct.	As per Gas SLD, GIS CT Core-4 and 5 to be placed in Bus-1 side of Circuit Breaker and Core 1, 2 and 3 to be placed in the other side of Circuit Breaker for 400, 220 and 132kV GIS
44		144		SLD	For 400kV GIS, the ISF is less than 5. It is difficult to manufacturer this CT coil. So we suggest ISF 35 for 3000/1A, ISF 30 for 2000/1A, ISF 15 for 1000/1A, ISF 10 for 500/1A. Please clarify.	Pl. follow SLD
45		144		SLD	For 220kV GIS, the ISF is less than 5. It is difficult to manufacturer this CT coil. So we suggest ISF 15 for 2000/1A, ISF 10 for 1600/1A, ISF 10 for 1000/1A, ISF 5 for 500/1A. Please clarify.	Pl. follow SLD
46		144		SLD	For 132kV GIS, the ISF is less than 5. It is difficult to manufacturer this CT coil. So we suggest ISF 15 for 1600/1A, ISF 10 for 800/1A, ISF 5 for 400/1A. Please clarify.	Pl. follow SLD.
47	1.4 pg 3 of 6			ix) Crane lifting capacity shall be designed to handle at least two times the maximum weight of the heaviest package of GIS. The crane capacity shall be 10 tonnes (for 400kV) and 6 tonnes (for 220kV & 132kV) with micro switch arrangement	For 400kV, assembled bay, net weight shall be > 10T. At site, assembled bay is not handled with EOT crane	Weight of largest package to be handled for maintenance to be less than 50% of crane capacity. Crane Capacity for 400kV-10T, 220kV-10T, 132 kV -6 T.
48	Annex-1, 4A10			Controlled Switching Device for ONE set of 2000A, 3 x 1 phase, SF6 insulated circuit breaker - 3 Nos.	CSD is already included in 420kV bay description of ICT and BR bay. Repeated in 4A10. Please clarify.	CSD to be quoted as separate item, as per BOQ. Refer amendment.
49	Pg 53 of 187			Pre-insertion resistor requirement	As per BOQ description and as indicated in SLD, there is no requirement of PIR specified for CBs. Hence we presume all 400kV CBs are without PIR.	No PIR required for 400kV Circuit breakers
50	Pg 54 of 187			For all kV levels: i) Line charging current - 50A rms ii) Cable charging current - 120Arms iv) Small inductive breaking current - 10A rms	For 400kV, 220kV and 132kV GIS, the line charging, cable charging and inductive breaking current shall be as per IEC.	IEC shall be followed
51	Pg 57 of 187			Rated lightning impulse withstand voltage - Across the open contacts (for 400kV) - 1200 + or - 240kVp	For 400kV, Lightning impulse withstand voltage across the open contacts shall be 1425 + or - 240kVp	ref amendment
52	Pg 64 to 66 of 187			CT and VT parameters of all kV levels (Table 1A - 1D) and VT table	CT parameters given in these tables are not same as indicated in BHEL approved CT and VT Tablest(with drawing). Please clarify and confirm. 0.2S class is not VT accuracy class	Pl. refer project SLD.
53	5.4 pg 84 of 187			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 which is atleast 5 % greater than the rated voltage	Partial discharge level and test voltages shall be as per IEC 60271-203.	Confirmed

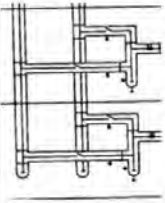
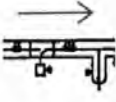
Clarification to bidders for 400/220/132 kV GIS for Rasra, Ballia

S.No	Reference Document	Reference Clause/Doc.No.	Technical Issue	Technical Specification	Bidder's Remarks	Clarification
54	5.22 pg 85 of 187			Manufacturer shall submit the study report of VFTO generated for GIS installation	Relevant type test reports shall be submitted.	VFTO study shall be conducted as part of insulation coordination study and report to be submitted during detailed engineering.
55	31.2 pg 118 of 187			The LCCs shall be provided with the following features: a) A mimic diagram showing the single line diagram.	As clarified, BCU can be fixed in LCC. Separate mimic LED display with control shall not be provided. Request to note that supply of BCU shall be in main contractor's scope. Cables from BCU to CRP, testing of BCU at factory & commissioning at site are excluded from scope. Pls. confirm.	Supply of BCU, Cables from BCU to CRP, testing of BCU at factory & commissioning of BCU at site are excluded from scope. LCC shall be in bidder's scope.
56	Annex-A-1 pg 131 of 187			1.0 Dew point meter 2.0 Portable UHF partial discharge monitor for GIS 3.0 Specification for Automatic relay testing kit with: 4.0 Contact resistance meter 5.0 Circuit breaker operational analyzer 6.0 SF6 gas leakage detector 7.0 Digital Earth resistance meter 8.0 Specification for multigas on-line dissolved gas analyzer. 9. Digital Tan-Delta Kit 10. 5kV Automated insulation resistance meter 11. Digital transformer ratio meter.	Request to note that GIS tools along with AIS tools indicated in spec. We will consider tools as per BOQ given. Pls. confirm.	Confirmed
57	Section-3 pg 146 of 187			The reports for all type tests and additional type tests as per technical specification furnished by the Bidder shall be of the tests conducted within last 05(five) years prior to the date of bid opening. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/IEC Guide 25/17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.	As per Section-1, clause 1.7 pg 5 of 187, The offered equipments must have been fully type tested as per relevant ISS and/or any other specified international standards, during the last 10 years period to be reckoned from 17.04.18. Also as per clause 15 of Section-3 page 158 of 187, ".....shall be of the tests conducted within last 10(ten) years prior to date of bid opening. Please clarify and confirm	Please follow section 1
58	Annexure-B pg 175 of 187			Seismic withstand test procedure	Seismic calculation note shall be submitted as per clause 23.0 of Section-1 pg 111 of 187	Confirmed
59	Annexure-F pg 186 of 187			Measures to limit external overvoltages (e.g. surge arresters) should be considered and detailed out based on the site conditions etc.	As per scope descriptions given and as per approved SLD, there is no GIS surge arrester (all kV levels). Optional unit price shall be provided for GIS surge arrester with commercial offer.	Outdoor Surge arresters shall be provided by BHEL as indicated in layout. However, Bidder to conduct insulation coordination study including VFTO and in-case additional surge arresters are to be provided, same is in scope of bidder, to be provided inside GIS

Clarification to bidders for 400/220/132 kV GIS for Rasra, Ballia

S.No	Reference Document	Reference Clause/Doc No.	Technical Issue	Technical Specification	Bidder's Remarks	Clarification
60	Section 1	1.4 iv)		"CT & VT details shown in single line diagram are tentative and may change at contract stage. Changes to be incorporated by bidder without any cost and delivery implication to BHEL."	The best technically feasible CT and VT parameters for this request are as per the Enclosed data sheet. We request a concurrence on the same. Any changes to the parameters during detail engineering shall be associated with a price implication.	CT and VT parameters shall be as per TS only
61	Section 1	1.4 iv)		"CT & VT details shown in single line diagram are tentative and may change at contract stage. Changes to be incorporated by bidder without any cost and delivery implication to BHEL."	There exists a discrepancy between the CT parameters as per Annexure A1 and the project SLD. The best technically feasible CT and VT parameters for this request are as per the Enclosed data sheet. We request a concurrence on the same.	Pl. refer project SLD.
62	400 kV GIS - Bill of Materials Annexure-1	4 A		... with Partial discharge monitoring sensors comprising of following modules :-	We recommend 3 channel portable UHF type PD monitoring kit (Make DMS Qualitrol) for offered 400 kV GIS, 220 kV GIS, and 132 kV GIS. Request a check and concurrence for the acceptance of the same.	Bidder to offer the model suitable to Technical specification requirement Final decision for same shall be taken by UPPCL during contract execution stage and shall be provided as per UPPCL requirement without any extra cost.
63	220 kV GIS - Bill of Materials Annexure-2	2A9		Gas insulated terminal connection for connecting XLPE cable cable termination enclosure and other accessories with etc. to complete Line feeder bay module as per technical (1 set for 3 phase) . 4	The Supply of Cable Termination Kits (Male/Female) shall be excluded from scope. The scope document for cable terminations as per IEC is enclosed.	Cable termination at GIS end are in scope of bidder as per BOQ , scope of supply as per IEC 62271-209
64	GIS Technical Specifications	1.2		Following associated items shall also be included in the scope of supply:- a) to h)	We understand that supply quantity of these items shall be as per BOQ.	Price to be quoted for items as per BOQ
65	GIS Technical Specifications	5.31.2		Local control cubicle for GIS shall be equipped with suitable hardware & software for remote control operation and conform to the bay level controller as detailed in Section. Substation Automation System.	We understand that the BCU shall be part of CRP panels and shall not be incorporated in the LCC panels. Kindly confirm the same.	Confirmed
66	GIS Technical Specifications	8.1 a		However, for design purposes, ambient temperature should be considered as 50 degree-C.	As per IEC the design ambient temperature shall be 40 deg C. However the temperature rise shall be as per IEC 62271-1.	Ambient design temperature will be 50 deg C only
67	GIS Technical Specifications	14.6.7		Static Contact Resistance Meter and Dynamic Contact Resistance Meter shall also be provided along with CB operational analyzer.	We understand that supply quantity of these items shall be as per BOQ.	Confirmed
68	GIS Technical Specifications	26		GAS FILLING AND EVACUATING PLANT	We understand that supply quantity of these items shall be as per BOQ.	Confirmed

Clarification to bidders for 400/220/132 kV GIS for Rasra, Ballia

S.No	Reference Document	Reference Clause/Doc.No.	Technical Issue	Technical Specification	Bidder's Remarks	Clarification
	GIS Technical Specifications	Annex. A-1			Point 1, 2, 4, 5, 6, 7 : Supply quantity of these items shall be as per price schedule only. We understand that, these items written apart from the price schedule is just for information purpose and shall not be considered for the supply purpose. Only BOQ quantity shall be supplied. Point 3, 8, 9, 10, 11, 12 : These items are not applicable to GIS and shall not be supplied. Kindly confirm that 1 No. of each item shall be supplied for the complete project scope (400kV, 220kV and 145kV GIS taken together)	Supply quantity of these items shall be as per price schedule only
69					Below is the clarification received from the UPPCL on the gas SLD. "The passive busbar shall also be accepted subject to condition that the gas compartments shall be divided in such a fashion that the required service continuity as per spec shall be achieved." Kindly note that the subject requirement can be met with the sectionalisation arrangement as follows	Passive busbar is acceptable subject to meeting service continuity requirement as per technical specification and IEC 62271-203
70	GIS Technical Specifications	400kV/220kV GIS Gas SLD			The GIS CT shall be located after GIS CB request a concurrence on the same. This shall not have any specific impact over the protection and control requirements of the customer. Request to kindly confirm.	as per TS
71	GIS Technical Specifications	145kV GIS Gas SLD			We request BHEL to kindly support us with the make and model number of these items required for further scope clarity. We request BHEL to kindly update the same in the BOQ.	Bidder to offer the model suitable to Technical specification requirement
72	GIS Technical Specifications	BOQ		Testing & Maintenance Equipment for GIS	As the busbars of 400 kV and 220 kV GIS are passive- no switching device is present in the bus bars compartments- the busbar modules shall not have any gas barriers in between them.	To be provided as per technical specification GAS SLD/IEC, meeting service continuity requirement of Technical specification
73	18 of 80	5.3		The GIS assembly shall consist of separate modular compartments e.g Circuit Breaker compartment, Bus bar compartment filled with SF6 Gas and separated by gas tight partitions so as to minimize risk to human life, allow ease of.....	The burn through time shall be according to IEC 62271-203, Table 4	As per IEC
74	19 of 80	5.7		The material and thickness of the enclosures shall be such as to withstand an internal flash over without burn through for a period of 300 ms at rated short time withstand current.		
75	20 of 80	5.15		The bus enclosure should be sectionalized in a manner that maintenance work on any bus disconnector (when bus and bus disconnector are enclosed in a single enclosure)	For 220 and 400 KV: As the offered switchgears shall have passive busbars and bus disconnect switches are not in the same gas compartments as the busbars, there won't be any gas barriers in the bus bar sections.	refer amendment

Clarification to bidders for 400/220/132 kV GIS for Rasra, Ballia

S.No	Reference Document	Reference Clause/DocNo.	Technical Issue	Technical Specification	Bidder's Remarks	Clarification
76	23 of 80	8.31.3		BCU/BPU can also be used as Local Control Cubicle (LCC) depending upon the design of the offered equipment, as such separate LCC need not be provided	Local control cubicles shall be of the conventional types and will not have any BCU's in them	Confirmed
77	30 of 80	14.6.7		Static Contact Resistance Meter and Dynamic Contact Resistance Meter shall also be provided along with CB operational analyzer	Supply of these tools are excluded from our scope of work	Tools to be quoted as per BOQ
78	62 of 80	38.1.2		In case that the equipment of the type and design offered has already been type tested, the bidder shall furnish type test reports which are certified by internationally authorized/accredited laboratory along with the offer. The type test reports of GIS offered and the individual switchgear and control gear equipment of the GIS offered shall not be earlier than 5(five) years as on the date	As per the clause 4.1.1d of the QR, we understand that if type tests are carried out within ten years as on the date of bid opening, a bidder complying to the above requirements shall be qualified for the tender under discussion, and also presume that this clause shall supersede the clause in the specification.	As per section 1.
79				CT parameters	There is an ambiguity in CT parameters. The ratio and knee point voltages in the CT table and technical parameters are not matching. Kindly confirm the same.	Pl. refer project SLD.
80	1.5			Earthing of GIS	We understand that the supply and erection of the earthing material up to the riser above the floor level shall be in scope of BHEL. Please confirm	Earthmat and risers shall be provided by BHEL upto floor level as per bidder's recommendation. Refer section 1
81	1G 2G			1G Services: Training 2G Services: Training	We understand that training has to be provided in single go for all three voltage class GIS and we have to consider travel boarding and lodging charges in single lot. Please confirm. Further inform the no of engineers for the training in Single Lot.	Training to be quoted separately for each rating of GIS as per boq.
82	1G 2G			1G Services: Training 2G Services: Training	We confirm that the training charges shall be included in our scope and changes shall provided as per the tender document but we request to accept the all other charges of the customers (BHEL & JPTCL) including travelling and boarding & lodging charges in BHEL scope. Request for your confirmation.	To be quoted as per Technical specification
83	12.1			A bursting pressure test shall be carried out at 5 times the design pressure as a type test on each type of enclosure.	We confirm to submit the type test reports to prove the strength of enclosure, but conduction/repetition of any type test is not foreseen and will not be conducted. Request for your confirmation	Noted. Type test will be conducted free of cost only if reports are invalid
84	29.1			(2) The clearance (outer to outer) between nearest bus ducts of two adjacent circuits shall be minimum one (1) meter. (3) The minimum outer to outer horizontal clearance between each GIS bus duct shall be 0.75 meter for 400 kV voltage level and 0.5 meter for 220 kV & 132 kV voltage level.	The clearances shall be as per the GIS manufacturer design and earlier supplied projects in various utilities across India. We confirm to provide the clearance as per the specification outside the GIS building after the first bend in the Bus duct. Request for your confirmation.	As per Technical Specification /IEC

Section – III of Technical specification under 1. SF-6 Gas Insulated Switchgear of Clause No. 3.0 should be read as

1.0 PRINCIPAL PARAMETERS

1.1 requirements shall be deemed to be included. The required overall parameters of GIS are as follows:-

Sl. No.	Technical particulars	400 kV System	220 kV System	132 kV System
I	GIS			
1.	Type of GIS encapsulation	Single Phase Segregated	Single Phase /Three Phase encapsulated	Single Phase /Three Phase encapsulated
2.	Location	Indoor	Indoor	Indoor
3.	Rated voltage	420 kV (rms)	245kV rms	145kV rms
4.	Rated frequency	50 HZ	50 HZ	50 HZ
5.	Number of Phases	3	3	3
6.	Grounding	Effectively earthed	Effectively earthed	Effectively earthed
7.	Rated continuous current rating at design ambient temperature i.e. 50 °C a) Busbar and Bus coupler Bay ii) Feeder and Transformer Bay	4000 Amp. 2000 Amp.	3000 Amp. 2000 Amp.	2000 Amp. 1600 Amp.
8.	Rated burn through time of enclosure due to internal arc to short circuit current	According to IEC	According to IEC	According to IEC
9.	Rated lightning impulse (1.2/50 micro sec.) withstand voltage	±1425 kVp	± 1050 kV peak	± 650 kV peak
10.	Switching impulse voltage (250/2500 mic.-sec)	±1050 kVp	-	-
11.	One minute power frequency withstand voltage	650 kV (rms)	460 kV rms	275 kV rms
12.	Rated short time withstand current (3 sec)	50 kA rms	40 kA rms	40 kA rms
13.	Rated peak withstand current	125 kA peak	100 kA peak	100 kA peak
14.	Material of enclosure	Aluminium alloy	Aluminium alloy	Aluminium alloy
15.	Minimum thickness of enclosure (mm)	As per IEC/CENELEC Standard	As per IEC/CENELEC Standard	As per IEC/CENELEC Standard

16.	Material of busbar conductor	Aluminium and/or Copper	Aluminium and/or Copper	Aluminium and/or Copper
17.	Guaranteed maximum gas losses for complete installation as well as for all individual sections in %.	Less than 0.5% as per IEC-62271-203	Less than 0.5% as per IEC-62271-203	Less than 0.5% as per IEC-62271-203
18.	Seismic level	Zone- IV, as per IS-1893, Year-2002	Zone- IV, as per IS-1893, Year-2002	Zone- IV, as per IS-1893, Year-2002
II	Circuit Breaker (CB)			
1.	Rated voltage	420kV (rms)	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Type of Circuit Breaker	SF6 insulated	SF6 insulated	SF6 insulated
4.	System neutral Earthing	Solidly Grounded	Solidly Grounded	Solidly Grounded
5.	Rated continuous current rating at design ambient temperature i.e. 50 °C -Feeder Bay -Transformer Bay -Bus coupler Bay	3150 Amp. 3150 Amp. 4000 Amp.	2500 Amp. 2500 Amp. 3000 Amp.	1600 Amp. 1600 Amp. 2500 Amp.
6.	No. of poles	3	3	3
7.	Type of operation	Single Phase Operation	Single Phase Operation	Three Phase Gang Operation
8.	Operating Mechanism	Hydro-Mechanical spring drive/Hydraulic/Spring drive	Hydro-Mechanical spring drive/Hydraulic/Spring drive	Hydro-Mechanical spring drive/Hydraulic/Spring drive
9.	Auto re-closing duty	Three Phase/ Single Phase	Three Phase/ Single Phase	Three Phase
10.	Pre-insertion resistor requirement			
	Rating (ohms)	400Ω	NA	NA
	Minimum preinsertion time (ms)	8	NA	NA
	Opening of PIR contacts	PIR contacts should open immediately after closing of main contacts OR At least 5 ms	NA	NA

		before opening of main contacts at rated gas pressure where the PIR contact remain closed		
11.	Rated operating duty cycle	O-0.3 sec-CO-3 min-CO	O-0.3 sec-CO-3 min-CO	O-0.3 sec-CO-3 min-CO
12.	First pole to clear factor	1.3	1.3	1.3
13.	Maximum closing time	Not more than 150 ms	Not more than 200 ms	Not more than 200 ms
14.	Maximum breaking time at rated breaking capacity	40 ms	40 ms	40 ms
15.	Total break time (ms)	45 ms	65 ms	65 ms
16.	Rated lighting impulse withstand voltage -between line terminals and ground	± 1425 kVp	± 1050 kV peak	± 650 kV peak
	-between terminals with circuit breaker open	± 1425 kVp	± 1050 kV peak	± 650 kV peak
17.	One minute power frequency phase to earth voltage (kv rms) - between line terminals and ground - between terminals with circuit breaker open	650 kV rms 815 kV rms	460 kV rms 530 kV rms	275 kV rms 315 kV rms
18.	Rated breaking current capacity i) Rated short circuit current withstand capacity (1 sec) ii) Line charging current iii) Cable charging current iv) Small inductive breaking current	50 kA 50 A rms/ As per IEC 120 A rms 10 A rms	40 kA 50 A rms/ As per IEC 120 A rms 10 A rms	40 kA 50 A rms/ As per IEC 120 A rms 10 A rms
19.	Rated short time	125 kA peak	100 kA peak	100 kA peak

	making current capacity			
20.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 156 kV	1000 Micro volts	1000 Micro volts	500 Micro volts
21.	Max. difference in the instants of closing/opening of contacts (ms) between poles	As per IEC	As per IEC	As per IEC
22.	Trip coil and closing coil voltage	220 V DC with variation as specified in GTR	220 V DC with variation as specified in GTR	220 V DC with variation as specified in GTR
23.	Auxiliary Contacts Auxiliary switch shall also comply with requirements as given, independent single pole reversible contacts (from NO to NC & vice versa)	Each circuit breaker pole shall be provided with an auxiliary switch with 20% of spare – NO and 20% spare NC contact for use in future.	Each circuit breaker pole shall be provided with an auxiliary switch with 20% of spare – NO and 20% spare NC contact for use in future.	Each circuit breaker pole shall be provided with an auxiliary switch with 20% of spare – NO and 20% spare NC contact for use in future.
	Rating of auxiliary contacts	10A at 220V DC	10A at 220V DC	10A at 220V DC
	Breaking capacity of Aux. Contacts less than 20 ms	10A at 220 V DC	10A at 220 V DC	10A at 220 V DC
III	Disconnectors (DS)			
1.	Rated voltage	42-kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Type	SF6 insulated	SF6 insulated	SF6 insulated
4.	System Earthing	Effectively Earthed	Effectively Earthed	Effectively Earthed
5.	Rated short time withstand current (3 sec)	50 kA rms	40 kA rms	40 kA rms
6.	Rated short time making current capacity	125 kA peak	100 kA peak	100 kA peak
7.	No. of poles	3	3	3
8.	Rated continuous current rating at design ambient temperature i.e. 50 °C Feeder Bay	3150 Amp.	2000 Amp.	1600 Amp.

	contacts on each earthing switch			
IV	Earthig Switches (ES)			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated short time withstand current (1 sec)	50 kA rms	40 kA rms	40 kA rms
4.	Rated short time making current capacity -For high speed earthing switch	125 kA peak	100 kA peak	100 kA peak
5.	Rated lightning impulse withstand voltage	± 1425 kVp	± 1050 kV peak	± 650 kV peak
6.	One minute power frequency withstand voltage	650 kV rms	460 kV rms	275 kV rms
7.	Operating Mechanism - For maintenance earthing switch -For high speed earthing switch	Motor Motor	Motor Motor	Motor Motor
8.	Operating time -For maintenance earthing switch -For high speed earthing switch	Less than 12 sec. Less than 300 m sec	Less than 12 sec. Less than 300 m sec	Less than 12 sec. Less than 300 m sec
V	Current Transformer (CT)			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed
4.	Maximum temperature rise over an ambient temperature of 50°C	As per IEC 60044-1	As per IEC 60044-1	As per IEC 60044-1
5.	Radio interference voltage at 1.1 $U_n/\sqrt{3}$ and frequency range 0.5 to 2 MHz	≤ 1000 micro-volts	≤ 1000 micro-volts	≤ 500 micro-volts
6.	One minute power frequency withstand voltage	5 kV (rms) As per ISS/IEC	5 kV (rms)	5 kV (rms)

	Transformer Bay Bus coupler Bay	2000 Amp. 4000 Amp.	2000 Amp. 3000 Amp.	1600 Amp. 1600 Amp.
9.	Operating Mechanism	Motor	Motor	Motor
10.	Operating time	Less than 12 sec.	Less than 12 sec.	Less than 12 sec.
11.	Rated lightning impulse withstand voltage - Phase to earth - Across the open contacts	± 1425 kV peak ± 1200 -/+240V peak	± 1050 kV peak ± 1200 kV peak	± 650 kV peak ± 750 kV peak
12.	One minute power frequency withstand voltage - Phase to earth - Across the open contacts	650 kV rms 815 kV rms	460 kV rms 530 kV rms	275 kV rms 315 kV rms
13.	Rated mechanical terminal load	As per IEC	As per IEC	As per IEC
14.	Rated switching impulse withstand voltage (250/2500 micro-sec.) Dry & wet			
	between line terminals and ground:	+/- 1050 kVp	N.A	N.A
	Between terminals with Isolator open:	+/- 900 kVp impulse on one terminal & 345 kVp of opposite polarity on the other terminal.	N.A	N.A
15.	Mechanical Endurance clause as per IEC	M2 M2	M2 M2	M1
16.	Rated mechanical terminal load	As per IEC	As per IEC	As per IEC
17.	Rating of auxiliary contacts	10A at 220V DC	10A at 220V DC	10A at 220V DC
18.	Breaking capacity of auxiliary contacts	2 A	2 A	2 A
19.	No. of auxiliary contacts on each isolator	6 NO and 6 NC	6 NO and 6 NC	6 NO and 6 NC
20.	No. of auxiliary	6 NO and 6 NC	6 NO and 6 NC	6 NO and 6 NC

	between sec. Terminal & earth			
7.	Partial discharge level	≤ 5 pico coulombs	≤ 5 pico coulombs	≤ 5 pico coulombs
8.	Rated insulation level i) 1.2/50 micro second impulse voltage ii) 1 Minute power frequency withstand voltage iii) 250/2500 micro second switching impulse voltage (dry & wet)	± 1425 kVp 650 kV (rms) 1050 kVp	± 1050 kVp 460 kV (rms) -	± 650 kVp 275 kV (rms) -
9.	Current Ratio - For Feeders - For Transformer - For bus coupler	3000-1000-500/1A 3000-2000-1000/1A 3000-2000-1000/1A	2000-1600-1000-500/1A 2000-1600-1000-500/1A 2000-1600-1000-500/1A	1000-800-400/1A 200MVA (1000-800-400/1A), 1600-800-400/1A
10.	Ratio taps	On secondary side	On secondary side	On secondary side
11.	Accuracy Class -For protection -For metering	PS 0.2s	PS 0.2s	PS 0.2s
12.	Burden -For protection -For metering	20 VA 20 VA	20 VA 20 VA	20 VA 20 VA
13.	Rated short time withstand current	50 kA rms for 1 second.	40 kA rms for 1 second.	40 kA rms for 1 second.
14.	Rated dynamic withstand current	125 kA peak for 1 second.	100 kA peak for 1 second.	100 kA peak for 1 second.
15.	Safety factor for metering	< 5	< 5	< 5
16.	Parameters/ Approval Finalization	Burden, Knee Point Voltage Rct, Excitation Current and other parameters shall be got approved by purchaser as per protection co-ordination/ scheme requirements during detailed engineering based on details/ calculations to be	Burden, Knee Point Voltage Rct, Excitation Current and other parameters shall be got approved by purchaser as per protection co-ordination/ scheme requirements during detailed engineering	Burden, Knee Point Voltage Rct, Excitation Current and other parameters shall be got approved by purchaser as per protection co-ordination/ scheme requirements during detailed

		submitted by successful bidder	based on details/ calculations to be submitted by successful bidder	engineering based on details/ calculations to be submitted by successful bidder
VI	Voltage Transformers			
1.	Rated System voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Type	Electromagnetic	Electromagnetic	Electromagnetic
4.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed
5.	System fault level	50 kAp. for 1 second.	40 kAp. for 1 second.	40 kAp. for 1 second.
6.	Rated insulation levels			
	i) 1.2/50 micro second impulse voltage	± 1425 kV peak	± 1050 kV peak	± 650 kV peak
	ii) 1 Minute power frequency withstand voltage	650 kV rms	460 kV rms	275 kV rms
	iii) 250/2500 micro second switching impulse voltage (dry & wet)	1050 kVp for 400 kV system	-	-
7.	One minute power frequency withstand voltage for secondary winding	3 kV rms	3 kV rms	3 kV rms
8.	Radio interference voltage at 1.1 $U_n/\sqrt{3}$ and frequency range 0.5 to 2 MHz	≤ 1000 micro volts	≤ 1000 micro volts	≤ 500 micro volts
9.	Rated total thermal burden	400 VA	400 VA	100 VA
10.	Partial discharge level	≤ 10 pico coulombs	≤ 10 pico coulombs	≤ 10 pico coulombs
11.	Voltage Ratio	$420/\sqrt{3} : 110 V/\sqrt{3}$	$245/\sqrt{3} : 110 V/\sqrt{3}$	$145/\sqrt{3} : 110 V/\sqrt{3}$
12.	Number of secondary winding	3	3	3
13.	Rated voltage factor	1.5 for 30 seconds 1.2 continuous	1.5 for 30 seconds 1.2 continuous	1.5 for 30 seconds 1.2 continuous

14.	Phase angle error	± 10 min (for metering core)			± 10 min (for metering core)			± 10 min (for metering core)		
15.	Rated voltage	Sec-I $110/\sqrt{3}$	Sec-II $110/\sqrt{3}$	Sec-III $110/\sqrt{3}$	Sec-I $110/\sqrt{3}$	Sec-II $110/\sqrt{3}$	Sec-III $110/\sqrt{3}$	Sec-I $110/\sqrt{3}$	Sec-II $110/\sqrt{3}$	Sec-III $110/\sqrt{3}$
	Application	Prot.	Prot.	Metering	Prot.	Prot.	Metering	Prot.	Prot.	Metering
	Accuracy	3P	3P	0.2	3P	3P	0.2	3P	3P	0.2
	Output Burden (Min.) VA	50	50	50	50	50	50	50	50	50
VII	Lightning Arresters (LA)	(OUTDOOR TYPE)								
1.	Highest system voltage	420 kV rms			245 kV rms			145 kV rms		
2.	Rated arrester voltage	390 kV rms			216 kV rms			120 kV rms		
3.	Continuous operating voltage at 50 °C	303 kV			168 kV			102 kV		
4.	Type (Tank Type)	Gapless type/ Metal Zinc Oxide type			Gapless type/ Metal Zinc Oxide type			Gapless type/ Metal Zinc Oxide type		
5.	Long duration Discharge Class	Class 4			Class 3			Class 3		
6.	Nominal discharge current corresponding to 8/20 microsec wave shape	20 kA of 8/20 μ s wave			10 kA of 8/20 μ s wave			10 kA of 8/20 μ s wave		
7.	Rated frequency	50 HZ			50 HZ			50 HZ		
8.	Minimum discharge capability voltage corresponding to minimum discharge characteristic	12 kJ/kV (referred to rated arrester)			5 kJ/kV (referred to rated arrester)			5 kJ/kV (referred to rated arrester)		
9.	System neutral earthing	Effectively earthed			Effectively earthed			Effectively earthed		
10.	Max. switching surge residual voltage(1 kA)	780 kVp			500 kVp			280 kVp		
11.	Max. residual voltage at i) 5 kA ii) 10 kA nominal discharge current iii) 20 kA nominal discharge current	- 900 kVp 880 kVp			560 kVp 600 kVp -			310 kVp 330 kVp -		
12.	High current short duration test value (4/10 micro second	100 kVp			100 kVp			100 kVp		

	wave)			
13.	Current for pressure relief test	50 kA rms	40 kA rms	40 kA rms
14.	Prospective symmetrical fault current	50 kA rms for 0.2 Sec	40 kA rms for 0.2 Sec	40 kA rms for 0.2 Sec
15.	Pressure relief class	A	A	A
16.	RIV at 1.1 Un/$\sqrt{3}$ kV rms	Less than 500 (micro volts)	Less than 500 (micro volts)	Less than 500 (micro volts)
17.	Partial discharge at 1.05 COV	Not more than 5pc	Not more than 5 pc	Not more than 5pc
18.	Low current long duration test value (2000 micro sec.)	As per IEC	As per IEC	As per IEC
19.	Discharge counter and leakage current meter to be provided	Yes	Yes	Yes
VIII	Busbar			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	4000 A rms	3000 A rms	2000 A rms
4.	Rated short time withstand current	50 kA rms/1sec	40 kA rms/1sec	40 kA rms/1sec
5.	Temperature rise -For enclosure -For conductor	According to IEC According to IEC	According to IEC According to IEC	According to IEC According to IEC
6.	Rated lightning impulse withstand voltage	± 1425 kV peak	± 1050 kV peak	± 650 kV peak
7.	One minute power frequency withstand voltage	650 kV (rms)	460 kV (rms)	275 kV (rms)
IX	Bus Coupler			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	4000 A rms	3000 A rms	2000 A rms
4.	Rated short time withstand current	50 kA rms/1sec	40 kA rms/1sec	40 kA rms/1sec
5.	Temperature rise -For enclosure -For conductor	According to IEC According to IEC	According to IEC According to IEC	According to IEC According to IEC
6.	Rated lightning impulse withstand voltage	± 1050 kV peak	± 1050 kV peak	± 650 kV peak
7.	One minute power frequency withstand voltage	650 kV (rms)	460 kV (rms)	275 kV (rms)
X	Cable Head			

