DEENDAYAL PORT AUTHORITY

An ISO 9001 : 2008 & ISO 14001 : 2004 Certified Port

Office of Executive Engineer
(Electrical),
Ground Floor, P & C Building,
New Kandla, Kutch
– 370210
Tel: 02836 270 342
Mob: 9825227048
Email: electricalkandla@gmail.com

No.: EL/WK/2803 Date : 15/11/2023

Expression of Interest [EOI] for

"Design, Manufacturing, Supply, Installation, Erection, Testing and Commissioning of 66/11 KV GIS Substation and Shifting of Transformers to New GIS Substation at DPA."

Executive Engineer (Electrical), DPA invites Expression of Interest for the work of "Design, Manufacturing, Supply, Installation, Erection, Testing and Commissioning of 66/11 KV GIS Substation and Shifting of Transformers to New GIS Substation at DPA" from the reputed firms from those who have executed similar work in Government/public sectors and other leading private organizations. The Expression of Interest (EOI) documents containing details of Scope of Work and technical specifications are enclosed herewith.

The interested firms are requested to submit budgetary quotation for the said work in format enclosed at Annexure - I. The completed EOI (Expression of Interest) shall be submitted to the office of the undersigned on or before 29/11/2023.

s/d-

Executive Engineer (E)
Deendayal Port Authority

Annexure I

Bill of Quantities

Name of Work : "Design, Manufacturing, Supply, Installation, Erection, Testing and Commissioning of 66/11 KV GIS Substation and Shifting of 11 KV Power Transformers to New GIS Substation at DPA"

Sr. No.	Description	Unit	Qty.	Supply Rate	Installation, Testing and Commissioning Rate	Supply Amount	ITC Amount
A	**Main Equipment 66/11 KV GIS Sub-Station**						
1	**66 KV GIS Equipment**						
1.1	**66 KV Indoor Type Double BUS SF-6 GAS Insulated Switchgear.**	Set	1				
	Supply, Installation, Testing and Commissioning of 66 KV 2500 A, 31.5 KA for 3 Sec. Indoor type GIS Switchgear suitable for monitoring and controlling from SCADA over IEC : 61850 Protocol with Double Bus Arrangement, in line with the tender SLD, with all required accessories, first fill SF-6 Gas, PD Sensors, Blanking Plates, Test Plugs, Conforming to the Tech. Spec. No. 1, relevant latest standards & latest GETCO specifications, as applicable. Offered GIS shall be supplied with all required accessories/modules to facilitate the future expansion on both the sides. Configurations shall be as below : Incomer : 2 Nos. Outgoing Transformer Feeder : 3 Nos. BUS Coupler : 1 No. BUS PT - 1 & 2 : 2 Nos.						
1.2	**Incomer Module**	Set	2				
	3- Ø 66 KV, 2500 A, 31.5 KA-						

	3 sec, Metal Enclosed SF-6 Gas Insulated Switchgear Line Bay Module comprising of (a) Circuit Breaker (b) Current Transformer (c) Line side Disconnector with one maintenance Free Earthing Switch (d) High speed/Fast Acting Line Earthing switch (e) Voltage Transformer, 66 KV/√3//110 V/√3, 3C (f) Bus Disconnector with Earthing Switch (Bus side common earthing switch for two Buses) (g) Bus Disconnector without Earthing Switch (h) LCC Panel (i) 66 KV Power Cable Module (j) All other items including control cables as per Tech. Spec. No. 1.						
1.3	**Outgoing Transformer Module**	Set	3				
	3- Ø 66 KV, 2500 A, 31.5 KA-3 Sec, Metal Enclosed SF-6 Gas Insulated Switchgear - Line Bay Module comprising of (a) Circuit Breaker (b) Current Transformer (c) Line side Disconnector with one maintenance Free Earthing Switch (d) High Speed/Fast Acting Line Earthing switch (e) Voltage Transformer, 66 KV/√3//110 V/√3, 3C (f) Bus Disconnector with Earthing Switch (Bus side common earthing switch for two Buses) (g) Bus Disconnector without Earthing Switch (h) LCC Panel (i) 66 KV Power Cable Module (j) All other items including control cables as per Tech. Spec. No. 1.						
1.4	**Main Bus-Coupler**	Set	1				
	3- Ø 66 KV, 2500 A, 31.5 KA-3 Sec., Metal Enclosed SF-6 Gas Insulated Switchgear - Bus Coupler Bay Module						

	comprising of (a) Circuit Breaker (b) Current Transformer (c) Bus Dis-connector with one Earthing Switch (d) LCC Panel (e) All other items as per Tech. Spec. No. 1.						
1.5	**BUS VT Module**	Set	2				
	3 - Ø 66 KV, 31.5 KA-3 Sec., Metal Enclosed SF-6 Gas Insulated Switchgear - Bus VT Module comprising of (a) 3 X Single Phase Voltage Transformer 66 KV/√3//110V/ √3 - segregated from Bus Bar Unit (b) High Speed/Fast Acting Earthing Switch (c) Bus Disconnector with Earthing Switch (d) All other items as per Tech. Spec. No. 1.						
I.	1C X 630 Sq. mm. 66 KV, XLPE, Poly Al. Armoured Cable.	Mtrs.	1550				
II.	66 KV GIS Termination suitable for 1C X 630 Sq. mm. AL. 66 KV Cable with Male and Female Contacts.	Set	15				
III.	66 KV Outdoor Termination suitable for 1C X 630 Sq. mm. AL. 66 KV Cable.	Set	25				
IV.	66 KV Outdoor Termination suitable for 1C X 630 Sq. mm. AL. 66 KV Cable with 66 KV Metal Oxide Lightning Arrestor, Hardware, Accessories suitable for Mounting on Tower of D/C Transmission Line.	Set	6				
V.	3 phase Link box with SVL	Set	5				
VI.	3 phase Link box without SVL	Set	5				
VII.	Co-Axial Cable	Mtrs.	200				

2	**11 KV Indoor GIS Switchboard**	Set					
	Supply, Installation, Testing and Commissioning of 11 KV, 2500 A, 26.3 KA for 3 Sec. Indoor type GIS Switchgear with Numerical Protection relays suitable for monitoring and controlling from SCADA over IEC : 61850 Protocol, in line with the tender SLD, with all required accessories, first fill SF-6 Gas, test plugs, Conforming to the Tech. Spec. No. 2. Offered GIS shall be supplied with all required accessories / modules to facilitate future expansion on both the sides.						
2.1	**Incomer Module**	Set	3				
	3- Ø, 11 KV, 2500 A, Short Circuit Current Rating of 26.3 KA for 3 Sec., Three Phase encapsulated Unit, SF-6 Gas Insulated, Metal enclosed Bus Bars, Bus Enclosures running along the length of the Switchgear to interconnect each of the Feeder Modules in Single Main Bus System. Each Phase shall be complete with Inductive Voltage Transformers (VTs) / Current Transformer (CTs), Isolator / Disconnect-cum-Earth Switches and Safety Grounding Switch, Capacitive Voltage Detector, Surge Arrestor, Numerical Protection Relays and all others, complete with Manual & Motor Driven Operating Mechanisms and Accessories etc. complete in all respects Connection, Tapping, Lugging etc.						
2.2	**DG 11 KV Incomer**	Set	1				

	Module						
	3- Ø, 11 KV, 2500 A, Short Circuit Current Rating of 26.3 KA for 3 Sec., Three Phase encapsulated Unit, SF-6 Gas Insulated, Metal enclosed Bus Bars, Bus Enclosures running along the length of the Switchgear to interconnect each of the Feeder Modules in Single Main Bus System. Each Phase shall be complete with Inductive Voltage Transformers (VTs) Current Transformer (CTs), Isolator / Disconnect-cum-Earth Switches and Safety Grounding Switch, Capacitive Voltage Detector, Surge Arrestor, Numerical Protection Relays, all, complete with Manual & Motor Driven Operating Mechanisms and Accessories etc. complete in all respects, Connection, Tapping, Lugging etc.						
2.3	**BUS Coupler Module**	Set	2				
	3- Ø, 11 KV, 2500 A, Short Circuit Current Rating of 26.3 KA for 3 Sec., Three Phase encapsulated Unit, SF-6 Gas Insulated, Metal enclosed Bus Bars, Bus Enclosures running along the length of the Switchgear to interconnect each of the Feeder Modules in Single Main Bus System. Each Phase shall be complete with Current Transformer (CTs), Isolator / Disconnect cum Earth Switches and Safety Grounding Switch, Capacitive Voltage detector on both the sides, Numerical Protection relay/s all, complete with						

	Manual and Motor Driven Operating Mechanisms and Accessories etc. complete in all respects, Connection, Tapping, Lugging etc.						
2.4	**Outgoing Line New Feeder Module**	Set	16				
	3- Ø, 11 KV, 1250 A, Short Circuit Current Rating of 26.3 KA for 3 Sec., Three Phase encapsulated Unit, SF-6 Gas Insulated, Metal enclosed Bus Bars, Bus Enclosures running along the length of the Switchgear to interconnect each of the Feeder Modules in Single Main Bus System. Each Phase shall be complete with Current Transformer (CTs), Isolator / Dis-connector-cum-Earth Switches and Safety Grounding Switch, Capacitive Voltage Detector, Surge Arrestor, Numerical Protection Relay/s, all, complete with Manual & Motor Driven Operating Mechanisms and Accessories etc. complete in all respects, Connection, Tapping, Lugging etc.						
2.5	**11 KV Capacitor Feeder Module**	Set	3				
	3- Ø, 11 KV, 1250 A, Short Circuit Current Rating of 26.3 KA for 3 seconds, Three Phase encapsulated Unit, SF-6 Gas Insulated, Metal enclosed Bus Bars, Bus Enclosures running along the length of the Switchgear to						

	interconnect each of the Feeder Module in Single Main Bus System. Each Phase shall be complete with Current Transformer (CTs), Isolator / Disconnect-cum-Earth Switches and Safety Grounding Switch, Capacitive Voltage detector, Surge Arrestor, Numerical Protection Relay/s, all, complete with Manual & Motor Driven Operating Mechanisms and Accessories etc. complete in all respects, Connection, Tapping, Lugging etc.						
3	**Power / Distribution Transformer**						
3.1	Supply, Installation, Testing and Commissioning of 12.5 MVA, 66/11 KV, Dyn-11, KNAN Power Transformer with Ester Oil, OLTC, RTCC, first fill Oil, NIPS, Soak Pit & all Accessories, suitable for running in parallel with existing Power Transformers, as per Tech. Spec. No. 3 and Standards.	No.	1				
3.2	Disconnection from existing Services, Cables, Oil Draining, Dismantling from existing Substation with all Accessories, Packing, Loading & Unloading, Shifting, Re-Installation at new Substation with new Soak Pit with all Accessories, Testing and Commissioning of 10 & 12.5 MVA, 66/11 KV, Dyn-11, ONAN Transformer with Ester Oil, OLTC, RTCC, NIFPS, NGR, Accessories, Oil Re-filling and Filtration, Supply of Consumables, Minor Fabrication / Repair works, as per Tech. Spec. No. 4 and	Nos.	2				

	standards.						
3.3	Supply, Installation, Testing and Commissioning of NGR of 11/√3 kV, 656A, 9.68 Ohm suitable for Outdoor installation as per the Tech. Spec. No. 6.	No.	1				
3.4	Supply, Installation, Testing and Commissioning of Nitrogen based Fire Prevention and Protection System for 12.5 MVA 66/11 KV, KNAN Transformer with Ester Oil as per the Tech. Spec. No. 7.	No.	1				
3.5	Disconnection from existing services, Cables, Dismantling from existing Substation, Loading & Unloading, Shifting, Re-Installation at the new Substation with all Accessories, Testing and Commissioning of 500 KVA, 11/0.415 KV, ONAN Indoor Duty Distribution Transformer.	No.	1				
4	**66 KV Outdoor Equipment for Metering Yard**						
4.1	Dismantling, Packing, Loading, Shifting, Unloading, Installation, Testing and Commissioning of 66 KV, 1250 A, Isolators with Earth Switch for Incoming 66 KV Lines, including Insulators, Support Structures, Accessories etc.	Set	2				
4.2	Dismantling, Packing, Loading, Shifting, Unloading, Installation, Testing and Commissioning of 66 KV, Lighting Arrestor for Incoming 66 KV Lines, including Support Structures, necessary Fabrication / Modification for fixing 66 KV Cables,	Nos.	12				

	Hardware and Accessories etc.						
4.3	Disconnection, Dismantling, Packing, Loading, Shifting, Unloading, Installation, Testing and Commissioning of 66 KV, Oil type Tariff Metering PT for Incoming 66 KV Lines, including Support Structures, Hardware and Accessories etc.	Nos.	6				
4.4	Disconnection, Dismantling, Packing, Loading, Shifting, Unloading, Installation, Testing and Commissioning of 66 KV, Oil type Tariff Metering CT for Incoming 66 KV Lines, including Support Structures, Hardware and Accessories.	Nos.	6				
4.5	Supply, Fabrication, Modification of additional Cross-Arm for 66 KV Cable Termination, 66 KV Metal Oxide Lighting Arrestor with necessary Hardware on existing D/C Transmission Line Tower with all metal parts Hot Dip Galvenised as per GETCO Standards.	Job	1				
4.6	Supply, Installation, Testing and Commissioning of PS Type D/C Transmission Line Tower with additional Cross Arm, Structure, Hardware, Accessories suitable for connecting 66 KV Cable, Lightning Arrestors, Cable Tray, etc. All metal parts shall be of Hot Dip Galvenised as per GETCO Standards.	No.	1				
4.7	Foundation of PS Type D/C Transmission Line Tower. It shall be on Pile Foundation as per GETCO Standards.	No.	1				
	Supply, installation, testing and commissioning of ACSR Panther Conductor as per						