	(CHD)			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	4000 A rms	3000 A rms	2000 A rms
4.	Rated short time withstand current	50kA rms/1sec	40 kA rms/1sec	40 kA rms/1sec
5.	Rated lightning impulse withstand voltage	±1425 kV peak	±1050 kV peak	±650 kV peak
6.	One minute power frequency withstand voltage	650 kV (rms)	460 kV (rms)	275 kV (rms)
7.	Interface with power cable sealing end	According to IEC	According to IEC	According to IEC
XI	SF6 Bus Interconnection Duct Termination Head			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	4000 A rms	3000 A rms	2000 A rms
4.	Rated short time withstand current	50 kA rms/1sec	40 kA rms/1sec	40 kA rms/1sec
5.	Rated lightning impulse withstand voltage	±1425 kV peak	±1050 kV peak	±650 kV peak
6.	One minute power frequency withstand voltage	450 kV (rms)	460 kV (rms)	275 kV (rms)
7.	Interface with SF6 Duct end	According to IEC	According to IEC	According to IEC
XII	Bus Sectionalizers			
1.	Rated voltage	-	-	-
2.	Rated frequency	-	-	-
3.	Rated current	-	-	-
4.	Rated short time withstand current	-	-	-
5.	Temperature rise -For enclosure -For conductor	-	-	-
6.	Rated lightning impulse withstand voltage	-	-	-
7.	One minute power frequency withstand voltage	-	-	-
XIII	TECHNICAL PARAMETERS FOR SF6/AIR BUSHING			

1.	Rated Voltage (kV)	420 kV (rms)	245 kV (rms)	145 kV (rms)
2.	Rated Current (Amp)	2000/3150/ 5000 as applicable	3000	2000
3.	1.2/50 micro second impulse voltage (Lightning impulse withstand voltage)	1425 kVp	1050 kVp	630 kVp
4.	250/2500 micro second switching impulse voltage	1050 kVp	-	-
5.	One minute power frequency withstand voltage	650 kV (rms)		275 kV (rms)
6.	Minimum total Creepage distance in mm	10500	6125	3625
7.	Minimum Cantilever strength (kN)	10	8	5

Section – III of Technical specification under 1. SF-6 Gas Insulated Switchgear of Clause No. 38.0 Tests under 38.4.4 should be read as

TABLE-I A-I

REQUIREMENTS FOR 420 kV CURRENT TRANSFORMER

No. of cores	Core no.	Application	Current ratio	Output Burden (VA)	Accuracy Class as Per IEC; 44-1	Min. Knee pt. Voltage V _k	Max. CT Sec. Wdg. Resistance (ohm)	Max. Excitation current at V _k (in mA)
5	1	BUS DIFF CHECK	3000-2000-1000/1	-	PS	2000/2000/1000	15/10/5	20 on 2000/1 tap. 30 on 2000/1 tap 60 on 1000/1 tap
	2	BUS DIFF MAIN	3000-2000-1000/1	-	PS	2000/2000/1000	15/10/5	20 on 2000/1 tap. 30 on 2000/1 tap 60 on 1000/1 tap
	3	METERING	3000-2000-1000/1	20 20 20	0.2S 0.2S 0.2S	-	-	-
	4	TRANS BACK UP/ LINE PRTN.	3000-2000-1000/1	-	PS	4000/4000/2000	15/10/5	20 on 2000/1 tap. 30 on 2000/1 tap 60 on 1000/1 tap
	5	TRANS DIFF/ LINE PRTN.	3000-2000-1000/1	-	PS	4000/4000/2000	15/10/5	20 on 2000/1 tap. 30 on 2000/1 tap 60 on 1000/1 tap

TABLE-I B

REQUIREMENTS FOR 245 kV CURRENT TRANSFORMER

No. of cores	Core no.	Application	Current ratio	Output Burden (VA)	Accuracy Class as Per IEC; 44-1	Min. Knee pt. Voltage V _k	Max. CT Sec. Wdg. Resistance (ohm)	Max. Excitation current at V _k (in mA)
5	1	BUS DIFF CHECK	2000-1600-1000-500/1	-	PS	2000/1600-1000/500	10/8/5/2.5	30 on 2000/1 tap. 40 on 1600/1 tap 60 on 1000/1 tap 120 on 500/1 tap
	2	BUS DIFF MAIN	2000-1600-1000-500/1	-	PS	2000/1600-1000/500	10/8/5/2.5	30 on 2000/1 tap. 40 on 1600/1 tap 60 on 1000/1 tap 120 on 500/1 tap
	3	METERING	2000-1600-1000-500/1	20	0.2S	-	-	-
	4	TRANS BACK UP/ LINE PRTN.	2000-1600-1000-500/1	-	PS	2000/1600-1000/500	10/8/5/2.5	30 on 2000/1 tap. 40 on 1600/1 tap 60 on 1000/1 tap 120 on 500/1 tap
	5	TRANS DIFF/ LINE PRTN.	2000-1600-1000-500/1	-	PS	2000/1600-1000/500	10/8/5/2.5	30 on 2000/1 tap. 40 on 1600/1 tap 60 on 1000/1 tap 120 on 500/1 tap

Note:

1. All relaying CTs shall be of accuracy class PS as per IS: 2705.
2. Instrument Security Factor for Metering Core should not exceed 5.
3. Burden and Knee Point Voltage etc. as mentioned are indicative and shall be approved during detailed engineering by the purchaser as per requirement/ calculation for overall protection needs.
4. The Bidder will ensure compatibility of CT and numerical relay in respect of knee-point voltage as well as operating time of relay to avoid mal-functioning or damage to the numerical relay.

TABLE – I C

REQUIREMENTS FOR 145 KV CURRENT TRANSFORMERS

No. of Cores	Core No.	Application	Current ratio	Output burden (VA)	Accuracy class as per IEC: 44-1	Min. knee pt. voltage (Vk)	Max. CT sec. wdg. resistance (ohms)	Max. Excitation current at Vk (in mA)
5	1	BUS DIFF CHECK	1000-800-400/1	-	PS	1600/800/400	8/4/2	30 on 1000/1 tap. 50 on 800/1 tap 100 on 800/1 tap
	2	BUS DIFF MAIN	1000-800-400/1	-	PS	1600/800/400	8/4/2	30 on 1000/1 tap. 50 on 800/1 tap 100 on 800/1 tap
	3	METERING	1000-800-400/1	20	0.2S	-	-	-
	4	TRANS. BACK UP/ LINEP ROTN.	1000-800-400/1	-	PS	1600/800/400	8/4/2	30 on 1000/1 tap. 50 on 800/1 tap 100 on 800/1 tap
	5	TRANS. DIFF/ LINE PROT N	1000-800-400/1	-	PS	1600/800/400	8/4/2	30 on 1000/1 tap. 50 on 800/1 tap 100 on 800/1 tap

TABLE – I D

REQUIREMENTS FOR 145 KV CURRENT TRANSFORMERS

No. of Cores	Core No.	Application	Current ratio	Output burden (VA)	Accuracy class as per IEC: 44-1	Min. knee pt. voltage (Vk)	Max. CT sec. wdg. resistance (ohms)	Max. Excitation current at Vk (in mA)
5	1	BUS DIFF CHECK	1600-800-400/1	-	PS	1600/800/400	8/4/2	30 on 1000/1 tap. 50 on 800/1 tap 100 on 800/1 tap
	2	BUS DIFF MAIN	1600-800-400/1	-	PS	1600/800/400	8/4/2	30 on 1000/1 tap. 50 on 800/1 tap 100 on 800/1 tap
	3	METERING	1600-800-400/1	20	0.2S	-	-	-
	4	TRANS. BACK UP/ LINEP ROTN.	1600-800-400/1	-	PS	1600/800/400	8/4/2	30 on 1000/1 tap. 50 on 800/1 tap 100 on 800/1 tap
	5	TRANS. DIFF/ LINE PROT N	1600-800-400/1	-	PS	1600/800/400	8/4/2	30 on 1000/1 tap. 50 on 800/1 tap 100 on 800/1 tap

Note:

1. All relaying CTs shall be of accuracy class PS as per IS: 2705.
2. Instrument Security Factor for Metering Core should not exceed 5.
3. Burden and Knee Point Voltage etc. as mentioned are indicative and shall be approved during detailed engineering by the purchaser as per requirement/ calculation for overall protection needs.
4. The Bidder will ensure compatibility of CT and numerical relay in respect of knee-point voltage as well as operating time of relay to avoid mal-functioning or damage to the numerical relay.

TABLE-II A

REQUIREMENT OF VOLTAGE TRANSFORMERS

Sl. No.	PARTICULARS	400 kV			220 kV			132 kV		
1.	Rated primary voltage	420/ $\sqrt{3}$ kV			245/ $\sqrt{3}$ kV			145/ $\sqrt{3}$ kV		
2.	Type	Electromagnetic, or Single phase capacitor VT			Electromagnetic			Electromagnetic		
3.	No. of secondaries	3			3			3		
4.	Rated voltage factor	1.2 continuous 1.5 for 30 seconds			1.2 continuous 1.5 for 30 seconds			1.2 continuous 1.5 for 30 seconds		
5.	Phase angle error	± 10 minutes (for metering core)			± 10 minutes (for metering core)			± 10 minutes (for metering core)		
		Sec I	Sec II	Sec III	Sec I	Sec II	Sec III	Sec I	Sec II	Sec III
6.	Rated voltage (V)	110/ $\sqrt{3}$	10/ $\sqrt{3}$	110/ $\sqrt{3}$	110/ $\sqrt{3}$	10/ $\sqrt{3}$	110/ $\sqrt{3}$	110/ $\sqrt{3}$	110/ $\sqrt{3}$	110/ $\sqrt{3}$
7.	Application	Protn	Protn	Metering	Protn	Protn	Metering	Protn	Protn	Metering
8.	Accuracy	3P	3P	0.2S	3P	3P	0.2S	3P	3P	0.2S
9.	Output burden (VA) (minimum)	50	50	50	50	50	50	50	50	50

SF6 GAS INSULATED METAL ENCLOSED SWITCHGEARS (GIS)

CONTENTS

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6.0	SF6 Gas Leak Detector
7.0	Specification for Digital Earth Resistance Meter
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9.0	Technical Data for Digital Tan Delta Kit
10.0	5 KV Automated Insulation Resistance Tester
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6.0	SF6 Gas Leak Detector
7.0	Specification for Digital Earth Resistance Meter
8.0	Specification for Multigas On-Line Dissolved Gas Analyzer
9.0	Technical Data for Digital Tan Delta Kit
10.0	5 KV Automated Insulation Resistance Tester
11.0	Digital Transformer Ratiometer for 3-Phase Ratio Measurement
12.0	Transforemer Winding Resistance Meter

TECHNICAL SPECIFICATION FOR SF6 GAS INSULATED METAL ENCLOSED SWITCHGEARS (GIS)

1.0 SCOPE

- 1.1** This specification covers design, engineering, manufacture, assembly, stage testing, inspection and testing before supply, packing, forwarding (in assembled condition to the extent suitable for transportation) and delivery at site and erection, testing and commissioning of 400 kV, 220 kV, and 132 kV SF6 gas insulated metal encapsulated switchgears (GIS) suitable for indoor installation alongwith the accessories and auxiliary equipments required for its satisfactory operation as per details given in this specification.

The GIS shall be double bus bar arrangement and each module shall be complete with SF6 breaker, disconnectors, current and voltage transformers, earthing switches and all necessary components as detailed in this specification. All parts of the switchgear should be single phase (segregated) enclosed for 400 kV & 220 kV GIS and single phase/ three phases encapsulated for 132 kV GIS. Offered equipment should be duly type tested as per the latest IEC.

- 1.2** Following associated items shall also be included in the scope of supply:-

- a) Local control cubicles for switchgears.
- b) Gas handling equipment for draining and refilling of each compartment of GIS including filtration and purification equipment and vacuum pump.
- c) SF6 gas, sufficient for first filling of the entire switchgear including usual losses during commissioning.
- d) 4 Nos. bottles (40 kg each) of SF6 gas in non-returnable vessels.
- e) Gas leakage detectors.
- f) Measuring instrument for air content and moisture content in SF6 gas.
- g) Special tools and tackles for erection, operation and maintenance of GIS.
- h) Mandatory spares and tools as per relevant schedule.

- 1.3** The GIS offered shall conform in all respects to the high standard of engineering, design and workmanship and shall be complete with all the components necessary for its effective and trouble free operation. Such components shall be deemed to be within the scope of the bidder irrespective of whether they specifically mentioned in this specification or not.

2.0 REFERENCE STANDARDS

The metal-enclosed gas-insulated switchgear, including the operating devices, accessories and auxiliary equipment forming integral part thereof, shall be designed, manufactured, assembled and tested in accordance with the following

International Electro-technical Commission (IEC) Publications including their parts and supplements as amended or revised to date:

IEC 62271-203	Gas Insulated metal-enclosed switchgear for rated voltages above 52kV
IEC 60376	New sulphur hexafluoride
IEC 62271- 100	High voltage alternating current Circuit breakers
IEC 60694	Common clauses for high voltage Switchgear and control-gear standards
IEC 62271-102	Alternating current disconnectors(isolate) and earthing switches
IEC 61128	Alternating current disconnectors. Bus-transfer current switching by disconnectors.
IEC 61129	Alternating current earthing switches. Induced current switching
IEC 66044-1	Current transformers
IEC 66044-2	Voltage transformers
IEC 60137	Bushings for alternating voltages above 1000 V
IEC 60859	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.
IEC 60427	Report on synthetic testing of high-voltage alternating-current breaker.
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 72.5 kV and above.

The components and devices which are not covered by the above standards shall conform to, and comply with, the latest applicable standards, rules, codes and regulations of the internationally recognized standardizing bodies and professional societies as may be approved by the Employer. The manufacturer shall list all applicable standards, codes etc. and provide copies thereof for necessary approval.

In case the requirements laid down herein differ from those given in above standard in any aspect the switchgear shall comply with the requirements indicated herein in regard thereto.

3.0 PRINCIPAL PARAMETERS

- 3.1 The SF6 gas insulated metal enclosed switchgear shall be totally safe against inadvertent touch of any of its live constituent parts. It should be designed for indoor/outdoor (as specified) application with meteorological conditions at site.
- 3.2 The metal-enclosed gas insulated switchgear, including the operating devices, accessories and auxiliary equipment forming integral part thereof, shall be designed, manufactured, assembled and tested in accordance with the IEC-62271-203 publications including their parts and supplements as amended or revised to date.
- 3.3 The arrangement of gas sections or compartments shall be such as to facilitate future extension of any make on either end 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.
- 3.4 The design should be such that all parts subjected to wear and tear are easily accessible for maintenance purposes. The equipment offered shall be protected against all types of voltage surges and any equipment necessary to satisfy this requirement shall be deemed to be included. The required overall parameters of GIS are as follows:-

REF ANNEXURE-A1

Sl. No.	Technical particulars	400 kV System	220 kV System	132 kV System
I	GIS			
1.	Type of GIS encapsulation	Single Phase Segregated	Single Phase Segregated	Single Phase /Three Phase encapsulated
2.	Location	Indoor	Indoor	Indoor
3.	Rated voltage	420 kV (rms)	245kV rms	145kV rms
4.	Rated frequency	50 HZ	50 HZ	50 HZ
5.	Number of Phases	3	3	3
6.	Grounding	Effectively earthed	Effectively earthed	Effectively earthed
7.	Rated continuous current rating at design ambient temperature i.e. 50 °C i) Busbar and Bus coupler Bay ii) Feeder and Transformer Bay	3000 Amp. 2000 Amp.	3000 Amp. 2000 Amp.	1200 Amp. 800 Amp.
8.	Rated burn through time of enclosure due to internal arc to short circuit current	According to IEC	According to IEC	According to IEC
9.	Rated lightning	±1425 kVp	± 1050 kV peak	± 650 kV peak

	impulse (1.2/50 micro sec.) withstand voltage			
10.	Switching impulse voltage (250/2500 mic.-sec)	± 1050 kVp	-	-
11.	One minute power frequency withstand voltage	650 kV (rms)	460 kV rms	275 kV rms
12.	Rated short time withstand current (1 sec)	63/50/ 40 kA rms (As applicable)	50/ 40 kA rms (As applicable)	40/31.5 kA rms (As applicable)
13.	Rated peak withstand current	157.5/125/100 kA peak (As applicable)	125/100 kA peak (As applicable)	125/100 kA peak (As applicable)
14.	Material of enclosure	Aluminium alloy	Aluminium alloy	Aluminium alloy
15.	Minimum thickness of enclosure (mm)	As per IEC/CENELEC Standard	As per IEC/CENELEC Standard	As per IEC/CENELEC Standard
16.	Material of busbar conductor	Aluminium and/or Copper	Aluminium and/or Copper	Aluminium and/or Copper
17.	Guaranteed maximum gas losses for complete installation as well as for all individual sections in %.	Less than 0.5% as per IEC-62271-203	Less than 0.5% as per IEC-62271-203	Less than 0.5% as per IEC-62271-203
18.	Seismic level	Zone- IV, as per IS-1893, Year-2002	Zone- IV, as per IS-1893, Year-2002	Zone- IV, as per IS-1893, Year-2002
II	Circuit Breaker (CB)			
1.	Rated voltage	420kV (rms)	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Type of Circuit Breaker	SF6 insulated	SF6 insulated	SF6 insulated
4.	System neutral Earthing	Solidly Grounded	Solidly Grounded	Solidly Grounded
5.	Rated continuous current rating at design ambient temperature i.e. 50 °C -Feeder Bay -Transformer Bay -Bus coupler Bay	3150 Amp. 2000 Amp. 4000 Amp.	2000 Amp. 2000 Amp. 3000 Amp.	800 Amp. 800 Amp. 1600 Amp.
6.	No. of poles	3	3	3
7.	Type of operation	Single Phase Operation	Single Phase Operation	Three Phase Gang Operation

8.	Operating Mechanism	Hydro-Mechanical spring drive/Hydraulic/Spring drive	Hydro-Mechanical spring drive/Hydraulic/Spring drive	Hydro-Mechanical spring drive/Hydraulic/Spring drive
9.	Auto re-closing duty	Three Phase/ Single Phase	Three Phase/ Single Phase	Three Phase
10.	Pre-insertion resistor requirement			
	Rating (ohms)	400Ω	NA	NA
	Minimum preinsertion time (ms)	8	NA	NA
	Opening of PIR contacts	PIR contacts should open immediately after closing of main contacts OR At least 5 ms before opening of main contacts at rated gas pressure where the PIR contact remain closed	NA	NA
11.	Rated operating duty cycle	O-0.3 sec-CO-3 min-CO	O-0.3 sec-CO-3 min-CO	O-0.3 sec-CO-3 min-CO
12.	First pole to clear factor	1.3	1.3	1.3
13.	Maximum closing time	Not more than 150 ms	Not more than 200 ms	Not more than 200 ms
14.	Maximum breaking time at rated breaking capacity	40 ms	60 ms	60 ms
15.	Total break time (ms)	45 ms	65 ms	65 ms
16.	Rated lighting impulse withstand voltage -between line terminals and ground	±1425 kVp	±1050 kV peak	± 650 kV peak
	-between terminals with circuit breaker open	±1425 kVp	±1050 kV peak	± 650 kV peak
17.	One minute power frequency phase to earth voltage (kv rms)			

	-between line terminals and ground	650 kV rms	460 kV rms	275 kV rms
	-between terminals with circuit breaker open	815 kV rms	530 kV rms	315 kV rms
18.	Rated breaking current capacity i) Rated short circuit current withstand capacity (1 sec) ii) Line charging current iii) Cable charging current iv) Small inductive breaking current	63/50/40 kA (As applicable) 50 A rms/ As per IEC 120 A rms 10 A rms	50/40 kA (As applicable) 50 A rms/ As per IEC 120 A rms 10 A rms	40/31.5 kA (As applicable) 50 A rms/ As per IEC 120 A rms 10 A rms
19.	Rated short time making current capacity	157.5/125/100 kA peak (As applicable)	125/100 kA peak (As applicable)	125/100 kA peak (As applicable)
20.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 156 kV	1000 Micro volts	1000 Micro volts	500 Micro volts
21.	Max. difference in the instants of closing/opening of contacts (ms) between poles	As per IEC	As per IEC	As per IEC
22.	Trip coil and closing coil voltage	220 V DC with variation as specified in GTR	220 V DC with variation as specified in GTR	220 V DC with variation as specified in GTR
23.	Auxiliary Contacts Auxiliary switch shall also comply with requirements as given, independent single pole reversible contacts (from NO to NC & vice versa)	Each circuit breaker pole shall be provided with an auxiliary switch with 20% of spare – NO and 20% spare NC contact for use in future.	Each circuit breaker pole shall be provided with an auxiliary switch with 20% of spare – NO and 20% spare NC contact for use in future.	Each circuit breaker pole shall be provided with an auxiliary switch with 20% of spare – NO and 20% spare NC contact for use in future.
	Rating of auxliary contacts	10A at 220V DC	10A at 220V DC	10A at 220V DC
	Breaking capacity of Aux. Contacts less than 20 ms	10A at 220 V DC	10A at 220 V DC	10A at 220 V DC

III	Disconnectors (DS)			
1.	Rated voltage	42-kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Type	SF6 insulated	SF6 insulated	SF6 insulated
4.	System Earthing	Effectively Earthed	Effectively Earthed	Effectively Earthed
5.	Rated short time withstand current (1 sec)	63/50/ 40 kA rms (As applicable)	50/ 40 kA rms (As applicable)	40/315 kA rms (As applicable)
6.	Rated short time making current capacity	157.5/125/100 kA peak (As applicable)	125/100 kA peak (As applicable)	125/100 kA peak (As applicable)
7.	No. of poles	3	3	3
8.	Rated continuous current rating at design ambient temperature i.e. 50 °C Feeder Bay Transformer Bay Bus coupler Bay	3150 Amp. 2000 Amp. 4000 Amp.	1600 Amp. 2000 Amp. 3000 Amp.	800 Amp. 800 Amp. 1600 Amp.
9.	Operating Mechanism	Motor	Motor	Motor
10.	Operating time	Less than 12 sec.	Less than 12 sec.	Less than 12 sec.
11.	Rated lightning impulse withstand voltage - Phase to earth - Across the open contacts	±1425 kV peak ±1200 -/+240V peak	±1050 kV peak ±1200 kV peak	±650 kV peak ±750 kV peak
12.	One minute power frequency withstand voltage - Phase to earth - Across the open contacts	650 kV rms 815 kV rms	460 kV rms 530 kV rms	275 kV rms 315 kV rms
13.	Rated mechanical terminal load	As per IEC	As per IEC	As per IEC
14.	Rated switching impulse withstand voltage (250/2500 micro-sec.) Dry & wet			
	between line terminals and ground:	+/- 1050 kVp	N.A	N.A

	Between terminals with Isolator open:	+/- 900 kVp impulse on one terminal & 345 kVp of opposite polarity on the other terminal.	N.A	N.A
15.	Mechanical Endurance clause as per IEC	M2 M2	M2 M2	M1
16.	Rated mechanical terminal load	As per IEC	As per IEC	As per IEC
17.	Rating of auxiliary contacts	10A at 220V DC	10A at 220V DC	10A at 220V DC
18.	Breaking capacity of auxiliary contacts	2 A	2 A	2 A
19.	No. of auxiliary contacts on each isolator	6 NO and 6 NC	6 NO and 6 NC	6 NO and 6 NC
20.	No. of auxiliary contacts on each earthing switch	6 NO and 6 NC	6 NO and 6 NC	6 NO and 6 NC
IV	Earthing Switches (ES)			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated short time withstand current (1 sec)	50/ 40 kA rms (As applicable)	50/ 40 kA rms (As applicable)	50/ 40 kA rms (As applicable)
4.	Rated short time making current capacity -For high speed earthing switch	125/100 kA peak (As applicable)	125/100 kA peak (As applicable)	125/100 kA peak (As applicable)
5.	Rated lightning impulse withstand voltage	±1425 kVp	±1050 kV peak	±650 kV peak
6.	One minute power frequency withstand voltage	650 kV rms	460 kV rms	275 kV rms
7.	Operating Mechanism - For maintenance earthing switch -For high speed earthing switch	Motor Motor	Motor Motor	Motor Motor
8.	Operating time -For maintenance earthing switch	Less than 12 sec.	Less than 12 sec.	Less than 12 sec.

	-For high speed earthing switch	Less than 300 m sec	Less than 300 m sec	Less than 300 m sec
V	Current Transformer (CT)			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed
4.	Maximum temperature rise over an ambient temperature of 50°C	As per IEC 60044-1	As per IEC 60044-1	As per IEC 60044-1
5.	Radio interference voltage at 1.1 Un/√3 and frequency range 0.5 to 2 MHz	≤ 1000 micro-volts	≤ 1000 micro-volts	≤ 500 micro-volts
6.	One minute power frequency withstand voltage between sec. Terminal & earth	5 kV (rms)	5 kV (rms)	5 kV (rms)
7.	Partial discharge level	≤ 5 pico coulombs	≤ 5 pico coulombs	≤ 5 pico coulombs
8.	Rated insulation level i) 1.2/50 micro second impulse voltage ii) 1 Minute power frequency withstand voltage iii) 250/2500 micro second switching impulse voltage (dry & wet)	±1425 kVp 650 kV (rms) 1050 kVp	±1050 kVp 460 kV (rms) -	± 650 kVp 275 kV (rms) -
9.	Current Ratio - For Feeders - For Transformer - For bus coupler	2000-1000-500/1A 3000-2000-1000/1A 3000-2000-1000/1A	1600-800-500-300/1A 1600-800-500-300/1A 1600-800-500-300/1A	800-400-200/1A 160MVA (800-400/1A), 100MVA (500/1A), 800-400-200/1A
10.	Ratio taps	On secondary side	On secondary side	On secondary side
11.	Accuracy Class -For protection -For metering	PS 0.2	PS 0.2	PS 0.2

12.	Burden -For protection -For metering	20 VA 20 VA	20 VA 20 VA	20 VA 20 VA
13.	Rated short time withstand current	63/50/ 40 kA rms (As applicable) for 1 Second.	50/ 40 kA rms (As applicable) for 1 Second.	40/31.5 kA rms (As applicable) for 1 Second.
14.	Rated dynamic withstand current	157.5/125/100 kA peak (As applicable)) for 1 Second.	125/100 kA peak (As applicable)) for 1 Second.	125/100 kA peak (As applicable)) for 1 Second.
15.	Safety factor for metering	< 5	< 5	< 5
16.	Parameters/ Approval Finalization	Burden, Knee Point Voltage Rct, Excitation Current and other parameters shall be got approved by purchaser as per protection co- ordination/ scheme requirements during detailed engineering based on details/ calculations to be submitted by successful bidder	Burden, Knee Point Voltage Rct, Excitation Current and other parameters shall be got approved by purchaser as per protection co- ordination/ scheme requirements during detailed engineering based on details/ calculations to be submitted by successful bidder	Burden, Knee Point Voltage Rct, Excitation Current and other parameters shall be got approved by purchaser as per protection co- ordination/ scheme requirements during detailed engineering based on details/ calculations to be submitted by successful bidder
VI	Voltage Transformers			
1.	Rated System voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Type	Electromagnetic	Electromagnetic	Electromagnetic
4.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed
5.	System fault level	50/40 kAp. (As applicable) for 1 Second.	50/40 kAp. (As applicable) for 1 Second.	50/40 kAp. (As applicable) for 1 Second.
6.	Rated insulation levels			
	i) 1.2/50 micro second impulse voltage	± 1425 kV peak	± 1050 kV peak	± 650 kV peak
	ii) 1 Minute power frequency withstand voltage	650 kV rms	460 kV rms	275 kV rms

	iii) 250/2500 micro second switching impulse voltage (dry & wet)	1050 kVp for 400 kV system	-	-
7.	One minute power frequency withstand voltage for secondary winding	3 kV rms	3 kV rms	3 kV rms
8.	Radio interference voltage at 1.1 Un/ $\sqrt{3}$ and frequency range 0.5 to 2 MHz	≤ 1000 micro volts	≤ 1000 micro volts	≤ 500 micro volts
9.	Rated total thermal burden	400 VA	400 VA	100 VA
10.	Partial discharge level	≤ 10 pico coulombs	≤ 10 pico coulombs	≤ 10 pico coulombs
11.	Voltage Ratio	420/ $\sqrt{3}$:110 V/ $\sqrt{3}$	245/ $\sqrt{3}$:110 V/ $\sqrt{3}$	145/ $\sqrt{3}$:110 V/ $\sqrt{3}$
12.	Number of secondary winding	3	3	3
13.	Rated voltage factor	1.5 for 30 seconds 1.2 continuous	1.5 for 30 seconds 1.2 continuous	1.5 for 30 seconds 1.2 continuous
14.	Phase angle error	± 10 min (for metering core)	± 10 min (for metering core)	± 10 min (for metering core)
15.	Rated voltage Application Accuracy Output Burden (Min.) VA	Sec-I 110/ $\sqrt{3}$ 3 Prot. 3P 50	Sec-II 110/ $\sqrt{3}$ 3 Prot. 3P 50	Sec-III 110/ $\sqrt{3}$ Metering 0.2 50
VII Lightning Arresters (LA)				
1.	Highest system voltage	420 kV rms	245 kV rms	145 kV rms
2.	Rated arrester voltage	390 kV rms	216 kV rms	120 kV rms
3.	Continuous operating voltage at 50 °C	303 kV	168 kV	102 kV
4.	Type (Tank Type)	Gapless type/ Metal Zinc Oxide type	Gapless type/ Metal Zinc Oxide type	Gapless type/ Metal Zinc Oxide type
5.	Long duration Discharge Class	Class 4	Class 3	Class 3
6.	Nominal discharge current	20 kA of 8/20 μ s wave	10 kA of 8/20 μ s wave	10 kA of 8/20 μ s wave

	corresponding to 8/20 microsec wave shape			
7.	Rated frequency	50 HZ	50 HZ	50 HZ
8.	Minimum discharge capability voltage corresponding to minimum discharge characteristic	12 kJ/kV (referred to rated arrester)	5 kJ/kV (referred to rated arrester)	5 kJ/kV (referred to rated arrester)
9.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed
10.	Max. switching surge residual voltage(1 kA)	780 kVp	500 kVp	280 kVp
11.	Max. residual voltage at i) 5 kA ii) 10 kA nominal discharge current iii) 20 kA nominal discharge current	- 900 kVp 880 kVp	560 kVp 600 kVp -	310 kVp 330 kVp -
12.	High current short duration test value (4/10 micro second wave)	100 kVp	100 kVp	100 kVp
13.	Current for pressure relief test	50/40 kA rms	50/40 kA rms	40/31.5 kA rms
14.	Prospective symmetrical fault current	4050/63 kA rms for 0.2 Sec	40 kA rms for 0.2 Sec	40 kA rms for 0.2 Sec
15.	Pressure relief class	A	A	A
16.	RIV at 1.1 Un/ $\sqrt{3}$ kV rms	Less than 500 (micro volts)	Less than 500 (micro volts)	Less than 500 (micro volts)
17.	Partial discharge at 1.05 COV	Not more than 5pc	Not more than 5 pc	Not more than 5pc
18.	Low current long duration test value (2000 micro sec.)	As per IEC	As per IEC	As per IEC
19.	Discharge counter and leakage current meter to be provided	Yes	Yes	Yes
VIII	Busbar			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	3000 A rms	3000 A rms	1600 A rms
4.	Rated short time withstand current	40.0 kA rms/3sec	40.0 kA rms/3sec	40.0 kA rms/3sec
5.	Temperature rise			

	-For enclosure -For conductor	According to IEC According to IEC	According to IEC According to IEC	According to IEC According to IEC
6.	Rated lightning impulse withstand voltage	±1425 kV peak	±1050 kV peak	±650 kV peak
7.	One minute power frequency withstand voltage	650 kV (rms)	460 kV (rms)	275 kV (rms)
IX	Bus Coupler			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	3000 A rms	3000 A rms	1600 A rms
4.	Rated short time withstand current	40.0 kA rms/3sec	40.0 kA rms/3sec	40.0 kA rms/3sec
5.	Temperature rise -For enclosure -For conductor	According to IEC According to IEC	According to IEC According to IEC	According to IEC According to IEC
6.	Rated lightning impulse withstand voltage	±1050 kV peak	±1050 kV peak	±650 kV peak
7.	One minute power frequency withstand voltage	650 kV (rms)	460 kV (rms)	275 kV (rms)
X	Cable Head (CHD)			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	3000 A rms	3000 A rms	1600 A rms
4.	Rated short time withstand current	40.0 kA rms	40.0 kA rms	40.0 kA rms
5.	Rated lightning impulse withstand voltage	±1425 kV peak	±1050 kV peak	±650 kV peak
6.	One minute power frequency withstand voltage	650 kV (rms)	460 kV (rms)	275 kV (rms)
7.	Interface with power cable sealing end	According to IEC	According to IEC	According to IEC
XI	SF6 Bus Interconnection Duct Termination Head			
1.	Rated voltage	420kV rms	245kV rms	145kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	3000 A rms	3000 A rms	1600 A rms
4.	Rated short time withstand current	40.0 kA rms	40.0 kA rms	40.0 kA rms
5.	Rated lightning	±1425 kV peak	±1050 kV peak	±650 kV peak

	impulse withstand voltage			
6.	One minute power frequency withstand voltage	450 kV (rms)	460 kV (rms)	275 kV (rms)
7.	Interface with SF6 Duct end	According to IEC	According to IEC	According to IEC
XII Bus Sectionalizers				
1.	Rated voltage	-	-	-
2.	Rated frequency	-	-	-
3.	Rated current	-	-	-
4.	Rated short time withstand current	-	-	-
5.	Temperature rise -For enclosure -For conductor	-	-	-
6.	Rated lightning impulse withstand voltage	-	-	-
7.	One minute power frequency withstand voltage	-	-	-
XIII TECHNICAL PARAMETERS FOR SF6/AIR BUSHING				
1.	Rated Voltage (kV)	420 kV (rms)	245 kV (rms)	145 kV (rms)
2.	Rated Current (Amp)	2000/3150/5000 as applicable	1600	600
3.	1.2/50 micro second impulse voltage (Lightning impulse withstand voltage)	1425 kVp	1050 kVp	630 kVp
4.	250/2500 micro second switching impulse voltage	1050 kVp	-	-
5.	One minute power frequency withstand voltage	650 kV (rms)		275 kV (rms)
6.	Minimum total Creepage distance in mm	10500	6125	3625
7.	Minimum Cantilever strength (kN)	10	8	5

4.0 DEFINITIONS

4.1 Assembly

Assembly refers to the entire completed GIS equipment furnished under contract.

4.2 Bay

Bay refers to the area occupied by one Circuit Breaker and associated equipments used to protect one feeders/line/bus coupler in double bus scheme.

4.3 Compartment

When used in conjunction with GIS equipment, compartment refers to a gas tight volume bounded by enclosure walls and gas tight isolating barriers.

4.4 Enclosure

When used in conjunction with GIS equipment, enclosure refers to the grounded metal housing or shell which contains and protects internal Power system equipment (breaker, disconnecting switch, grounding switch, voltage transformer, current transformer surge arresters, interconnecting bus etc.)

4.5 Manual Operations

Manual operation means operation by hand without using any other source of Power.

4.6 Module

When used in conjunction with GIS equipment, module refers to a portion of that equipment. Each module includes its own enclosure. A module can contain more than one piece of equipment, for example, a module can contain a disconnecting switch and a grounding switch.

4.7 Reservoir

When used in conjunction with GIS equipment reservoir refers to a larger gastight volume.

5.0 GENERAL DESIGN AND SAFETY REQUIREMENT

5.1 The GIS shall be designed, manufactured and tested in accordance with the best international engineering practices under strict quality control to meet the requirement stipulated in the technical specification. Adequate safety margin with respect to thermal, mechanical, dielectric stress and insulation coordination etc. shall be maintained during design, selection of raw material, manufacturing process etc. so that the GIS provides long life with least maintenance.

5.2 The workmanship shall be of the highest quality and shall conform to the latest modern practices for the manufacture of high technology machinery and electrical switchgear

5.3 The GIS assembly shall consist of separate modular compartments e.g Circuit Breaker compartment, Bus bar compartment filled with SF6 Gas and separated by gas tight partitions so as to minimize risk to human life, allow ease of

maintenance and limit the effects of gas leaks failures & internal arcs etc. These compartments shall be such that maintenance 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.

- 5.4 The switchgear, which shall be of modular design, shall have complete phase isolation. The conductors and the live parts shall be mounted on high graded 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 which is atleast 5 % greater than the rated voltage. They should be designed to have high structural and dielectric strength properties and 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.
- 5.5 Gas barrier insulators shall be provided so as to divide the GIS into separate compartments. They 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, it should be ensured by the bidder that adjacent compartment would remain in service with reduced pressure. The gas tight barriers shall be clearly marked on the outside of the enclosures.
- 5.6 The bus enclosure should be sectionalized in a manner that maintenance work on any bus disconnecter (when bus and bus disconnecter are enclosed in a single enclosure) can be carried out by isolating and evacuating the small effected section and not the entire bus. The design of the 400 kV GIS shall be such that in case one circuit breaker module is removed for maintenance, there is no disruption in the power flow in any of the two circuits in the diameter. The design of 220 kV GIS shall be such that in case a circuit breaker module of a feeder is removed for maintenance, both busbars shall remain in service. Further the design of 132kV GIS shall be such that that in case a circuit breaker module of a feeder is removed for maintenance, the bus bar 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 The material and thickness of the enclosures shall be such as to withstand an internal flash over without burn through for a period of 300 ms at rated short time withstand current. The material shall be such that it has no effect of environment as well as from the by-products of SF6 breakdown under arcing condition.

- 5.8 Each section shall have plug-in or easily removable connection pieces to allow for easy replacement of any component with the minimum of disturbance to the

remainder of the equipment. Inspection windows shall be provided for Disconnectors and earth switches.

- 5.9 The material used for manufacturing the switchgear equipment shall be of the type, composition and have physical properties best suited to their particular purposes and in accordance with the latest engineering practices. All the conductors shall be fabricated of aluminum/ copper tubes of cross sectional area suitable to meet the normal and short circuit current rating requirements. The finish of the conductors shall be smooth so as to prevent any electrical discharge. The conductor ends shall be silver plated and fitted into finger contacts or tulip contacts. The contacts shall be of sliding type to allow the conductors to expand or contract axially due to temperature variation without imposing any mechanical stress on supporting insulators.
- 5.10 Each pressure filled enclosure shall be designed and fabricated to comply with the requirements of the applicable pressure vessel codes and based on the design temperature and design pressures as defined in IEC-62271-203.
- 5.11 The maximum SF6 gas leakage shall not exceed 0.5% (half percent) per year for the whole equipment and for any individual gas compartment separately. The SF6 gas leakage should not exceed 0.5% per year and the leakage rate shall be guaranteed for at least 10 years. In case the leakage under the specified conditions is found to be greater than 0.5% after one year of commissioning, the manufacturer will have to supply free of cost, the total gas requirement for subsequent ten (10) years, based on actual leakage observed during the first year of operation after commissioning.
- 5.12 Each gas-filled compartment shall be equipped with static filters, density switches, filling valve and safety diaphragm. The filters shall be capable of absorbing any water vapour which may penetrate into the enclosures as well as the by-products of SF6 during interruption. Each gas compartment shall be fitted with separate non-return valve connectors for evacuating & filling the gas and checking the gas pressure etc.
- 5.13 The switchgear line-up when installed and operating under the ambient conditions shall perform satisfactorily and safely under all normal and fault conditions. Even repeated operations up to the permissible servicing intervals under 100% rated and fault conditions shall not diminish the performance or significantly shorten the useful life of the switchgear. Any fault caused by external reasons shall be positively confined to the originating compartment and shall not spread to other parts of the switchgear.
- 5.14 The thermal rating of all current carrying parts shall be minimum for one sec. for the rated symmetrical short-circuit current.
- 5.15 The switchgear shall be of the free standing, self-supporting with easy accessibility to all the parts during installation & maintenance with all high-voltage equipment installed inside gasinsulated metallic and earthed enclosures, suitably sub-divided into individual arc and gasproof compartments preferably for:

- 1) Bus bars
- 2) Intermediate compartment
- 3) Circuit breakers
- 4) Line disconnectors
- 5) Voltage Transformers
- 6) Gas Insulated bus duct section between GIS and XLPE cable/Overhead Conductor.
- 7) Gas Insulated bus section between GIS & Oil filled Transformer/ Reactor (if applicable)

- ✓ 5.16 The bus enclosure should 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.
- 5.17 The arrangement of the individual switchgear bays shall be such so as to achieve optimum space-saving, neat and logical arrangement and adequate accessibility to all external components.
- 5.18 The layout of the substation equipment, bus bars and switchgear bays shall preferably be based on the principle of "phase grouping". Switchgear layout based on the "mixed phases" principle shall not be accepted without mutual agreement between supplier and employer. The arrangement of the equipment offered must provide adequate access for operation, testing and maintenance.
- 5.19 All the elements shall be accessible without removing support structures for routine inspections. The removal of individual enclosure parts or entire breaker bays shall be possible without disturbing the enclosures of neighboring bays.
- 5.20 It should be impossible to unwillingly touch live parts of the switchgear or to perform operations that lead to arcing faults without the use of tools or brute force. All interlocks that prevent potentially dangerous mal-operations, shall be constructed such that they cannot be operated easily, i.e. the operator must use tools or brute force to over-ride them.
- 5.21 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 which the equipment is subjected to specified test voltage. There shall be no radio interference from the energized switchgear at rated voltage.
- 5.22 The GIS shall be designed, so as to take care of the 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 (LIWV) of the equipment. Necessary measures shall be under taken by

GIS manufacture to restrict maximum VFT over voltages lower than the LIWV. Manufacturer shall submit the study report of VFTO generated for GIS installation.

- 5.23 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.

- 5.24 The fabricated metal enclosures shall be of Aluminum alloy having high resistance to corrosion, low electrical losses and negligible magnetic losses. All joint surfaces shall be machined and all castings shall be spot faced for all bolt heads or nuts and washers. All screws, bolts, studs and nuts shall conform to metric system.

- 5.25 The elbows, bends, cross and T-sections of interconnections shall include the insulators bearing the conductor when the direction changes take place in order to ensure that live parts remain perfectly centered and the electrical field is not increased at such points.

- 5.26 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.

- 5.27 The switchgear shall have provision for connection with ground mat risers. This provision shall consist of grounding pads to be connected to the ground mat riser in the vicinity of the equipment.

- 5.28 The ladders and walkways shall be provided wherever necessary for access to the equipment.

- 5.29 Wherever required, the heaters shall be provided for the equipment in order to ensure the proper functioning of the switchgear at specified ambient temperatures. The heaters shall be rated for 240V AC supply and shall be complete with thermostat, control switches and fuses, connected as a balanced 3-phase, 4-wire load. The heaters shall be so arranged and protected as to create no hazard to adjacent equipment from the heat produced.

- 5.30 It is required that the three phases of each switchgear bay be arranged side by side. The arrangement of the equipment offered must provide adequate access for operation, testing and maintenance.

5.31 Local Control & Substation Automation System:-

- 5.31.1 Separate control cubicle including gas monitoring kiosk shall be provided for each bay which shall be installed near the switchgear for local control & monitoring of respective switchgear bay.
- 5.31.2 Local control cubicle for GIS shall be equipped with suitable hardware & software for remote control operation and conform to the bay level controller as detailed in Section: Substation Automation System.
- 5.31.3 BCU/BPU can also be used as Local Control Cubicle (LCC) depending upon the design of the offered equipment, as such separate LCC need not be provided.
- 5.31.4 Relay & Protection panels room shall house these equipments and shall be located adjacent to GIS room. It shall be air- conditioned through split air conditioners.
- 5.32 In case of any repair or maintenance on one busbar disconnectors, the other busbar should be live and in service.
- 5.33 All interlocks that prevent potentially dangerous mal-operations, shall be constructed such that they can not be operated easily, i.e. the operator must use tools or brute force to over-ride them.
- 5.34 The fabricated metal enclosures shall be of Aluminium alloy having high resistance to corrosion, low electrical losses and negligible magnetic losses. All joint surfaces shall be machined and all castings shall be spot faced for all bolt heads or nuts and washers. All screws, bolts, studs and nuts shall conform to metric system.
- 5.35 The breaker enclosure shall have provision for easy withdrawal of the interrupter assemblies. The removed interrupter assembly must be easily and safely accessible for inspection and possible repairs.
- 5.36 The enclosure shall be designed to practically eliminate the external electromagnetic field and thereby electrodynamic stresses even under short circuit conditions.
- 5.37 The elbows, bends, cross and T-sections of interconnections shall include the insulators bearing the conductor when the direction changes take place in order to ensure that live parts remain perfectly centered and the electrical field is not increased at such points.
- 5.38 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.
- 5.39 The Bidder shall furnish the following information regarding the loosely distributed metallic particles within the GIS encapsulation.
- a) Calculations of critical field strength for specific particles of defined mass and geometry.

- b) The methodology and all the equipment for electrical partial discharge (PD) detection and/or acoustic detection methods, including that mentioned in the specification.
- 5.40 The switchgear shall have provision for connection with ground mat risers. This provision shall consist of grounding pads to be connected to the ground mat riser in the vicinity of the equipment.

6.0 Steel Structures

- 6.1 The bidder shall design, fabricate and supply all equipment supporting structures including permanent access ladders, stairways, walkways, all rails, transverse and longitudinal beams and supporting members, wherever necessary, complete with all necessary hardware. Consideration shall be made to minimize induced magnetic heating and circulating current in the support structures.
- 6.2 All stairs, platforms and walkways shall be provided with a safety non-slip surface such as safety abrasive treads or equivalent. A portable ladder with adjustable height may also be supplied to access to the equipment.
- 6.3 All steel structure members shall be hot-dipped galvanized after fabrication. All field assembly joints shall be bolted. Field welding is not acceptable.
- 6.4 Non corrosive metal or plated steel shall be used for bolts and nuts throughout the work. The bidder shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts shall be provided to fasten the switchgear base frames to the foundation channels. The supplier shall furnish anchor bolts location plan and other loading information for foundation design.
- 6.5 Wherever required, the heaters shall be provided for the equipment in order to ensure the proper functioning of the switchgear at specified ambient temperatures. The heaters shall be rated for 240V AC supply and shall be complete with thermostat, control switches and fuses, connected as a balanced 3-phase, 4-wire load. The possibility of using heaters without thermostats in order to achieve the higher reliability may be examined by the bidder and accordingly included in the offer but it shall be ensured by the bidder that the temperature rise of different enclosures where heating is provided should be within safe limits as per relevant standards. One copy of the relevant extract of standard to which the above arrangement conforms along with cost reduction in offer. If any, shall also be furnished along with the offer. The heaters shall be so arranged and protected as to create no hazard to adjacent equipment from the heat produced.
- 6.6 The enclosure & support structure shall be designed that a mechanic 1780 mm in height and 80 kg in weight is able to climb on the equipment for maintenance.
- 6.7 The sealing provided between flanges of two modules/ enclosures shall be such that long term tightness is achieved.

- 6.8 Alarm circuit shall not respond to faults for momentary conditions. The following indications including those required elsewhere in the specifications shall be generally provided in the alarm and indication circuits.

7.0 Gas Insulating System:

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

8.0 Operating System:

- a) Low operating pressure.
- b) Loss of Heater power.
- c) Loss of operating power.
- d) Loss of control.
- e) Pole Disordance.

- 8.1 The equipment will be operated under the following ambient conditions:

- a) The ambient temperature varies between 0 degree-C and 50 degree-C. However, for design purposes, ambient temperature should be considered as 50 degree-C.
- b) The humidity will be about 95% (indoors)
- c) The elevation is less than 1000 metres.

- 8.2 Temperature rise of current carrying parts shall be limited to the values stipulated in IEC-694, under rated current and the climatic conditions at site. The temperature rise for accessible enclosure shall not exceed 20 degree C above the ambient temperature of 50 degree C. In the case of enclosures, which are accessible but need not be touched during normal operation, the temperature rise limit may be permitted upto 30 degree C above the ambient of 50 degree C.

- 8.3 In case of any internal arc fault regardless whether it occurs in a bus bar section, a bus bar isolator or the circuit breaker, repair works should be possible without shutting down the substation; at least one busbar and the undisturbed feeder should remain in operation. It should be possible to remove and replace a fully assembled circuit breaker without interfering the operation of the adjacent feeder. All circuit breakers should be interchangeable.

- 8.4 The GIS equipments shall be arranged in such a manner that in case of maintenance work on any of the equipment, at least one bus bar should be available for operation.

- 8.5 The inter bay width shall be sufficient to allow access to all drive mechanisms and other termination boxes without the need of dismantling other apparatuses.

These conditions shall be taken into account by the supplier in the design of the equipment.

9.0 BELLOWS OR COMPENSATING UNITS

Adequate provision shall be made to allow for the thermal expansion of the conductors and of differential thermal expansion between the conductors and the enclosures. The bellows shall be metallic (preferably of stainless steel) of following types or other suitable equivalent arrangement shall be provided wherever necessary.

- 9.1 **Lateral / Vertical mounting units:** These shall be inserted, as required, between sections of busbars, on transformer, shunt reactor and XLPE cable etc. Lateral mounting shall be made possible by a sliding section of enclosure and tubular conductors.
- 9.2 **Axial compensators :** These shall be provided to accommodate changes in length of busbars due to temperature variations.
- 9.3 **Parallel compensators:** These shall be provided to accommodate large linear expansions and angle tolerances.
- 9.4 **Tolerance compensators:** These shall be provided for taking up manufacturing, site assembly and foundation tolerances.
- 9.5 **Vibration compensators:** These bellow compensators shall be provided for absorbing vibrations caused by the transformers and shunt reactors when connected to SF6 switchgear by oil- SF6 bushings.
- 9.6 The electrical connections across the bellows or compensating units shall be made by means of suitable connectors.

10.0 INDICATION AND VERIFICATION OF SWITCH POSITIONS

- 10.1 Indicators shall be provided on all circuit breakers, isolators and earth-switches, which shall clearly show whether the switches are open or closed. The indicators shall be mechanically coupled directly to the main contact operating drive rod or linkages and shall be mounted in a position where they are clearly visible from the floor or the platform in the vicinity of the equipment.
- 10.2 Windows shall also be provided with all isolators and earthswitches so that the switch contact positions can be verified by direct visual inspection.

11.0 PRESSURE RELIEF

- 11.1 Pressure relief devices shall be provided in the gas sections to protect the main gas enclosures from damage or distortion during the occurrence of abnormal pressure increase or shock waves generated by internal electrical fault arcs (preferably in downward direction).

- 11.2 Pressure relief shall be achieved either by means of diaphragms or plugs venting directly into the atmosphere in a controlled direction.
- 11.3 If the pressure relief devices vent directly into the atmosphere, suitable guards and deflectors shall be provided. Contractor shall submit to the purchaser the detailed criteria/ design regarding of pressure relief devices/rupture diaphragms.

12.0 PRESSURE VESSEL REQUIREMENTS

- 12.1 The enclosure shall be designed for the mechanical and thermal loads to which it is subjected in service. The enclosure shall be manufactured and tested according to the pressure vessel code (ASME/CENELEC code for pressure Vessel). Each enclosure has to be tested as a routine test at 1.5 time the design pressure for one minute. 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.

13.0 GROUNDING

- 13.1 The grounding system shall be designed and provided as per IEEE-80-2000 and CIGRE-44 to protect operating staff against any hazardous touch voltages and electro-magnetic interferences.
- 13.2 The GIS supplier shall define clearly what constitutes the main grounding bus of the GIS. The GIS supplier must supply the entire material for grounding bus of GIS viz conductor, clamps, joints, operating and safety platforms etc. The GIS supplier is also required to supply all the earthing conductors and associated hardware material for the following:
 - 1) Connecting all GIS equipment, bus ducts, enclosures, control cabinets, supporting structure etc. to the ground bus of GIS.
 - 2) Grounding of transformer and other outdoor switchyard equipments/ structures etc.
- 13.3 The enclosure of the GIS may be grounded at several points so that there shall be grounded cage around all the live parts. A minimum of two nos. of grounding connections should be provided for each of circuit breaker, transformer terminals, cable terminals, surge arresters, earth switches and at each end of the bus bars. The grounding continuity between each enclosure shall be effectively interconnected with Cu/ Al bonds of suitable size to bridge the flanges. In case the bidder does not offer external bonding, the bidder shall demonstrate that the connectivity offered by them between each enclosure is effective and does not require external bonding. Further similar design should have been in service. Subassembly to sub-assembly bonding shall be provided to provide gap & safe voltage gradients between all intentionally grounded parts of the GIS assembly & between those parts and the main grounding bus of the GIS.

- 13.4 Each marshalling box, local control panel, power and control cable sheaths and other non current carrying metallic structures shall be connected to the grounding system of GIS via connections that are separated from GIS enclosures.
- 13.5 The grounding connector shall be of sufficient mechanical strength to withstand electromagnetic forces as well as capable of carrying the anticipated maximum fault current without overheating. At least two grounding paths shall be provided to connect each point to the main grounding bus. Necessary precautions should be under taken to prevent excessive currents from being induced into adjacent frames, structures of reinforcing steel and to avoid establishment of current loops via other station equipment.
- 13.6 All flexible bonding leads shall be tinned copper. All connectors, for attaching flexible bonding leads to grounding conductors and grounding conductors to support structures shall be tinned bronze with stainless steel or tinned bronze hardware.
- 13.7 The contractor shall provide suitable measure to mitigate transient enclosure voltage caused by high frequency currents caused by lightning strikes, operation of surge arrester, ph./ earth fault and discharges between contacts during switching operation. The grounding system shall ensure safe touch & step voltages in all the enclosures.
- 13.8 **UHF sensors for PD detection:** 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 the employer. Further UHF sensors shall necessarily be provided in close proximity to VT compartments

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.

14.0 CIRCUIT BREAKERS

14.1 General

- 14.1.1 SF6 gas insulated metal enclosed circuit breakers (for 400kV, 220kV & 132kV) shall comply with the latest revisions of IEC- 62271-100 & relevant IEC except to the extent explicitly modified in the specification and shall meet with requirements specified.
- 14.1.2 Circuit breakers shall be equipped with the operating mechanism. Circuit breakers shall be of single pressure (puffer) type. Complete circuit breaker with all necessary items for successful operation shall be supplied. The circuit breakers shall be designed for high speed single and three phase reclosing with an operating sequence and timing as specified.

only for 400 kV & 220 kV CB

14.2 Duty Requirements

Circuit breaker shall be C2 – M2 class as per IEC 62271-100.

Circuit breaker shall meet the duty requirements for any type of fault or fault location also for line charging and dropping when used on 400kV and 220kV effectively grounded system and perform make and break operations as per the stipulated duty cycles satisfactorily.

14.3 The circuit breaker shall be capable of:

- i) Interrupting the steady and transient magnetizing current corresponding to 400/220/33 kV class transformers of 500MVA ratings on both 400 kV & 220 kV side and 220/132/11 kV class transformers of 200MVA ratings on both 220 kV & 132 kV side.
- ii) Interrupting line/cable charging current as per IEC without re-strikes and without use of opening resistors.
- iii) Clearing short line fault (Kilometric faults) with source impedance behind the bus equivalent to symmetrical fault current specified.
- iv) Breaking 25% the rated fault current at twice the rated voltage under phase opposition condition.
- v) The breaker shall satisfactorily withstand the high stresses imposed on them during fault clearing, load rejection and re-energisation of lines with trapped charges.

14.4 Total Break Time

The total break time shall not be exceeded under any of the following duties:

- ii) Test duties T10, T30, T60, T100 (with TRV as per IEC- 62271-100)
- ii) Short line fault L90, L75 (with TRV as per IEC-62271-100)

The Bidder may please note that 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 bidder 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.

14.5 CONSTRUCTIONAL FEATURES

The features and constructional details of breakers shall be in accordance with requirements stated hereunder:

14.6 Contacts

- 14.6.1 All making and breaking contacts shall be sealed and free from atmospheric effects. Contacts shall be designed to have adequate thermal and current carrying capacity for the duty specified and to have a life expectancy so that frequent replacement due to excessive burning will not be necessary. Provision shall be made for rapid dissipation of heat generated by the arc on opening.
- 14.6.2 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.
- 14.6.3 Breakers shall be so designed that when operated within their specified rating, the temperature of each part will be limited to values consistent with a long life for the material used. The temperature rise shall not exceed that indicated in IEC-62271-100 under specified ambient conditions.
- 14.6.4 The gap between the open contacts shall be such that it can withstand atleast the rated phase to ground voltage for eight hours at zero pressure above atmospheric level of SF6 gas due to its leakage. The breaker should be able to withstand all dielectric stresses imposed on it in open condition at lockout pressure continuously (i.e. 2 pu. power frequency voltage across the breaker continuously)
- 14.6.5 In the interrupter assembly there shall be an adsorbing product box to minimize the effect of SF6 decomposition products and moisture. The material used in the construction of the circuit breakers shall be such as to be fully compatible with SF6 gas decomposition products.
- 14.6.6 Provisions shall be made for attaching an operational analyzer to record travel, speed and making measurement of operating timings etc. after installation at site.
- 14.6.7 Static Contact Resistance Meter and Dynamic Contact Resistance Meter shall also be provided along with CB operational analyzer.

REF
ANNEXURE-B

AS
PER
IEC

14.7 OPERATING MECHANISM

14.7.1 General Requirements :

- Circuit breaker shall be operated by spring charged mechanism or electro hydraulic mechanism or a combination of these. The mechanism shall be housed in a dust proof cabinet and shall have IP: 42 degree of protection.
- The operating mechanism shall be strong, rigid, not subject to rebound or to critical adjustments at site and shall be readily accessible for maintenance.
- The operating mechanism shall be suitable for high speed reclosing and other duties specified. During reclosing the breaker contacts shall close fully and then open. The mechanism shall be antipumping and trip free (as per IEC definition) under every method of closing.

- d) The mechanism shall be such that the failure of any auxiliary spring will not prevent tripping and will not cause trip or closing operation of the power operating devices.
- e) A mechanical indicator shall be provided to show open and close position of the breaker. It shall be located in a position where it will be visible to a man standing on the ground level with the mechanism housing closed. An operation counter shall also be provided in the central control cabinet.
- f) Working parts of the mechanism shall be of corrosion resisting material, bearings which require grease shall be equipped with pressure type grease fittings. Bearing pin, bolts, nuts and other parts shall be adequately pinned or locked to prevent loosening or changing adjustment with repeated operation of the breaker.
- g) The bidder shall furnish detailed operation and maintenance manual of the mechanism alongwith the operation manual for the circuit breaker.

14.7.2 Control

- a) The close and trip circuits shall be designed to permit use of momentary-contact switches and push buttons.
- b) Each breaker pole shall be provided with two (2) independent tripping circuits, valves, pressure switches, and coils each connected to a different set of protective relays.
- c) The breaker shall normally be operated by remote electrical control. Electrical tripping shall be performed by shunt trip coils. However, provisions shall be made for local electrical control. For this purpose a local/remote selector switch and close and trip control switch/push buttons shall be provided in the breaker central control cabinet.
- d) The trip coil shall be suitable for trip circuit supervision during both open and close position of breaker.
- e) Closing coil and associated circuits shall operate correctly at all values of voltage between 85% and 110% of the rated voltage. Shunt trip and associated circuits shall operate correctly under all operating conditions of the circuit breaker upto the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110% of rated voltage. If additional elements are introduced in the trip coil circuit their successful operation and reliability for similar applications on circuit breakers shall be clearly brought out in the additional information schedules. In the absence of adequate details the offer is likely to be rejected.
- f) Densimeter contacts and pressure switch contacts shall be suitable for direct use as permissives in closing and tripping circuits. Separate contacts have to be used for each of tripping and closing circuits. If contacts are not suitably rated and multiplying relays are used then fail safe logic/schemes are to be employed. DC supplies for all auxiliary circuit shall be monitored and for remote annunciations and operation lockout in case of dc failures.
- g) The auxiliary switch of the breaker shall be positively driven by the breaker operating rod.

14.7.3 Spring operated Mechanism

- a) Spring operated mechanism shall be complete with motor in accordance with GTR. Opening spring and closing spring with limit switch for automatic charging and other necessary accessories to make the mechanism a complete operating unit shall also be provided.
- b) 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.
- c) After failure of power supply to the motor one close open operation shall be possible with the energy contained in the operating mechanism.
- d) 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 required preferably not more than 60 seconds for full charging of the closing spring.
- e) Closing action of circuit breaker shall compress the opening spring ready for tripping.
- f) When closing springs are discharged after closing a breaker, closing springs shall automatically be charged for the next operation and an indication of this shall be provided in the local and remote control cabinet.
- g) Provisions shall be made to prevent a closing operation of the breaker when the spring is in the partial charged condition.
- h) Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of closing springs when the breaker is in the closed position.
- i) The spring operating mechanism shall have adequate energy stored in the operating spring to close and latch the circuit breaker against the rated making current and also to provide the required energy for the tripping mechanism in case the tripping energy is derived from the operating mechanism.