4.8	GETCO Standards and Specifications with all the test certificates.	Mtrs.	250				
4.9	Supply, Installation, Testing and Commissioning of 66 KV Bus Post Insulator including Support Structures with necessary Hardware and Accessories etc.	Nos.	2				
4.10	Supply, Installation, Testing and Commissioning of 66 KV, Polymeric Metal Oxide, Class-II Lightning Arrestor for Power Transformer, including support Structures, necessary, hardware and accessories etc. as per GETCO Specifications and Standards.	Nos.	11				
5	**66 KV C & R Panel as per Technical Specification.**						
	Control and Protection Panels with Numerical Relay, Bay Control Unit all with latest state of art technology suitable for Control & Monitoring of GIS Switchgear Modules from SCADA over IEC : 61850 Communication Protocol as per Technical Specifications and latest GETCO specifications & practice.	Nos.	2				
5.1	Control and Protection Panels for 66 KV Line Bays as per GETCO Standards and Specifications.	Nos.	2				
5.2	Control and Protection Panels for 66/11 KV Transformer Bays as per GETCO Standards and Specifications.	Nos.	3				
5.3	Control and Protection panels for 66 KV Bus Coupler as per GETCO Standards and Specifications.	Set	1				
6	**Substation Automation System (SCADA)**						

6.1	Supply, Erection, Testing and Commissioning of SCADA equipment and materials as per respective Tech. Spec. No. 8 and suitable for Control & Monitoring of 66 KV GIS Switchgear Modules, 11 KV New GIS Switchboard, 11 KV Existing GIS Switchboard with Switches & OFC (02 lengths), Station Auxiliaries, etc. from SCADA over IEC : 61850 Communication protocol with UPS for SCADA with at least 1 Hr. back up, all required Hardware, Accessories, Communication Cables, Patch Cables, SCADA Furniture, etc. as per Tech. Spec. No. 8 and latest GETCO specifications & practice with minimum spec, but not limited to it.	LOT	1				
6.2	Supply, Laying, Termination & Commissioning of 6-F, Double Sheath Armoured Outdoor, Single Mode Optic Fiber Cable fully compliant with IEC: 60794-3, with heavy duty HDPE duct.	Mtrs.	3000				
6.3	Ethernet Switch, Necessary Hardware, Modification / wiring if required, Communication Cable for Existing 11KV GIS for integration with SCADA under the scope of this tender	LOT	1				
7	**11 KV HT Capacitor Bank**						
	11 KV, 400 KVAR Indoor Fixed type Capacitor Bank complete with Disconnecting Isolator, HT Contactor, Series reactor, RVT etc. as per GETCO specifications & standards.	Set	3				
8	**110 V DC Batteries and Battery Charger as per technical specification.**						

I.	Supply, Installation, testing and commissioning of 110 V, 240 AH VRLA DC Battery set along with mounting racks.	Set	1				
II.	Supply, Installation, testing and commissioning of Electronic, SCADA Compatible Float and Float-cum-Boost Charger of 110 V DC, with mandatory Protections including Surge Protection and Annunciation as per latest GETCO Specifications and Standards.	Set	1				
9	**110 V DCDB**						
	Supply, Installation, Testing, & Commissioning of DC Distribution Board with 20 OG Feeders.	No.	1				
10	**LT AC Distribution Board as per technical specification**						
10.1	Supply, Installation, Testing and Commissioning of SCADA compatible 415 V, Main LT Distribution Board for Station Auxiliaries as per SLD and Tech. Spec. Incomer Feeder shall be fixed type 1000 A, ACB with LSIG Numerical Protection Relay suitable for controlling & monitoring from SCADA. Outgoing shall be MCB/MCCB as per required ratings with status monitoring Indicating Lamps on Panel.	Set	1				
10.2	415 V, Main Lighting Distribution Board as per requirement for the new Substation.	Set	1				
10.3	415 V Emergency Lighting Distribution Board as per requirement for the new Substation.	Set	1				
	415 V Normal Lighting Distribution Board with Timer Control as per requirement	Set	1				

10.4	for the 66 KV Metering Bays, Road, at new Station.						
10.5	415 V Distribution Board for Air Conditioner of New Substation.	Set	1				
10.6	110 V DC Emergency Lighting Distribution Board for new substation.	Set	1				
11	**Inverter with Battery for Emergency Lighting as per technical specification**						
	Inverter System provided with Battery Bank with total of 115 Nos. of Batteries to connect in LT Panel Supply for Emergency Lighting failure.	Set	2				
12	**Visual Monitoring System – CCTV as per Technical Specification.**						
	Visual Monitoring System (CCTV) as per the Tech. Spec. No. 9 along with local PC monitoring set up, State of the Art Night Vision HD Camera of 20 Nos., necessary Panels, Hardware, Accessories, etc. for the complete new Substation Building.	Set	1				
13	**Illumination, Air Conditioners System, Switch Board with Receptacles etc. as per Technical specification.**						
13.1	**SS Building / HT DG Room / Diesel Store Room / Meter Room.**						
I.	100 W LED High Bay Light Fixtures (GIS Hall)	Nos.	14				
II.	36 W LED - 600 X 600 Recess Mounted Light Fixtures - CRP / SCADA / Office	Nos.	20				
III.	22 W LED Tube light.	Nos.	70				
IV.	Split Type Cassette AC - 3 Ton - CRP Room.	Nos.	3				
V.	Split Type AC - 1.5 Ton -	Nos.	4				

	Office, SCADA Room.						
VI.	Split Type AC - 1.0 Ton - Meter Room.	No.	1				
13.2	**Outdoor**						
I.	High Mast for Outdoor Illumination with necessary accessories, Control Panel and required Light Fixtures.	Set	3				
II.	470 W LED Flood Lights.	Nos.	30				
13.3	**Power Sockets**						
I.	230 V Single phase Earth (16 or 20 A) Power Sockets.	Nos.	18				
II.	3 phase (415 V), 63 A Power Sockets with plugs (Industrial Socket)	Nos.	5				
13.4	**Ceiling Fans**						
	1200 mm. Sweep Fan with 5 Star Rating as per BEE.	Nos.	6				
13.5	**Exhaust Fans**						
	Higher capacity Industrial Standard Exhaust Fans.	Nos.	10				
13.6	**Lighting DB's**						
I.	8 Ways Lighting DB (24 Nos. SP MCB).	Nos.	6				
II.	6 Ways Lighting DB (18 Nos. SP MCB).	Nos.	4				
III.	4 Ways Lighting DB (12 Nos. SP MCB).	Nos.	6				
IV.	Industrial Lighting Distribution Board.	Nos.	10				
13.7	**Conduits/Flexible Wires**						
1.	Conduits for Illumination	Mtrs.	300				
2.	Flexible Wires - 4 / 2.5 Sq. mm. with all the wirings shall be concealed.	Mtrs.	5000				
14	**LT Power and Control Cables (FRLS)**						
14.1	**LT Power Cables**						
I.	4C X 400 Sq. mm. XLPE AL. Cable	Mtrs.	200				
II.	4C X 70 Sq. mm. XLPE AL Cable.	Mtrs.	250				
III.	1 X 35 Sq. mm. Copper Flexible Cable (Battery)	Mtrs.	150				
IV.	4C X 16 Sq. mm. AL Cable	Mtrs.	500				
V.	4C X 6 Sq. mm. AL cable	Mtrs.	1000				
VI.	2C X 6 Sq. mm. AL cable	Mtrs.	750				

14.2	**Glands**						
I.	4 X 400 Sq. mm. XLPE AL. Cable.	Nos.	4				
II.	4 X 70 Sq. mm. XLPE AL Cable.	Nos.	6				
III.	1 X 35 Sq. mm. Copper Flexible Cable (Battery).	Nos.	8				
IV.	4C X 16 Sq. mm. AL Cable	Nos.	40				
V.	4C X 6 Sq. mm. AL Cable.	Nos.	40				
VI.	2C X 6 Sq. mm. AL Cable	Nos.	34				
14.3	**LUGS**						
I.	400 Sq. mm. Al Cable	Nos.	16				
II.	70 Sq. mm. Al Cable	Nos.	24				
III.	35 Sq. mm. Al Cable	Nos.	8				
IV.	16 Sq. mm. Al Cable	Nos.	160				
V.	6 Sq. mm. Al Cable	Nos.	228				
14.4	**Control Cable (Copper)**						
I.	12C X 4 Sq. mm.	Mtrs.	500				
II.	4C X 2.5 Sq. mm.	Mtrs.	500				
III.	12C X 2.5 Sq. mm.	Mtrs.	750				
IV.	19C X 2.5 Sq. mm.	Mtrs.	750				
V.	27C X 2.5 sq.mm	Mtrs.	1000				
14.5	**Glands**						
I.	12C X 2.5 Sq. mm.	Nos.	30				
II.	12C X 4 Sq. mm.	Mtrs.	32				
III.	4C X 2.5 Sq. mm.	Mtrs.	40				
IV.	19C X 2.5 Sq. mm.	Mtrs.	30				
V.	27C X 2.5 sq.mm	Mtrs.	30				
14.6	**LUGS**						
1.	2.5 Sq. mm.	Nos.	3000				
2.	4 Sq. mm.	Nos.	500				
15	**Mechanical Auxiliary System**						

I.	Ventilation System for 66 KV GIS Hall as per GETCO Specifications.	No.	1				
II.	Portable Aluminium/FRP Ladder Extendable type of adequate height (as directed) for Maintenance.	Nos.	5				
III.	Water Cooler with purifier.	No.	1				
IV.	Office furniture	LOT	1				
V.	1.0 MT, Manual operated Chain Pulley Block with mono rail.	Set	1				
VI.	Rubber Insulating Mat Confirming to IS : 15652 : 2006 of Size 2000 X 1000 X 3 mm.	Nos.	60				
VII.	**Fire Alarm System as per technical specification**: - Fire detection should be such that all the smoke / fire sensors installed in the system should be given individual ID and if any abnormality is observed in any of the sensors, its ID should display on LCD Screen of the Detection Panel with Alarm and Annunciation, so that, the operational personnel can target that particular place for fire extinguishing covering all the Rooms in the GIS Building.	LOT	1				
VIII.	Carbon-di-oxide type fire extinguisher of 2 Kgs. Capacity, CO2 gas as per IS : 15222.	Set	2				
IX.	Carbon-di-oxide type fire extinguisher of 4.5 Kgs., Capacity, CO2 gas as per IS : 15222.	Nos.	12				
X.	Mechanical Foam type fire extinguisher 9 Lts.	Set	2				
XI.	ABC powder type fire extinguisher of 6 Kgs.	Nos.	5				

XII.	Fire buckets round bottom type enamel painted, white inside & Red outside and Letter "FIRE" in black outside and handle with mounting bracket.	Nos.	12				
XIII.	Fire Buckets with Stand (Set of 4).	Set	1				
16	**DG Set as per technical specification.**						
	Supply, Installation, Connection, Testing and Commissioning of LT DG 150 KVA With AMF Panel & Protection & LT Panel from Old Substation to new Substation.	Set	1				
17	**EOT Crane (Supply, Installation etc.) as per technical specification.**						
	66 KV GIS Hall 5.0 MT with permanent fixed ladder from ground to EOT Crane.	Set	1				
18	**Earthing & Lightning System and Accessories (Supply, Installation etc.)**						
I.	Copper Bar Electrodes 32 mm. dia. (3 M rod)	Nos.	10				
II.	Copper Bar Rod 32 mm. dia. for Main earthing.	Ton	7				
III.	75 X 12 mm. G. I. Flat.	Ton	1.86				
IV.	24 mm. Dia. 3000 mm. long Copper bonded Maintenance free Chemical Earthing.	Nos.	32				
V.	25 X 3 mm. GI Flat for horizontal and down conductor for control building	Mtrs.	300				
VI.	25 mm. dia. 1000 mm. Long Air Termination Spike.	Nos.	8				
VII.	Epoxy Fixing Clamps for down conductors	Nos.	150				
III.	Check Pits	Nos.	8				
19	**66 KV Outdoor Equipment (Supply, laying etc.)**						
I.	All types of Hardware & Fittings/Spacers/Clamp &	No.	1				

	Connectors						
II.	66 KV Long Rod suspension insulators	LOT	6				
III.	66 KV Long rod Tension Insulators	Nos.	6				
IV.	Tariff Metering Panel and RTU system as per GETCO Specification (Main & Check per Set).	Set	2				
V.	11 KV, 3C X 300 Sq. mm. XLPE Al. Conductor Cable.	Mtrs.	13000				
VI.	11 KV Indoor Termination Kit suitable for 3C X 300 Sq. mm. XLPE, AL. Cable suitable for 11 KV GIS with Boots	Nos.	48				
VII.	11 KV Indoor Termination Kit suitable for 3C X 300 Sq. mm. XLPE, AL. Cable suitable for Power Transformer Cable Box	Nos.	10				
VIII.	11 KV Indoor Termination kit suitable for 3C X 300 Sq. mm. XLPE, AL. Cable Suitable for APFC / DG Set	Nos.	4				
IX.	11 KV St. Through Joint Kit suitable for 3C X 300 Sq. mm. XLPE, AL. Cable.	Nos.	36				
X.	Portable Earthing Rod	Nos.	6				
XI.	HDPE Pipe (150 mm. Diameter)	Mtrs.	3000				
B	**Testing & Maintenance Equipment**						
1.	Portable partial Discharge Monitoring Kit.	No.	1				
2.	Meggar 5 KV (Motorized)	No.	1				
3.	Meggar 1 kV (Motorized)	No.	1				
4.	Digital Multi meter	No.	1				
5.	Circuit Breaker CB Analyzer with 6-Channel DCRM Kit with all required accessories, Laptop, Transducer - 1 Set, required software.	No.	1				
6.	Digital Manometer	No.	1				
7.	Micro Ohm Meter Portable Type suitable for measuring Contact Resistance of High Voltage Equipment	Set	1				