14.7.4 Hydraulically Operated Mechanism :

- a) Hydraulically operated mechanism shall comprise of operating unit with power cylinder, control valves, high and low pressure reservoir, motor etc.
- b) The hydraulic oil used shall be fully compatible for the temperature range to be encountered during operation.
- c) 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.
- d) 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.

- e) 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.
- f) Trip lockout shall be provided to prevent operations of the circuit breaker below the minimum specified hydraulic pressure. Alarm contacts for lost of Nitrogen shall also be provided.
- g) All hydraulic joints shall have no oil leakage under the site conditions and joints shall be tested at factory against oil leakage.

15.0 ADDITIONAL DATA TO BE FURNISHED ALONGWITH THE OFFER :

- a) Drawing showing contacts in close, arc initiation, full arcing, arc extinction and open position.
- b) Data on capabilities of circuit breakers in terms of time and number of operations at duties ranging from 100 fault currents to load currents of the lowest possible value without requiring any maintenance or checks.
- c) Curves supported by test data indicating the opening time under close open operation with combined variation of trip coil voltage and hydraulic pressure.

16.0 TESTS

In accordance with the requirements stipulated in GTR the circuit breaker alongwith its operating mechanism shall conform to the type tests as per IEC-62271-100.

16.1 Routine Tests

Routine tests as per IEC: 62271-100 shall be performed on all circuit breakers. In addition to the mechanical and electrical tests specified by IEC, the following shall also be performed.

Speed curves for each breaker shall be obtained with the help of a suitable operation analyzer to determine the breaker contact movement during opening, closing, autoreclosing and trip free operation under normal as well as limiting operating conditions (control voltage, pneumatic pressure etc.). The tests shall show the speed of contacts directly at various stages of operation, travel of contacts, opening time, closing time, shortest time between separation and meeting of contacts at break make operation etc. This test shall also be performed at site for which the necessary operation analyzer alongwith necessary transducers, cables, console etc. shall be furnished as mandatory maintenance equipment.

17.0 DISCONNECTORS (ISOLATORS)

17.1 General

3 pole group operated type
for 132 kV.

REF
ANNEXURE -B

Disconnectors shall be of the single-pole, group operated type, installed in the switchgear to provide electrical isolation of the circuit breakers, the transformers, double bus and transmission lines. The disconnectors shall conform to IEC-62271-102 and shall have the ratings as specified in Clause 3.0 PRINCIPAL PARAMETERS.

17.2 Construction & Design.

1. The single pole group operated disconnectors shall be operated by electric motor suitable for use on 220V DC system and shall be equipped with a manual operating mechanism for emergency use. The motor shall be protected against over current and short circuit.
2. Disconnectors shall be designed as per relevant IEC. These shall be suitable to make and break the charging currents during their opening and closing. They shall also be able to make and break loop current which appears during transfer between bus bars. The contact shielding shall also be designed to prevent restrikes and high local stresses caused by transient recovery voltages when these currents are interrupted.
3. The disconnecting switches shall be arranged in such a way that all the three phases operate simultaneously. All the parts of the operating mechanism shall be able to withstand starting torque of the motor mechanism without damage until the motor overload protection operates.
4. It shall be possible to operate the disconnecting switches manually by cranks or handwheels. The contacts shall be both mechanically and electrically disconnected during the manual operation.
5. The operating mechanisms shall be complete with all necessary linkages, clamps, couplings, operating rods, support brackets and grounding devices. All the bearings shall be permanently lubricated or shall be of such a type that no lubrication or maintenance is required.
6. The opening and closing of the disconnectors shall be achieved by either local or remote control. The local operation shall be by means of a two-position control switch located in the bay module control cabinet.
7. Remote control of the disconnectors from the control room shall be made by means of remote/ local transfer switch.
8. The disconnector operations shall be inter-locked electrically with the associated circuit breakers in such a way that the disconnector control is inoperative if the circuit breaker is closed.
9. Each disconnector shall be supplied with auxiliary switch having six normally open and six normally closed contacts for future use over and above those required for switchgear interlocking and automation purposes. The auxiliary switch contacts are to be continuously adjustable such that, when required, they can be adjusted to make contact before the main switch contacts.
10. The signaling of the closed position of the disconnector 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.

11. The signaling 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.
12. All auxiliary switches and auxiliary circuits shall be capable of carrying a current of at least 10A DC continuously.
13. The auxiliary switches shall be capable of breaking at least 2A in a 220V DC circuit with a time constant of not less than 20 milliseconds.
14. The disconnectors and safety grounding switches shall have a mechanical key (pad locking key) and electrical inter-locks to prevent closing of the grounding switches when isolator switches are in the closed position and to prevent closing of the disconnectors when the grounding switch is in the closed position.
15. The local control of the isolator and high-speed grounding switches from the bay module control panel should be achieved from the individual control switches with the remote/local transfer switch set to local.
16. All electrical sequence interlocks will apply in both remote and local control modes.
17. Each disconnector shall have a clearly identifiable local, positively driven mechanical position indicator, together with position indicator on the bay module control cabinet and provisions for taking the signals to the control room. The details of the inscriptions and colouring for the indicator are given as under :

	SIGN	COLOUR
Open position	Open	Green
Closed position	Closed	Red

18. All the disconnecting switches shall have arrangement allowing easy visual inspection of the travel of the switch contacts in both open and close positions, from the outside of the enclosure.
19. The disconnecting switches shall be provided with rating plates and shall be accessible for inspection.
20. The disconnecting switches shall be capable of being padlocked in both the open and closed positions with the operating motor automatically disengaged. The padlocking device shall be suitable for a standard size lock with a 10 mm shank. The padlock must be visible and directly lock the final output shaft of the operating mechanism. Integrally mounted lock when provided shall be equipped with a unique key for such three phase group. Master key is not permitted.

18.0 SAFETY GROUNDING SWITCHES

- 18.1 Three-pole, group operated, safety grounding switches shall be operated by electric motor for use on 220V DC ungrounded system and shall be equipped with a manual operating mechanism for emergency use. The motor shall be protected against over-current and short circuit.
- 18.2 Each safety grounding switch shall be electrically interlocked with its associated disconnector and circuit breaker such that it can only be closed if both the current breaker and disconnector are in open position. Safety grounding switch shall also be mechanically key interlocked with its associated disconnector.

- 18.3 Each safety grounding switch shall have clearly identifiable local positive driven mechanical indicator together with position indicator on the bay module control cabinet and provision for taking the signal to Control room.
- 18.4 The details of the inscription and colouring for the indicator are given as under:

	SIGN	COLOUR
Open position	Open	Green
Closed position	Closed	Red

- 18.5 Interlocks shall be provided so that manual operation of the switches or insertion of the manual operating device will disable the electrical control circuits.
- 18.6 Each ground switch shall be fitted with auxiliary switches having six normally open and six normally closed contacts for use by others over and above those required for local interlocking and position indication purposes.
- 18.7 Provision shall be made for padlocking the ground switches in either the open or closed position.
- 18.8 All portions of the grounding switch and operating mechanism required for grounding shall be connected together utilizing flexible copper conductors having a minimum cross sectional area of 100 sq. mm.
- 18.9 The main grounding connections on each grounding switch shall be rated to carry the full short circuit rating of the switch for 1 sec. and shall be equipped with a silver-plated terminal connector suitable for steel strap of adequate rating for connection to the grounding grid.
- 18.10 The safety grounding switches shall conform to the requirements of IEC- 62271-102
- 18.11 Mechanical position indication shall be provided locally at each switch and remotely at each bay module control cabinet/ substation automation system.

19.0 HIGH SPEED MAKE PROOF GROUNDING SWITCHES

- 19.1 Grounding switches located at the beginning of the line feeder bay modules shall be of the high speed, make proof type and will be used to discharge the respective charging currents, in addition to their safety grounding function. These grounding switches shall be capable of interrupting the inductive currents and to withstand the associated TRV.
- 19.2 Single phase switches shall be provided with operating mechanism suitable for operation from a 220V DC. The switches shall be fitted with a stored energy closing system to provide fault making capacity.
- 19.3 The short circuit making current rating of each ground switch shall be at least equal to its peak withstand current rating of 125/100 kA (As applicable). The switches shall have inductive/ capacitive current switching capacity as per IEC-62271-102.
- 19.4 Each high speed make proof grounding switch shall have clearly identifiable local positive driven mechanical indicator together with position indicator on the bay

REF
ANNEXURE-B

module control cabinet and provision for taking the signal Control Room. The details of the inscription and colouring for the indicator shall be as under:-

	SIGN	COLOUR
OPEN POSITION	Open	Green
CLOSED POSITION	Closed	Red

- 19.5 High speed ground switch operation should be possible locally from the bay module control cabinet, or remotely from the control room in conjunction with opening of the associated disconnecter.
- 19.6 These high speed grounding switches shall be electrically interlocked with their associated circuit breakers and disconnectors so that the grounding switches can not be closed if the circuit breakers and disconnectors are closed.
- 19.7 Interlocks shall be provided so that the insertion of the manual operating devices will disable the electrical control circuits.
- 19.8 Each high speed ground switch shall be fitted with auxiliary switches having six NO & six NC auxiliary contacts for use by others, over and above these required for local interlocking and position indication. All contacts shall be wired to terminal blocks in the local bay control cabinet. Provision shall be made for padlocking the ground switches in their open or closed position.
- 19.9 All portion of the grounding switches and operating mechanism required for connection to ground shall be connected together utilizing copper conductor having minimum cross-sectional area of 100 sq. Mm.
- 19.20 The main grounding connection on each grounding switch shall be rated to carry the peak withstand current rating of the switch for 1 sec. And shall be equipped with a silver plated terminal connector suitable for steel strap of adequate design for connection to the grounding grid.
- 19.21 The high speed make proof grounding switches shall confirm to the requirements of IEC-62271-102.

20.0 INSTRUMENT TRANSFORMERS

20.1 Instrument Transformers

20.1.1 Current Transformers

A) General

- i) The current transformers and accessories shall conform to IEC : 60044-1 and other relevant standards except to the extent explicitly modified in the specification.
- ii) The particulars of the various cores may change within reasonable limits as per the requirements of protection relay supplier. The manufacturer is required to have these values confirmed from the purchaser before proceeding with design of the cores. The other characteristics of CTs shall be as given in TECHNICAL PARAMETER of Current Transformer.

B) Ratios and Characteristics

The number, rating, ratios, accuracy class, etc. for the individual current transformers secondary cores shall be in accordance with table at clause 3.0 above. Where multi-ratio current transformers are required the various ratios shall be obtained by changing the effective number of turns on the secondary winding.

C) Rating and Diagram Plates

Rating and diagram plates shall be as specified in the IEC specification incorporating the year of manufacture. The rated extended current rating voltage and rated thermal current shall also be marked on the name plate. The diagram plates shall show the terminal markings and the relative physical arrangement of the current transformer cores with respect to the primary terminals (P1 & P2). The position of each primary terminal in the current transformer SF6 gas section shall be clearly marked by two plates fixed to the enclosure at each end of the current transformer.

D) Constructional Details

- REF ANNEXURE-B
- a) The current transformers incorporated into the GIS will be used for protective relaying and metering and shall be of metal enclosed type. All the current transformers shall have effective electromagnetic shields to protect against high frequency transients.
 - b) Each current transformer shall be equipped with a marshalling box with terminals for the secondary circuits, which are connected to the local control cubicle. The star/ delta configuration and the inter connection to the line protection panels will be done at the CT terminal block located in the local control cubicle.
 - c) Current transformers guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.
 - d) The rated extended primary current shall be 150% at highest ratio and 200% at ratios other than highest ratios.
 - e) 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.
 - f) The wiring diagram, for the interconnections of the three single phase CTs shall be provided inside the marshalling box.
 - g) The current transformers shall be suitable for high speed auto-reclosing.
 - h) Provisions shall be made for primary injection testing either within CT or outside.
 - i) Electromagnetic shields to be provided against high frequency transients typically 1-30 MHz.
- TABLE 1C

20.1.2 VOLTAGE TRANSFORMERS

A) General

The voltage transformers shall conform to IEC- 60044-2 and other relevant standards except to the extent explicitly modified in the specification. Voltage transformers shall be of the electromagnetic type with SF6 gas insulation. The earth end of the high voltage winding and the ends of the secondary winding shall be brought out in the terminal box.

B) Ratios and Characteristics

The rating, ratio, accuracy class, connection etc. for the voltage transformers shall be in accordance with the table at clause 3.0.

C) Rating and diagram plates

Rating and diagram plate shall be provided complying with the requirements of the IEC specification incorporating the year of manufacture and including turns ratio, voltage ratio, burden, connection diagram etc.

D) Secondary Terminals, Earthing and Fuses

The beginning and end of each secondary winding shall be wired to suitable terminals accommodated in a terminal box mounted directly on the voltage transformer section of the SF6 switchgear.

All terminals shall be stamped or otherwise marked to correspond with the marking on the diagram plate. Provision shall be made for earthing of the secondary windings inside the terminal box.

E) The transformer shall be able to sustain full line to line voltage without saturation of transformer.

The accuracy class will be at maximum tap.

F) Constructional Details of Voltage Transformers:

- a) The voltage transformers shall be located in a separate bay module on the bus and will be connected phase- to ground and shall be used for protection, metering and synchronization.
- b) The voltage transformers shall be of inductive type, non resistant and shall be contained in their own-SF6 compartment, separated from other parts of installation. The voltage transformers shall be effectively shielded against high frequency electromagnetic transients. The voltage transformers shall have three secondary windings.
- c) Voltage transformers secondaries shall be protected by HRC cartridge type fuses for all the windings. In addition fuses shall be provided for the

protection and metering windings for fuse monitoring scheme. The secondary terminals of the VT's shall be terminated to the stud type non-disconnecting terminal blocks in the secondary boxes via the fuse.

- d) The voltage transformer should be thermally and dielectrically safe when the secondary terminals are loaded with the guaranteed thermal burdens.
- e) The accuracy of 0.2 on secondary III should be maintained through out the entire burden range upto 100VA on all the three windings without any adjustments during operation.
- f) The diagram for the interconnection of the VTs shall be provided inside the marshalling box.

20.2 TESTS:

Current and voltage transformers shall conform to type tests and shall be subjected to routine test in accordance with IEC.

20.3 OUTDOOR BUSHINGS

A) General

Outdoor bushings, for the connection of conventional external conductors to the SF6 metal enclosed switchgear, shall be provided where specified and shall conform to the requirements given in GTR. The dimensional and clearance requirements for the metal enclosure will be the responsibility of the manufacturer and their dimensions must be coordinated with the switchgear. Bushings shall generally be in accordance with the requirements of IEC publication 137 as applicable.

B) Insulation levels and creepage distances

All bushings shall have an impulse and power frequency withstand level that is greater than or equal to the levels specified for GIS. The creepage distance over the external surface of outdoor bushings shall not be less than 25 mm/kV.

C) Bushing types and fitting

Condenser type bushings will be preferred but alternative types can also be considered. Liquid filled bushings shall be provided with liquid level gauges clearly visible from ground level, preferably of the direct reading prismatic type or the magnetic type. Other types of liquid level gauges will only be accepted if specifically approved.

D) Mechanical forces on bushing terminals

Outdoor bushings must be capable of withstanding cantilever forces due to weight of busduct and short circuit forces. Design calculations in support of the cantilever strength chosen shall be submitted for purchaser's review and approval.

21.0 SURGE ARRESTERS

The surge arresters shall conform in general to latest IEC –60099-4.

21.1 INSULATION CO-ORDINATION AND SELECTION OF SURGE ARRESTER

The ~~contractor~~^{bidder} shall be fully responsible for complete insulation co-ordination of switchyard including GIS. Contractor shall carry out detailed studies and design calculations to evolve the required parameters locations, energy capability etc. of surge arresters such that adequate protective margin is available between peak impulse, surge and power frequency discharge voltages and BIL of the protected requirement. The locations of surge arresters shown in single line diagram is indicative only. If the bidder feels that at some more locations the surge arresters are required to be provided the same should also be included in the offer.

The ~~contractor~~^{bidder} shall perform all necessary studies. 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 arrester and shall demonstrate that the selected arrester's protective and withstand levels, discharge and coordinating currents, and arrester ratings and comply with the requirement of this specification.

The ~~contractor~~^{bidder} 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 Purchaser's approval.

21.2 Duty requirements

- a) The surge arrester shall be of heavy duty station class and gapless (Metal oxide/ Zinc Oxide) type without any series or shunt gaps.
- b) The surge arresters shall be capable of discharging over-voltages occurring during switching of unloaded transformers and long lines.
- c) 420kV, 245kV and 145kV class arrester shall be capable of discharging energy equivalent to class 3 of IEC for a 420kV, 245kV and 145kV system on two successive operations.
- d) The reference current of the arresters shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.
- e) The surge arresters are being provided to protect the followings whose insulation levels are indicated in the table given below:-

Equipment to be protected	Lightning impulse (kVp) for 420 kV system	Switching surge (kVp) for 420 kV system	Lightning impulse (kVp) for 245 kV system	Lightning impulse (kVp) for 145 kV system
Power Transformer	± 1300	± 1050	± 950	± 550
Instrument Transformer	± 1425	± 1050	± 1050	± 650
Reactor	± 1300	± 1050	-	
CB/Isolator Phase to ground	± 1425	± 1050	± 1050	± 650
Across open contacts	± 1200 (-/+240)	± 900 (-/+345)	± 1200	± 750

21.3 Constructional Features

The nonlinear blocks shall be of inferred metal oxide/ Zinc Oxide material. These shall be provided in such a way as to obtain robust construction, with excellent mechanical and electrical properties even after repeated operations.

The arrester enclosure shall be vertically or horizontally mounted to suit the layout of the switchgear as suggested by the manufacturer and shall be fitted with a discharge counter located in an easily accessible position.

The main grounding connection from the surge arrester to the earth shall be provided by the bidder. The size of the connecting conductor shall be such that all the energy is dissipated to the ground without getting overheated.

21.4 Fittings and Accessories for outdoor SA

- a) Self contained discharge counters, suitably enclosed and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit. Suitable leakage current meters should also be supplied within the same enclosure. The reading of milliammeter and counters shall be visible through an inspection glass panel.
- b) Micro processor based instrument for monitoring resistive current or watt loss of the arrester shall also be provided.

21.5 Tests

In accordance with the requirements stipulated the surge arresters shall conform to type tests and shall be subjected to routine and acceptance tests in accordance with IEC document.

Each metaloxide block shall be tested for the guaranteed specific energy capability in addition to the routine/acceptance test as per IEC-60099.

21.6 Test on Surge Monitors:

The Surge monitors shall also be connected in series with the test specimens during residual voltage and current impulse withstand tests to verify efficacy of the same. Additional routine/functional tests with one 100A and 10kA current impulse, (8/20 micro sec.) shall also be performed on the surge monitor.

22.0 400/220/132KV GIS BUILDING

- a) The buildings shall house 400kV, 220kV and 132kV Gas Insulated Switchgear (GIS) separately and other associated equipments inside in each of the GIS building. The building shall have arrangement to maintain pressurised air in order to prevent the ingress of dust in the GIS Hall. The technical specification of Ventilation System for GIS Hall shall be as under:

The GIS hall shall have an independent ventilation system. Each ventilation system shall consist of two 100% capacity systems, one operating and one stand-by.

To ensure that the air being supplied to the GIS hall is free from dust particles, a minimum **two** stage dust filtration process shall be supplied. This shall consist of at least the following:

1. **Pre Filters:** To remove dust particles down to 10 micron in size with at least 95% efficiency.
2. **Fine Filters:** To remove dust particles down to 5 microns in size with at least 99% efficiency.

All the filters shall be panel type. Easy access should be available to the filters for replacement/cleaning.

The ventilation of the GIS hall shall be of a positive pressure type with minimum 4 air changes per hour. The pressure inside the GIS hall shall be maintained 5 mm of Water above the atmospheric pressure. Fresh outdoor air shall be filtered before being blown into the GIS hall by the air fans to avoid dust accumulation on components present in the GIS hall. Each GIS hall shall be provided with motorized exhaust dampers with local control.

- b) The bidder shall submit the design and construction proposal of the building along with necessary information, data, and drawings in the techno-commercial bid according to the complete requirements.
- c) The plot plan of floor for 400kV, 220kV and 132kV GIS building is enclosed. The dimension given is for reference only and may vary according to requirement of the equipment to be installed inside. The bidder shall finalize the dimensions according to the equipment offered by them providing enough space and access for erection, operation and maintenance. The main floor shall be at a common level through out the building to facilitate movement. Convenient routing of cables from the GIS building to control, protection and other auxiliary building shall be considered.
- d) **Electric Overhead Travelling (EOT) Crane:**

EOT cranes shall be provided in 400kV, 220kV and 132kV GIS buildings for GIS equipments handling during installation, commissioning and maintenance etc. Crane lifting capacity shall be adequate to handle at least two times the maximum weight of the heaviest package of GIS but shall not be less than 10 tonnes (for 400kV) and 6 tonnes (for 220kV & 132kV) with micro switch arrangement. Crane capacity for GIS is to match with the maximum size/weight of single unit which is required to be handled by the crane. Crane of adequate capacity commensurating with the requirements for erection & maintenance shall be provided in the 400kV, 220kV and 132kV GIS room. Capacity would have adequate safety margin of at least two times the maximum weight of the equipment to be handled. The crane shall be possible to be operated through the cable & through the pendant control, which shall be easily accessible from the floor of GIS building.

The bidder shall submit the capacity calculation of the crane. The minimum height of crane hook shall be 9.0 meter or as per actual requirement whichever is higher. The crane shall consist of all special requirements for erection and maintenance of GIS equipments. The crane shall be possible to be operated through the cable and through the pendant control, which shall be easily accessible from the floor of GIS building. *(Please refer Technical Specification for "Electric Overhead Travelling (EOT) Crane" for details).*

EOT cranes shall be supplied for 400kV, 220kV and 132kV GIS.

22.1 Extension of GIS

- (1) 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.
- (2) As the GIS is likely to be extended in future, the 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. Further GIS manufacturer supplying GIS under present scope shall furnish all the required details in addition to mentioned above necessary for design and successful implementation of an interface module during later stage while extending GIS by any other GIS manufacturer, without any help of GIS manufacturer who has supplied the GIS equipment in present scope.
- (3) The Interface module shall be designed to provide Isolating link with access hole on enclosure. The Isolating link shall be provided in such a way so that HV test can be performed on either side of the interface module separately, keeping other side of GIS remain isolated.
- (4) Further the contractor who is extending the existing GIS installation shall optimally utilize the space inside the GIS hall (including the extension portion) for accommodating the interface module being supplied under the contract and the space (along the length of the hall) inside the GIS hall for interface module shall preferably be limited to 2 meter for 400kV , 2 meter for 220kV and 1 meter for 132kV.

- 13.11 The bidders shall provide lightning mast/GS shield wire at suitable place for protection of whole sub-station including transformers, GIS cum control room building etc. The bidder shall submit detailed proposal for grounding system of whole substation including indoor and outdoor equipments with Earthmat using 40mm. dia MS rod for approval of purchaser. The riser shall be GS flat of size 75x12mm for outdoor equipments and 50x6mm for indoor.
- 13.12 The bidder shall submit detailed proposal for grounding system for approval of purchaser. Any provision to be made in the building design to take care of earthing requirement shall also be clearly spelt-out.

22.2 INSTALLATION OF GIS

- (1) Civil works of GIS Hall shall be completed in all respects for taking up the installation and it shall be ensured that all dust and dirt in the hall are removed. All openings (including Bus Duct) except entry door should be closed and proper sealed
- (2) The installation area shall be secured against entry of unauthorized personnel. Only certified manufacturer's engineer and supervisor shall supervise critical & important erection works. The help of local technicians can be taken only for material handling and non-critical erection works. Engineers and supervisors of the manufacturer shall submit authorization and competency certificate to UPPTCL.
- (3) Assembly drawing for GIS erection for the section under progress shall be available and displayed in GIS hall at the time of work.
- (4) Proper power supply shall be ensured by installing DG Set of proper rating and frequency if required prior to commencement of erection work so that assembly work is not interrupted in the middle which is critical for GIS installation.
- (5) Working personnel shall clean their shoes or apply covers on shoes before entering the immediate working area. The working clothes of authorized personnel shall be made of non fluffy material.
- (6) GIS hall door shall have automatic close facility after entry of personnel to avoid dust and moisture entry. Walls and ceiling shall be in a condition so that neither dirt nor plaster might fall or rub off and formation of condensation water in ceiling shall be prevented under any circumstances.
- (7) Floor in the installation area shall have a firm surface and shall be kept dust free with a vacuum cleaner. Vacuum cleaning to be done at regular interval throughout the day with separate team of persons assigned for cleaning work only.
- (8) Only T&P and consumables required for GIS erection shall be kept in GIS during erection.
- (9) In case of outdoor installation of GIS or of GIS components open gas compartments shall be protected from dust and moisture ingress (by tarpaulin covers etc)
- (10) Bus duct exit in the GIS hall wall shall be kept covered by suitable means until permanent cover is provided after installation of bus ducts.

- UPPTCL
- (11) A separate room shall be identified in consultation with ~~POWERGRID~~ for carrying out repair works/ small part assembly and the room shall be weather protected and lockable. All excess material (not required for immediate installation works) test equipment and tools and tackles to be stored separately from GIS hall in the separate room for rework.
- (12) All assembly work shall be done by qualified personnel only who are to be identified and list submitted to ~~POWERGRID~~ site before starting of erection work.
- UPPTCL
- (13) Erection agency shall submit method statement and make available formats for checking during each stage of hall preparation, assembly process and final checks to be approved by ~~POWERGRID~~ site before start of erection. Method statement shall include record of shock/ impact recorder at the time of unpacking. Shock recorder down loaded data and analysis shall be submitted before commencement of erection work. In case of violation of shock limits, expert from manufacturer shall visit and do the internal inspection before giving clearance for erection.
- (14) Cleaning is of utmost importance and hence before assembly, all the loose metal parts, subassemblies and all contact & sealing surfaces shall be cleaned before installation. Cleaning shall be carried out with specified cleaning agents of the manufacturer in no condition water is to be used except for external surfaces. Further, Prior to opening, gas compartment shall be thoroughly cleaned and vacuum cleaning of the installation area shall also be done specially the immediate vicinity of the flanges to be connected. Dust disturbance in the area to be avoided. Also, before closing a flange connection clean the immediate vicinity and all accessible parts of the components shall be connected with a vacuum cleaner.
- (15) Once the transport covers are removed installation of flanges shall be done without any interruptions, if interruptions cannot be avoided open flanges are to be covered with clean plastic foil. Transport covers, O-rings and other packing material shall be taken out of GIS after immediately after removal.
- (16) O Rings shall be properly stored and taken out only before installation. O Rings are also to be cleaned before use with manufacturer authorized cleaning agent.
- (17) At all points of time during installation authorized personnel shall use disposable gloves to avoid contamination.
- (18) Cable termination work shall commence only after completion of GIS equipment as during GIS installation period laying and termination of cables interferes with the GIS erection work and affects cleanliness.

23.0 SEISMIC DESIGN CRITERIA

The equipment shall be designed for operation in seismic zone for earthquake resistance. The seismic loads are due to the horizontal and vertical acceleration which may be assumed to act non concurrently. Seismic level Zone- IV, as per new IS- 1893, Year-2002 has to be considered for the design of equipment. The seismic loads shall be equal to static loads corresponding to the weight of the parts multiplied by the acceleration. The equipments along with its parts shall be strong enough and sufficiently well connected to resist total operating stresses resulting from the forces in normal operation but in case of abnormal condition shall also resist with forces superimposed due to earthquakes. The copies of type test reports for similar rated equipment, if tested earlier, should be furnished along with the

tender. If the equipment has not been type tested earlier, design calculations of simulated parameters should be furnished along with the offer.

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 the purchase's approval.

24.0 QUALITY OF SF6 GAS

- a) The SF6 gas insulated metal-clad switchgear shall be designed for use with SF6 gas complying with the recommendations of IEC 376, 376A & 376B, at the time of the first charging with gas. All SF6 gas supplied as part of the contract shall comply with the requirements of IEC as above as a minimum & should be suitable in all respects for use in the switchgear under all operating conditions.
- b) The high pressure cylinders in which SF6 gas is supplied & stored at site shall comply with the requirements of following standards & regulations:

IS: 4379 Identification of the contents of industrial gas cylinders.

IS: 7311 Seamless high carbon steel cylinders for permanent & high pressure liquefiable gases. The cylinders shall also meet Indian Boilers Regulations. (Mandatory)

- c) **Test**

SF6 gas shall be tested for purity, dew point, air, hydrolysable fluorides and water contents as per IEC:376, 376A & 376B and test certificates shall be furnished to the purchaser indicating all test results as per IEC standards for each lot of SF6 gas. Further 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.

- d) 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 and the percentage of purity of the gas on annual basis.
- e) 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.

- f) 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.

25.0 SF6 GAS MONITORING DEVICES AND ALARM CIRCUITS

- 25.1 Dial type temperature compensated gas density or density monitoring devices with associated pressure gauge will be provided. The devices shall provide continuous and automatic monitoring of the state of the gas and a separate device shall be provided for each gas compartment so that each compartment can be monitored simultaneously as follows:-

1) Compartments except circuit breaker

a) Gas Refill level

This will be used to annunciate the need for the gas refilling. The contractor shall provide a contact for remote indication.

b) 'Zone Trip' level

This is the minimum level at which the manufacturer will guarantee the insulation rating of the assembly. Contacts shall be in accordance with requirement.

2) Circuit Breaker

a) 'Gas Refill' level

This will be used to annunciate the need for gas refilling. The contractor shall provide a contact for remote indication.

b) 'Breaker Block' level

This is the minimum gas density at which the manufacturer will guarantee the rated fault interrupting capability of the breaker. At this level the breaker block contact shall operate & the trip-ping & closing circuit shall be blocked.

c) 'Zone Trip' level

This is the minimum level at which the manufacturer will guarantee the insulation rating of the assembly. Contacts shall be in accordance with requirement.

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.

25.2 a) Gas Leakage

The maximum gas leakage shall not exceed 0.5% (half percent) per year for the whole equipment and for any individual gas compartment separately.

b) Gas Supply

The contractor shall include the supply of all SF6 gas necessary for filling & putting into operation the complete switchgear installation being supplied. In addition 20% of total gas requirement shall be supplied in separate cylinders as spare requirement, over & above the requirement of gas for successful commissioning. Pl. refer list of mandatory spares in this connection.

26.0 GAS FILLING AND EVACUATING PLANT

All the plant necessary for filling and evacuating the SF6 gas in the switchgear shall be supplied with the contract to enable any maintenance work to be carried out. This shall include all the necessary gas cylinders for temporarily storing the evacuated SF6 gas. The capacity of the temporary storage facilities shall at least be sufficient for storing the maximum quantity of gas that could be removed when carrying out maintenance or repair work on the switchgear and associate equipment of at least one complete bay.

Where any item of the filling and evacuating plant is of such a weight that it cannot easily be carried by maintenance personnel, it shall be provided with lifting hooks for lifting and moving with the overhead cranes.

The capacity of evacuation plant will be as under :

Vacuum Pump: 40 M3/Hour (Nominal suction pressure)

Compressor: 15 M3/Hour (Delivery)

The evacuation equipment shall be provided with all the necessary pipes, couplings, flexible tubes and valves for coupling up to the switchgear for filling or evacuating all the gases.

The gas compartments shall preferably be fitted with permanent non-return valves through which the gas is pumped into or evacuated from the compartments.

Details of the filling and evacuating plant that will be supplied, as well as the description of the filling and evacuating procedures shall be provided along with the bid.

27.0 SF6 GIS TO XLPE CABLE TERMINATION

- 27.1 The underground cables shall be connected to GIS by the interfacing of XLPE cable sealing end to GIS Cable termination enclosure.
- 27.2 The SF6 GIS to XLPE cable termination shall conform to IEC-859 (latest edition).
- 27.3 The rating of XLPE cables for different voltages are specified in the Technical specification.
- 27.4 Cable termination kit shall be in the scope of the contractor. The ducts and the casing shall be suitable for the requirements for which it is designed. This interface section shall be designed in a manner which will allow ease of operation and maintenance.
- 27.5 The provision shall be made for a removable link. The gap created when the link is removed should have sufficient electric strength to withstand the switchgear high voltage site tests. The bidder may suggest alternative arrangements to meet these requirements. 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.
- 27.6 All supporting structures for the SF6 bus-duct connections between the XLPE cable sealing ends and the GIS shall be supplied by the supplier. The supplier may specify alternative connecting & supporting arrangements for approval of the purchaser.
- 27.7 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. The typical arrangement drawing of interconnecting bus-duct from GIS bay module to XLPE cable termination end shall be submitted along with offer.

28.0 TRANSFORMER / REACTOR TERMINATION MODULE (If applicable)

- 28.1 The transformer / reactor termination module enables a direct transition from the SF6 gas insulation to the bushing of an oil-insulated transformer / reactor. For this purpose, the transformer / reactor bushing must be oil-tight, gas-tight and pressure resistant. Any temperature related movement and irregular setting of the switchgear's or transformer's / reactor's foundations are absorbed by the expansion fittings.
- 28.2 The oil filled transformers and reactors are as shown in the substation SLD. The oil to air bushings of the transformers and reactors shall be supplied by the respective supplier's and the same shall be connected to the SF6 ducts thru air to SF6 bushings to be provided under present scope.
- 28.3 Terminal connection arrangement to connect GIS duct to bushing and duct mounting arrangement details shall be submitted during detailed engineering for Purchaser's approval and for co-ordination with transformer and reactor supplier. Any modification suggested by autotransformer and reactor supplier shall have to

be carried out by the supplier to facilitate proper connection with the bushings of the autotransformer and reactors.

- 28.4 In case of single phase transformers are being installed in the substation, HV & IV auxiliary bus for the transformer bank for connecting spare unit shall be formed inside the GIS hall as per the SLD furnished and as specified in the specification.
- 28.5 In case of single phase reactors are being installed in the substation auxiliary bus of rated voltage for the reactor bank for connecting spare unit shall be formed inside the GIS hall as per the SLD furnished and as specified in Section project.
- 28.6 The transformer shall be of conventional type and are required to be interconnected to conventional line equipments. The transformer bays are to be connected by XLPE cables/ using suitable length SF6 Bus Duct (with suitable support structure) and SF6 to Air Termination to conventional equipments/ switchgears. The tentative/ indicative arrangement for termination at transformer end is shown (only for reference purpose). However the actual arrangement shall be proposed/ indicated by bidders in their bids. The final arrangement for transformer and line bays shall be got approved by the successful bidder by the purchaser before execution.

29.0 GAS INSULATED BUS DUCT

The components of the GIS shall be connected by a single phase bus ducts. The enclosure shall be connected by use of bolted and gasketed joints. The bus conductor shall be connected with plug in contacts with silver plated contact surface. The bus system shall be capable of withstand the mechanical and thermal stresses due to short circuit currents, as well as thermal expansion and contraction created by temperature cycling.

29.1 Gas Insulated Bus (GIB) layout :

GIB shall be designed based on the following criteria

- (1) Maximum weight of gas in a gas tight section of GIB shall not exceed 400 Kg (for 400 kV)/ 250 Kg (for 220 kV & 132 kV).
- (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 (1) meter.
- (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 UPPTCL and the vertical clearance between layers shall be minimum one (1) meter in such case.
- (4) The minimum outer to outer horizontal clearance between each GIS bus duct shall be 0.75 meter for 400 kV voltage level and 0.5 meter for 220 kV & 132 kV voltage level.
- (5) The minimum vertical ground clearance of GIB at road crossing shall be 5.5 meters

AS PER IEC / ISS

AS PER IEC / ISS

- (6) The horizontal clearance between GIB and GIS building /any other building wall shall be minimum three (3) meters.
- (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.
- (8) The GIB height outside the GIS hall in switchyard area shall not obstruct easy access to GIB, movement of crane for maintenance work.
- (9) Optimisation of outdoor GIB length using overhead AIS connection with Bus Post Insulator of respective voltage class is generally acceptable subject to meeting the electrical clearances as stipulated.
- (10) For the maintenance of GIB of one circuit, only that circuit shall be isolated.

30.0 SF6/AIR BUSHINGS

30.1 GENERAL

Outdoor SF6 to air bushings, for the connection between the GIS and overhead lines or conventional air insulated equipment shall be furnished where specified. Bushings shall comply with the relevant IEC standards. The bushings can be with composite insulators (Silicone rubber) or with porcelain insulators with all surfaces free from imperfections. The internal insulation of the bushings can be a resin impregnated paper winding (RIP body) or compressed SF6-gas. The internal and external electrical field of the bushings can be controlled by a capacitive grading body /grading shields. The RIP body must consists of resin impregnated paper insulation with concentric aluminium layers. The space between the RIP body and the insulator must be filled with insulating foam compound or compressed SF6-gas. Bushings with porcelain insulators must designed to cause negligible damages in case of porcelain rupture, having either a low pressure volume or a small SF6-gas volume next to the porcelain.

30.2 Insulation levels and creepage distances:

The insulation levels are applicable to normal sea level atmospheric conditions. The creepage distance over the external surface of outdoor bushings shall not be less than 25 mm/kV.

30.3 Mechanical forces on bushing terminals:

Outdoor bushings must be capable of withstanding a cantilever force applied to the terminal of at least 2500 N.

30.4 Interface definition

The flange and conductor connection between bushing and GIS component shall be the standard of the GIS supplier.

31.0 LOCAL CONTROL CUBICLE (LCC)

31.1 GENERAL

A local control cubicle (LCC) shall be supplied for the local control and operation of each GIS circuit breaker bay. Each LCC shall contain the local control, interlocking, operation and indication devices associated with the GIS bay.

The LCCs shall be free-standing / integrated with the GIS switchgear. A general arrangement drawing showing the installation position shall be submitted with the quotation.

The LCCs shall be installed indoors but care must be taken with the design to ensure that all LCCs are drip, weather proof and splash proof. The LCCs shall also be dust and vermin proof. The control and operation circuits shall be well shielded and with safety measures to protect operator from touching energized parts. Power frequency withstand of control circuits shall be 2 kV for 1 minute.

31.2 Required features for local control cabinets

The LCCs shall be provided with the following features:

- a) A mimic diagram showing the single line diagram. Position indicators, on/off switches for the HV devices and local / off / remote switches shall be installed on or adjacent to the various symbols of the mimic diagram. The following devices shall be supplied as a minimum:
 - Circuit breaker control switch with two indicating lights.
 - Circuit breaker "local-remote" selector switch.
 - Disconnect switch control switch with two indicating lights.
 - Grounding switch control switch with two indicating lights.
 - Mimic bus including symbols according to the single line diagram.
 - Annunciator panel.
- b) Any interposing relays and control switches associated with the circuit breakers, disconnect switches, grounding switches etc.
- c) The alarm and indication devices specified.
- d) Fuses and links. These shall be installed in the interior of the LCCs.
- e) Terminal blocks for the terminating and marshaling of auxiliary supply circuits, control, interlocking, indication and alarm circuits from the GIS and for cable connections to the remote control room or the purchaser's control system.
- f) Each LCC shall be furnished with a guarded resistance heater to prevent the internal equipment from humidity deposit. The heater shall be rated 230V AC and fed through a two pole fused disconnect switch.
- g) A fluorescent lamp and a duplex convenience outlet rated 230V AC, 15 amps with ground fault interrupter shall be installed in each LCC.

31.3 Cable connections within the GIS and their LCC's

All cable connections between the various GIS modules and the LCCs shall be made by prefabricated multi-core cables with multipoint plug-in connections on both ends. PTs and CTs shall be hard wired. All cables shall be shielded and adequate for their application (indoor/ outdoor). The cables shall be fire retardant and PVC-free.

The wiring must be carried out with stranded copper conductors of at least 7 strands. The size of the conductors shall be suitable enough for the expected usage, but it must not be less than 1.5 sq.mm.

All precautions should be taken to minimize the inductive and capacity coupling between circuits of especially with the wiring of the AC and DC circuits.

The cable trays shall be designed in such a way that it has at least 20% space for future usage.

31.4 Terminal Blocks

The design of the terminal shall be as per the relevant standards in vogue.

The terminals permitting the direct control of SF6 surveillance from pressure monitoring devices must be fitted with test point.

The outgoing terminal connection must be unique and comprises of 2 distinct parts:

- an arrangement for auxiliary voltage supply (alternating or direct current)
- an arrangement for control common.

31.5 Worker Safety

All precautions must be taken to ensure an efficient protection against accidental contact with the live elements.

31.6 Degree of protection

The required level of protection shall be established for the enclosures of boxes and cubicles as per the relevant standards in vogue.

31.7 Frame work

The boxes and cubicles shall have metallic enclosures to ensure effective protection against radio interference. If these enclosures are of non-metallic materials, the screen shall be connected to the earth to ensure efficient protection.

31.8 Cable entrance

Cable glands or grommets shall be provided for cable entry through the lower side. These cable glands should avoid electrolytic corrosion at the lower side of the box.

31.9 Closing devices

A simple handle will be suffice at the door of the cubicles. The door must open at at least 120 deg.

31.10 Lighting and socket

Lighting facility at the cubicles shall be activated by opening the door. In each local control cubicle a single phase 3 pin socket with switch shall also be provided. The lighting points and sockets should be connected by a circuit separate from other circuits.

31.11 Space heaters

In each box and local control cubicle a space heater is required to prevent condensation. It should be connected by the same separate A.C. circuit as above.

Space heaters shall be of hygrostat with PTC heaters (Positive thermal coefficient heaters)

The manufacturer shall indicate the electrical power of each heater.

31.12 Earthing of boxes and cubicles

Depending upon the location of boxes and cubicles, the earthing terminal is either linked to the metal enclosure, or linked directly to the general earth mat by an earthing conductor of reduced cross – section.

Equipotential connections between boxes, cubicles and doors shall be provided to ensure that no movable part of the enclosure can, once it is in place, be isolated from the part to which the earthing terminal is connected.

32.0 PAINTING OF ENCLOSURE

All enclosures shall be painted externally as per manufacturer's painting procedure. The painting procedures as followed shall be enclosed with the bid.

33.0 HEATERS

Wherever required, heaters shall be provided to prevent moisture condensation. Heaters are not allowed in side the main circuit.

34.0 IDENTIFICATION AND RATING PLATE

- i) Each bay shall have a nameplate showing
 - a) A listing of the basic equipment from air entrance bushing to air entrance bushing (such as a breaker, disconnectors grounding switches, current transformers, voltage transformers, and bushings).
 - b) A schematic diagram indicating their relative locations.

- c) UPPTCL Contract Number.
- ii) Each module will have its own Identification & rating plate.

The rating plate marking for each individual equipments like circuit breaker, disconnectors grounding switches, current transformer, voltage transformers, surge arrester etc shall be as per their relevant IEC.

35.0 QUALITY ASSURANCE PLAN

- 35.1 The Bidder shall invariably furnish the following information alongwith the offer, failing which the offer will be liable for rejection.

- i) Statement giving list of important raw materials.
- ii) Names of sub suppliers for the raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials in the presence of Bidder's representative and copy of test certificates.
- iii) Information and copies of test certificate as in (ii) above in respect of bought out accessories also.
- iv) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such test and inspections.
- v) Special features provided in the equipment to make them maintenance free.
- vi) List of testing equipment available with the bidder for final testing of GIS and the limitations of these equipments and other available facilities. These limitations shall be clearly out in the relevant schedule.

- 35.2 The successful bidder shall within 30 days of placement of order, submit the following information to the Purchaser:

- i) List of raw materials and bought out accessories and the names of sub-suppliers selected from those furnished along with offers.
- ii) A quality assurance plan (QAP) and "hold points" for Purchaser's inspection. The quality assurance plan and hold points shall be discussed between the Purchaser and the Bidder before the QAP is finalized.

- 35.3 The successful bidder shall submit the routine test certificate of bought out items and raw materials, at the time of routine testing of the fully assembled GIS.

36.0 DRAWINGS AND DOCUMENTS

- 36.1 All drawings shall conform to International Standards Organization (ISO) 'A' series of drawing sheet/Indian Standards Specification IS-656. All drawings shall be suitable for micro filming. All dimensions and data shall be only in S.I. units.
- 36.2 List of Drawings and Documents to be submitted.
- 36.2.1 The bidder shall furnish three sets of the followings drawings and documents along with the offers:
- i) A detailed single line diagram of the GIS offered, in line with the single line diagram enclosed with this specification indicating clearly the switching scheme, busbar nomenclature, switchgear and instrument transformer locations, CT core positions and numbers, earthing switch locations, no. of outgoing feeders and future extension, possible etc.
 - ii) General layout (both plan and elevation) and sectional view drawings for the GIS. These drawings shall clearly show the recommended clearances for safe operation and maintenance of the switchgear including the required lifting clearances for installation, floor area required etc. These drawings shall also show the location and general arrangement of all auxiliary devices and terminal arrangement. The equipment under scope of supply shall be marked. All dimensions shall be in mm.
 - iii) Required AC and DC schematic diagrams and detailed wiring.
 - iv) Drawings, technical details and operational capabilities of the SF6 gas handling unit proposed for use with this installation.
 - v) Description of untanking procedure for circuit breaker diagrams and detailed wiring diagrams.
 - vi) Details of circuit breaker interrupting chambers and operating mechanism.
 - vii) Details of disconnectors, earthing switches and associated operating mechanisms.
 - viii) Details of current and potential transformer construction, including types of insulation materials used.
 - ix) Details of gas pressure/density monitoring system and devices.
 - x) General arrangement and details of control cubicle and its components.
 - xi) Details of annunciation system proposed, including typical schematic or wiring diagram.
 - xii) Details of electrical and mechanical interlocking system proposed.
 - xiii) Details of support structures.
 - xiv) Material specification for various equipment components.
 - xv) Painting systems, cleaning and application procedures.
 - xvi) Copies of relevant pressure vessel codes of which the pressurized enclosures conform.
 - xvii) Copies in English of the standards to which the gas insulated switchgear and auxiliaries will conform, if different from those specified in clause 2.0.

- 36.2.2 The successful bidder shall, within 4 weeks of placement of order, submit three (3) sets of final version of all the above drawings and documents for the Purchaser approval. After receipt of the Purchaser's approval, the bidder shall submit adequate number of prints and reproducible (of approved drawings) for the Purchaser's use. The exact number of copies required for this purpose shall be mutually decided between the Purchaser and the successful bidder. Adequate number of copies of finally approved "Technical data sheets" shall also be submitted by the successful bidder.
- 36.2.3 The successful bidder shall also furnish 5(five) copies of manuals covering erection, commissioning, operation and maintenance instruction and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices. Marked erection drawings shall identify the component parts of the equipment, as shipped, to enable the Purchaser to carry out erection with his own personnel. Each manual shall also contain one set of all the approved drawings, type test reports as well as acceptance reports of the corresponding consignment dispatched.
- 36.2.4 The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication work in connection with equipment prior to the approval of the drawing shall be at Bidder's risk.
- 36.2.5 Approval of drawings and documents by the Purchaser shall not relieve the bidder of any of their responsibilities for ensuring correctness and correct interpretation of the drawings for meeting the requirements of the latest revision of the applicable standards and codes of practices. The equipment shall conform in all the respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of supply and the Purchaser shall have the power to reject any work or materials which in their judgment is not in full accordance therewith.
- 36.3.0 Test Reports.
- 36.3.1 Four copies of type test reports, if conducted afresh, shall be furnished to the Purchaser within one month of conducting the test. If found in order one copy will be returned duly certified by the Purchaser to the bidder. The bidder shall go ahead with commercial production of the concerned material.
- 36.3.2 All record of routine test reports shall be maintained by the bidder at his works for periodic inspection by the Purchaser.
- 36.3.3 After conducting all performance tests and site and acceptance of the same by the Purchaser, four sets of complete test reports of the same shall be submitted by the bidder.

37.0 PACKING AND FORWARDING

- 37.1 The equipment shall be packed in suitable crates so as to withstand handling during transit. The bidder shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing and handling. The easily damageable materials shall be carefully packed and marked with appropriate caution symbols. Wherever necessary, proper arrangement for lifting such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be made up by the Bidder immediately without any extra cost. The order number shall be indelibly marked on each packing case.
- 37.2 Each consignment shall be accompanied by a detailed packing list containing the following information:
- a) Name of the consignee
 - b) Details of consignment
 - c) Destination
 - d) Total weight of consignment
 - e) Sign showing upper/lower side of the crate
 - f) Handling and unpacking instructions
 - g) Bill of materials indicating contents of each package and spare material.
- 37.3 The bidder shall ensure that the packing list and bill of material are approved by the Purchaser before despatch.
- 37.4 The size of each transportable unit of SF6 metalclad equipment shall be in the assembled units as large as possible so as to reduce the amount of field installation work on site to a minimum. Auxiliary cabinets with secondary equipment shall be transported as completely assembled units.
- 37.5 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. Should the units be considered too large for packing in crates, they shall be suitably lagged and protected to prevent damage to any part, particularly small projections, during transport and handling. Special lugs or protective supports shall be provided for lifting to prevent slings and other lifting equipment from causing damage. Each crate, container or shipping unit shall be marked clearly on the outside to show where the weight is bearing and the correct position for the slings.
- 37.6 The type of packing used must be suitable for the means of transportation use from the manufacture's works to the installation site.
- 37.7 The packing must be suitable for outdoor storage of the equipment. Sufficient drying agent shall be provided in the packing to absorb condensed moisture.
- 37.8 Care shall be taken to seal off connecting flanges of the individual switchgear bays which are not yet connected to prevent damage and ingress of contamination into the gas compartment. Machined sealing surfaces must be suitably protected

against mechanical damage and corrosion. Sealing surfaces which are exposed to the atmosphere during transport must be protected by a protective coating.

- 37.9 The static filters provided for the inside of the gas compartment which are not pre-filled shall not be installed before transportation but separately packed in airtight sealed tin cans and marked suitably.
- 37.10 All interconnecting control cables and gas piping which are not directly mounted on the bay shall be packed separately and suitably marked.
- 37.11 The modules shall be properly treated with dry air or nitrogen during transportation. The initial filling of the switchgear shall be transported separately in approved steel cylinders marked according to international regulations.
- 37.12 Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. This applies particularly to the metalclad 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. 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.
- 37.13 Valves and other gas couplings associated with the switchgear gas systems shall be adequately protected against damage from any bumps or physical blows. They shall also be capped to prevent ingress of dirt or moisture or damage to any coupling, pipes, threads or special fittings. Any explosion vents and other pressure relief devices, shall be suitably sealed and protected to prevent accidental exposure of the sealed sections during shipment to site.
- 37.14 For bus ducts involving male and female joints of the current carrying conductor, the same shall be transported in disassembled condition to avoid any damage during transit. All bright parts liable to rust shall receive a coat of anti rusting composition and shall be suitably protected.
- 37.15 The contractor shall ensure that during the period between arrival at site and erection, all materials and parts of the contract works are suitably stored in such approved manner as to prevent damage by weather, corrosion, insects, vermin or fungoral growth. The scope of providing the necessary protection, storing off the ground, as required etc. is included in the works to be performed by the contractor.
- 37.16 The equipment shall only be unpacked or removed from the containers immediately prior to being installed. They shall not be left lying unnecessarily in open crates or containers. Special precautions shall be taken when gas sections which have been sealed and pressurized for shipping are opened up to reduce the ingress of dirt and atmospheric moisture to a minimum. Whenever possible this shall only be done immediately prior to installation and if any section is to be left

outside for any length of time after being opened, it shall be resealed and pressurized with either dry nitrogen/air or SF6 gas until required.

- 37.17 Each individual piece to be shipped, whether crate, container or large unit, shall be marked with a notation of the part or parts contained therein. Marking of transport containers must be approved by the purchaser. Guidelines for special marking must be followed meticulously to ensure positive identification at the job site.
- 37.18 A packing list must be provided for each individual packing unit to enable the Purchaser's personnel to identify the unit clearly at the site.

38.0 TESTS

38.1 Type Tests

- 38.1.1 The GIS offered shall be fully type tested as per IEC: 62271-203 and other relevant standards. The individual switchgear and control gear equipment of the GIS offered shall also be type tested as per relevant IEC standards. The bidder shall submit type test reports for the following type tests.

Sl.No.	Description of the Type Test
1.	Tests to verify the insulation level of the equipment and dielectric test on auxiliary circuits
2.	Tests to prove the temperature rise of any part of the equipment and measurement of the resistance of the main circuit
3.	Tests to prove the ability of the main and Earthing circuits to carry the rated peak and rated short time withstand current
4.	Tests to verify the making and breaking capacity of the included switching devices
5.	Tests to prove the satisfactory operation of the included switching devices
6.	Tests to prove the strength of the enclosures
7.	Gas tightness tests
8.	Tests on partitions
9.	Tests to prove the satisfactory operation at limit temperatures
10.	Tests to assess the effects of arcing due to internal fault
11.	Verification of the degree of protection of the enclosure
12.	Tests to prove performance under thermal cycling and gas tightness tests on insulators
13.	Additional tests on auxiliary and control circuits
14.	Tests to prove the radio interference voltage (RIV) level (if applicable)
15.	Electromagnetic Compatibility Test (EMC)

38.1.2 In case that the equipment of the type and design offered has already been type tested, the bidder shall furnish type test reports which are certified by internationally authorized/accredited laboratory along with the offer. The type test reports of GIS offered and the individual switchgear and control gear equipment of the GIS offered shall not be earlier than ~~SEVEN~~^{TEN} years as on the date of opening of bids. The Purchaser reserves the right to demand repetition of some or all the type tests in the presence of the Purchaser's representative without any extra cost.

38.1.3 The Purchaser may decide to get some or all for the following "special type tests" conducted. The type test charges for these tests shall be quoted along with other type tested as per IEC: 62271-203.

- i) Radio interference voltage (RIV) level test.
- ii) Internal arc test
- iii) Thermal stability tests
- iv) Operation tests at limit temperature
- v) Gas tightness test

38.1.4 Type tests on components:

complete latest type test reports for all the components like circuit breaker, disconnector, earthing switches, CT, VT, etc, as referred in the relevant clauses above and as per relevant IEC standards shall be furnished along with the offer.

38.2 Acceptance/Routine tests:

All acceptance /routine tests as per the relevant IEC standard shall be conducted on the GIS and its components. The Bidder shall include the proposed factory test and site test procedure in the offer.

38.3 Performance Tests:

Performance tests will be carried out to prove that the equipment meets the requirements of the specification and guarantee. All tests shall be conducted by the successful Bidder subject to the Purchaser's approval. The successful Bidder shall supply all consumables, material, equipment, meters, gauges and the like necessary for the performance of all tests and recording the results of the tests and assume full responsibility for the operation and safety of the equipment during all tests. The performance tests shall comprise of:

- a) Field stage tests, to be carried out during erection, to demonstrate that the equipment or any component or sub-assembly has been properly erected and functions correctly.
- b) Commissioning tests, to be conducted on completion of erection.
- c) Final acceptance tests, precedent to issue of a final acceptance certificate by the Purchaser, to prove compliance with guaranteed parameters.

38.3.1 Field Stage Tests:

These tests shall include but not be limited to the following:

- i) Continuous testing of the properties of SF6 gas through the entire filling period.
- ii) Test to check the continuity of wiring and correct operation of electrical systems.
- iii) Testing of all current carrying parts and ground connection of all conductors and terminal pads to ensure that full clamping pressure is applied to all contact surfaces and all bolted connections are tightly secured with lock washers. Testing of all flexible connections to ensure that sufficient slack is available for expansion.
- iv) Inspection of pressure relief devices, pressure gauges and all other auxiliary devices, to ensure correct operation. All the above tests shall be carried out by the Purchaser's site Engineers.

38.3.2 Commissioning Test:

On completion of the erection and installation of the GIS along with all accessories, control cubicles, cabling etc. the bidder shall give a written certificate to the Purchaser, stating that the equipment has been erected and installed in accordance with the erection manual and approved drawings and that the equipment is now ready for carrying out the commissioning tests. The commissioning test shall demonstrate that all guarantees have been met by the bidder and the entire equipment including all auxiliary equipment and accessories has been properly erected, installed and correctly adjusted.

Following are the commissioning tests to be carried out:

- i) High voltage tests on the main circuit.
- ii) Dielectric/Megger test on auxiliary and control cables.
- ii) Operation tests and sealed tests.
- iv) Measurement of contact resistance of the main circuit.
- v) Measurement of SF6 gas condition.
- vi) Check on gas density monitors and measurement of moisture content.
- vii) Gas tightness test.
- viii) Proper function verification test for interlock and all control, measuring, protective and regulating equipment including heating and lighting.

38.3.3 A test shall also be carried out by the bidder to prove the absence of dangerous circulating in the enclosure and other metal part such as pipes and framework which are not intended for such currents.

38.3.4 The bidder shall provide one set of high voltage test equipment suitable for testing of 400kV, 220kV and 132kV GIS and include in the offer.

HV TEST KIT ON RETURNABLE BASIS

38.4 General Condition For Tests:

- 38.4.1 Immediately after finalization of the program of type/ acceptance/ routine testing, the successful bidder shall give sufficient advance intimation to the Purchaser so as to enable Purchaser depute their representative for witnessing the tests.
- 38.4.2 The Purchaser reserves the right to carry out tests of reasonable nature, other than those mentioned in this specification at the work of the Bidder; site or any recognized laboratory/ research Institute at the cost of Purchaser to satisfy that the material complies with the intent of this specification.
- 38.4.3 Should the tests prove existence of any fault in the equipment of failure to meet the requirements of this specification, the Purchaser may direct the bidder to remedy the defects or repair/ reconstruct or replace work and the bidder shall, without delay, carry out the instruction of the Purchaser in this respect, without any extra cost.
- 38.4.4 Supplier shall arrange the necessary testing equipment at site for carrying out all the performance tests as per clause 30.3

TABLE-I A-I REFER ANNEXURE-A

REQUIREMENTS FOR 420 kV CURRENT TRANSFORMER

No. of cores	Core no.	Application	Current ratio	Output Burden (VA)	Accuracy Class as Per IEC: 44-1	Min. Knee pt. Voltage Vk	Max. CT Sec. Wdg. Resistance (ohm)	Max. Excitation current at Vk (in mA)
5	1	BUS DIFF CHECK	3000-2000-1000/1	-	PS	2000/2000/1000	15/10/5	20 on 2000/1 tap, 30 on 2000/1 tap, 60 on 1000/1 tap
	2	BUS DIFF MAIN	3000-2000-1000/1	-	PS	2000/2000/1000	15/10/5	20 on 2000/1 tap, 30 on 2000/1 tap, 60 on 1000/1 tap
	3	METERING	3000-2000-1000/1	20 20 20	0.2 0.2 0.2	-	-	-
	4	TRANS BACK UP/ LINE PRTN.	3000-2000-1000/1	-	PS	4000/4000/2000	15/10/5	20 on 2000/1 tap, 30 on 2000/1 tap, 60 on 1000/1 tap
	5	TRANS DIFF/ LINE PRTN.	3000-2000-1000/1	-	PS	4000/4000/2000	15/10/5	20 on 2000/1 tap, 30 on 2000/1 tap, 60 on 1000/1 tap

TABLE-I A-II

REQUIREMENTS FOR 420 kV CURRENT TRANSFORMER

No. of	Core no.	Application	Current ratio	Output Burden	Accuracy Class as	Min. Knee pt.	Max. CT Sec.	Max. Excitation current at Vk
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cores				(VA)	Per IEC: 44-1	Voltage Vk	Wdg. Resistance (ohm)	(in mA)
5	1	BUS DIFF CHECK	2000- 1000/1	-	-	2000/ 1000	10/5	30 on 2000/1 tap 60 on 1000/1 tap
	2	BUS DIFF MAIN	2000- 1000/1	-	-	2000/ 1000	10/5	30 on 2000/1 tap 60 on 1000/1 tap
	3	METERING	2000- 1000- 500/1	20 20 20	0.2 0.2 0.2	-	-	-
	4	TRANS BACK UP/ LINE PRTN.	2000- 1000- 500/1	-	-	4000/ 2000/ 1000	10/5/2.5	30 on 2000/1 tap. 60 on 1000/1 tap 120 on 500/1 tap
	5	TRANS DIFF/ LINE PRTN.	2000- 1000- 500/1	-	-	4000/ 2000/ 1000	10/5/2.5	30 on 2000/1 tap. 60 on 1000/1 tap 120 on 500/1 tap

TABLE-I B REFER ANNEXURE-A

REQUIREMENTS FOR 245 kV CURRENT TRANSFORMER

No. of cores	Core no.	Application	Current ratio	Output Burden (VA)	Accuracy Class as Per IEC: 44-1	Min. Knee pt. Voltage Vk	Max. CT Sec. Wdg. Resistance (ohm)	Max. Excitation current at Vk (in mA)
5	1	BUS DIFF CHECK	2000- 1000- 500/1	-	PS	2000/ 1000/ 500	10/5/2.5	30 on 2000/1 tap. 60 on 1000/1 tap 120 on 500/1 tap
	2	BUS DIFF MAIN	2000- 1000- 500/1	-	PS	2000/ 1000/ 500	10/5/2.5	30 on 2000/1 tap. 60 on 1000/1 tap 120 on 500/1 tap
	3	METERING	2000- 1000- 500/1	20	0.2	-	-	-
	4	TRANS BACK UP/ LINE PRTN.	2000- 1000- 500/1	-	PS	2000/ 1000/ 500	10/5/2.5	30 on 2000/1 tap. 60 on 1000/1 tap 120 on 500/1 tap
	5	TRANS DIFF/ LINE PRTN.	2000- 1000- 500/1	-	PS	2000/ 1000/ 500	10/5/2.5	30 on 2000/1 tap. 60 on 1000/1 tap 120 on 500/1 tap

Note:

1. All relaying CTs shall be of accuracy class PS as per IS: 2705.
2. Instrument Security Factor for Metering Core should not exceed 5.
3. Burden and Knee Point Voltage etc. as mentioned are indicative and shall be approved during detailed engineering by the purchaser as per requirement/ calculation for overall protection needs.
4. The Bidder will ensure compatibility of CT and numerical relay in respect of knee-point voltage as well as operating time of relay to avoid mal-functioning or damage to the numerical relay.