8.	Automatic Capacitance and Tan Delta Kit	No.	1				
9.	Automatic Turn Ratio Tester.	Set	1				
10	DC Winding Resistance Kit.	Set	1				
11	Primary Current Injection Set (1000 A).	Set	1				
12	Circuit Breaker Time Analyzer.	Set	1				
13	Universal Relay Testing Kit	Set	1				
14	SF-6 Gas Purity, Dew Point Measuring Kit with gas components like SO2, H2O, CF4, HF, Air, purity, etc.	Set	1				
15	Gas leakage detector	Set	1				
16	SF-6 Gas Filling, Recovery and purification unit with all required accessories DILO make : Model B-057-R17 having Compression - 4.8 M^3/Hr., Vacuum Pump - 40 M^3/Hr., Storage Tank - 280 Ltrs. WIKA make : Model GFU 20 having Compression - 6 M^3/Hr., Vacuum Pump - 40 M^3/Hr., Storage Tank - 300 Ltrs.	Set	1				
17	Oil BDV Testing Kit with measuring gauge (GO and NO-GO) as per IS from following make and model. Megger make : Model OTS100AF/ BAUR make: Model DTA100C/ Motwane make : Model OTA100S.	Set	1				
18	Hydraulic Pallet Truck with all required accessories Wont Ind. Equip Make : Model W-HOPT 30 (Four Clip).	Set	1				
19	Digital Earth Resistance Tester with all required accessories from following make and model - GE-OHM C Make: Model no EN 61557/VDE 0413 (Made in Germany) / Megger make : DET3D, Motwane make :	Set	1				

	DET20 / DECT20						
C	**Mandatory Spares**						
	Mandatory Spares for Power Transformer						
1.	66 KV bushing complete in all respects.	No.	1				
2.	11 KV bushing complete in all respects.	No.	1				
3.	Bucholz Relay complete with float and contact (Main Tank).	Set	1				
4.	Local and Remote Winding Temperature Indicator with contact and sensing device.	Set	1				
5.	Oil Temperature Indicator with contact and sensing device (Local and Remote).	Set	1				
6.	Set of Valves of all sizes (Complete set for 1 Transformer)	Set	1				
7.	Complete set of Gaskets used per Transformer.	No.	1				
8.	Pressure relief device.	Nos.	2				
9.	Magnetic Oil Level Gauge	Nos.	2				
10.	Oil surge Relay	No.	1				
11.	Plank/dummy plates for radiators opening.	LOT					
12.	Oil temperature sensing cable with capillary.	Nos.	2				
13.	Pressure relief device for OLTC.	No.	1				
14.	Breather Assembly (for Conservator and OLTC).	Set	1				
20	**Common Spares, Maintenance Tools for 66 / 11 KV GIS**						
20.1	**Spares for 66 KV GIS.**						
I.	SF-6 Gas Pressure Relief Devices 03 Nos. of each type.	Set	1				
II.	Pressure Gauge along with Coupling Device Rubber Gaskets, "O" Rings and Seals for SF-6 gas.	No.	1				

III.	Density Monitor for SF-6 Gas.	No.	1				
IV.	All Types of Control Valves for SF-6 Gas.	No.	1				
V.	Molecular Filter for SF-6 Gas with Filter Bags.	%	20				
VI.	SF-6 Gas - Quantity be weight.	%	20				
VII.	Locking Device to keep the Dis-connectors (Isolators) and Earthing Switches in CLOSE or OPEN.	Set	1				
VIII.	Coupling device for pressure gauge cum switch for connecting gas handling plant (03 Nos. of each type).	Set	1				
IX.	Relays, Power Contactors, push Buttons, timers & MCB etc. of each type and Rating.	Set	1				
X.	Operation Counter	No.	1				
XI.	Spring operating mechanism, complete with all necessary connecting apparatus.	Set	1				
XII.	Spring Charging Motor	Set	1				
XIII.	Motor for drive Dis-connector / Earth Switch / Fast Acting Earth Switch of each rating and type.	Set	1				
XIV.	Indicating lamps of each make and type.	%	10				
XV.	Complete set of 3 phase dis-connector including main circuit, enclosure, driving mechanism etc. for one bay	No.	1				
XVI.	High speed/Fast acting fault making grounding switch including main circuit, enclosure and driving mechanism etc. for one complete Bay.	No.	1				
VII.	Three phase Earthing Switch including main circuit, enclosure, driving mechanism etc.	No.	1				

VIII.	66 KV, single phase current transformer complete with mounting hardware of each type and rating	Nos.	2				
XIX.	66 KV, single phase Voltage Transformer ratio, 66 KV/√3/110 V/ √3/110 V/√3 with mounting hardware	Nos.	2				
20.2	**Spares for 11 KV GIS Board**						
I.	Each type and rating complete with interrupter, main circuit enclosure, with marshalling box and operating mechanism.	No.	1				
II.	Rubber gasket, 'O' rings and seals of SF-6 gas of each type.	Set	1				
III.	Trip Coils with Resistor as applicable (3 Nos. of each type)	Set	1				
IV.	Closing Coils with resistor as applicable (3 Nos. of each type).	Set	1				
V.	Molecular Filter for SF-6 Gas with Filter Bags.	10% of total quantity	10				
VI.	Density / Gas pressure monitor (3 Nos. of each type)	Set	1				
VII.	Relays, Power Contactors, push Buttons, timers & MCB etc. of each type and Rating	Set	1				
VIII.	Operation Counter	No.	1				
IX.	Spring operating mechanism, complete with all necessary connecting apparatus.	Set	1				
X.	Spring Charging Motor	Set	1				
XI.	Coupling device for pressure gauge cum switch for connecting gas handling plant (3 Nos. of each type).	Set	1				
XII.	Indicating lamps of each make and type	%	10				

XIII.	Numerical Protection Relay / BCPU of each make and model no.	No.	1				
XIV.	Relay Programming and configuration Software with necessary and suitable cables for each make and type.	No.	1				
XV.	Trip Relay / Supervision Relay / Auxiliary Relay / Contact Multiplier / Timers, of each make and Type.	No.	1				
XVI.	MCB / Control Switch of each make and type.	No.	1				
XVII.	Annunciator of each make and type	No.	1				
XVIII.	Semaphore of each make and type	Nos.	3				
XIX.	Multifunction Meter of each make and type	No.	1				
XX.	Indicating lamps of each make and type.	%	10				
21	**Spares for 66 KV Isolator and Earth Switch.**						
I.	Complete set of 3 Phase Isolator Main Power components / contacts including operating rods and driving Mechanism of each make and type	Set	1				
II.	Complete set of three phase earthing switch main Power components contacts, operating rods and driving mechanism of each make and type.	Set	1				
III.	Limit switches and auxiliary switches for complete three phase equipment.	Set	1				
IV.	For isolator	Set	3				
V.	For earth switch	Set	1				
VI.	Relays, Power Contactors, Push Buttons, Timers & MCB etc. of each type and rating	Set	1				
VII.	For Isolator	Set	3				
VIII.	For Earth switch	Set	1				
IX.	Auxiliary Switch Assembly with NO + NC (3 Nos. of each	Set	1				

	type).						
X.	Drive Motor for Isolator	Set	1				
XI.	Annunciator of each make and type.	Nos.	2				
22	**11 KV GIS Switchgear Mandatory spares & Tools**						
I.	11 KV single phase current transformer complete with mounting hardware of each type and rating.	No.	1				
II.	11 KV single phase voltage transformer of each type and rating.	No.	1				
22.1	**Circuit Breaker**						
I.	Tripping coil	No.	1				
II.	Closing coil	No.	1				
III.	Spring charge motor	No.	1				
IV.	3-ph Vacuum Circuit Breaker Module.	No.	1				
V.	Annunciator of each make and type	Nos.	2				
22.2	**Spares for 110 V DC Battery Charger & DCDB**						
I.	Set of Relays (1 No. of each type).	Set	1				
II.	Set of contactor (1 No. of each type).	Set	1				
III.	Set of switches (1 No. of each type).	Set	1				
IV.	DP MCB (five nos. of each type and rating).	Set	1				
22.3	**Spares of LT Switchgear**	LOT	1				
I.	Auxiliary Relays (1 No. of each type)	Set	1				
II.	CTs and PTs (1 No. of each type).	Set	1				
III.	Switches/Push buttons (1No. of each type).	Set	1				
IV.	MCCB (1 No. of each type and rating)	Set	1				
V.	Voltmeters	No.	1				
VI.	Ammeter	No.	1				
VII.	O/C & E/F relay	No.	1				

VIII.	Auxiliary contactors (1 No. of each type)	Set	1				
	Bus-bar						
a)	Bus-bar insulators	Nos.	5				
b)	Inter-phase barrier	Nos.	2				
c)	Bus-bar strip (Aluminium)	Mtrs.	5				
22.4	**Spares for 66 KV Control Relay and Protection Panels / SCADA**						
I.	Numerical Protection Relay of each make and model no.	No.	1				
II.	Bay Control Unit of each make and model no.	No.	1				
III.	Relay Programming and configuration Software with necessary and suitable cables for each make and type	No.	1				
IV.	Trip Relay / Supervision Relay / Auxiliary Relay / Contact multipler / Timers, of each make and Type	No.	1				
V.	MCB / Control Switch of each make and type	No.	1				
VI.	Semaphore of each make and type	Nos.	3				
VII.	Multifunction Meter of each make and type	No.	1				
VIII.	Ethernet switch of each type	No.	1				
IX.	LIU of each type/ configuration	No.	1				
X.	Communication Cable of each type	%	20				
XI.	Indicating lamps of each make and type	%	10				
XII.	Convertors of each make and type	No.	1				
Total of Electrical Work (A+B+C)							

D	Civil Works for GIS 66/11 KV Substation				
Sr. No.	**Description**	**Unit**	**Qty.**	**Unit Rate**	**Amount**
<u>Excavation Work</u> : (Cutting, Filling, Levelling & Foundation of 66 KV Substation)					
1.	Preparing topographical contour survey and geotechnical survey investigation, collection climatological data like rainfall, highest flood level, wind direction and speed etc. required for design.	JOB	1.00		
2.	Preparing Soil bearing test with required equipment as per IS code including field and lab test with submitting test report and taking load test at site as directed by engineer in charge.	JOB	1.00		
3.	Excavation for foundation in trenches up to 1.5 Mtr. depth including sorting out and stacking of useful materials and disposing off the excavated stuff up to 50 Mtr. lead a for Loose or soft soil.	CMT	4,677.56		
4.	Excavation for foundation for depth from 1.5 Mtr. to 3 Mtr. depth including sorting out and stacking of useful materials and disposing of the excavated stuff up to 50 Mtr. lead for Loose or soft soil.	CMT	302.88		
5.	Do as above but above 3.0 Mtr. depth	CUM	37.48		
6.	Drilling of 300 mm. dia. pile at required location and depth by means of mechanical equipment with required tools and tackles as directed by engineer in charge.	RMT	146.00		
7.	Do as above but for 450 mm. dia. pile	RMT	662.76		
8.	Filling in plinth/trenches & yard with earth in 200 mm., thick layers including watering, ramming, consolidating etc., complete as directed by EIC, with excavated earth from foundation. The item rate includes all leads & lifts.	CMT	1,809.92		
9.	Filling in foundation and plinth with murrum or selected soil in layers of 200 mm. thickness including watering, ramming and consolidating, etc. complete with all lead and lift. Murrum or selected soil shall be brought from outside at any lead.	CMT	2,021.33		
10.	Removal of surplus excavated materials not required for backfill shall be deposited in areas outside plot boundary by mechanical means up to any lead as directed by Engineer-in-charge including loading, unloading & spreading in layers as per requirement of Engineer-in-Charge.	CMT	3,161.44		
11.	Filling in plinth with sand under floors including watering, ramming, consolidating and dressing etc. complete.	CMT.	14.10		
12.	Providing brick masonry in foundation and up to plinth or mezzanine floor in C.M. (1:6) including racking out joints up to 12 mm. depth, scaffolding, curing, filling up the gaps between the joints complete as directed by E.I.C. with	CMT	123.28		

	Conventional Bricks.				
13.	Do as above Item No. 12 but for super structure Up to 5.0 Mtr. height or ground floor height with Conventional Bricks.	CMT	249.11		
14.	Do as above Item No. 12 but for super structure above 5.0 Mtr. height or first floor height including parapet and stair cabin with Conventional Bricks.	CMT	218.87		
15.	Do as above item No. 12 but for partition wall in C.M. (1:4) up to plinth & two floors G.F+F.F+Stair Cabin. Conventional Bricks.	SMT	290.13		
16.	Providing & laying control cement concrete 1:4:8 as per mix design exposed work with curing etc. complete including the cost of ply wood / steel sheathing form work & adjustable tubular steel supports / Props. but excluding the cost of reinforcement. G.F+F.F+Stair Cabin for Footing	SMT	313.50		
17.	Providing & laying control cement concrete M15 as per mix design exposed work with curing etc. complete including the cost of ply wood / steel sheathing form work & adjustable tubular steel supports / Props. but excluding the cost of reinforcement. G.F+F.F+Stair Cabin for Footing	CMT	323.59		
18.	Providing & laying control cement concrete M20 as per mix design exposed work with curing etc. complete Excluding the cost of ply wood / steel sheathing form work & adjustable tubular steel supports / Props. but excluding the cost of reinforcement.	CMT	762.46		
19.	Providing and laying controlled design mix Reinforced Cement Concrete of M25 grade with 20 mm. down size graded crushed stone aggregates for all elements including cup lock scaffolding, opening, recesses, chamfering, finishing top surfaces, vibrating, machine mixing tamping, curing, (excluding cost of centering, shuttering and reinforcement) etc. complete as per the specifications, drawing and instruction of Engineer-in-charge. Concrete shall be finished to the true line, level & as per tolerances required. up to plinth or mezzanine floor.	CMT	1,215.29		
20.	Do as above M25 above item but up to 5.0 Mtr. height or first floor height.	CMT	327.86		
21.	Do as above M25 but above 5.0 Mtr. height or first floor height including perapit and stair cabin.	CMT	189.96		
22.	Do as above but for M30 concrete for Pile casting as directed.	CMT	118.87		

23.	Applying Power trowel to cocncrete floor of any thickness	SMT	287.79		
24.	Providing form work of steel / ply wood planking so as to give a smooth exposed finish including centering (steel adjustable tubular supports). Shuttering strutting and propping etc. for plinth or mezzanine floor propping and centering below supporting floor to ceiling etc.	SMT	12,870.95		
25.	Do as above plinth but up to 5.0 Mtr. or ground floor height.	SMT	2,458.93		
26.	Do as above plinth but above to 5.0 Mtr. or first floor height including perapit and stair cabin.	SMT	1,424.72		
27.	Providing Thermo Mechanically treated bars (CRS steel bars) confirmed to IS : 1786 FE 500 for RCC work including bending, binding and placing in position etc. completed for RCC work for required height.	MT	262.86		
28.	P/A one coat(@ 200 microns) of Nitocote ET 402 of Fosrock over a coat of primer to Nitoprime 25 to RCC structures below ground level coming in contact with soil.	SMT	5,241.92		
29.	Setting of template & foundation bolts in line and level before concreting of foundation and making arrangement of fixing template in such a way as it remains in position during concrete etc. comp. as directed by EIC. The rate includes supplying & fabrication for Gantry Foundation	No.	-		
30.	Setting of template & foundation bolts in line and level before concreting of foundation and making arrangement of fixing template in such a way as it remains in position during concrete etc. comp. as directed by EIC. The rate includes supplying & fabrication for Gantry Foundation	No.	44.00		
31.	Providing and laying 25 to 50 mm. thick Under pinning below base plate & the top surface of the foundation concrete with cement mortar in proportion of 1:3 with water cement ratio 0.4 by weight, blended with an approved free flow grout Cebex 100 OR Interplast NN or equivalent approved make (chemical supplied by contractor) as per manufacturer specification in line and level including shuttering , making top surface chamfered ,curing etc. complete as per specification & directed by Engineer in charge.	SMT	40.32		
32.	Supply & Labour charge for fixing in position anchor bolts, foundation bolts in line & level with template as per drawing including application of grease and covering with plastic cover. anchor bolt handling & positioning is in scope of civil contractor for fixing bolts & quoted rates includes the same as directed.	Kg.	498.00		

33.	Providing & placing 50 mm. thick & 300 mm. wide prestressed concrete cover (for clear span of up to 1.2 Meter in proportion (1:1:5:3) or M-20 necessary reinforcement or 4 mm. dia. HT steel wire-4 Nos. bars and 4 mm. dia. distribution bars at 150 mm. C/C as per drawing & design including providing & vibrating with vibrators. Finishing all the surfaces, curing by placing in water pond for ten days etc. complete as directed by E.I.C. (The rate includes cost of all material required, labour charges, transportation, loading, unloading etc.	SMT	147.00		
34.	Do as above but 75 mm. thick	SMT	1,375.00		
35.	Providing 20 mm. thick cement plaster single coat on masonry /bela/concrete wall/ceiling for plastering up to any floor level finished even and smooth in cement mortar 1:3 (1 Cement : 3 sand) finished with floating coat of neat cement slurry at required height.	SMT	4,953.66		
36.	Providing 20 mm. thick sand face cement plaster on wall up to height 10 Meters above ground level consisting of 12 mm. thick backing coat of C.M. 1:3 (1 cement: 3 sand) and 8 mm. thick finishing coat of C.M. 1:1 (1 cement : 1 sand) etc. complete at required hight.	SMT	3,982.92		
37.	Providing and fixing 24 Gauge Chicken Wire Mesh at the junction of masonry work and RCC work or on any other place as directed including fixing with nails, raw/ plugs etc. complete at all heights before applying plaster.	SMT	216.00		
38.	Providing cement vata (10 Cm. X 10 Cm. size) quarter round in cement mortar 1:1 including neat cement finishing watering etc. complete.	RMT	224.10		
39.	Providing distempering (three coats) with oil bound distemper of approved brand and manufacture and of required shade on undercoated wall surface to give an even shade over and incl. a priming coat with distemper primer of approved brand and manufacture after thoroughly brushing the surface free from mortar droppings and other foreign matter and also incl. preparing the surface even and sand papered smooth.	SMT	4,050.47		
40.	Providing & applying 3 coats of ACID/ALKALI resisting paint of approved shade & make to wall, ceiling including filling putty smoothing the surfaces scaffolding etc. complete as directed by E.I.C.	SMT	60.34		
41.	Providing & applying 2 coats of APOCOLITE APEX or its equiv. ACRYLIC EXTERIOR paint on existing plastered surface or approved make & shade including finishing & thinning as per manufacturer's instruction. A gap of 6 Hrs. Should be given between 2 subsequent coats. The work should be carried out strictly as per manufacturer's specification and requirement comp. as directed by EIC at	SMT	4,232.78		

	required height.				
42.	Providing and applying 1.5 mm. thick white cement based putty to full area of plaster in two coats to fill all pores of mortar/ concrete wall & ceiling, making the surfaces good & even for painting including scaffolding / staging, necessary tools etc. complete at all levels as per instructions of Engineer-In-Charge.	SMT	4,050.48		
43.	Supplying & laying self-leveling Epoxy floor topping of average 3 mm. thickness over the concrete floor for levelling undulations including filling of construction joints of size 5 mm. X 30 mm. deep / 10 mm. X 30 mm. deep, grinding the concrete surfaces if required, cleaning, checking dryness over the floor, etc. all complete.	SMT	287.79		
44.	Providing and fixing approved quality rolling shutters of approved make made of 80 mm. wide M.S. Laths interlocked together through their entire length and jointed together at the ends by end locks mounted on specially designed pipe shaft with bracket plates guide channels and arrangements for inside locking with push pull operation complete including the cost of hood cover & spring etc. & three coats of oil painting of approved quality & make etc., complete. (A) Shutter having width below 3.5 meter.	SMT	18.00		
45.	-Do- but extra over for providing motorised operation	SMT	30.00		
46.	Providing and fixing fully glazed / partly glazed double leaf 20 micron thick anodized aluminium door with following listed extruded section manufactured by Jindal Aluminium Ltd. & other accessories, the Alluminium sections are of HE9WP Group : 1) with door outer frame section of 63.5 x 38.1 x 3.18 mm thick weighing 1.777 Kg./RMT (J4605) 2) Door shutter vertical style (meeting style) of 53.7 X 44.45 X 2.30 mm. thickness (J4537) weighing 1.238 Kg./Mtr. 3) Hinge side 53.7 X 44.45 X 2.30 mm. thickness (J4540) weighing 1.173 Kg./RMT. 4) Bottom rail of size 150 X 44.45 X 2.40 mm. thickness (J4538) weighing 2.376 Kg./RMT 5) Lock rail of size 150 X 44.45 X 2.40 mm. thickness (J4538) weighing 2.376 Kg./RMT. 6) Top rail of size 47.62 X 44.45 X 3.18 mm. thickness (J4506) weighing 1.501 Kg./RMT. 7) Ventilator middle member (if required) 49.91 X 44.45 X 3.00 mm. thickness (J4621) weighing 1.495 Kg./RMT.	SMT	81.06		

	8) Aluminium handle 127.00 X 37 X 3.65 mm. thickness (J4483) weighing 1.912 Kg./No. 9) Tower bolt 250 mm. long (J4954) 10) Aluminium bending mortice lock (J4420) 11) Top panel using 6.0 mm. thick Triveni or Modi or Saint Gobain make float glass fixed with PVC Clear gasket 12) Bottom panel using 12 mm. thick exterior grade pre-laminated particle board of make approved by the Engineer - in - Charge (for partly glazed door) fixed with virgin PVC clear gasket. 13) Door Closer of make approved by the Engineer-in–Charge with all other required fixtures and fastening of colour anodized with aluminium beading, with all labours and materials etc. complete as directed by EIC. Aluminium section user for fixing hinges, door closer, etc. shall be filled with country teak wood to receive screws.				
47.	Providing and fixing window and ventilation having extruded aluminium anodized section frame main outer size 63.50 X 38.10 X 19.5 mm. (of Jindal Section no : 4605, @ wt 1.094 Kg./Rmt), horizontal two track member size 61.85 mm. X 31.75 mm. X 1.20 mm. (of Jindal Section no.: 8687 @ wt of 0.695 Kg./Mtr), vertical member of size 61.85 mm. X 31.75mm X 1.30 mm. (of Jindal section no: 8758 @ wt of 0.659 Kg./Mtr.) with Sliding Shutters of horizontal member Size 40 mm. X 18 mm. X 1.29 mm. (of Jindal section no: 8949 @ Wt. of 0.456 Kg./Mtr.), vertical member of size 40 mm. X 18 mm. X 1.29 mm. (of Jindal Section : 8947 @ Wt. 0.457 Kg./Mtr., section 8948 @ 0.457 Kg./Mtr.) with 5 mm. thick transparent bronze colour/white tinted float glass with aluminium fittings and fixtures and transparent silicon sealant glass fixing to frame as per details etc. complete for Window.	SMT	74.25		
48.	Providing and fixing in position Partly glazed & partly paneled partition using "Jindal/ Hindalco /Banco" make aluminum section with approved Poly Propelene Based Powder coating (DFT = 65-80 micron) having intermediate frame (Double groove)of size 63.5 mm. X 38.1 mm. X 3.2 mm. @ 1.79 Kg./Mtr., (Jindal code no. 20004) Outer frames (single groove)of size 63.5 mm. X 38.1 X 2.5 mm. @ 1.369 Kg./m (Jindal code no. 20065), clip 19.0 X 17.3 X 1.2 mm. @ 0.154 Kg./Mtr. (Jindal code no. 19377), Glazing Strip /Plate 44.45 X 5.72 X 3.22 @0.453 Kg./RMT, corner box section where required of size 63.5 x 2.38 @ 1.571 Kg./Mtr. (Jindal code no. 14492) as per detailed sketch including silicon sealant filing between alu. section & wall, all necessary fittings, 6.0 mm. thick plain/brown float glass /frosted glass in middle panel, Top & bottom	SMT	10.50		

	panel with 10 mm. thk. water proof PLY fixing with 1 mm. thk. Laminates on both side .				
49.	Providing and fixing Hydraulic door closure of "dorma" or approved ISI make into position etc. complete as directed.	No.	14.00		
50.	Providing & fixing double action hydraulic floor spring of "HARDWYN"(MODEL No. 3000) or approved equivalent make (conforming to I.S. 6315) for aluminum doors including cost of cutting floors as required, embedding in floors and cover plates, brass pivot, single piece M.S. outer box with side plate etc. complete as per the direction of Engineer-in-Charge.	No.	27.00		
51.	Providing and fabricating and placing approved quality steel work welded in built up sections, framed work incl. cutting, hoisting, fixing in position and applying a priming coat of red lead paint and 3 coats of oil painting of approved shade & make. rate includes the erection of angle post for CL fencing :-(A) In beams and joints channels angles, tees, flats with connecting cleats as in main and cross beams, hip and jack rafters, purloins connected to common rafters, for cable trench rack & Tray etc..	Kg.	25,500.56		
52.	Providing & fixing MS Grill of approved quality & design weighing 15 to 20 Kg./Sq. Mtr. as per drawing & as directed with necessary grill door (if required) including welding or bolted fixtures and fastening. M.S. Flat hold fasts, 300 mm. long, 16mm dia. aldrop & 300 mm. long tower bolt necessary with handles etc. with 3 coats of oil painting of approved shade & tint with one coat of red oxide primer including grouted hold fast in CC (1:2:4) etc. complete as directed by EIC.	SMT	74.25		
53.	Providing and Fixing Stainless Steel railing as per specification, drawing and as directed. Item includes all material, labour, machinery, etc. required as instructed.	RMT	54.40		
54.	Providing and laying approved quality polished Kotah Stone slab (25 mm. thk.) flooring including using 35 X 25 mm. approved quality machine cut, marble strip over 20 mm. (average) thick base of cement mortar 1:6 (1 cement : 6 course sand or L.M. 1:1.5 laid over and jointed with grey cement slurry including rubbing and mirror polishing using polishing machine with grinding six emery's of different no. including using special chemical powder for polishing including white cement coating two times during polishing for filling up minute holes or cracks in joints etc. comp. (R & B, CH-14, Item-12, P-53+ Rs. 120.00 for mirror polishing)	SMT	434.98		