TABLE-I C REFER ANNEXURE-A

REQUIREMENTS FOR 145 KV CURRENT TRANSFORMERS

No. of Cores	Core No.	Application	Current ratio	Output burden (VA)	Accuracy class as per IEC: 44-1	Min. knee pt. voltage (Vk)	Max. CT sec. wdg. resistance (ohms)	Max. Excitation current at Vk (In mA)
5	1	BUS DIFF CHECK	1600-800-400/1	-	PS	1600/800/400	8/4/2	25 on 1600/1 tap. 50 on 800/1 tap 100 on 400/1 tap
	2	BUS DIFF MAIN	1600-800-400/1	-	PS	1600/800/400	8/4/2	25 on 1600/1 tap. 50 on 800/1 tap 100 on 400/1 tap
	3	METERING	1600-800-400/1	20	0.2	-	-	-
	4	TRANS. BACK UP/ LINE PROT.	1600-800-400/1	-	PS	1600/800/400	8/4/2	25 on 1600/1 tap. 50 on 800/1 tap 100 on 400/1 tap
	5	TRANS. DIFF/ LINE PROT.	1600-800-400/1	-	PS	1600/800/400	8/4/2	25 on 1600/1 tap. 50 on 800/1 tap 100 on 400/1 tap

Note:

1. All relaying CTs shall be of accuracy class PS as per IS: 2705.
2. Instrument Security Factor for Metering Core should not exceed 5.
3. Burden and Knee Point Voltage etc. as mentioned are indicative and shall be approved during detailed engineering by the purchaser as per requirement/ calculation for overall protection needs.
4. The Bidder will ensure compatibility of CT and numerical relay in respect of knee-point voltage as well as operating time of relay to avoid mal-functioning or damage to the numerical relay.

TABLE-II A REFER ANNEXURE-A

REQUIREMENT OF VOLTAGE TRANSFORMERS

Sl. No.	PARTICULARS	400 kV	220 kV	132 kV
1.	Rated primary voltage	420/ $\sqrt{3}$ kV	245/ $\sqrt{3}$ kV	145/ $\sqrt{3}$ kV
2.	Type	Electromagnetic, or Single phase capacitor VT	Electromagnetic	Electromagnetic
3.	No. of secondaries	3	3	3
4.	Rated voltage factor	1.2 continuous 1.5 for 30 seconds	1.2 continuous 1.5 for 30 seconds	1.2 continuous 1.5 for 30 seconds
5.	Phase angle error	± 10 minutes (for metering core)	± 10 minutes (for metering core)	± 10 minutes (for metering core)
		Sec I Sec II Sec III	Sec I Sec II Sec III	Sec I Sec II Sec III
6.	Rated voltage (V)	110/ $\sqrt{3}$ 10/ $\sqrt{3}$ 110/ $\sqrt{3}$	110/ $\sqrt{3}$ 10/ $\sqrt{3}$ 110/ $\sqrt{3}$	110/ $\sqrt{3}$ 110/ $\sqrt{3}$ 110/ $\sqrt{3}$
7.	Application	Protn Protn Metering	Protn Protn Metering	Protn Protn Metering
8.	Accuracy	3P 3P 0.2	3P 3P 0.2	3P 3P 0.2
9.	Output burden (VA) (minimum)	50 50 50	50 50 50	50 50 50

1.0 TECHNICAL SPECIFICATION FOR DEW POINT METER

The meter shall be capable of measuring the dew point of SF6 Gas of the Circuit Breaker/ GIS equipment. It should be portable and adequately protected for outdoor use. The meter shall be provided with dew point hygrometer with digital indication to display the dew point temperature in degree C., degree F or PPM. It should be capable of measuring the corresponding pressure at which dew point is being measured.

The measurement and use of the instrument must be simple, direct without the use of any other material/ chemical like dry ice/ acetone etc. It should be suitable for operation on 220 Volts AC mains supply.

Technical specification:

1. Measuring range : Upto -50 degree C Dew Point.
2. Accuracy: + 2 degree c.
3. Display: 4 digit LCD, 0.5 inch. High.

2.0 PORTABLE UHF PARTIAL DISCHARGE MONITOR FOR GIS

2.1 GENERAL

The Portable UHF Monitor detects and records the UHF signals generated by partial discharges in a GIS. The Monitor is often used to undertake surveys in substations to provide early warning of developing faults, enabling them to be corrected before complete breakdown occurs.

The Portable UHF Monitor and its associated Laptop PC are fitted into an aluminium travelling case and require only the connection of a mains supply to be ready for use. The Monitor can be left connected and unattended, when it will collect and store data from up to three couplers. The Monitor can also be connected via a modem to a telephone line and interrogated remotely.

The Monitor can be supplied with separate programs for use during the HV commissioning on new GIS and the in-service operation of the substation. For optimum sensitivity, the frequency response of the couplers used with the Monitor need to match the UHF characteristics of the ports to which they are fitted. The company should design couplers for a particular application, and calibrates them to ensure they meet the users' specification, i.e. the specification produced by The National Grid Company plc. Used in conjunction with couplers meeting that specification (and properly positioned on the GIS), the Monitor has the sensitivity required to detect all critical defects (e.g. particles, coronas, voids in a spacer, etc.) as required by CIGRE.

Following detection using the portable UHF Monitor, the UHF technique allows a defect to be located by time of flight methods using a suitable oscilloscope.

2.2 HARDWARE

Operational limits

- Supply voltage 100-230V, 50/60 Hz.
- Supply current 200mA at 230V.
- Temperature -10°C to + 50°C.
- Humidity - 95% RH.

UHF specification

- No. of channels: 3.
- Input connectors: N type sockets.
- Overall gain 35dB, with automatic three stage gain control.
- Signal detection threshold: -65dBm.
- 3dB bandwidth 100-1400MHz (no filter).
- Standard filter 500MHz (high-pass).

Features

- PD timing resolution 312µs.
- External sync 3-10V rms.
- Sync. output: 5V positive square wave.
- Automatic self-test.
- LED indicators: show power on and communication with the PC.
- If required, integrated 12V DC supply for DMS external coupler with amplifier.

Couplers & accessories

- Operation with internal or external passive couplers.
- Operation with DMS active couplers.
- Transient overvoltage protectors supplied for use with internal couplers.
- 3 co-axial cables of 5 metres and 3 co-axial cables of 10 metres complete with N connectors for the connection of couplers to the Portable UHF Monitor.

Transient overvoltages

- Electronics fully protected.
- Transient overvoltage protectors must be fitted where the system is used with internal couplers.

EMC compliance

- Circuits tested to Industrial Generic Immunity and Industrial Emission Standards.

Computer

- Removable Laptop PC with DMS software installed.
- RS232 interface to portable base unit.

2.3 SOFTWARE

Outline of data recording & display

(i) Data recorded

2D continuous data - the system continuously records both the highest amplitude and highest count rate (number of discharge pulses/second) of the coupler signals over 64 time intervals in a mains cycle to provide the point on wave distribution of the discharges.

3D snapshot data - the discharge signals in 50/60 consecutive cycles (i.e. for one second) are captured, each cycle being divided into 64 time intervals. The data is displayed in 3D oblique form and updated every few seconds. In both of these modes, specimen data from a library can be recalled.

(ii) **On line data display**

On line 2D continuous mode - the highest values of both the amplitude and count rate recorded in each time interval across the cycle are displayed. These values are held unless they are exceeded in later cycles, when they are updated. The updating continues until the display is held or cleared to start again. Every 15 minutes the records can be automatically stored, the system cleared and the procedure repeated. Software in the PC extracts the highest amplitude and highest count rate which have been recorded over each 24 hour period. This forms the history records.

On line 3D continuous mode - the system continually cycles and updates the display with 3D snapshots of the coupler output. Display data may be stored in the system library for recall and analysis.

Event mode - the system records a 3D snapshot of an event (discharge) which exceeds a programmable threshold level. These events are automatically stored and may be recalled for analysis.

(iii) **Off line data display**

History - the highest daily amplitudes and highest count rates from each coupler for the last 100 days can be recalled together with the date on which they occurred. Selecting any of these records gives the 15 minute highest amplitudes and highest count rates for the chosen day. Selecting one 15 minute period gives the highest amplitude/count rate record taken within that period.

Library - the library contains specimen snapshots and continuous data recorded from typical discharge sources and is used to assist in the identification of an unrecognised signal. Any snapshot or continuous record may be stored in the library for future reference.

3.0 **SPECIFICATION FOR AUTOMATIC RELAY TESTING KIT WITH IEC 61850, ENERGY METER TESTING FACILITY**

Sr. No.	Description	Specifications
1	Function	Shall test all types and models of distance current, voltage, frequency, reclosing relay and protection scheme of transformer reactor and busbar of all the major manufacturers in automatic as well as manual mode. Kit should be able to conduct test for Zone mapping, Zone verification, SOFT testing etc. The test kit shall be menu driven suitable for dynamic and transient testing etc, with facility of

		COMTRADE data playback. The kit shall be suitable for testing of two winding transformers Differential protection. The kit shall be suitable for testing of current, voltage and power transducers. The relay testing kit should be automatic, IEC-61850 compliant.
2.	Amplifiers	All amplifier output shall be completely independent with regard to phase amplitude and frequency and have over voltage and short circuit protection. Specifically, all the voltages and current generators shall have over-voltages/ short circuit protection
3.	Current amplifiers	Software controlled six phase AC current outputs ranging from 0-15 Amp minimum convertible to three phase AC current from 0-30 Amp minimum, with increment/resolution of 1Ma. Output power with each Current generators shall be minimum 100VA at 10 A. For single phase VA be 480 VA at 60 A.
4.	Voltage Amplifier	Software controlled Three phase voltage (AC/DC) range from 0-300Volts (AC) (Ph-G), with increment resolution of 10mV. Output power with each Voltage generators shall be minimum 85VA at 300V.
5.	Aux DC output	Software controlled 0-300V DC minimum, and should be continuous with an output power of 150W at 300V.
6.	Amplifier output frequency	Amplifier shall have controlled frequency range from 10 to 1KHz for sine and 0 to 10 KHz (minimum) for transient with resolution of 0.0001Hz or better. Accuracy should be 0.002%.
7.	Phase Angle	0 to 359 degree lead with resolution of 0.01 degree or better. Accuracy should be 0.1 degree.
8.	Guaranteed Accuracy	Shall be 0.08% of the reading +0.02% of the range or better for voltage and current output.
9.	Power supply	It shall work on single phase 110 to 240V AC, 50 Hz $\pm 5\%$, supply with variations in voltage and frequency respectively.
10.	Binary I/O Configuration	Binary inputs Binary inputs should be in two groups (8+4). 8 Binary inputs should have input characteristics of 0-250 V DC or potential free with auto detection. It should have a sampling rate of 10KHz with a resolution of 100 micro sec. Remaining 4 binary inputs should have input characteristics of 0-5 V DC or potential free. It should have a sampling rate of 100KHz with a resolution of 10 micro sec. Both should have a maximum measuring time of 9999 Sec. Binary Outputs Binary outputs should be in two groups (4+4). 4 Binary outputs should be semiconductor type with a breaking capacity of 3000VDC, 0.5A and 150W. Remaining 4 binary outputs should be potential free contacts with a breaking capacity of 300VAC, 8A, 2000VA.
11.	Measuring Inputs	It should have DC Voltage measuring inputs of range 0 to 10V with an accuracy of 0.05% of the range.

		It should have DC Current measuring inputs of range 0 to 20mA with an accuracy of 0.05% of the range. The kit should have AC Voltage measurement range 0 - 400VAC and a current range 0-20A AC with a typical accuracy of 0.05% of the range. This terminal should have the facility of measuring the phase angle with an accuracy of 0.5 degree.
12.	Repeatability	It should offer repeatability of test results in 400kV charged area.
13.	Energy meter testing	The kit should have facility to carry out 3-phase 3-wire/ 3-phase 4-wire active/reactive energy meter. Necessary software as well as hardware attachment viz optical sensor may be provided along with the kit.
14.	IEC 61850 Testing	The kit shall equipped with IEC-61850 port for connecting to substation automation LAN so that it can communicate with IED's directly on IEC- 61850 bus and exchange various information e.g. GOOSE messaging etc.
15.	Analog Recording Feature	The kit should have facility to measure and record thee internal and external analog signals like an oscilloscope. This should be done when the test is in process or otherwise it should also have the facility to record the binary inputs and output status. It also should hhave the provision of analyzing the external analog signals like Phase angle, Power, and harmonics etc. Measurement should be done directly without the help of a current clamp. Number- 10 Channels Voltage input range- 0-300V rms Current input range- 0-30A rms Amplitude accuracy-0.5% Band Width-0-1 KHz Sampling Frequency- 3.5KHz Measurement Functions- Voltage, Current, Power, Frequency, Phase Angle, Energy, Harmonics, Event recording and Transient Recording.
16.	Software	Software of the kit should be Windows based, Menu driven and user friendly. It should have all the templates/ routines/ modules/ versions/ advanced features, available or required for complete testing (including checking of all the features & dynamic testing) of different types and models of relays of all the manufacturers in automatic as well as manual mode. The preconfigured test menus/ modules/ templates/ routines should be also be possible to graphically make templates for testing any relay, with the facility of changing reach values, number of points to be tested, operating angle, fault timings etc. Without the need of winding equations or any algorithm. Specifically for distance relays, it should be possible to graphically draw the relay characteristics and test the relay at required points(in terms of impendence values) both in manual as well as in automatic mode. The software should have the

facility of searching and plotting the characteristics in 360 degree if a readymade characteristics is not provided.

For differential relay testing, the software should have the facility of testing the Pick-up 2nd and 5th harmonic restraint, slope. The software should have the facility of searching and plotting the slope if readymade slope is not provided.

It should be also having the facility of COMTRADE data playback, by accepting transient fault recorder by Distributors recorders Numerical relay from floppy & CD etc. preferably having the facility to extend prefault/ post fault durations.

The kit should also have software for testing of transducers

The kit should have Test sequence for making the custom made sequences. Further it should also generate proper report in user friendly format.

17. Inter Facing Laptop

It shall including one laptop PC of reputed brand with latest/ better specifications such as

- Intel ® Core TM 2 Duo Processor
- Genuine Windows Vista Home Premium
- Intel ®) 965PM Chipset
- 2 GB Dual channel 667 MHz DDR2 SDRAM
- 160 GB 15400RPM SATA Hard Drive
- 15.4" Wide Screen WXGA(1280X800) TFT Display
- VGA Card

4.0 CONTACT RESISTANCE METER

General

The equipment shall measure and display the static contact resistance of circuit breaker, isolator, bus bar joints and earth switches etc: directly in micro-ohms under live switchyard conditions.

Technical Specification

Ranges: 1999.9 micro ohm, 1999 micro ohm and 19.99 micro ohm.
Resolution: 0.1 micro ohm, 1 ohm, and 10 micro ohm. respectively.
Accuracy: Value : $\pm 1\%$: ± 2 digits.
Current: 200A DC,
Display: Two, 3½ digit ½ inch LCD, for current and resistance Values.
Power: 220V AC $\pm 10\%$ 50 Hz $\pm 5\%$, 30VA
Battery: Instrument operation on input rechargeable battery (12V 7AH Maintenance free).

5.0 CIRCUIT BREAKER OPERATIONAL ANALYSER

General : Main Equipment

- (i) The Computer Aided CB Analyzer system comprising of CB operation unit, programme unit, travel analyzer unit & analysis software should be capable to perform close, open, close-open, open-close, open-close, open operation on CB under test, with a facility to introduce time delays between composite operation.
- (ii) The CB Analyzer should be capable to measure, record and analyze the CB operation timing.
- (iii) The CB Analyzer should be able to measure and record current rise and fall of tripping coils as well as of closing coils of all three poles of CB simultaneously.
- (iv) The CB Analyzer should be capable to measure and record travel and speed of movement of operating mechanism of CB.
- (v) The CB Analyzer should be capable to measure and record dynamic contact resistance of main and arcing contacts of CB with injection of minimum 100 Amp. DC current.
- (vi) The CB Analyzer should be capable to measure pole discrepancy timing.
- (vii) The CB Analyzer should be capable of measuring contact closing & opening timing up to four (04) main and four(04) no. PIR contact.
- (viii) The CB Analyzer should be capable to calculate and print all contact closing & opening tuning in tabular form also.
- (ix) Suitable mounting kits for transducers and sensors, alongwith sensor cable of suitable length should be supplied with CB analyzer system.
- (x) Test leads with suitable clamp and connectors and having length suitable for leads with suitable clamp and connectors and having length suitable for connection to EHV CBs should be supplied with CB Analyzer system for
- (xi) Necessary custom built travel transformer cum fixtures suitable for mounting on BHEL/ABB/CGL/Siemens/ALSTOM (132kV and above) makes of CBs, to monitor travel related parameters like contact gap. Contact insertion, over travel etc. should be supplied with CB Analyzer.

System Operation hardware/software, peripherals and analysis software

- (i) The test report for recording motion should provide test results both in form of curve and tables. The tables should consist of calculated CB parameters such as closing/opening speed etc.
- (ii) The entry of various data/parameters (pertaining to CB) be possible sing built in display of menu.
- (iii) The battery backup and real time clock should be provided for automatic date and time functions.
- (iv)
 - a) The computer aided analysis software should have sampling frequency upto 40 KHz or more.
 - b) The analyzer should be capable to record transient phenomenon for a duration at least 500 ms.
- (v) The binary channel accuracy and analogue channel accuracy should be suitable meet all desired functions (stated above).

- (vi) The CB analyzer should be provided with facility of down loading data to a IBM compatible PC.
- (vii) The printer provided with CB analyzer should be preferably a plain paper printer.
- (viii) The computer aided CB analysis software should be supported with suitable report generation.
- (ix) It should be possible to change scale factor of time axis to enable enlarged view of part of diagram.
- (x) It should be possible to change amplitude scale to make best use of available space.
- (xi) It should be possible to study on speed curve, the damping and speed variations at CB opening and closing time.
- (xii) The CB analyzer should be supplied with portable memory bank to store test result taken by test kit to enable further down loading to centrally located PC.
- (xiii) Window based PC down loading software should be provided with CB analyzer to facilities downloading test result from memory bank to PC where it can be analyzed and stored in proper directory/file.
- (xiv) It should be possible to compare present results with previous one. The feature of Zooming the graph and moving the cursors on graph, thereby indicating instantaneous values of test parameters should also be provided.
- (xv) The latest version of CB analyzer system (hardwares and softwares) to be supplied and time to time updating of software should be offered.
- (xvi) As and when required, technical support for analysis of critical test result to be offered, on regular basis.

Other Essential Requirements

- (i) The CB analyzer should operate on power supply of 220 volts ($\pm 10\%$) at 50 Hz ($\pm 5\%$) frequency .
- (ii) The CB analyzer should be capable of working in high electro-magnetic and electrostatic conditions.
- (iii) The CB analyzer should be capable of functioning accurately in environmental condition of temperature 0° to 50° C and humidity (RH) up to 95% (non-condensing).
- (iv) The CB analyzer should be portable so as to facilitate movement from one site to other and supplied with suitable transportation case.
- (v) The supplier should have adequate after sale service facility.
- (vi) As per ISO: 9001 requirement, calibration certificates for each instrument should be supplied.
- (vii) Installation :
 - a) Indoor/outdoor
 - b) The equipment should be portable easy to handle robust and sturdy, for field applications.

6.0 SF6 GAS LEAK DETECTOR

The SF6 gas leak detector shall comprise of circuit breaker operation unit, programme unit, travel analyzer, analyzer software and transducers and other accessories.

- a) The detector shall be free from induced voltage effects .
- b) The sensing probe shall be such that it can reach all the points on the breaker where leakage is to be sensed.

7.0 SPECIFICATION FOR DIGITAL EARTH RESISTANCE METER

1.0 General:

Digital Earth Resistance Meter shall be used to measure earth resistance of substations, power transmission towers, building rods, primary cabins etc. & soil-resistivity at 132kV, 220kV and 400kV Substations.

2.0 General Requirements:

- 2.1 The calibration certificate should be supplied with test kit (for entire range).
- 2.2 If supplier is not the manufacturer, maintenance facility should be available with the supplier.
- 2.3 The earth testing kit should be supplied complete in all respect i.e. with suitable spikes and test leads etc.
- 2.4 The meter should have synchronous internal Generator to inject AC current.
- 2.5 The meter should have suitable circuit to regulate the current automatically.
- 2.6 The meter should comply with IP54 class for Environmental protection.
- 2.7 The Instrument should meet safety class requirements as per IEC 61010- 1/1990 or equivalent.
- 2.8 The Instrument should meet IEC 61326-1 or equivalent for EMC.
- 2.9 The Instrument should have CE marking.
- 2.10 The meter should weigh not more than 3 kg.

3.0 Functional Requirements:

- 3.1 Suitable to measure resistance of earth electrode and resistivity of soil.
- 3.2 Comply with testing requirements set by international standards.
- 3.3 Measurement should not be influenced by electrostatic/electromagnetic interference present in EHV switchyards.
- 3.4 Indication for condition of battery should be provided e.g. "Low-Battery" OR "Replace-Battery" OR "Charge-Battery" etc.

4.0 Range and Accuracy:

- 4.1 Earth Resistance Range : 0 Ω to 1.99 K Ω (in multiple ranges)
- 4.2 Accuracy : $\pm 2.0\% + 3$ digits or better

- 4.3 Resolution : 0.01
- 4.4 Maximum output voltage : ≤ 50 Volts
- 4.5 Test current : ≤ 30 mA
- 4.6 Environmental conditions:
 - 4.6.1 Operating Temp : Up to 50°C
 - 4.6.2 Operating R.H. : Up to 90% (at 40°C) non condensing
- 4.7 Power supply:
 - 4.7.1 Rechargeable battery/cells.
 - 4.7.2 Charger : Internal/external
 - 4.7.3 Charger : Suitable for 230 Volts Single phase 50 Hz AC supply.

8.0 SPECIFICATION FOR MULTIGAS ON-LINE DISSOLVED GAS ANALYZER

The equipment shall be used for Online monitoring of Fault gas Analysis in transformer oil. It shall measures all eight transformer Fault indicating gases i.e. Acetylene (C₂H₂), Methane (CH₄), Ethane (C₂H₆), Hydrogen(H₂), Oxygen(O₂), Ethylene (C₂H₄), Carbon Monoxide(CO) and Carbon Dioxide(CO₂) and MOISTURE(H₂O). The results shall be communicated to control room or remote location.

Technical parameters and other features:

The equipment shall be capable to extract eight on-line gases from transformer oil. The equipment shall connect to the transformer's main body in two locations. One connection is for the supply of oil from the transformer. Second connection is for the return of the oil to the transformer.

Communication interface : Analyzer is outfitted within the ability to communicate via modem or RS-232/RS-485. The results shall be communicated to the local computers as well as transmitted to remote location computers.

The equipment shall be able to measure gas concentration and when downloaded should immediately compare with it with user selected alarm & caution level for immediate display.

The sampling rate shall be selectable as 4 or 6 or 12 hours etc. The equipment shall have inbuilt memory to store these results.

The equipment should have LCD display to provide up to date information at site.

The equipment should not use any Carrier or Calibration Gases.

The level of dissolved gases shall be displayed in PPM or as a percent of alarm setting, making recognition of dangerous levels immediately. The technical feature of the equipment shall be as under:

Detection and Measurement of :	CH ₄ , CO ₂ , C ₂ H ₄ , H ₂ , CO, O ₂ and Moisture Type of Gases
Accuracy :	+ ₅ % + _{LDL} (Whichever is greater)
Repeatability :	+ ₂ % or + ₂ ppm (Whichever is greater)
Oil temperature range :	-40 C to + 120 C
External temperature range :	-40 C to + 55 C
Humidity range :	10 to 95%

Operating Voltage :	90-250 Vac, 47-63 Hz
Communications :	RS-232/RS-485, USB , PSTN Modem, GSM
Alarm :	Sophisticated Programmable alarm system
Load Monitoring :	Allows result to be analyzed along with loading of the Transformer

The suitable indication for power On, Alarm, Caution, normal operation etc. shall be provided on the front panel of the equipment.

Software: PC software provides fault indication and fault diagnostic including including the following:

Fault indication:

- i) IEEE, IEC or user configurable levels of dissolved gases
- ii) Rate of change of trending

Fault Diagnosis:

- i) Key gases
- ii) Ratios (Rogers, IEC, etc)
- iii) Duval's triangle
- iv) Church monogram
-) Cellulose degradation

Software can also provide diagnostic reports for individual pieces of equipment or for a full system, using the equipment tree.

9.0 **TECHNICAL DATA FOR DIGITAL TAN DELTA KIT**

1.	Input voltage and frequency -	230V $\pm$ 10%, 50 Hz $\pm$ 5%
2.	Power consumption -	1 KVA maximum
3.	Voltage indication -	0-100kV $\pm$ 1kV, Digital in three digits
4.	Resolution -	1 kV
5.	Test voltage -	0-100kV RMS
6.	Rate of voltage rise -	0.5kV/sec to 5kV/sec
7.	Display -	Dot Matrix, LCD Display giving alphanumeric information and kV Test voltage.
8.	No. of tests per set -	1 to 9 tests
9.	Switch off time on breakdown -	less than 1 second
10.	Electrode Gap -	Oil pot with 2.5 mm gap with GO/NO GO gauge (should be adjustable). It should confirm to IS-6792 or equivalent standard.

The instrument should be provided with zero start interlock and should be covered over H.T. points.

10.0 **5 kV AUTOMATED INSULATION RESISTANCE TESTER**

Description:

The Tera Ohm shall be of ultra high range insulation resistance testing instrument, with an output voltage to 5000 Volts DC and suitable for measurement up to 5T (5,000,000 Meg Ohm).

The instrument should be such that its test voltage can be selected in increments of 50 Volts, the duration of the test can be set by the operator, at the end to the test period, the sample is automatically discharged and the insulation resistance is indicated on the display.

Polarization Index tests can also be automatically conducted. At the end of the ten minute period, PI is automatically calculated and up to 1000 results can be stored in the instrument. These results can easily be recalled or can be transferred to a PC using the optional windows software Tera Link+.

The instrument can also be used to measure capacitance up to 50 μ F, voltage up to 600V AC or VDC, and frequency.

SPECIFICATIONS:

Insulation test	: 0.01M to 5T, $\pm 5\%$ accuracy
DC Test Voltage	: 250 to 5000V in 50V steps. Actual test voltage display, $\pm 3\%$ accuracy
Test Current	: > 1 mA, 5W max.
Voltage Measurement	: 0 to 600V AC or DC, $\pm 3\%$ accuracy
Frequency Measurement	: 45 65 Hz, ± 0.2 Hz
Withstanding Voltage	: 0 to 5000V, 0 to 1.4mA, $\pm 3\%$ accuracy
Capacitance	: 0 to 50 μ F, $\pm 5\%$ accuracy
Polarization Index (PI)	: 0 to 99.9, $\pm 5\%$ accuracy
Dielectric Discharge (DD)	: 0 to 99.9, $\pm 5\%$ accuracy
Protection	: Double insulation, CAT III 600V, Pollution degree 2
Power	: 6 "C" size rechargeable batteries, 115 or 230V AC

11.0 DIGITAL TRANSFORMER RATIO METER FOR 3-PHASE RATIO MEASUREMENT

SPECIFICATION:

Power Input	: 120V or 230V, 50/60 Hz
Ranges	: Ratio- 0.8000 – 1.9999 1.9999 -19.999 1.9999 -199.99 1.9999 -1999.9
Metering Ratio	: 4 ½ digit LED ratio calculating display
Excitation Current	: 3 ½ digit LCD, 0-199.9 Ma
Accuracy	: Ratio +/- 0.05 % or 1 turn in 2,000
Resolution	: Ratio +/- 0.005 % or 1 turn in 20,000
Temp Coefficient	: 10 ppm/ oC

Housing : Sturdy self-storing fibre glass case with lid and carrying handle.

12.0 TRANSFORMER WINDING RESISTANCE METER

A. General Requirements:

1. Environmental conditions such as temperature, humidity vibration bump etc. Shall be as per IS: 9001 or equivalent standards. Required certificates conforming to above standards shall be furnished along-with the offer.
2. As per requirement of ISO-9001, calibration certificate for each testing instrument covering entire range shall be supplied with the test kit at the time of supply.
3. Supplier should have adequate "after sales services" facility in India.
4. The bidder has to demonstrate the performance of equipment in live switchyard of UPPTCL during analysis of the offer.

B. Functional Specifications:

- i) The Test Set should be suitable for automatic measurement of winding resistance and to check tap switches sequence (make before break) of OLTC of single or three phase transformers up to 315 MVA capacity, having Delta or star configuration.
- ii) The winding resistance measurement should be done by applying suitable high test current (≥ 10 Amps) using a true four terminal methods (no lead compensation required).
- iii) The test set should be suitable for carrying out measurement in energized switchyard conditions up to 400 kV switchyard.
- iv) The test set should have built in rapid discharge circuit for automatically discharging the energy stored in the transformer at the end of each test and provided with suitable protection to take care of inductive voltage kick back & have protection against current lead disconnection while in use.
- v) Test set should have the facility to have correction of resistance value to a reference temperature i.e. provide temperature compensated reading of resistance (for copper & aluminum windings).

C. Technical Specification:

i	Input Power Supply	200-240V, 50 Hz AC
ii	Output/Test Supply	≥ 30 V DC (minimum 30 volts)
iii	Output/Test Current	≥ 25 Amps
iv	(Direct or on demand display of test current (in step or continuous)	
v	Resistance Ranges	Upto 100 ohm
vi	While testing any transformer, to have highest possible test current,	

	the desired test current at various resistance ranges is as below.	
	Resistance range	Current
a	Upto 75 m - Ohms	≥ 25 Amps
b	76 to 175 milli – ohms	≥ 22.5 Amps
c	176 to 275 milli – ohms	≥ 20 Amps
d	276 to 375 milli – ohms	≥ 17.5 Amps
e	376 to 475 milli – ohms	≥ 15 Amps
f	476 to 575 milli – ohms	≥ 12.5 Amps
g	576 to 675 milli – ohms	≥ 12 Amps
h	676 to 700 milli – ohms	≥ 10 Amps
vii	Input Channels	3 for winding resistance
viii	The length of test lead	15 meters (of copper)
ix	Resolution	0.02% of FS or 0.1 micro-ohm or 1 count 1.9999 counts
x	Accuracy	$\pm 0.5\%$ of reading or ± 1 count for 1- 19.999 micro-ohm range.
		$\pm 1.0\%$ of reading or ± 1 count for 20-999 milli-ohm range.
		$\pm 2.0\%$ of reading or ± 1 count for 1-100 ohm range
xi	Display	On LCD panel
xii	Memory	To store upto minimum 20 sets of test result.
xiii	Printer	Built in thermal printer/paper, strip printer (or any suitable printer to print the test results in the fields itself)
xiv	PC software	Window based
xv	Operating Temperature	Upto 50°C
xvi	Operating Relative Humidity	95%
xvii	Weight	Less than 20 Kg

SECTION-3

PROJECT DETAILS & GENERAL SPECIFICATION

SITE INFORMATION

	Particular	Details
a)	Owner	UPPTCL
b)	Customer	UPPTCL
c)	Project Title	400/220/132 kV GIS at Rasra, Ballia
d)	Location	Uttar Pradesh
e)	Transport Facilities	Nearest rail head - Ballia
SITE CONDITIONS		
a)	Max. ambient air temp.	50°C
b)	Min. ambient air temp.	0°C
c)	Max. design ambient emp.	50°C
d)	Design reference temp.	50°C
e)	Average Humidity	Max. 100%
f)	Special corrosion conditions	No
g)	Solar Radiation	
h)	Atmospheric UV radiation	High
i)	Altitude above sea level	Less than 1000meter
j)	Pollution Severity	High Pollution level
k)	Seismic Zone	As per the seismic zone defined in the relevant BIS / IEC-62271-300 but not less than 0.3g horizontal
WIND DATA		
	Wind load	195kg/sqm
	Average No. of thunderstorm days per annum	As per IS

1. GENERAL

This Chapter covers Technical Requirements and requirements of auxiliary items.