55.	Do as above Kota stone but length required length for step with one side polished and edge polish as required.	SMT	183.96		
56.	Providing & fixing one side polished, min. 1500 mm. long and 300 mm. wide stone for window sill / door frame /door jamb with half round moulding on one side and edge polish with chamfering on other side including laying on 20 mm. thick C.M. (1:4) bedding with adhesive material as required. Measurement shall be per running meter laid single length only) but with 18/20 mm. Granite Stone	SMT	113.03		
57.	Providing and laying color glazed tiles of size 300 mm. X 200 mm. X 8 mm./300 mm. X 450 mm. X 8 mm. - JOHNSON /KAJARIA /NITTCO or its equivalent make in flooring & dado laid on bed of 12 mm. thick cement mortar 1:3 (1 cement: 3 course sand) & fixing the same in cement & providing 12 mm. thick back coating of cement plaster in CM 1:3 for base, filling the joints with white/color cement neatly finishing the joints curing etc. complete.	SMT	70.36		
58.	Providing & laying ceramic tiles 6 mm. to 8 mm. Thick in flooring treads of steps and landing laid on 10 mm. thick cement mortar1:6 [1 cement : 6 coarse sand] and finished with white or colour cement complete as directed by EIC (for Battery room)	SMT	21.61		
59.	Providing & fixing approved quality approved quality vitrified tiles of any size 8 mm. to 10 mm. thick of best quality matt/glossy finish of Johnson/Kajaria/Nittco or its equivalent make of required size for flooring, skirting etc. including fixing the same in cement mortar (1:2) setting with readymade tile adhesive as recommended by manufacturer's including fillings of joints mixed with pigmented cement slurry of matching shade etc. complete - 8/ 10 mm. thick Vitrified tiles of any size 8/ 10 mm. thick Vitrified tiles of any size	SMT	342.77		
60.	Supplying and laying 50 mm. thick acid/alkali resistant flooring and dedo on concrete base with 25 mm. thick unglazed vitreous ceramic acid / alkali resistant tiles of size 600 X 600 mm. (Johnson make) of approved make conforming to IS:4457 over 25 mm. thick acid resistant mortar (Silicate mortar), bedding mortar in C.M 1:3 and filling the joints to full depths of tiles all as per drawings, specifications and directions of the Engineer, all materials, tools, plant and labour complete.	SMT	51.16		
61.	Providing and laying both side polished stone slabs as urinal / washbasin / platform partition to be fixed in wall including making & filing jari with cement mortar 1:3 (1 cement: 3 coarse sand) if required including cutting to required size, chamfering as required, full moulding and polishing complete. (measurement shall be taken as per	SMT	5.06		

	net plan area of slab fixed.)				
62.	Providing and laying 62 mm. thick cement concrete flooring with metallic concrete hardener topping under layer 50 mm. thick cement concrete M20 grade and top layer 12 mm. thick metallic concrete hardener mix : 2 stone aggregate 6 mm. nominal size) by volume with which metallic hardening compound of approved quality is mixed in the ratio 4:1 (4 parts of cement : 1 part of metallic floor hardening compound of approved quality by weight including cement slurry, rounding off edges and strips etc. but excluding the cost of nosing of steps etc. complete.(supply of metallic floor hardener is in scope of contractor)	SMT	287.79		
63.	Providing and laying 500 mm. X 500 mm. X 3 mm. thick flexible interlocking PVC tiles of "WONDER FLOOR", "ARMSTRONG" or "SUPREME" make in flooring & skirting including laying with proper joints on chequred base with all necessary materials at all levels and all heights etc. complete.	SMT	320.33		
64.	Providing & fixing 15 mm. thick 'India Gypsum' make mineral fiber board tiles of 595 X 595 mm. size with revealed edges in concealed option including fixing "Gypsteel ultra" celing section only. False ceiling shall be fixed from RCC slab using metal rawl plug, soffit cleat, wall angle, Main & Cross T section, angle etc. as per manufacturer specification only.	SMT	297.48		
65.	Providing laying and joining in true line and level UPVC pipe (SCH-40) including fittings of PRINCE/ SUPRIME/ ASTRAL/ FINOLEX or equivalent make or as approved by EIC. Pipe shall be fixed on the wall with the help of clamp at every 2000 mm. c/c or shall be concealed or necessary excavation in trenches as directed including necessary fittings including testing of pipe and joints and fixing the same with adhesive solvent, including cost of all materials and necessary refilling the trenches, dressing etc. complete. For 15 mm. dia. Pipe	RMT	30.00		
66.	Do but for 25 mm. pipe.	RMT	50.00		
67.	Do but for 40 mm. pipe	RMT	40.00		
68.	GI 'B" class pipe line of "Jindal" make including wrapping of layer of polythene sheet over a coat of bituminous paint for 15mm dia pipe.	RMT	20.00		

69.	Do but for 25mm dia pipe.	RMT	30.00		
70.	40 mm. dia. pipe.	RMT	50.00		
71.	Providing and fixing UPVC waste water pipe (IS:15328 -2003) of approved make for sewage line including cutting, testing and providing all necessary fitting & fixtures, excavation , backfilling & removal of surplus earth ,laying into required slope, jointing & sealing the same with sealant, making the surface good etc. all complete for 75 mm. dia.	RMT	56.47		
72.	110 mm. dia. - (SN -4)	RMT	30.00		
73.	Providing & fixing approved quality gun metal check or non-return wheel valve for 25 mm. dia.	No.	4.00		
74.	Do but for 40 mm. dia.	No.	3.00		
75.	Do but for 15 mm. dia.	No.	4.00		
76.	Providing and fixing approved quality screw down bib tapes of following size : (A) Brass screw down bib tap polished bright 15 mm. dia.	No.	20.00		
77.	Providing & fixing Stainless steel liquid soap holder cum dispenser of approved make to the wall with necessary brackets, screws, washers, plugs etc. all as specified & directed.	No.	2.00		
78.	Providing and placing on terrace (at all floor levels) polyethylene water storage tank (triple layer) of capacity 2000 Ltr. of ISI : 12701 marked indicating the BIS license No. with cover and suitable locking arrangement and making necessary holes for inlet, outlet and over flow pipes, supply and fixing of fittings but without the base support for tank (Sintex or equivalent having valid ISI License)	No.	2.00		
79.	Providing & fixing to all ceiling and floor 4.00 Kg/Sq. Cm. FINOLEX OR its equivalent rigid PVC pipes of the following outside diameter, wall clips, etc. including necessary fittings like bend, shoes, Y, Tee, etc. including testing of pipes and jointed with adhesive solvent cement including cost of all materials making good wall celing and floor.. For 100 mm. O.D. pipe	RMT	224.00		

80.	Providing and fixing best quality of H.D.P.E. PIPE of approved ISS quality with all accessories, fittings, jointing etc. suitable for laying cables etc. complete as directed by E.I.C. 163 mm. dia. Outer 10 Kg./Cm2	RMT	45.50		
81.	Supplying, fixing & testing PVC floor trap (6 Kg./Sq. Cm.) with solvent cement joints, including all the fittings. The work shall include wall chase and making good the same in cement mortar complete to the satisfaction of engineer-in-charge. 100 mm. Dia. with 150 X 150	No.	6.00		
82.	Providing and fixing Square Mouth Stone Ware Gully Trap grade "A" 100 X 100 size "P" type of approved quality, including 230 mm. thick brick masonry chamber of 300 X 300 mm. clear inside in C.M. (1:5) plastered on both sides in C.M. (1:3) with C.I cover not less than 4.5 kg and frame not less than 2.7 kg. to fixed in Cement concrete 1:2:4 including necessary excavation to required depth,1:4:8 bedding of 150 mm. thick etc. complete.	No.	4.00		
83.	Providing and constructing chambers / Manholes including excavation, backfilling, removal, formwork, reinforcement laying, M-7.5 bed concrete 150 mm. thick, 230/350 mm. thick brick masonry in cement mortar 1:6,12 mm. Plaster in C.M (1:3) with floating coat of neat cement on inside, outside & top surface, RCC M15 grade for coping and 100 mm. thk. slab foot rest of 20 mm. dia. bar @ 300 mm. c/c etc. to receive precast cover/grating/ C.I. cover, making necessary channel into floor with PCC 1:2:4 finished with floating coat of neat cement, (excluding pre cast cover, grating, angle frame, steel reinforcement) etc. complete. 450 X 450 X 600 clear size.	No.	6.00		
84.	600 X 600 X 750 mm. clear size.	No.	24.00		
85.	900 X 900 X 750 mm. clear size.	No.	-		
86.	1200 X 1200 X 1200	No.	3.00		
87.	Providing and fixing Oval wash basin (size 550 x 440 mm. of "Cera" make (No. 1025) of white colour standard quality including inlet and outlet connections, Pillar cock, stop cock, angle cock of approved quality, C.P. Brass bottle trap, CI Brackets CP brass waste coupling, cutting & making good the wall, etc. complete. (All plumbing fixtures shall be of "Jaquar" make).	No.	2.00		
88.	Providing & fixing approved quality light type C.I. Manhole covers 35 Kg. with water tight C.I. Frame & fixing the same in concrete etc. complete as directed by E.I.C. for 450 X 610 mm. size	No.	10.00		
89.	Providing and fixing CI step in septic tank sock pit in c.c. as directed.	No.	46.00		

90.	Providing and fixing glazed earthenware White Wall Hung European type standard WC pan of "Cera" make (no. 2115) with cistern, pair of CI chair brackets, white solid plastic seat cover (no. 2325), CP brass hinges and rubber buffers, supply & fixing of 25 mm. concealed Flush cock, 15 mm. concealed stop cock of "Jaquar" make, CP flanges, necessary fastner & fixing, cutting and making good the walls and floors where required, all complete. Providing & fixing 5 litre white P.V.C flushing cistern of Jaqar make(WHC WHT 184 A) make with necessary fixtures & fittings as per requirement.	No.	3.00		
91.	Providing and fixing C.P brass toilet paper holder.	No.	4.00		
92.	Providing and fixing approved make double type coat & hat hooks with flanges, fixed to wall / shutter etc. with necessary screws, washers and plugs all as specified & directed.	No.	4.00		
93.	Supplying and fixing white Large flat back standard urinal 635 X 395 X 420 of "Cera" make (no. 5001/5004) with C.I large brackets, G.I extension piece, C.P. Spreader and 10 mm. Dia. C.P. connector pipe, C.P. flanges, including dome type C.P. waste coupling, waste connection through C.P. bottle trap necessary fixtures etc. complete.	No.	2.00		
94.	Providing & laying of 150 mm. Dia. RCC NP-2 class conforming to IS : 458 for pipes with collar jointed drains, cables etc. including excavation upto required depth & width & disposal of surplus earth within plot boundary limits lowering to required level/gradient, jointing with CM 1:2, laying of pipe in joints, back filling the trenches, compaction and making good the same etc. complete (Encasing P.C.C. work and bed concrete for laying will be paid separately as per regular item). Inspection & hydraulic testing of the pipes will be witnessed by the representative of client/Consultant at Manufacturer's shop before dispatch.	RMT	36.00		
95.	Do, but NP-3 300 mm. Dia.	RMT	56.00		
96.	Supplying & stacking 25 to 40 mm. size crushed metal including transportation, filing the box etc. in S/S yard complete as directed by EIC. (Box measurement will be paid with 15% voids deductions)	CMT	118.38		
97.	Supplying & stacking 6mm size grit including transportation for spreading on road filling the box etc. complete.	CMT	46.50		
98.	Supplying & stacking quarry dust including transportation for spreading on road filling the box etc. complete.	CMT	46.50		
99.	Labour charges for spreading 25 to 40 mm. size metal in 100mm thick layers with required grade & camber & watering rolling the each layer with 8 to 10 tones power roller including filling depression which occur during	CMT	93.00		

	process etc. complete as directed by				
100.	Do as above but with murrum	CMT	139.50		
101.	Do as above but for grit	CMT	46.50		
102.	Do as above but for quarry dust	CMT	46.50		
103.	Providing and fixing in position best quality approved make 6 mm. beveled edge mirror of size 600 X 1000 mounted on 12 mm. thick water proof plywood backing and hardwood beading alround and mirror fixed to the backing with 4 Nos. of CP cap screws & washers including fixing the mirror to the wall with necessary screws, plugs & washers etc. complete.	No.	2.00		
104.	Providing & fixing approved quality 300 X 300 mm. size marble year plate with black border all round & letters including fixing the same in cement mortar etc. comp. As directed by EIC.	No.	1.00		
105.	Providing & fixing in position S.S. towel rail/napkin ring model No. 1121 & 1181 of approved make of 600 mm. length, 20 mm. dia. With a pair of brackets or flanges fixed to wall with necessary screws, plugs etc. all as specified & directed.	No.	4.00		
106.	Providing & laying water proofing treatment on terrace including applying neat cement slurry 2.75 Kg./Sq. Mtr. on cement admixed with water proofing component after cleaning the surface, Laying cement concrete with brick bat 75 mm. to 100 mm. thick with 50% of C.M. 1:5 admixed with water proofing component over 20 mm. thick layer of C.M. 1:5 to required slope including ramming at junction of wall and slab, after two days of proper curing applying a second coat of cement slurry, finished the surface with 20mm thick C.M. 1:4 china mosaic flooring and finally finished surface with white cement slurry, after finishing with terrace shall be finished with water for a period of two week. The contractor shall submit Performance Guarantee of the waterproofing item at the rate of 20% of cost of item of work order at par with the tender requirement of DPA valid for a period of 5 years from actual date of completion of work.	SMT	769.80		
107.	25 X 25 mm. expansion joint with Poly sulphide sealant	RMT	-		
108.	5 X 10 mm. groove in floor with Poly sulphide sealant	RMT	-		
109.	Providing & fixing G.I. Barbed wire fencing (12/14 Gauge) having mass and uniformity of Zinc coating & specifications shall be as per IS 2140 – 1978 & IS 4826 – 1979 code with minimum 70 micron coating having	RMT	420.00		

	3 horizontal rows, fixing with angle post.etc.				
110.	Providing and filling 40 to 50 mm. size brick bats up to 1.5 Mt. etc. comp. as directed by E.I.C.	No.	21.20		
111.	Providing and fixing with Labour charge for fabricating, erecting and fixing in position various Inserts like angles, channels, beams, chequered plates, etc. with necessary hold fasts including fixing with concrete or masonry surfaces to required level and alignment during concreting at all levels as per detail drawings, cleaning the surfaces after de-shuttering and providing and applying two coats epoxy primer and two coats of epoxy paint, consumables like welding rods etc. complete. Lugs for insert will be provided in this item. Rolling margin & wastages shall not be paid. Payment will be made based on theoretical consumption of materials worked out from construction drawings or measured as actuals if drawings are not available on weight basis by multing length / size of the section with standard unit weight as per IS. Quoted rate shall be inclusive of Hot dip galvanising of 910 Gm./Sq. Mtr. (127 Micron) for thickness of section above 5 mm. above & 610 Gm./Sq. Mtr. (87 micron) for thickness below 5 mm.	MT	17.78		
112.	Providing & applying anti termite treatment, as per IS 6313 (Part - II & II 2001) for building works in pre-construction & post const. stages, using chemicals conforming to relevant IS in water emulsion and effective when applied uniformly over the area to be treated. The chemical to be used is chlorophriphos 20% EC or its equivalent. The treatment is to be carried out as per the procedure mentioned below and treated plinth surface area is to be taken for measurement. (with performance guarantee for 5 years) a) For pre-construction treatment: The contractor shall submit Performance Guarantee of the waterproofing item at the rate of 20% of cost of item of work order at par with the tender requirement of DPA valid for a period of 5 years from actual date of completion of work.	SMT	846.78		
113.	Providing & fixing 110 mm. dia. PVC SWR Vent Cowl ventilator	No.	16.00		
114.	Providing & fixing Acrylic name plates of required size including painting letters as directed & fixing as directed by E.I.C.	No.	17.00		
115.	Providing and constructing plinth protection surrounding building as required size with excavation 300 mm. PCC 100 mm. sand filling and fixing paver blocks and curbing as per drawing.	SMT	135.14		

116.	Painting the letter with best enamel oil paint in 200 to 250 mm. size etc. complete as directed by EIC (paint should be brought by the contractor)	No.	20.00		
117.	Providing & Laying approved best quality of Heavy Grade – "C" class 150 mm. Dia. G.I. Water pipe including necessary excavation up to 750 mm. Depth refilling trenches including with all necessary fittings like Elbow, Tee, Union, Nipple, Plug, flange of required dia., at pipe end to connect with Trans bottom drain valve etc., welding cutting, threading as per site requirement giving leak proof test etc., complete as directed by E.I.C.	RMT	50.00		
118.	Providing & Fixing 250 mm. dia. Sluice valve of gun-metal drum with necessary overhead operating devices of 25 mm. dia. G.I. Pipe fitting with special pedestal wheel etc., as directed by E.I.C.	No.	4.00		
119.	Providing & fixing C.I. air pipes Heavy Type with C.I. Coupling, bends, Union end shoe, M.S. flat clamps & fixing the same with oil tank etc., complete as directed by E.I.C. (100 mm. dia.)	RMT	10.00		
120.	Galvenise cable tray of 450 mm. wide.	RMT	240.00		
121.	Galvenise cable tray of 600 mm. wide.	RMT	400.00		
122.	Preparing the sub-grade by trimming the surface to the required level, grade and camber by excavation or filling not exceeding 60 Cms. depth. No earth is to be brought from outside. In case of filling for sub-grade, earth is to be collected and transported to road site from available stack of earth in Plot boundary after necessary loading and unloading. Filling in road shall be done by spreading in layers of 150 mm. thick and compacted to 95% Standard Proctor Density after all necessary watering, rolling and compaction. In case of excavation, surplus earth is to be disposed, spread and stacked properly in owner plot boundary as directed by the Engineer in charge. The sub grade shall be properly rolled by 10 Ton Roller.	SQM	163.80		
123.	Providing and laying Water Bound Macadam Base Course of 350 mm. Thk. in three layer of 115 mm. thick each, average 158 mm. thick loose laid / 100 mm. consolidated using Black Trap Machine Cut Metal, procured from approved source, 1.58 to 1.25 Cum of 90 to 45 mm. size aggregates, 0.35 to 0.30 Cu. Mtr. of screening material of size 13.2 mm. and average 0.08 to 0.10 Cum of binding material required for each layer per 10 Sq. Mtr. of plan area of base course. Rate shall be inclusive of stacking of materials in stacks, spreading of materials, consolidation and compaction by 8/10 Ton Power roller to achieve proper grade, camber & level, watering, royalties, right of	CUM	163.80		

	way etc. complete. (Physical requirements and gradation of materials shall be as prescribed in Clause No. 404, Grading No. 2 or 3 as per the drawing, of Table No 400-7 and Specifications No. 404.2.6 and 404.2.7, of IRC-19 or M.O.R.T. & H.) Minimum CBR value of materials shall not be less than 100 %.				
124.	Providing and laying M7.5 grade (1:4:8) Plain Cement Concrete with 40mm down size graded metal including centering, shuttering if required laying, spreading, ramming, consolidating, curing and finishing top surface rough or smooth as per instructions of Engineer-in-charge.	CUM	163.80		
125.	Providing & fixing a separation membrane of minimum thickness 125 micron polythene between the concrete floor and the sub-base plain cement concrete to reduce friction including cutting of plastic sheet as per site measurements, longitudinal and cross laps of minimum 150 mm. to 200 mm. The said laps however, shall not be considered for payment, the same shall be deemed to have included in quoted rate.	SQM	420.00		
126.	Providing & laying controlled /design mix M20 grade concrete upto 300 mm. thick, for Road work, using 20 mm. & downgraded stone aggregates, in alternate panels of suitable size including machine mixing, mechanically vibrated with skirt vibrator, finishing to required level, grade and camber, Power troweling, brooming by appropriate wire brush, curing by ponding, etc. incl. MS Channel shuttering with provision of holes for tie / dowel bars and making saucer drain on both side of road etc. complete as per drawing as per instruction of engineer-in-charge. (Reinforcement shall be paid separately).	CUM	126.00		
127.	Using "Tre mix system" (vacuum dewatering system) in flooring as per manufacturer's specification.	SQM	707.79		
128.	Providing and filling Expansion joint 25 mm. wide in concrete road with top 25 mm. X 20 mm. deep gap sealed with bitumen sealing compound (grade- B), and balance bottom with 25 mm. thick. Duraboard of approved make including cleaning joint all complete as directed.	RMT	174.00		
129.	Providing & laying RCC NP-3 class conforming to IS: 458 for pipes with collar jointed drains, cables etc. including excavation up to required depth & width & disposal of surplus earth within plot boundary limits lowering to required level/gradient, jointing with CM 1:2, laying of pipe in joints, back filling the trenches, compaction and making good the same etc. complete (Encasing P.C.C. work and bed concrete for laying will be paid separately as per regular item). Inspection & hydraulic testing of the	RMT	80.40		

	pipes will be witnessed by the representative of client/Consultant at Manufacturer's shop before dispatch. 100mm dia.				
130.	Providing & fixing Factory made Kerb stone using M20 concrete grade including excavation and back filling, transporting, stcking, placing kerb in position, Joint filling with C.M 1:6 etc. complete. In case of embedding kerb stones in PCC, the same shall be paid under relevant item. size 300 X 450 X 150 mm. Thick	RMT	168.00		
131.	Providing and applying synthetic enamel Paint of approved make & approved colour to precast curbing in approved colour pattern in two or more coats to give good and even shade including suitable priming coat, and cleaning the surfaces with all labour and material etc. complete.	RMT	168.00		
132.	Providing & fixing factory made Decorative coloured Rubber Mould M-35 "Paver Block" of 60 mm. thick of any pattern as approved, laid in line & level over and including ungraded sand bed of 100 mm. Thick including transporting, loading, unloading, stacking & fixing in position.	SQM	-		
133.	Micrograding of site including cutting / filling up to average 300 mm. Depth & slope of 1:1000 from ridge to nearest drain and compacted by 3 Ton roller with suitable water sprinkling to form a smooth and compacted surface condition which shall be matching with required FGL of switchyard area including removal of surplus earth (if required) outside battery limit / plot boundary as directed by engineer in charge. No earth is to be brought from outside & if required only surplus earth available from excavation is to be utilized.	SQM	930.00		
134.	Supplying and spreading 'Round up"(Glyphosate 41% SL) of approved ISI standard make or equivalent weedicide for weed control in proportion of 100ml weedicide and 250 Gram Ammonium Sulphate, mixing with sticking agent mixed with 10 liter of clean fresh water and second spray with same treatment as stated above after two months and as per manufacturer's specification and as directed by Engineer-in-charge.	SQM	930.00		
135.	Supplying and lowering the approved ISI submersible pump of 5 HP with required cable starter as directed including testing and commissioning to meet the required delivery head with other accessories.	No.	1.00		
136.	Supply & Commissioning of a Pump Set with 1 HP Motor along with 150 Mtrs. Reinforced/braided ½ inches Dia. Pipe and 15 Mtrs, Cables.	SET	1		
TOTAL OF CIVIL WORKS (D)					

Important Note:

I. **Any item is not quoted by the bidder, but required for successful completion & commissioning of the scope of work shall be deemed to have been covered in other items cost and the contractor shall not be paid extra cost on the same account.**

II. **The above Quantities are tentative and may vary during detailed engineering of Project. However, these shall be considered for Evaluation of Bid.**

III. **The payment to the Contractor shall be made as per approved Bill of Material after detailed engineering on the Unit Rates quoted, hence the Bidder is advised to quote for Items that in his opinion are required in addition to above Items for successful completion and commissioning of the Scope of Work.**

TOTAL of ELECTRICAL WORKS (A+B+C)	
TOTAL of CIVIL WORKS (D)	
GRAND TOTAL of ALL WORKS (A+B+C+D)	

(In Words: Rupees _____)

(Note : The rates should be inclusive of all taxes, duties, fees, cess, all incidental charges etc. but exclusive of GST)

Signature & Seal
Contractor

Executive Engineer (E),
Deendayal Port Authority

Make List for Electrical Items		
Sr. No.	**Description**	**Recommended Makes**
1	HV VCB	SIEMENS /ABB/GE
1(a)	HV Gas Insulated Breakers	SIEMENS /ABB/ Schneider/GE/Hitachi
2	POWER TRANSFORMERS	VOLTAMP /SIEMENS/ABB/ Schneider/Prime Meiden/Hitachi
3	DISTRIBUTION TRANSFORMERS	VOLTAMP/ABB/Schneider/Kirloskar/Bhel/Bharat Bijlee/Prime Meiden
4	RESIN CAST TRANSFORMERS	
	A) RESIN CAST IMPREGNATED	VOLTAMP / KIRLOSKAR/Amex Impex
	B) DRY CAST	VOLTAMP/KIRLOSKAR/Amex Impex
5	HT XLPE CABLES	POLYCAB/TORRENT/RPG ASIAN/ NICCO/GLOSTER/ UNISTAR/ UNIVERSAL
6	LT XLPE CABLES	POLYCAB/TORRENT/RPG ASIAN/ NICCO/ RALLISON/RAVIN/ HAVELLS/ UNIVERSAL/ UNISTAR/AVOCAB
7	LT ACB	SIEMENS/ABB/SCHNEIDER
8	PROTECTION RELAYS	SIEMENS/ABB
9	LT PANEL	CPRI APPROVED
10	CHANGE OVER SWITCH	SIEMENS/ABB/GE/SCHNIDER/
11	SFU FOR MAIN LT DISTRIBUTION PANELS	SIEMENS/ABB/ Schneider
12	SFU FOR DISTRIBUTION PANELS & FEEDER PILLERS	SIEMENS/ABB/ SCHNEIDER
13	MCCB FOR MAIN LT DISTRIBUTION PANELS	SIEMENS/ABB/ Schneider
14	MCCB FOR DISTRIBUTION PANELS AND FEEDER PILLERS	SIEMENS/ABB/SCHNEIDER
15	MCB/ELCB/RCCB/ RCCBO FOR MAIN LT DISTRIBUTION PANELS	SIEMENS/ABB/ Schneider
16	MCB FOR DISTRIBUTION PANELS AND FEEDER PILLERS	SIEMENS/ABB/ Schneider