- 1.1 Equipments furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories specified &/or normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications.

Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost All similar standard components/ parts of similar standard equipment provided, shall be inter-changeable with one another.

- 1.2 The Bidder shall supply type tested (including special test as per technical specification) equipments and materials. The test reports/details shall be furnished by the Bidder in the bid.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification and/or IEC/ IS, same, shall be carried out without any additional cost implication to the Purchaser. The Purchaser reserves the right to get any or all type tests conducted/ repeated.

The reports for all type tests and additional type tests as per technical specification furnished by the Bidder shall be of the tests conducted within last 05(five) years prior to the date of bid opening. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.

2. SYSTEM PARTICULARS

	Rated System voltage	420 kV, 245kV, 145kV, 36kV
	System frequency	50 Hz, This may vary by $\pm 5\%$
	Number of phases	Three
	Neutral	Effectively Earthed
	Auxiliary power supply:-	
	Auxiliary electrical equipment shall be suitable for operation on the following supply system:	
(a)	Power device (Like drive motors)	400V, 3Phase, 4Wire 50Hz Effectively earthed AC system.
(b)	Lighting fixtures, space heaters, fractional Horse Power motors and control devices.	250V, 2wire, 50Hz, AC supply with one point grounded.
(c)	DC alarm, Control and Protective Devices from sub station batteries as under	2 wire ungrounded DC supplies (i) 400 kV S/S : 220V DC (ii) 220/132kV S/S : 110V DC (iii) Communication : 48 V DC The above supply voltage is subject to variation as follows: All devices must be suitable for a continuous operation over the entire range of voltage variations : (i) AC Voltage may vary by $\pm 10\%$. Frequency by $\pm 5\%$ Combined Voltage & frequency by $\pm 10\%$. (ii) DC a) 220 V may vary between 187 & 242 V b) 110 V may vary between 93 & 121 V c) 48 V may vary between 41 & 53 V

3. System parameters

Sl. No.	Description of Parameters	400 kV System	220 kV System	132 kV System	33 kV System
1	Nominal system voltage	400kV	220kV	132kV	33kV
2	Maximum operating voltage of the system(rms)	420kV	245kV	145kV	36kV
3	Rated frequency	50Hz	50Hz	50Hz	50Hz
4	No. of phase	3	3	3	3
5	Rated short time current	50 kA for 3 Sec.	40 kA for 3 SEC	40 kA for 3 SEC	25 kA for 3 SEC
6	Dry and wet one minute power frequency withstand voltage	680 kV	460 kV	275 kV	95 kV
7	Dry and wet impulse withstand voltage positive and negative	1550 kVp	1050 kVp	650 kVp	250 kVp
8	Corona extinction voltage	320 kV	156 kV	105 kV	-
9	Max. Radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765kV, 320kV rms for 400kV system and 156kV rms for 220kV system & 92kV rms for 132kV system system & 92kV rms for 132kV system	1000 microvolt	1000 microvolt	500 microvolt	-
10	Minimum total creepage	25mm/kV (10500 mm)	25mm/kV (6125 mm)	25mm/kV (3625 mm)	25mm/kV (1300 mm)
11	Min. clearances				
	i. Phase to phase	4000mm (for Conductor-conductor)	2100 mm	1300 mm	320 mm
		4200mm (for rod - Conductor)			
	ii. Phase to earth	3500 mm	2100 mm	1300 mm	320 mm
	iii) Sectional clearances	6500 mm	5000 mm	4000 mm	3000 mm
12.	System neutral earthing	Effectively Earthed			

4. SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

- 4.1** All equipments shall perform satisfactorily under various electrical, electromechanical and meteorological conditions of the installation site.
- 4.2** All equipment shall be able to withstand all external and internal mechanical thermal and electromechanical forces due to various factors like wind load temperature variation, ice & snow (wherever applicable) short circuit etc for the equipment.

3. System parameters

Sl. No.	Description of Parameters	400 kV System	220 kV System	132 kV System	33 kV System
1	Nominal system voltage	4000kV	220kV	132kV	33kV
2	Maximum operating voltage of the system(rms)	420kV	245kV	145kV	36kV
3	Rated frequency	50Hz	50Hz	50Hz	50Hz
4	No. of phase	3	3	3	3
5	Rated short time current	50 kA for 3 Sec.	40 kA for 3 SEC	40 kA for 3 SEC	25 kA for 3 SEC
6	Dry and wet one minute power frequency withstand voltage	680 kV	460 kV	275 kV	95 kV
7	Dry and wet impulse withstand voltage positive and negative	1550 kVp	1050 kVp	650 kVp	250 kVp
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4.2 All equipment shall be able to withstand all external and internal mechanical thermal and electromechanical forces due to various factors like wind load temperature variation, ice & snow (wherever applicable) short circuit etc for the equipment.

-
- 4.3 The Bidder shall design the various forces which the terminal connectors of the equipment are required to withstand.
 - 4.4 All outdoor EHV equipments except marshalling kiosks shall be suitable for hot line washing.
 - 4.5 To facilitate erection of equipment, all items to be assembled at site shall be "matchmarked".

5. SUPPORT STRUCTURES (If in the scope of Bidder)

The base design of all the equipments, to be installed on auxiliary structures, shall conform to the standard auxiliary structure designs presently being used in UPPTCL at 400/220/132/33kV Substations.

All equipment support structures shall be supplied along with brackets, angles, stools etc. for attaching the operating mechanism, control cabinets and marshalling box (wherever applicable) etc. The support structures should be hot dip galvanised with minimum 610 gram/sq.m net of zinc.

6. STANDARDS

- 6.1 **Except** as modified by this Bid specification, all material and equipment shall conform to the requirement of the latest editions of relevant ISS/ IEC and other applicable standards. The equipments/ works shall be designed, engineered, manufactured, built, tested and commissioned shall be carried out in accordance with the Acts, Rules, Laws and Regulations in force in India.
- 6.2 In addition to meeting the specific requirements called for in the respective sections of the Technical Specification, the equipment shall also conform to the general requirement of the relevant standards which shall form an integral part of the specification. When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.
- 6.3 In the event of the Bidder offering equipment conforming to standards other than ISS/IES standards, which ensure equivalent or better performance than that specified in the standards, the salient point of comparison between the standards adopted and relevant ISS/ IEC standards shall be indicated clearly in the proposal, along with English language version of such standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's approval.
- 6.4 The standards mentioned in the respective equipment specifications are not mutually exclusive or complete in themselves. The equipment &/or work shall also conform to any other applicable standard, even if not specifically mentioned in these specifications.
- 6.5 Should the Bidder wish to depart from the provisions of the specifications, either on accounts of manufacturing practices or for any other reason, he shall clearly mention the departure and submit complete justification supported by information, drawings etc. as will enable to assess the suitability of equipment(s) offered. In the event of the Bidder's specifications, drawings, forms and tables etc. being found to disagree with the

requirement of the Bid specifications at any stage, Bid specifications shall be binding, unless the departures have been duly approved in writing by the purchaser.

6.6 REFERENCE OF STANDARDS

Reference	Abbreviation	Name and Address
BS	British Standards,	British Standards Institution, 101, Pentonville Road, N-19-ND UK
ISO	International Organization	Danish Board of Standardization Danish Standardising Sraat, Aurehoegvej-12, DK-2900, Heelstrup, DENMARK
NEMA	For Standardization, National Electric Manufacture Associate	115, East 44th Street, New York NY 10017 U.S.A
BS	British Standards,	British Standards Institution, 101, Pentonville Road, N-19-ND UK
ISO	International Organization	Danish Board of Standardization Danish Standardising Sraat, Aurehoegvej-12, DK-2900, Heelstrup, DENMARK
NEMA	For Standardization, National Electric Manufacture Associate	115, East 44th Street, New York NY 10017 U.S.A

7. ENGINEERING DATA AND DRAWINGS

7.1 SUBMISSION AND APPROVAL OF DRAWINGS/ DOCUMENTS

- 7.1.1 The Bidder shall follow a well-defined coding system for proper and quick identification of all systems/ sub-systems/ equipments/ assemblies/ sub-assemblies/ accessories/ other plant material/ spare parts/ special tools and plants and drawings for the execution of the plant and later for its operation and maintenance.

Copies of coding documents defining the above shall be supplied along with drawings to understand the system.

- 7.1.2 All drawings submitted by the Bidder shall be in sufficient details to indicate the type, size arrangement, weight of each component, details for packing and shipment, the external connections, fixing arrangements, dimensions required for installation arrangement, dimensions required for installation and interconnections with other equipment and other information specifically, as called for in the drawing schedules. All the equipments tapping points etc. shall be numbered according to pre-determined scheme/ system which shall be subject to approval of Purchaser.

- 7.1.3 Each drawing shall be clearly marked with the name of the Purchaser, unit designation, UPPTCL's Contract No. and the name of the project. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawings shall be in English. All the dimensions should be in metric units.
- 7.1.4 If any dimension figures on a drawing or a plan differs from those obtained by scaling the drawing or plan, the dimensions as mentioned in figures on the drawing or plan shall be taken as correct.

7.2 Submission and distribution of drawings/ documents

All the drawings which do not require approval shall be submitted along with reproducible in required number and those requiring approval shall be initially submitted for comments/ approval before submitting along with reproducible as per "Document Distribution Schedule".

7.3 APPROVAL OF DRAWINGS

- 7.3.1 The Purchaser shall return to the Bidder one set of drawings, plans and technical data requiring approval after marking them with their comments/ corrections, if any, either (a) marked 'Approved' or (b) marked 'Approved subject to incorporation of comments' or (c) marked 'Not Approved' with comments requiring resubmission of drawings etc. in 14 days or (d) marked 'Approval not required', where drawing is for information only. In case of (a) no further revision of drawings will be required. In case of (b) Bidder can proceed with the work but will resubmit the drawings incorporating the corrections as per comments only within fourteen (14) days. In case of (c) Bidder can proceed with the work only after resubmitting the drawings within fourteen (14) days and getting approval under (a) or (b) categories above. In case of (d) the Bidder drawing is deemed to have been received only for information purpose.

- 7.3.2 The Purchaser shall have the right to ask the Bidder to make any change in the design/ drawing which may be necessary to make equipment conform to the provisions and intent of the contract, without any extra cost to the Purchaser.

The drawings submitted shall be re-viewed by the Purchaser and shall be modified by the Bidder as required. The Bidder shall incorporate such modifications and/or corrections and submit the final drawings for approval/ reference.

- 7.3.3 No deviation from the approved drawings shall be permitted without the written approval of the Engineer.

- 7.3.4 The review of drawings/ data by the Purchaser will cover only general conformance of the data of the specifications and document, interfaces with the equipment provided under the specifications, external connections and the dimensions which might effect substation layout.

This review by the Purchaser may not indicate thorough review of all dimensions, quantities and details of the equipment, wiring, materials, any devices or items indicated or the accuracy of the information submitted. This review and/ or approval by the purchaser shall not be considered by the Bidder, as limiting any of his responsibilities specified under these specifications and documents.

Approval/ comments conveyed as above shall neither relieve the Bidder of his contractual obligations and his responsibilities for correctness of dimensions, material of construction, quantities, design details, assembly fits, performance particulars, guarantees and conformity of the supplies with the specifications, schemes, systems and statutory laws, nor does it limit the Purchasers right under the contract.

- 7.3.5 Should any minor revision be made after 'approval', at the time of erection/ commissioning the Bidder shall redistribute prints and reproducible, clearly certifying the changes incorporated in the drawing and marking it in a block. Every revision shall be marked by a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.
- 7.3.6 The Bidder shall be responsible for and shall pay for any alterations of the work due to any discrepancies, errors and omissions in the drawings or other particulars supplied by him, whether such drawings or particulars have been approved by Engineer or not.

No extension of delivery periods shall be granted on this account.

7.3.7 As- build drawings

Drawings of all equipments as detailed in technical specifications of respective equipments necessarily including schematic drawings and terminal block drawings wherever applicable whether mentioned in respective technical specifications or not.

8. NAME PLATE, MARKING OF PARTS, LABELS

- 8.1 All equipment shall have metal name plates fixed in suitable position with full particulars engraved legibly thereon and not painted.
- 8.2 Each main and auxiliary item of plant is to have permanently attached to it in a conspicuous position, a rating plate of non corrosive material upon which is to be engraved identifying manufacturer's name, equipment type or serial number, rating together with details of the loading/ operating conditions under which the item or plant in question has been designed to operate and such diagram plates as may be required by the Engineer.
- 8.3 Each item of plant is to be provided with a name plate or label designating the service of the particular equipment. These inscriptions are to be approved by the Engineer or as detailed in the appropriate sections of the technical specifications.
- 8.4 Such name plates or labels are to be white non hygroscopic material with engraved block lettering or, alternatively, in the case of indoor equipments of transparent plastic material with suitably colored lettering engraved on the back.
- 8.5 Each bay module in GIS room will have a clear marking showing the name of bay, identification, name and rating plate marking for each individual equipment like circuit breaker, disconnectors grounding switches, current transformer, voltage transformers and bushings etc. as per relevant IEC to facilitate identification during routine operation/ maintenance.
- 8.6 All such name plates, instruction plates, lubrication charts etc. shall be bilingual with Hindi inscription first followed by English. Provisions shall be made to fit in name plates, lubrication/ connection diagram plates etc.
- 8.7 In order to facilitate identification, the parts of the equipment shall be suitably marked.

9. INSTRUCTION MANUALS

- 9.1 The Bidder shall submit to the Engineer 'Descriptive Manuals', i.e. system design concept, detailed catalogues of equipment and typical equipment instructions for this project, for all major systems and equipment, covered under this contract along with dispatch of equipment.

These initial copies of descriptive manuals shall be in sufficient details, bringing out detailed internal construction, characteristics, performance parameters, principles of operation, maintenance requirements, replacement and renewals needed, erection and overhauling procedure, testing and operation procedure etc. for various equipment.

- 9.2 The integrated instruction manuals, fully defining the interfaces between various systems and complete in all respects shall be submitted by the Bidder one month before scheduled date of commissioning. The instruction manuals shall contain full details of designation and drawings of all the equipment furnished, the erection procedure, testing procedure, operation and maintenance procedure of the equipment, single line diagrams, and schematics. After the commissioning and initial operation of the plant, modifications/ additions/ changes, wherever required shall be incorporated in the instruction manuals and drawings shall be submitted by the Bidder to the Purchaser.

- 9.3 The manuals shall be specific to the equipment supplied and not of general nature.

10. DOCUMENTS AND ERECTION DRAWINGS

The Bidder shall submit within a reasonable time but at least four (4) weeks before dispatch of equipment (as per distribution schedule) the following drawings/ documents and instruction manuals etc. to the consignee and the Engineer.

- I. List of item-wise equipment as proposed to be dispatched by the Bidder.
- II. Erection drawings along with reproducible prints of each drawings.
- III. Instruction books for proper handling/ checking of material on receipt at site/storage,
- IV. erection and assembly of all equipment and necessary instruction for checking and
- V. recording proper assembly of the plant.
- VI. Instruction sheets for proper balancing, alignment, adjustment, checking and calibrations
- VII. as may be necessary.
- VIII. Descriptive literature and drawings to illustrate the working principals, methods of
- IX. assembly and dismantling of plants and equipment.
- X. Testing/commissioning format for recording data during erection/testing/
- XI. commissioning and trial run. These formats/data sheets shall clearly indicate the results
- XII. obtained during shop tests and permissible deviations.

11. QUALITY CONTROL PROGRAMME

To ensure that the equipment construction work and the services covered under this job are in accordance with the specifications and conform to the high standard of workmanship. It is obligatory on the part of the Bidder to adopt a suitable quality control program. Such a program shall include suitable hold point for check for major equipments during manufacture at supplier's work, during erection at site and during the construction

stage such that material checks for attaining proper strength and dimensional checks for attaining close tolerances required for equipment installation can be obtained.

In order to attain the above objectives, the Bidder shall draw out a plan listing all quality control checks in detail, including all hold points at which the quality checks shall be applied, also specifically mentioning those hold points where the Purchaser shall also participate in the quality check to assure him of the quality of the products supplied. Such a program shall be outlined by the Bidder for the acceptance by the Purchaser. The Bidder shall furnish detailed information regarding his quality control program and its strict implementation. Following information shall be included in the proposal along with others regarding quality control program;

- I. The quality control organizations and the proposal of its implementation.
- II. The system for controlling drawings and documents for correctness.
- III. The system of quality control for raw materials, process control and maintaining tolerances during manufacturing, assembly and fabrication.
- IV. Quality control during purchase of components, sub-systems and assemblies.
- V. Methods for ensuring selection of proper vendors/ sub-vendors.
- VI. Inspection of testing at shop after assembly.
- VII. Control of accuracy during calibration of measuring and testing equipments.
- VIII. Preservation and quality control during the transit.
- IX. Procedure for inspection before erection and quality control during erection.
- X. System for storage and delivery.

Bidder shall be wholly responsible for the quality control and quality assurance for the manufacture, supply, erection, testing and commissioning etc.

During inspection, destructive testing and non destructive test evaluation shall be done wherever applicable, in presence of Purchaser's representative in accordance with established norms. Directions of Purchaser shall be rigorously followed.

12. INSPECTION

&

TESTING

- 12.1** The Purchaser reserves the right to inspect any machinery and material to ensure that approved Q.A.P. is being strictly implemented by the Bidder or his Sub Bidder/ Supplier under this contract and to reject any item found defective in workmanship or design or otherwise unsuitable for the use and purpose intended or which is not in accordance with the intent of this contract. The Bidder should on demand by the Purchaser, rectify or replace such defective or unsuitable equipment, or the Purchaser may at the Bidder's expense, rectify or replace such defective or unsuitable equipment whether before or after supply.
- 12.2** That Bidder shall, for purpose of clause 15 of the annexed conditions of contract Form-A inform to the Purchaser places of manufacture, testing and inspection of various equipment offered by him. Unless specifically provided otherwise, all tests shall be carried out at the Bidder's work or for bought out items at sub-vendors works before dispatch.
- 12.3** The Bidder shall advise the Purchaser at least 4 weeks in advance as to when the equipment will be ready for stage/ final inspection at the Bidder's works or at his Sub-

Bidder's works.

PENAL CHARGES

In case the equipment is not available for inspection at the time of arrival of inspection officers,

the Bidder shall pay to UPPTCL towards futile journey a sum decided by Chief Engineer (765 KV DU), UPPTCL and demanded by "Engineer of Contract". This amount shall be paid within 10 days from the date of demand. Further action for inspection of the material shall be taken only after the said amount is deposited.

- 12.4** During inspection, the Purchaser's Inspecting Engineers at all times have access to all part of shops where the equipment is being manufactured and also shall be provided with all reasonable inspection facilities by the Bidder and/ or sub-Bidders. Even without scheduled inspection, the Engineer and/or his duly authorized representative shall have at all reasonable times access to the Bidder's premises, works or site and shall have the power to inspect and examine the materials and workmanship of the works during it's manufacture or erection.

- 12.5** All plants equipment/ parts, sub assemblies/ assemblies shall comply with the requirement of type tests and shall be subjected to the routine/ acceptance tests specified in the set of standards adopted and to such other tests as are stipulated in the respective technical specifications.

The Purchaser reserves to himself the right of having at his own expense any inspection or special test of a reasonable nature at Bidder's premises or at site, in addition to those prescribed in applicable standards and the enclosed technical specifications.

- 12.6** The Engineer shall either depute his representative to witness the tests as applicable and inspect the material or shall waive the inspection. In case of waiver the Bidder or his sub-Bidder shall carryout the all applicable tests in absence of Purchaser's representative. In both the cases i.e. either inspection or waiver the test certificates shall be submitted to Engineer of Contract for approval and issue of dispatch authorization. In case of inspection the test certificates must bear signatures of the Purchaser's inspecting officer.

The Engineer of Contract, within 10 days of receipt of test certificates, shall issue approval/ dispatch authorization, if test certificates are found satisfactory.

In case test certificates are not found satisfactory the Engineer of Contract, within 10 days of receipt of test certificates, shall communicate his objections and actions required to be taken in writing to the Bidder. The Bidder shall take remedial action and shall re-submit the test certificates or re-offer the material for inspection as asked for by the Engineer. Subsequent actions shall follow as in case of fresh offer for inspection. No extension of delivery/ completion period shall be granted on this account.

12.7 REJECTON

Purchaser reserves the right to reject any equipment if during the tests at works or site, the test value achieved do not comply with the respective standard/ specifications and

exceeds that tolerable limits. Rejection of any equipment will not be held as a valid reason for delay in timely completion of the work.

- 12.8** No equipment to be furnished or used in connection with this contract shall be dispatched, until factory inspection and acceptance test have been carried out satisfactorily and dispatch authorization issued by Engineer of Contract. Such factory inspection of the equipment or approval of acceptance tests shall not however, relieve the Bidder from full responsibility for supplying equipment conforming to the requirements of this contract, nor prejudice any claim, right or privilege which the Purchaser may have because of the use of defective or unsatisfactory equipment. Should Purchaser waive the right to inspect any equipment, such waiver shall not relieve the Bidder in any way from his obligations under this contract. The inspection/waiver by Engineer and/ or approval of test certificates shall in no way limit the liabilities and responsibilities of the Bidder in respect of the agreed quality assurance program, and the desired performance of the equipment.
- 12.9** In all cases where the contract provides for tests whether at the premises or works of the Bidder or of any Sub-Bidder, the Bidder shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably required to carry out effectively, such tests on the equipment in accordance with the contract and shall give facilities to the Engineer or to his authorized representative to accomplish inspection. All the expenses incurred for testing including material consumed in testing shall be to the Bidder's account.
- 12.10** Purchaser will not entertain any request for waiver of inspection on the ground that subvendors are not agreeing for the Purchaser's inspection. It is the responsibility of the Bidder to ensure that all the requirements of the Purchaser as envisaged in the technical specifications are incorporated.
- 12.11** The Bidder is required to record the following certificates on the invoices and challans of each and every consignment:
"Certified that material being dispatched against the above invoices and challan has been inspected and tested by the representative of Engineer of the contract on (date) and all the test results were satisfactory, as per approved test certificate enclosed."

Or
Certified that inspection of material being dispatched against the above invoice and challan has been waived off by Engineer of Contract vide letter
No.....Dt..... (Copy enclosed) and all the acceptance and routine tests as per relevant standards and those provided in Contract, have been conducted and all the test results were found satisfactory as per test certificates enclosed."
- 12.12** In case the inspection or testing of the material is to be carried out outside India, all the expenditure including boarding and lodging etc. of the inspecting officer/ officers shall be borne by the contractor and information regarding inspection has to given at least 8 weeks in advance.

13. PACKING

- 13.1** All equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection.
While packing all the materials, the limitations from the point of view of availability of transportation facilities in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage.
- 13.2** The Bidder shall include and provide for security protection and packing the plant so as to avoid loss or damage during transport by any mode.
- 13.3** All packing shall allow for easy removal and checking at site. Wherever necessary, proper arrangement for attaching slings for lifting shall be provided. All packages shall be clearly marked for with signs showing 'UP' and 'DOWN' side of boxes, and handling and unpacking instructions as considered necessary. Special precautions shall be taken to prevent rusting of steel and iron parts during transit and storage. Gas seals or other methods proposed to be adopted for protection against moisture during transit shall be to the satisfaction of the engineer.
- 13.4** The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols i.e. FRAGILE, HANDLE WITH CARE, USE NO HOOKS etc.
- 13.5** Each package delivered under the contract shall be marked by the Bidder at his expense and such marking must be distinct (all previous irrelevant marking being carefully obliterated). Such marking shall show the description and quantity of contents, the name of consignee and address, the gross and net weights of the package, the name of Bidder with a distinctive number of mark sufficient for purpose of identification. All markings shall be carried out with such materials as to ensure quickness of drying, fastness and legibility.
- 13.6** Each Package shall contain a note quoting specifically the name of the Bidder, the number and date of contract or order and the name of office placing the contract, nomenclature of the stores and include a schedule of parts for each complete equipment giving the parts number with reference to the General Arrangement/ Assembly drawing and the quantity of each part, drawing number and tag numbers.
- 13.7** All equipment/ material shall be suitably packed for transport, carriage at site and outdoor storage during transit. The Bidder shall be responsible for any damage to the equipment during transit. The contents of each package shall bear marking that can be readily identified from the package list and packing shall provide complete protection from moisture, termites and mechanical shocks etc.
- 13.8** Any material found short inside the packing cases shall be supplied by the Bidder without any extra cost.
- 13.9** Notwithstanding anything stated in this clause the Bidder shall be entirely responsible for any loss, damage or depreciation to the stores.

14. DESPATCH OF EQUIPMENT

- 14.1** Detailed dispatch instructions will be intimated to the Bidder. All materials shall be dispatched by road.
- 14.2** The Bidder shall intimate, at least thirty (30) days in advance to the consignee as well as the concerned Superintending Engineer at site, the probable date when the equipment will be ready for dispatch from the works. Notification of delivery or dispatch in regard to each and every consignment shall be made to the Purchaser immediately after dispatch or delivery. The supplier shall further supply to the consignee a priced invoice and packing account of all stores delivered or dispatched by him. All packages, containers, bundles and loose materials forming parts of each and every consignment shall be described fully in the packing account, and full details of the contents of packages and quantity of material shall be given to enable the consignee to check the stores on arrival at destination.
- 14.3** A list in duplicate containing details of equipment for verification at site shall also be placed inside each package and shall correspond with the advice note. One additional copy of each of the package lists shall also be sent to the consignee.

15. TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

The Bidder shall supply type tested (including special test as per technical specification) equipments and materials. The test reports/details shall be furnished by the Bidder in the bid.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification and/or IEC/ IS, same, shall be carried out without any additional cost implication to the Purchaser. The Purchaser reserves the right to get any or all type tests conducted/ repeated.

The reports for all type tests and additional type tests as per technical specification furnished by the Bidder shall be of the tests conducted within last 10(five) years prior to the date of bid opening. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.

15.1 Pre-commissioning Tests

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Purchaser and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests to be performed are given in respective chapters and shall be included in the Contractor's quality assurance programme.

15.2 Commissioning Tests

- 15.2.1** The available instrumentation and control equipment will to be used during such tests

and the Purchaser will calibrate, all such measuring equipment and devices as far as practicable.

- 15.2.2 Any special equipment, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.
- 15.2.3 The specific tests requirement on equipment have been brought out in the respective chapters of the technical specification.
- 15.2.4 The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning the equipment and the switchyard. However necessary fee shall be reimbursed by POWERGRID on production of requisite documents.

16. MATERIAL WORKMANSHIP

16.1 General Requirement

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

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

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

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be considered as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances, instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits.

Suitable guards shall be provided for the protection of personnel on all exposed rotating and/ or moving machine parts and shall be designed for easy installation and removal

for maintenance purposes. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

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

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

A cast iron or welded steel base plate shall be provided for all rotating equipment which are to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of design with pads for anchoring the units and shall have a raised up all around and shall have threaded in air connections, of so required.

16.2 Provisions For Exposure to Hot and Humid climate

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

16.3 Space Heaters

The heaters shall be suitable for continuous operation at 240V AC supply. On-off switch and fuse shall be provided for the heater.

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

The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centred in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternatively, they shall consist of a resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulator wire or other component in the compartments.

16.4 FUNGI STATIC VARNISH

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

16.5 Ventilation opening

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with

shutter type blinds and suitable provision shall be made so as to avoid any communication of air/ dust with any part in the enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc.

16.6 Degree of Protection

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

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

The degree of protection shall be in accordance with IS:13947 (Part-I) / IEC-60947(Part-I) / IS 12063 / IEC-60529. Type test report for degree of protection test, shall be submitted for approval.

16.7 RATING PLATES, NAME PLATES AND LABELS

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

All such nameplates, instructions plates, rating plates CB, CT, VT, SA, Isolators and Relay & Protection panels equipments shall be bilingual with Hindi inscription first followed by English.

Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

16.8 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

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

17. Surface finish

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

All external painting shall be as per shade No. 631 of IS: 5.

18. HOT DIP GALVANISING

All ferrous parts including all sizes of nuts, bolts, plain and spring washers, support channels, structures, shall be hot dip galvanized conforming to latest version of IS: 2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electrogalvanized.

Minimum weight of zinc coating shall be 610 gm/ sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6 mm. For items lower than 6mm thickness, requirement of coating shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq. m minimum.

The galvanized surfaces shall have a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

19. PAINTING

- 19.1** All sheet steel work shall be degreased, pickled, phosphated in accordance with the IS-6005 "Code of practice for phosphating iron and sheet". All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swaf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.
- 19.2** After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be "flash dried" while the second coat shall be stoved.
- 19.3** After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.
- 19.4** The exterior and interior colour of the paint in case of new substations shall preferably be RAL 7032 for all equipment, marshalling boxes, junction boxes, control cabinets, panels etc. unless specifically mentioned under respective sections of the equipments. Glossy white colour inside the equipments /boards/panels/junction boxes is also acceptable. The exterior colour for panels shall bematching with the existing panels in case of extension of a substation. Each coatof primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments.
- 19.5** In case the Bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures, like electrostatic painting etc., the procedure shall be submitted alongwith the Bids for Purchaser's review & approval.

The colour scheme as given below shall be followed for Fire Protection and Air Conditioning systems

S.No.	PIPE LINE	Base colour	Band colour
Fire Protection System			
1	Hydrant and Emulsifier system pipeline	FIRE RED	-
2	Emulsifier system detection line – water	FIRE RED	Sea Green
3	Emulsifier system detection line – Air	FIRE RED	Sky Blue
4	Pylon support pipes	FIRE RED	
Air Conditioning System			

5	Refrigerant gas pipeline – at compressor suction	Canary Yellow	-
6	Refrigerant gas pipeline – at compressor discharge	Canary Yellow	Red
7	Refrigerant liquid pipeline	Dark Admiralty Green	-
8	Chilled water pipeline	Sea Green	-
9	Condenser water pipeline	Sea Green	Dark Blue

19.6 COLOUR SCHEME AND CODES FOR PIPE SERVICE

The Bidder shall propose a colour scheme for the those equipments/ items for which the colour scheme has not been specified in the specification. For the approval of

- a) For connecting ACSR/ AAC conductor Aluminum alloy casting conforming to designation A6 of IS:617 and shall be tested for all tests as per IS:617
- b) For connecting equipment terminals made of copper or ACSR conductor Bimetallic connectors made from aluminum alloy casting conforming to designation A6 IS: 617 with 4mm thick cast copper lines and shall be tested as per IS:617
- c) For connecting G.I.Shield wire Malleable iron casting.
- d) Bolts, nuts and plain washers. Hot dip galvanising mild steel
- e) Spring washers for items 'a' to 'c' Electrogalvanised-suitable for at least 3 service conditions as per IS:3063 & IS:1573
- f) Misc. Mild steel.

21. CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

21.1 All power clamps and connectors shall conform to IS:5561 & NEMA CC1 and shall be made of materials listed below:

- ε For connecting ACSR conductors Aluminum alloy casting, conforming to designation A6 of IS:617 and all test shall conform to IS:617

k	For connecting equipment terminals made of copper with ACSR conductors	Bimetallic connectors made from aluminum alloy casting, conforming to designation A6 of IS:617 with 2mm thick bimetallic liner and all test shall conform to IS:617
c	For connecting G.I	Galvanised mild steel shield wire
d) i)	Bolts, nuts & Plain, washers galvanised.	i) Electro-galvanised for sizes below M12, for others hot dip
ii)	Spring washers items 'a' to 'c' IS:1573	ii) Electro-galvanised mild for steel suitable for atleast service condition-3 as per

- 21.2** Necessary clamps and connectors shall be supplied for all equipment and connections. The requirement regarding external corona and RIV as specified for any equipment shall include its terminal fittings. If corona rings are required to meet these requirements they shall be considered as part of that equipment and included in the scope of work.
- 21.3** Where copper to aluminum connections are required, bi-metallic clamps shall be used, which shall be properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to parts which are not current carrying or subjected to stress.
- 21.4** Low voltage connectors, grounding connectors and accessories for grounding allequipment as specified in each particular case, are also included in the scope of Work.
- 21.5** No current carrying part of any clamp shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner of minimum 2 mm thickness shall be cast integral with aluminum body or 2 mm thick bi-metallic strips shall be provided for Bi-metallic clamps.
- 21.6** All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.
- 21.7** Flexible connectors, braids or laminated straps made for the terminal clamps for bus posts shall be suitable for both expansion or through (fixed/sliding) type connection of 4" IPS AL. tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.
- 21.8** Clamp shall be designed to carry the same current as the conductor and the temperature rise shall be equal or less than that of the conductor at the specified ambient temperature. The rated current for which the clamp/connector is designed with respect to the specified reference ambient temperature, shall also be indelibly marked on each component of the clamp/connector, except on the hardware.
- 21.9** All current carrying parts shall be designed and manufactured to have minimum contact resistance.
- 21.10** Clamps and connectors shall be designed to be corona controlled.
- 21.11 Tests**
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Clamps and connectors should be type tested as per IS:5561 and shall also be subjected to routine tests as per IS:5561. Following type test reports shall be submitted for approval as per clause 9.2 above except for sl. no.(ii) & (iii) for which type test once conducted shall be applicable (i.e. the requirement of test conducted within last ten years shall not be applicable).

- I. Temperature rise test (maximum temperature rise allowed is 35°C over 50°C ambient)
- II. Short time current test
- III. Corona (dry) and RIV (dry) test (for 220 KV and above voltage level clamps)
- IV. Resistance test and tensile test

22. CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

- 22.1** All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS- 5039/ IS-8623, IEC-60439, as applicable, and the clauses given below.
- 22.2** Control cabinets, junction boxes, marshalling boxes and terminal boxes shall be made of sheet steel or aluminum enclosure and shall be dust, water and vermin proof. Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminum enclosed box, the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.
- 22.3** Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements. A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes/ Control cabinets to prevent ingress of rain water.
- 22.4** Cabinet/boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of the gasket shall be such that it does not get damaged/cracked during the operation of the equipment.
- 22.5** All doors, removable covers and plates shall be provided gasket all around with suitably profiled EPDM/Neoprene gaskets. The gasket shall be tested in accordance with approved quality plan, IS:11149 and IS:3400. The quality of gasket shall be such that it does not get damaged/cracked during 10(ten) years of operation of the equipment or its major overhaul whichever is earlier.

All gasketed surfaces shall be smooth straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters, the screen shall be fine wire mesh made of brass.

- 22.6** All boxes/ cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable

gland plate projecting at least 150 mm above the base of the marshalling kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland plate. Gland plate shall have provision for some future glands to be provided later, if required.

- 22.7** A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.

- 22.8** For illumination, a 20 Watts fluorescent tube or 15 watts CFL/LED bulb shall be provided. The switching of the fittings shall be controlled by the door switch.

For junction boxes of smaller sizes such as lighting junction box, manual operated earth switch mechanism box etc., plug socket, heater and illumination is not required to be provided.

- 22.9** All control switches shall be of rotary type. Toggle piano switches shall not be accepted.

- 22.10** Positive earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire/ strip shall be terminated on to the earthing pad and secured by the use of self etching washer. Earthing of hinged door shall be done by using a separate earth wire.

- 22.11** The bay marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/feruling by pasting the same on the inside of the door.

- 22.12** The following routine tests alongwith the routine tests as per IS: 5039 shall also be conducted:

Check for wiring
Visual and dimension check

The enclosure of bay marshalling kiosk, junction box, terminal box shall be type tested for IP-55 as per IS: 13947. After IP-55 test, 2.5 kVrms for 1 (one) minute, insulation resistance and functional test should be conducted.

22.13 Auxiliary Switches

All the auxiliary switches shall be fully type tested as per relevant IS.

The following type test reports on auxiliary switches shall be submitted:

- a) Electrical endurance test - A minimum of 2000 operation for 2A D. C. with a time constant greater than or equal to 20 millisecond with a subsequent examination of mV drop/visual defects/temperature rise test.
- b) Mechanical endurance test. A minimum of 1,00,000 operations with a subsequent checking of contact pressure test/visual examination.
- c) Heat run test on contacts.
- d) IR/HV test etc.

23. TERMINAL BLOCKS AND WIRING

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- 23.1 Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All interphase and external connections to equipment or to control cubicles will be made through terminal blocks.
- 23.2 Terminal blocks shall be 1100 V grade and have continuous rating to carry the maximum expected current on the terminals. These shall be of moulded piece, complete with insulated/barriers stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals.
- 23.3 But preferably the terminal blocks shall be non-disconnecting stud type of Elmex type CATM4, phoenix cage clamp type or equivalent. The insulating material of terminal block shall be nylon which shall be free of halogens, fluorocarbons etc.
- 23.4 Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.
- 23.5 The terminals shall be such that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally.
- 23.6 The conducting part in contact with cable shall preferably be tinned or silver plated, however Nickel plated copper or zinc plated steel shall also be acceptable.
- 23.7 The terminal blocks shall be of extensible design.
- 23.8 The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.
- 23.9 The terminal blocks shall be fully enclosed with removable covers of transparent, non-deterioration type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.
- 23.10 Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.
- a) All circuits except CT circuits - Minimum of 2 nos. of 2.5 sq. mm copper flexible
 - b) All CT circuits - Minimum of 4 nos. of 2.5 sq. mm copper flexible
- 23.11 The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live.
- 23.12 At least 20% spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminal rows.
- 23.13 There shall be minimum clearance of 250 mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm.
-

23.14 The Bidder shall furnish all wire, conduits and terminals for the necessary interphase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets.

23.15 All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The Bidder shall also provide necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

24. LAMPS & SOCKETS

24.1 Lamps

All incandescent lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

24.2 Sockets

All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

24.3 Hand Lamp

A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON- OFF Switch for connection of hand lamps.

24.4 Switches and Fuses

Each panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with miniature circuit breaker/ switchfuse units. Selection of the main and Sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

All fuses shall be of HRC cartridge type conforming to IS-9228 mounted on plug-in type fuse bases. Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints to the fuse rating and voltage. All control switches shall be of rotary type. Toggle piano switches shall not be accepted.

25. Bushings, Hollow Column Insulators, Support Insulators:

25.1 Bushings shall be manufactured and tested in accordance with IS:2099 & IEC-60137 while hollow column insulators shall be manufactured and tested in accordance with IEC-62155/IS:5621. The support insulators shall be manufactured and tested as per IS:2544/IEC-60168 and IEC-60273. The insulators shall also conform to IEC-60815 as applicable. The bidder may also offer composite hollow insulators, conforming to IEC-61462.

25.2 Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to

moisture.

- 25.3** Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.
- 25.4** Support insulators/bushings/hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.
- 25.5** When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the normal rated voltage.
- 25.6** Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.
- 25.7** All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.
- 25.8 Tests**

In bushing, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests in accordance with IS: 2099 & IS:2544 & IS : 5621.

26. MOTORS

Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall be subjected to routine tests as per applicable standards. The motors shall be of approved make.

26.1 Enclosures

- a) Motors to be installed outdoor without enclosure shall have hose proof enclosure equivalent to IP-55 as per IS: 4691. For motors to be installed indoor i.e. inside a box, the motor enclosure, shall be dust proof equivalent to IP-44 as per IS: 4691.
- b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
- c) Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor

casing.

- d) Motors weighing more than 25 Kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

26.2 Operational Features

- a) Continuous motor rating (name plate rating) shall be at least ten (10) percent above the maximum load demand of the driven equipment at design duty point and the motor shall not be over loaded at any operating point of driven equipment that will rise in service.
- b) Motor shall be capable at giving rated output without reduction in the expected life span when operated continuously in the system having the particulars as given in Clause 15.0 of this Section.

26.3 Starting Requirements:

- a) All induction motors shall be suitable for full voltage direct-on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.
- b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.
- c) The locked rotor current shall not exceed six (6) times the rated full load current for all motors, subject to tolerance as given in IS:325.
- d) Motors when started with the driven equipment imposing full starting torque under the supply voltage conditions specified under Clause 15.0 shall be capable of withstanding atleast two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.
- e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speed lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

26.4 Running Requirements:

- a) The maximum permissible temperature rise over the ambient temperature of 50 degree C shall be within the limits specified in IS:325 (for 3 - phase induction motors) after adjustment due to increased ambient temperature specified.
- b) The double amplitude of motor vibration shall be within the limits

specified in IS: 4729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

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

26.5 TESTING AND COMMISSIONING

An indicative list of tests is given below. Contractor shall perform any additional test based on specialities of the items as per the field Q.P./Instructions of the equipment Contractor or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

- (a) Insulation resistance.
 - (b) Phase sequence and proper direction of rotation.
 - (c) Any motor operating incorrectly shall be checked to determine the cause and the conditions corrected.
-

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1.0 General

Unless otherwise stipulated, all equipment together with its associated connectors, where applicable, shall be tested for external corona (for 400 kV & above) both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and by measurement of radio interference voltage (RIV) for 132 kV above.

2.0 Test Levels

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

3.0 Test Methods for RIV

3.1 RIV tests shall be made according to measuring circuit as per International Special-Committee on Radio Interference (CISPR) Publication 16-1(1993) Part -1. The measuring circuit shall preferably be tuned to frequency with 10% of 0.5 MHz but other frequencies in the range of 0.5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be in microvolts.

3.2 Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107-1964, except otherwise noted herein.

3.3 In measurement of, RIV, temporary additional external corona shielding may be provided. In measurements of RIV only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.

3.4 Ambient noise shall be measured before and after each series of tests to ensure that there is no variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100%, and 110% of the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 400kV, 220kV, 132kV is listed in the detailed specification together with maximum permissible RIV level in microvolts.

3.5 The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.

3.6 The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to voltage read by noise meter.

4.0 Test Methods for Visible Corona

The purpose of this test is to determine the corona extinction voltage of apparatus, connectors etc. The test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltage, when the test voltage is raised

and lowered to determine their precise values. The test voltage shall be raised to 110% of specified corona extinction voltage and maintained there for five minutes. In case corona inception does not take place at 110%, test shall be stopped, otherwise test shall be continued and the voltage will then be decreased slowly until all visible corona disappears. The procedure shall be repeated at least 4 times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purposes of determining compliance with the specification shall be the lowest of the four values at which visible corona (negative or positive polarity) disappears. Photographs with laboratory in complete darkness shall be taken under test conditions, at all voltage steps i.e. 85%, 100%, and 110%. Additional photographs shall be taken at corona inception and extinction voltages. At least two views shall be photographed in each case using Panchromatic film with an ASA daylight rating of 400 with an exposure of two minutes at a lens aperture of f/5.6 or equivalent. The photographic process shall be such that prints are available for inspection and comparison with conditions as determined from direct observation. Photographs shall be taken from above and below the level of connector so as to show corona on bushing, insulators and all parts of energised connectors. The photographs shall be framed such that test object essentially, fills the frame with no cut-off.

For recording purpose, modern devices utilizing UV recording methods such as image intensifier may also be used.

- 4.1 The test shall be recorded on each photograph. Additional photograph shall be taken from each camera position with lights on to show the relative position of test object to facilitate precise corona location from the photographic evidence.
- 4.2 In addition to photographs of the test object preferably four photographs shall be taken of the complete test assembly showing relative positions of all the test equipment and test objects. These four photographs shall be taken from four points equally spaced around the test arrangement to show its features from all sides. Drawings of the laboratory and test set up locations shall be provided to indicate camera positions and angles. The precise location of camera shall be approved by Purchaser's inspector, after determining the best camera locations by trial energisation of test object at a voltage which results in corona.
- 4.3 The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.
- 4.4 However, both test shall be carried out with the same test set up and as little time duration between tests as possible. No modification on treatment of the sample between tests will be allowed. Simultaneous RIV and visible corona extinction voltage testing may be permitted at the discretion of Purchaser's inspector if, in his opinion, it will not prejudice other test.

5.0 Test Records

In addition to the information previously mentioned and the requirements specified as per CISPR or NEMA 107-1964 the following data shall be included in test report:

- a) Background noise before and after test.
- b) Detailed procedure of application of test voltage.
- c) Measurements of RIV levels expressed in micro volts at each level.

- d) Results and observations with regard to location and type of interference sources detected at each step.
- e) Test voltage shall be recorded when measured RIV passes through 100 microvolts in each direction.
- f) Onset and extinction of visual corona for each of the four tests required shall be recorded.

ANNEXURE – B1

SEISMIC WITHSTAND TEST PROCEDURE

The seismic withstanding test on the complete equipment (for 132 kV and above) shall be carried out alongwith supporting structure.

The Bidder shall arrange to transport the structure from his Contractor's premises/UPPTCL sites for the purpose of seismic withstand test only.

The seismic level specified shall be applied at the base of the structure. The accelerometers shall be provided at the Terminal Pad of the equipment and any other point as agreed by the Purchaser. The seismic test shall be carried out in all possible combinations of the equipment. The seismic test procedure shall be furnished for approval of the Purchaser.

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Section 4: **Annexures**

1. Annexure C-Compliance Certificate for Technical Specification
2. Annexure D-Deviation/ Change Request for Technical Specification
3. Annexure E-Guaranteed Technical Particulars for GIS & its accessories
4. Annexure F-Technical Checklist (Rev-01)

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ANNEXURE-C

COMPLIANCE CERTIFICATE OF TECHNICAL SPECIFICATION

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.
2. There are no deviation(s) with respect to specification other than those furnished in the 'schedule of deviations'.
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

Date:

Bidder's Stamp & Signature

ANNEXURE-D
DEVIATION/ CHANGE REQUEST OF TECHNICAL SPECIFICATION

Bidder shall list out all technical potential deviation/ change request (s) along with clause with respect to technical specifications. It is also to be noted that bidder shall provide the Impacts of Potential Deviation(s) without any failure. In case, details have not been furnished, such requests shall not be considered.

Sl. No.	Contract requirement with clause No.	Potential deviation/ change request(s)	Impacts of Potential Deviation(s)		
			Technological (Inferior/ Equal/ Superior)	Schedule Impact (Delay/ NIL/ Acceleration)	Cost Impact (Increase/ NIL/ Decrease)

Any deviation not specifically brought out in this section shall not be admissible for any 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.

Date:

Bidder's Stamp & Signature

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS

GIS (400kV/220kV/132kV)

SL. NO.	Description	Particulars		
		400 kV GIS	220 kV GIS	132 kV GIS
A.	Complete GIS Module			
1.	Type of GIS Enclosure (isolated/ encapsulated)			
2.	Material of enclosure			
3.	Minimum thickness of enclosure (mm)			
4.	Nominal voltage of system (kV)			
5.	Rated voltage of system (kV)			
6.	Rated voltage for equipment (U_r), kV			
7.	Rated insulation levels phase-to-earth and between phases			
	Rated short-duration power-frequency withstand voltage (U_d), kV			
8.	Rated switching impulse withstand voltage (U_s)			
	Phase-to-earth, kV			
	Between phases, kV			
9.	Rated lightning impulse withstand voltage (U_p)			
10.	Rated frequency (f_r), Hz			
11.	Rated normal current (I_r), A			
12.	Rated short-time withstand current (I_k), kA			
13.	Rated peak withstand current (I_p), kA			
14.	Rated duration of short-circuit (t_k),s			
15.	Rated supply voltage of closing and opening devices and of auxiliary and control circuits (U_a),V			
16.	Rated supply frequency of closing and opening devices and of auxiliary circuits(Hz DC or 50 or 60)			
17.	Neutral earthing Solidly or not solidly			
18.	Number of phases			
19.	Single- or three-phase design			
20.	Maximum SF6 leakage rate(% / year)			
21.	Rated filling pressure p_r			
	Circuit-breaker			

- Other compartments
- 22. Alarm pressure p_a
 - Circuit-breaker
 - Other compartments
- 23. Minimum functional pressure p_m
 - Circuit-breaker
 - Other compartments
- 24. Design pressure of enclosures
 - Circuit-breaker
 - Other compartments
- 25. Type test pressure of enclosures
 - Circuit-breaker
 - Other compartments
- 26. Routine test pressure of enclosures
 - Circuit-breaker
 - Other compartments
- 27. Operating pressure of pressure relief device
 - Circuit –breaker
 - Other compartments
- 28. Internal fault
 - Short-circuit current (kA)
- 29. Quantity of SF₆ gas of complete GIS at filling pressure (kg)
- 30. Quantity of SF₆ gas of the largest compartment at filling pressure (kg)
- 31. Maximum permissible gas dew point (°C)
- 32. Number of gas compartments
- 33. Length of longest section for transportation (m)
- 34. Weight of the heaviest piece of equipment to be handled during installation on-site (kg)
- 35. Seismic acceleration

B. Bus ducts

- 1. Inductance (H/m)
- 2. Capacitance (pF/m)
- 3. Resistance of enclosure at f_r (Ω/m)
- 4. Resistance of conductor at f_r (Ω/m)

5. Surge impedance (Ω)

C. Bushing (Outdoor-immersed bushing)

1. Type of internal insulation
2. Type of external insulation
3. Nominal specific creepage distance (mm/kV)
4. Shed profile 4. Normal or alternating
5. Rated short-duration, power-frequency (kV)
6. withstand voltage (U_d)
7. Rated switching impulse withstand voltage (U_s), kV
8. Rated lightning impulse withstand voltage (U_p), kV
9. Cantilever test load (N)
10. Cantilever operation load (N)
11. Type of line termination

D. ENCLOSURES BUSBARS

1. Type of busbar and standard
2. Rated working voltage
3. Maximum voltage at which busbar can operate continuously. (kV, rms)
4. Shape of busbar
5. Material and cross sectional area of busbar (sq.mm)
6. Continuous current rating of busbar (Amps)
7. Temperature rise over at specified ambient Temp (deg. C)
 - a) Busbars
 - b) Enclosure
8. Short time current withstand for 1 sec (kA, rms)
9. Type of encapsulation
10. Material and shape of enclosure
11. Thickness of enclosure material (mm)
12. Standard length of each unit (mm)
13. Losses in the busbars (watts)
14. Losses in the enclosure (watts)
15. One minute power frequency test withstand

Voltage (kV rms)

16. 1.2/50 microsec. Lighting impulse test
withstand voltage (kV peak)
17. Arrangement of earthing and size of
Earthing conductors
18. Rated 1.2/50 micron seconds impulse
withstand voltage (kV, rms)
19. One minute power frequency
withstand voltage (kV, rms)
20. Details of cable termination
21. Type and material of connector between
adjacent joints
22. DC resistance/phase/meter (ohms)
23. Inductance/phase/meter (mH)
24. Capacitance to earth/phase/meter
25. Phase to phase spacing (mm)
26. Enclosure burn through time at rated
short circuit current (seconds)
27. Enclosure design pressure (kg/cm.sq)
28. Enclosure rupturing pressure (kg/cm/sq)
29. Gas losses per gas compartment per year
30. Minimum creepage distance over insulator (mm)
31. a) Type/material of insulators
b) P.C. level of insulators
c) Whether insulators are suitable for SF6
arcing contact
32. Circulating and eddy current of enclosure
during normal operation
33. Maximum potential rise of enclosure
34. a) Under short circuit condition
b) Under normal operating condition
35. Whether temperature compensated density
Monitor, pressure relief devices provided
with each compartment

- 36. Dielectric strength of compartment if SF6
Gas pressure falls to atmospheric
pressure (For information purpose)
- 37. i) Lighting impulse withstand level
 - a) Circuit breaker compartment
 - b) Othersii) Continuous AC operating voltage
 - a) Circuit breaker compartment
 - b) Others
- 38. Pressure relief device
 - a) Rupturing pressure and time of rupture

(E) LOCAL CONTROL CUBICLES

- 1. Manufacturer's name
- 2. Degree of protection
- 3. Thickness of sheet steel
 - a) Front
 - b) Back
 - c) Sides
- 4. Paint treatment and color shades
- 5. Weight of each panel
- 6. Dimensions (width x depth x height) mm
- 7. Mimic bus material and colors
- 8. Cable glands included
- 9. Auxiliary relays
 - a) Make
 - b) Type designation
- 10. Control switches
 - a) Make
 - b) Type designation
- 11. Push buttons
 - a) Make
 - b) Actuator type
- 12. Indicating lamps
 - a) Type
 - b) Rating

- i) Voltage
- ii) Wattage

(F) SF6 GAS

1. Normal operating pressure (kg/cm²)
2. Normal operating density (gms/cc)
3. Maximum permissible pressure (kg/cm²)
4. Maximum gas density (gms/cc)
5. Minimum pressure to maintain dielectric Insulation (kg/cm²)
6. Maximum leakage rate (percent / year)
7. Maximum permissible moisture content by weight (ppm)
8. Permissible variation in ambient temperature Deg. C
9. Details of gas filters
10. Effective life of gas filters
11. Test pressure for gas system (kg/cm²)
12. Constituents of gas in percent of weight and volume (SF₆, air, CF₄, H₂O)
13. Size and weight of gas cylinder with/without gas
14. Weight of gas for each different module

(G) GENERAL

1. Weights and dimensions
 - a) Shipping weight of heaviest section (kg)
 - b) Dimensions of largest package (mm)
 - c) Shipping weight of SF₆ gas treatment unit (kg)
 - d) Weight of each type of switchgear bay module (kg)
 - e) Untanking height (mm)
 - f) Shipping dimensions and weight of SF₆ gas cylinders required for first fillings and testing
 - g) Overall dimensions of the switchgear (mm x mm x mm)

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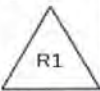
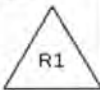
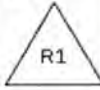
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ANNEXURE-F

TECHNICAL CHECKLIST

Sl. No.	Particulars	Confirmation by Bidder	
1	Technical Qualifying Requirement		
1.1	The bidder to furnish relevant documents for meeting the qualifying requirement. Performance certificates shall be submitted in English. Translated pages should be attested by the ultimate customer, if attested only by the bidder it shall be notarized.	Confirmed	Yes/No
1.2	The bid shall be submitted by the Manufacturer of GIS & its accessories in case of Indian Manufacturer, however agent may submit the technical offer in case of foreign manufacturer. The bidder's scope includes supply and services such as - Supervision of installation, - Testing and commissioning.	Confirmed	Yes/No
1.3	All the documents shall be submitted in English. Translated pages should be attested by the ultimate customer, if attested only by the bidder it shall be notarized.	Confirmed	Yes/No
2	Un-priced BOQ		
2.1 	Confirm that all items have been quoted separately. (If any item has not been quoted, the same shall be specifically brought out with technical reasons thereof) Any item '(main/ spares) Not Applicable/Not quoted as per bidder's design /confirmation., However, if found applicable later on, the same shall be deemed to be included in the scope of tender and shall be supplied free of cost by bidder.	Confirmed	Yes/No
2.2 	Any other supply/ service required for the execution for the complete work of GIS & its accessories is deemed to be included in the offer, whether specifically mentioned in the specification or not. Even if 'not quoted' or 'Not applicable' by the bidder, the same shall be deemed to be included in scope of tender and shall be supplied free of cost by bidder Bidder to submit list of items along with their respective quantities required for completeness of GIS & its accessories.	List of items required to be attached.	Yes/No
2.3 	Unit rate items Any item Not Applicable/ Not quoted, is found applicable and is required due to damages, theft, replacement etc. or any other reason as envisaged in clause of NIT, the required quantity shall be supplied free of cost till end of contract i.e. till end of guarantee period.		
2.4	Cable Connection module - Interface for connecting XLPE cable, structures etc shall be provided by the bidder. Limit of supply/ services between GIS manufactures and cable termination shall be as per 62271-209 for cable termination. The typical arrangement drawing of interconnecting bus-duct from GIS bay module to XLPE cable termination end shall be submitted along with technical offer.	Confirmed. submitted	Yes/No

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ANNEXURE-F

Sl. No.	Particulars	Confirmation by Bidder	
		Confirmed	Yes/No
2.5 	Isolating link in GIS end cable termination required during testing included in scope of supply		
2.6	Confirm that the consumables (list to be enclosed by bidder during contract stage) with shelf life of fewer than two years shall be supplied before erection after specific clearance by BHEL/Owner/PMC.	Confirmed	Yes/No
2.7	Commissioning spares for testing & commissioning of GIS till handing over shall be under bidder's scope.	Confirmed	Yes/No
2.8	Detailed list of Tools & tackle & Testing Equipment to be supplied at site on returnable/ non-returnable basis.	List attached	Yes/No
2.9	<u>The Switchgear shall be complete with all necessary terminal boxes, SF6 gas filling, interconnecting power and control wiring, grounding connections, gas monitoring equipment and piping, support structures.</u>	Confirmed	Yes/No
2.10	<u>The scope of supply shall also include all erection and mounting hardware and interconnecting cables within GIS.</u>	Confirmed	Yes/No
2.11	Design philosophy of earthing submitted with the bid	Confirmed	Yes/No
2.12	Design of Earthing of GIS shall be in bidder scope. The items and accessories required for completeness of earthing shall be in bidder's scope. Mesh on floor shall be provided by BHEL as per bidder's design. (refer section 1)	Confirmed	Yes/No
3	Technical		
3.1	Compliance with building size (including width required for withdrawal of equipment during , hook height and crane capacity for GIS	Confirmed	Yes/No
3.2	Maximum size of package for installation in line with section 1, crane capacity	Confirmed	Yes/No
3.3	GIS layout as per Building GA (section 1) drg enclosed with specification	Confirmed	Yes/No
3.4 	Gas partitions in line with enclosed GAS SLD/ service continuity requirement as per Annexure-5	Confirmed	Yes/No
3.6	Thermal rating for all current carrying parts as per section 2.	Confirmed	Yes/No
3.7	Internal components maintenance free for at least 10 years	Confirmed	Yes/No
3.8	Material of enclosure – non-magnetic material	Confirmed	Yes/No
3.9	Requirement of AC and DC auxiliary loads	Enclosed with bid	Yes/No
3.10	Catalogues of GIS	Enclosed with bid	Yes/No
3.11	Catalogues of all Maintenance equipment. Bidder to confirm that offered equipment meets the requirements of specification.	Enclosed with bid	Yes/No
4	Calculations		
4.1	The design of the equipment shall be such that the agreed permitted movement of foundations and mechanical or thermal effects do not impair the assigned performance of the equipment.	Confirmed	Yes/No
4.2	Insulation co-ordination study shall be conducted and based on the same the number & location of surge arresters shall be decided. The number and location of surge arresters shall be indicated with the bid.	Confirmed	Yes/No

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CUSTOMER: UTTAR PRADESH POWER TRANSMISSION CORPORATION LTD. (UPPTCL)

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ANNEXURE-F

Sl. No.	Particulars	Confirmation by Bidder	
	In-case additional surge arresters are to be provided , same is in scope of bidder, to be provided inside GIS		
4.3	Measures to limit external overvoltages (e.g. surge arresters) should be considered and detailed out based on the site conditions etc.	Enclosed with bid	Yes/No
5	Technical Deviations		
5.1	Confirm that the Complete systems have been offered as per the requirements of Technical Specification and Technical Deviation sheet has been submitted. Deviations mentioned elsewhere in the bid will not be considered.	Confirmed	Yes/No
6	Barchart		
6.1	Bidder will submit detailed bar chart indicating all the milestones from Engineering till manufacturing/ testing, dispatch to site and commissioning based on the drawing & document schedule attached in section1.	Confirmed	Yes/No
7	Conditions		
7.1	<u>Store</u> shall be provided by BHEL for GIS and accessories. Confirm that the space required for the material being supplied, both indoor and outdoor has been indicated.	Details given with the bid.	Yes/No
8	Site Test		
8.1	Only special tools shall be in bidder's scope. Bidder to submit list of tools, tackle, slings, spanners, gauges, slings and other lifting devices, drills, instruments and appliances necessary for the complete assembly and erection at site of the GIS, required for installation, gas filling, maintenance, site testing of the GIS which shall be arranged by BHEL. HV Test kit shall be in scope of bidder. EOT cranes shall be provided by BHEL in GIS Hall as per size recommended by bidder.	Confirmed	Yes/No
8.2	Bidder to furnish detailed BOQ for non-returnable Tools and Tackles along with unit prices to be handed over to ultimate customer.	Details given with the bid.	Yes/No
8.3	All field tests including tests during installation, pre-commissioning, commissioning, field acceptance tests shall be conducted by the Contractor, in presence of representative of the Employer. No separate site test will be conducted by BHEL/Customer	Confirmed	Yes/No
8.4 	QAP/SAT/FAT/Type test reports enclosed with your offer is only for information. Routine , acceptance & Site testing shall be as per UPPTCL approval during detailed engineering	Confirmed	Yes/No
9	TYPE TESTS REQUIREMENTS		
9.1	The offered GIS should have been type tested (as per relevant IEC). The GIS and equipment/components shall be of same make and type as that used in type test.	Confirmed	Yes/No
9.2	Type test report for offered GIS shall be submitted alongwith the bid. Differences, if any, in the items offered and those which have been type tested shall be clearly brought out alongwith explanation for suitability.	Confirmed and enclosed with bid	Yes/No
9.3	In case the test reports are not found technically valid during contract stage by BHEL/UPPTCL, the bidder shall repeat these test(s) <u>at no extra cost to the purchaser and no delivery implication.</u>	Confirmed	Yes/No

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ANNEXURE-F

Sl. No.	Particulars	Confirmation by Bidder	
	Technical valid - Any error or incompleteness (any/all additional type tests not carried out) or discrepancy in the test reports vis-à-vis offered equipment due to any design / manufacturing changes (including substitution of components) or non-compliance with the requirement stipulated in the Technical Specification.		
9.4	The type tests conducted earlier should have either been conducted in an accredited independent laboratory (accredited base on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located). The short circuit test should have been conducted in a laboratory which should be a member of STL (Short-Circuit Testing Liaison - www.stl-liaison.org). If the laboratory is not a national laboratory and member of STL, relevant papers of accreditation shall be submitted in English. If the laboratory is in-house, the tests should have been witnessed by a client.	Confirmed. Details provided with bid.	Yes/No
9.6	The type test report shall be complete including the list of test objects, photographs, oscillographs, test arrangement, drawing of tested objects (GIS, equipment etc) and test connections. The type test report shall be in English. If it is in any other language, it should include an English version (Translation shall be attested by the Bidder). The English version should be complete with measured values and conclusion.	Confirmed	Yes/No

Date:

Bidder's Stamp & Signature