17	MCB DISTRIBUTION BOARD	SIEMENS/ABB/ Schneider
18	MULTI FUNCTION DIGITAL METER FOR MAIN LT DISTRIBUTION PANELS/DIGITAL KWH METERS	ENERCON/SECURE/L&G
19	ANALOG VOLT/AMPARE METER FOR DISTRIBUTION PANELS AND FEEDER PILLERS	RISHABH/AE/ENERCON/L&T
20	SLECTOR SWITCH FOR VOLTMETER/AMPARE METER	L&T/SIEMENS/C&S
21	POWER CONTACTOR & OVER LOAD RELAYS	L&T/SIEMENS/ABB
22	QUARTZ TIME CLOCK SWITCH	L&T/INDOASIAN/SIEMENS
23	PVC WIRE WITH COPPER CONDUCTOR	RR KABEL/KEI/POLYCAB/MILEX/GUJCAB/ STANDARD/ FINOLEX/ ANCHOR
24	FLUSH TYPE SWITCHES, SOCKETS, HOLDERS AND CEILING ROSES & ELECTRONIC REGULATORS	ANCHOR/MK/NORTHWEST/VINAY/PANAMA/HAVELLS
25	DOOR BELLS/CALL BELLS	ANCHOR/LEGEND/MK/NORTHWEST
26	MODULAR SWITCHES, SOCKETS, PLATES & BOXES	ANCHOR / MK / NORTHWEST / LEGRAND /HAVELLS/ INDOASIAN/ SIEMENS
27	PVC CONDUIT/OVAL CONDUIT & CASSING CAPPING AND ACCESSORIES	PRECISION/VULCAN/FINOLEX/ GARWARE/ RESTOPLAST/ SWASTIK/ BPI
28	GLS LAMPS & FLUORESCENT LAMPS	PHILIPS / BAJAJ / WIPRO / CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE
29	HPSV, HPMV & METAL HELIDE LAMPS	PHILIPS / BAJAJ / WIPRO / CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE

30	IGNITORS FOR HPSV, METAL HELIDE LAMPS	PHILIPS / BAJAJ / WIPRO / CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE
31	LUMINARIES	PHILIPS/BAJAJ/WIPRO/CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE
31a	LED Luminaries	Philips /Bajaj/Wipro/CG/Surya/Pyrotech/Syska
32	CEILING FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES
33	WALL MOUNTING FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES
34	EXHUAST FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES
35	HEAVY DUTY INDUSTRIAL WALL MOUNTING FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES
36	WATER COOLER	VOLTAS/BLUE STAR
37	AIR CONDITIONERS	VOLTAS/CARRIER/BLUESTAR/HITACHI/SAMSUNG
38	REFRIGERATORS	VOLTAS/CARRIER/BLUESTAR/USHA/ HITACHI/LG/ SAMSUNG/WHIRLPOOL
39	INVERTERS	SUKAM / MICROTEK Note: Havells, ABB, SMA, Fronius, Delta or equivalent make Inverters are subject to submission of relevant documents ofsuccessful operation in various Government Organizations
40	D.G. SET A) HT/LT ENGINE B) ALTERNATOR	CUMMINS/GREAVES/KIRLOSKAR STAMFORD/CROMPTON GREAVES /JYOTI/ KIRLOSKAR ELECTRIC
42	ELECTRIC MOTOR	ALSTOM/CROMPTON GREAVES /SIEMENS/ KIRLOSKAR/ABB
43	EOT CRANE	CU-BUILT/KRISHNA/SAFAL

44	WATER PUMPS	SWASTIK / KSB
45	WATER GEYSER	BAJAJ/USHA / CROMPTON GREAVES / SPHEREHOT / RACOLD
46	LUGS & CABLE GLANDS	DOWELLS / JAINSON / BRACO
47	Computer System	HP, DELL, Lenovo or equivalent
48	UPS	Wipro, Emerson, Luminous, Microteck or equivalent
48	Printer + Scanner	Canon, HP or equivalent

Scope of Work and Technical Specifications :

The scope of work will cover the supply of all the materials required to complete the project and installation/erection, testing & commissioning with all ancillary work to complete the entire project as an EPC contract. It also includes liaising with GETCO, CEA etc. as required. However, the required charges to all the authorities will be paid by DPA. The entire work shall be carried out as per IER. For all underground cables, i.e. HT, OFC & LT; proper Cable Route Marker with civil, as directed shall be done by the contractor.
This also envisages the construction of a new Substation Building, filling up the plot area identified for new 66 KV Substation. The items & their quantities in the BoQ and the Technical Specifications, mentioned in the tender are broad & indicative; however, the contractor should understand the requirements in details and complete the work in all respects within the quoted amount, being an EPC Project. The Supply of license copy of all necessary software, required for the project, is in the scope of the contractor. (Like Relay configuration, programming, parameterization tool and other software etc.)

It also covers the Design, Manufacturing, Supply, Installation, Erection, Testing and Commissioning of 66/11 KV New GIS Substation with latest state of art technology at DPA as per latest GETCO specifications.
Requirement **:**

1. Indoor type 66 KV GIS module (Two Incomer/Three Outgoing/One Bus Coupler) Supplying, Installing, Connecting, Tapping, Erecting, Making, Grouting and Commissioning of Galvanized Steel Structure & shall be as per GETCO (All foundation drawings shall be submitted by contractor as per GETCO specifications).
2. 02 Nos. of Power Transformers of 12.5 & 10 MVA respectively along with LAs, Metering CTs, PTs, Isolators and ABT Meters etc. shall be removed & shifted to New 66 KV GIS Substation with RTCC/NGR/CRP/FIRE System including their Installation/Connection/ Testing/Commissioning.
3. Three Transformers' Installation & Connection with all Protection/Interlock/Relay/Meter/ Indicator.

4. Supply of a new 12.5 MVA Transformer shall be purchased with RTCC/NGR/NIPS/FIRE System with Installation/Connection/Testing/Commissioning.
5. 25 Ways 11 KV HT GIS Panel Board with Supply/Installation/Connection/Testing/ Commissioning consisting of latest Breakers & Protection Relays along with Meter/ Indicator/SCADA Monitor & Control.
6. All the Latest Feeder, Breaker, Relay, PT, CT, Isolator, Lighting Arrestor, Surge Arrestor with Installation/Connection/Testing/Commissioning for Line In/Out of 66 KV.
7. 01 No. DCDB Panel Supply/Installation/ Connection/Testing/Commissioning
8. Fire Alarm/ Smoke/ Gas/ Sprinkler/ System's Supply/ Installation/ Connection/ Testing/ Commissioning.
9. PLC, SCADA, RTU Panel Supply/Installation/ Connection/Testing/ Commissioning
10. 02 Nos. Battery Bank Panel (Battery Room) Supply/Installation/Connection/Testing/ Commissioning
11. 02 Nos. Battery Charger System's Supply/ Installation/ Connection/ Testing/ Commissioning
12. 03 Nos. C & RP Panel for GIS 66 KV with Diagram and TNC Switch, Indication, Meter, Protection Relay Supply/Installation/Connection/Testing/ Commissioning
13. 03 Nos. Capacitor Bank HT 400 KVAR Indoor Type Panel Installation/Connection/ Testing/Commissioning (HT Panel Room)
14. 01 No. EOT Crane 5 Ton Installation & Connection (GIS Room)
15. AHU Cooling or VRF System Provide all Electrical Room & Control Room Building Installation/ Connection/Testing/ Commissioning
16. Inverter/UPS Panel with Battery Bank Nos. 110 (2V/DC) Installation/Connection/ Testing/Commissioning
17. Lighting Panel installation (All Electrical Room /Control Room /DG Room)
18. Supply, Installation, Commissioning of CCTV system with 20 Nos. of Cameras with Server & Network unit
19. Supply of 1 No. DG Set of 150 KVA LT with Breaker & AMF Panel Installation/ Connection/Testing/Commissioning
20. LT Panel ACB 1000 A (No. 01)
21. Fire Fighting System with Hydrant Pipeline, Co2, Electrical & Sprinkler Transformer/DG Room
22. Construction of the Substation Building to accommodate 66 KV & 11 KV GIS, SCADA, Capacitor Bank, Charger, FCBC, DBDC, Battery, LT Panel, Cable, Air Conditioner, LT DG Set, Diesel Storage Room, Spares Room, Office, Operator's Room etc. as directed.
23. Development of 66 KV Yard as per IER and Room for ABT Meters.

1) Technical Specification of Item No. 1

This includes Design, Supply, installation, testing and commissioning of 66 KV Indoor GIS of approved make with double bus arrangement system with 6 Nos. Bays (Two Incomer and three outgoings and one Bus coupler) as under and conforming to specification enclosed & latest GETCO specifications as applicable.

2 Nos. of Double bus line bays for 66 KV, 2500 A, 31.5 KA for 3 Sec. SF-6 gas insulated line bay module comprising of 3 Nos. of single phase gas insulated voltage transformer

(66 KV /Sq. Rt.3 /110 /Sq. Rt.3 / 110 /Sq. Rt.3. This will be equipped with integrated disconnecting facility for GIS and power cable testing without any additional dismantling and gas handling) with 100 VA burden class 0.2 / 3P, 1 No. high speed safety ground switch, 1 No. disc connector switch with earthing switch, 2 No. 2500 A 31.5 KA fixed type SF-6 insulated circuit breaker, 2 Nos. of Isolators with earthing switch, 3 Nos. of single phase current transformer (150/1+1+1A) with 5P20 / 0.2 accuracy (this switch will connect to 2 different buses in gas insulated double bus-bar system), local control & monitoring system for complete bay showing density of SF-6 gas, interlocking between components, gas insulated terminal connection for connecting cable line with GIS Panel.

The Transformer Bay Module will consist of 3 Nos. of 66 KV, 2500 A, 31.5 KA for 3 Sec. SF-6 gas insulated each comprising of 3 Nos. of Isolators with earthing switch, 1 No. 2500 A 66 KV GIS, 6 Nos. of single phase CT 120/1+1+1+1 having protection class as PS /5P20/ 0.2/ PS 20VA burden, 6 Nos. of Isolator Switches with earthing along with female terminal connection for connecting cable with GIS through insulated interconnection bus etc. to complete transformer bay module. This will have local control center for showing density of SF-6 gas, interlocking between component, monitoring gas and other parameters.

The Bus Coupler in Double Bus Bar Bay will consist of 1 No. of bus coupler bay module and comprising of 3 Nos. of Isolator switches with earthing, 3 Nos. of single phase CT (150/1+1A) 15 VA burden 5P20/ 5P20 protection class, 1 No. 2500 A SF-6 insulated circuit breaker. This will have local control center for showing density of SF-6 gas, interlocking between component, monitoring gas and other parameters.

a. 66 KV GAS Insulated Switchgear (GIS) :-

a.1 General :-

The specification covers scope of design, engineering, fabrication, manufacturing, shop assembly, inspection and testing before supply, transportation, delivery at destination, unloading & storage at site, site erection, site testing, commissioning and putting in to successful operation complete with all materials, support structures, anchoring bolts, accessories, commissioning spares & maintenance spares, special spanners, tools & tackles, any specific required ancillary services, SF-6 Gas for first filling & spare, etc., for efficient and Trouble free operation for 66kv metal (aluminum alloy) encapsulated SF-6 gas insulated switch- gear suitable for Indoor installation as per GETCO specification.

The scope also covers provision of additional bays (without equipment) over and above bays shown in SLD, with foundations & earthing arrangements so as to install the bay module as and when required without any works pending except the procurement of the required bay module and other related equipment.

a. 2 Design Concept, construction & performance & Safety of SF-6 GIS :-

It is understood that each manufacture has its own particular SF-6 GIS design concept and it is not the purpose of this specification to impose unreasonable restrictions.

However, in the interest of safety, reliability and serviceableness, the switch gear offered shall meet the following minimum requirements.
"The tender stage layout and equipment's minimum required ratings shall be as per the single line diagram and general layout enclosed. However, the ratings of equipment to be supplied shall be as per submitted type test reports.
The supplier has to work out an optimum layout and building size considering the specific features of his product if any, but within overall dimensions of the plot."
All equipment, accessories and wiring shall have tropical protection, involving special treatment
of metal and insulation against fungus, insects and corrosion. Furthermore, no part of the enclosure, or any loose parts may fly off the switchgear in such an event, and no holes may burn through the enclosure until the nearest protective relay has tripped. All grounding connections must remain operational during and after an arc fault. Proper grounding for mitigating over voltages during dis-connector operation shall be included. Each section shall have plug-in modules or easily removable connection pieces to allow for easy replacement of any component with the minimum of disturbance to the remainder of the equipment The number of transport/shipping splits shall be minimized to keep installation time of GIS to a minimum. The arrangement shall afford maximum flexibility for routine maintenance. Equipment removal and SF6 handling should be accomplished with ease. The ease of operation shall be ensured. In general, the contours of energized metal parts of the GIS and any other accessory shall be such as to eliminate areas or points of high electrostatic flux concentrations. Surfaces shall be smooth with no projection or irregularities, which may cause corona. The equipment offered shall be protected against all types of voltage surges and any equipment necessary to satisfy this requirement shall have deemed to be included.

a.3 Modular Design & Future Extensions :-

The GIS switch gear shall be of modular design offering high degree of flexibility. Each module shall be complete with SF6 gas circuit breaker, Dis-connectors, Maintenance Grounding switches, fast Earthing switches, voltage transformers, Current transformers, bus & elbow sections, cable end enclosures, L.A., local control cubicle and all necessary components required for safe & reliable operation and maintenance. All the three phases of the bus bars and associated equipment like breakers, dis connectors, instrument transformers & earthing switches etc., as detailed in enclosed single line diagram are to be encapsulated in a single gas filled metallic enclosure for 66 kV & 11 kV voltage class and phase wise separate metallic enclosures for 66 kV class. For 66 kV class en closure it shall be single OR phase wise separate metallic type.
Irrespective of bus bar design, provision is to be made available for isolation of individual bay without disturbing adjacent bay.

- Materials used in the manufacture of the switchgear equipment shall be of the type, composition and physical properties best suited to their particular purposes and in accordance
with the latest engineering practices.

- The switchgear shall be of the freestanding, self-supporting dead-front design, with all high voltage
equipment installed inside gas-insulated, metallic grounded enclosures, and suitably sub-divided into individual arc and gas-proof compartments, preferably for:
1) Bus bars
2) Intermediate compartment
3) Circuit breakers
4) Current transformers
5) Line/Bus dis-connectors
6) Voltage transformers
7) Cable sealing End (CSE)
8) Gas Insulated bus duct section between GIS and XLPE cable/Overhead conductor
9) Gas insulated bus section between GIS and oil filled transformer or reactor (as applicable) The bus enclosure & GIS shall be sectionalized in a manner that maintenance work on any bus dis- connector can be carried out by isolating and evacuating affected bay & affected Dis connected bus bar only. In this condition, other bus bar & bays must be in energized condition.

-Gas barrier insulators shall be provided so as to divide the GIS & Bus bar into separate compartments. Continuous Bus bar without compartmentalization is not allowed.
These shall be suitably located in order to minimize disturbance in case of leakage or dismantling. They shall be designed to withstand any internal fault thereby keeping an internal arc inside the faulty compartment.
Further, it is prohibited to work adjacent to a gas compartment while it is fully pressurized on the other side. For such cases, the gas pressure in the adjacent compartments needs to be reduced. Accordingly, dummy compartment shall be provided to accomplish above requirement.

-Arc faults caused by external reasons shall be positively confined to the originating compartment and shall not spread to other parts of the switchgear. In case of any internal arc fault in a bus-bar, dis-connector or circuit breaker, of double bus system, repair works must be possible without shutting down complete substation and at least one bus-bar and the undisturbed bays must remain in operation Where bus Coupler sectionaliser is specified and in case of any internal arc fault in a bus-bar, dis-connector or sectionaliser, repair work must be possible without shutting down the complete substation and at least one half of the substation must remain in operation Documents indicating sequence of repair work steps and description of necessary restrictions during work shall be submitted with the technical bid Each bay module should be equipped with suitable arrangement for easy dismantling and refitting during maintenance without disturbing other units

- The maximum temperature in any part of the equipment at specified rating shall not exceed
the permissible limits as stipulated in the relevant standards.

- There shall not be any kind of interference to the connected & nearby equipment and system,
when the equipment is operated at maximum service voltage.

b. Maintenance and Repair of a Circuit Breaker & other Equipment :-

The arrangement of the equipment offered must provide adequate access for operation, testing, Repair and maintenance. The positioning of the circuit breaker in the GIS shall be such that it shall be possible to access the circuit breaker of any feeder from the front side for routine inspection, maintenance and repair without interfering with the operation of the adjacent feeders. The GIS shall be so designed that during breaker maintenance, only affected feeder can be shut down & both bus bars must be in energized condition. For achieving this requirement, adequate number of intermediate/dummy compartment, if required, shall be provided to ensure equipment & operating personnel's safety. 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 and LCC panels.

It should not be possible 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. 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.

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 undertaken 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 for all KV classes.

b.1 Interchangeability :-

As much as possible, all the parts shall be of standard manufacturer with similar parts and assemblies being interchangeable. 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 equipment. Inspection windows (View Ports) shall be provided for Disconnect Switch and both type of earth switches i.e. Maintenance and fast operating.

b.2 Future Extension :-

The modular design of GIS switch gear shall be capable of extension in the future on either end (i.e. Both ends) by the addition of extra feeders, bus couplers, bus- bars, circuit breakers, Dis-connectors, and other switch gear components without drilling cutting, welding or dismantling any major part of the equipment even if no future arrangement /space shown in tender layout. The Vendor is required to demonstrate clearly in his submitted documents the suitability of the switchgear design in this respect. The arrangement shall be such that expansion of the original installation can be accomplished with minimum GIS down time. In case of extension, the interface

shall incorporate facilities for installation and testing of extension to limit the part of the existing GIS to be re-tested and to allow for connection to the existing GIS without further dielectric testing. The arrangement of the interface module/End piece shall be such as to facilitate future extension of any make without any modification on the existing equipment and shall not be required to move or dislocate the existing switchgear bays. During detailed engineering stage, the EPC contractor shall make available the complete

Design detail of interface module such as cross section, enclosure material, enclosure dimensions (inner & outer), Flange diameter (inner & outer), conductor cross-section & connection arrangement, bolt spacing & dimension, rated gas pressure, Gasket detail etc. The Interface module /End piece shall be designed to provide Isolating link with viewing window. 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 remained isolated. Interface Module drawing with necessary detail shall be submitted for approval. Further the contractor who is extending the existing GIS installation, it shall be his responsibility to provide interface module matching with the existing GIS interface module. The drawing of existing GIS interface/end piece module shall be provided by the employer. However, it shall be the responsibility of the contractor to verify the existing details during site visit.

The EPC contractor shall optimally utilize the space inside the GIS hall (including the extension portion) for accommodating the interface module being supplied under the contract.
The SF-6 GIS shall be of Indoor type. Indoor GIS shall be having degree of protection as IP-42 & IP-55 for Outdoor GIS and suitable for the atmosphere of the location which is heavily polluted, windy, sandy desert & service condition indicated at The required switchgear shall be capable of being supplied in a completely gas- insulated version in which case all switchgear components including the bus-bars shall be of gas insulated type.

b.3 Service Continuity Criteria in case of GIS Equipment Maintenance :-

Type o Figs Equipment Maintenance	Requirement
(1) Bus-bar dis connector (Bus bar)	Only the affected feeder and the bus-bar to which the affected bus-bar disconnected, can be shutdown. The other bays shall still be energized.
(2) Circuit breaker	Only the affected feeder can be shutdown. Both the bus-bars shall still be energized.
(3) Current transformer	Only the affected feeder can be shutdown. Both the bus-bars shall still be energized
(4) Earthing switch next to the bus-bar	Only the affected feeder and one bus-bar (in case of internal fault)can be shutdown.

(5) Extension	The Interface module/End piece (dummy compartment) with isolating link shall be provided at both the ends of each bus in order to maintain the service continuity of the bays adjacent to the extension point during bus-bar connection so that during future extension at least one bus-bar must be in energized condition with all the existing feeders shall still been energized. - The additional bays shall be tested separately before connecting to main GIS set up.

b.4 Specification requirements :-

The 66 kV GIS switch-gear shall be with Double bus bar or One & half bus bar (as indicated in SLD/BOQ of respective tender) design having phase wise separate enclosure. The 66 kV GIS switch-gear shall be of Double bus bar design having either phase wise separate enclosure or three-phase common (single) enclosure.

The 66 kV GIS switch-gear shall be of a Double bus bar design having three-phase common (single) enclosure concept. It shall consist of Line & transformer bays as indicated in attached Single Line Diagram and General lay out plan. This configuration shall meet within the given area indicated in layout plan attached with respective tender.

b.5 Current Rating :-

The current rating of the switchgear should be assessed on the following requirements Capable of handling power to an extent of as to an ambient day-time mean temperature between – 5°C and + 50°C

The switchgear described in this specification is intended for continuous duty at the specified ratings and under all system operating conditions including sudden change of load and voltage within its ratings and at specified ambient conditions 24 hours a day, 365 days a year unless indicated otherwise.

The rating of the power transformer/s is given in SLD attached in respective tender.

b.6 Electrical, Mechanical and Thermal Capability :-

The assembled equipment shall be capable of withstanding the electrical, mechanical and thermal ratings of the specified system. All joints and connections shall be required to withstand the forces of expansion, vibration, contraction, and specified seismic requirements without deformation or malfunction and leakage**.** The apparatus shall be capable of withstanding the specified environment.

b.7 Insulation level :-

The switchgear and other equipment shall be designed for a maximum operating voltage and rated impulse withstand voltage as specified in cl. b.3. The switchgear

may require to be installed in an unmanned distribution network with predominantly overhead interconnection or EHV cable as the case may be. Circuit breakers shall be capable of interrupting line, transformer, capacitor bank & cable charging currents of the magnitude indicated in the data schedules

c.8 Physical arrangement :-

The layout shall be properly designed by the bidder to completely accommodate the present & future requirements of the substation as per the furnished single line diagram and the enclosed site plan. They may be adjusted as necessary to suit the manufacturer's standard design and GETCO need.

The arrangement of the switchgear offered must provide adequate access for checking and maintenance.

Otimized arrangements are required so as to reduce installation time, minimize maintenance & repair cost, provide ease of operation and facilitate future expansions.

For 66 kV voltage class GIS, wherever required, stairs, fixed ladder, platforms, and walkways for operation and maintenance access to the operating mechanism and monitoring devices should be provided to permit access. The structures shall be either aluminum or hot-dipped galvanized steel.

All the structure stairs, platforms, and walkways shall conform to the relevant occupational
health and safety regulations and designed in accordance with the latest industry standards and guidelines. The platforms and walkways shall have anti-skid surfaces that can be walked on. Handrails shall be provided where necessary.

In addition to above, suitable portable scissor lift shall be provided for access of distant portion of GIS installation for all kV class GIS.

b.9 Gas Sectional Arrangement :-

The switch-gear gas enclosures must be sectionlised, with gas tight barriers between sections or compartments.
The sections shall be so designed as to minimize the extent of plant rendered inoperative when gas pressure is reduced, either by excessive leakage or for maintenance purposes, and to minimize the quantity of gas that has to be evacuated and then recharged before and after maintaining any item of equipment.
It shall be ensured that circuit breaker enclosure will not include any other equipment in its gas compartment. However, CT may be placed in circuit breaker enclosure.

b.10 Expansion Joints and Flexible Connections :-

- The layout shall sufficiently take care to the thermal expansion / contraction of the assembly
by the provision of expansion joints. Expansion joints shall be placed in between any bay

section of the bus-bar. All joint surfaces shall be machined, and all castings shall be spot faced
for all bolt heads or nuts and washers.
- If necessary, the number and position of expansion joints or flexible connections are to be determined by the manufacturer to ensure that the complete installation will not be subject to any expansion stresses which could lead to distortion or premature failure of any piece of the SF-6 equipment, support structures or foundations.
- Bracing shall be provided for all mechanical components against the effects of short circuit currents specified under system parameter. The design of the equipment shall be such that the agreed permitted movement of foundations or thermal effects does not impair the assigned performance of the equipment.
- The design calculations for all the supports shall be submitted to ensure care taken.
- The continuity of service during thermal expansion / contraction and vibrations shall be ensured. Expansion joints, flexible connections and adjustable mountings shall be provided to compensate for reasonable manufacturing and construction tolerances in the associated equipment to which the GIS may be connected. Required sliding plug- in contacts for conductors shall be provided. This is to ensure that unreasonably excessive accuracy is not required when installing such equipment and constructing the associated foundations or support structures, e.g. transformers or the interconnection of isolated sections of switch-gear by means of long GIS bus-bar or duct installations. Flexible joints may also be provided to allow more efficient maintenance and future extensions of the GIS.

c. Barrier and Non-Barrier Insulators :-

c.1 Support insulators shall be used to maintain the conductors and enclosure in proper Relation. These support insulators may be of two types. Barrier insulators which are employed to isolate gas compartments and non-barrier insulators which allow the gas pressure to equalize.

c.2 The gas barrier insulators sealing to the conductors and the enclosure wall shall be designed to withstand the maximum pressure difference that could occur across the barrier, i.e. maximum operating pressure at one side while a vacuum is drawn at the other side & in case of internal arc fault with a safety factor

c.3 The support insulators and section barriers / insulators shall be manufactured from the highest quality material. They shall be free from all voids and the design shall be such as to reduce the electrical stresses in the insulators to a minimum. They shall also be of sufficient strength to ensure that the conductor spacing and clearances are maintained when short circuit faults occurs

c.4 Tests shall be carried out during the manufacture of the Switchgear to ensure that all parts of the equipment are free of partial discharge with a partial discharge extinction voltage which is at least 10% higher than the rated voltage.

c.5 Arrangement of section barriers/insulator with bus conductor shall be such that there shall not
Be any requirement for removal of adjacent bay while replacing of gas barriers.

d. Gas seals, Gas Density & Pressure and other requirements :-

d.1 Single sealing of O-ring type shall be used for sealing the connections between the switchgear

modules. The leakage rates shall be kept to an absolute minimum under all normal pressure, temperature, electrical load and fault conditions. The guaranteed leakage rate of each individual gas compartment and between compartments must be less than 0.5% p.a. for the service life of equipment.

d.2 Piping and fittings for gas monitoring and gas supply shall be made of copper or brass. The gas monitor device should be installed at each individual compartment of the module. Each
gas compartment must be independent, external gas pipe connections should be avoided to minimize leakage.

d.3 All gas compartments shall be fitted with filter material which absorbs the residual moisture and moisture entering inside the High-voltage enclosure. Filters in gas compartments with switching devices must also be capable to absorb the gas decomposition products resulting from the switching arc.

d.4 The rated pressure of the SF-6 insulating gas in the metal-clad equipment shall be as low as is compatible with the requirements for electrical insulation and space limitations to reduce the effects of leaks.

d.5 The SF6 switch-gear shall be designed for use with SF-6 gas complying with the Recommendations of IEC : 60376 at the time of the first charging with gas.

d.6 Connections including bolts and nuts shall be adequately protected from corrosion and easily accessible with the proper tools.

d.7 All components shall be fire retardant and shall be tested in accordance with relevant standards. Gas emissivity when the Material is heated shall be minimal.

e. Gas Treatment Requirements :-

Under normal operating conditions it shall not be necessary to treat the insulating SF-6 gas between major overhauls. In all gas compartments permanent efficient filters and desiccants shall be effective for the duration of time between major overhauls. Not with standing this, the insulators in the circuit breaker shall be made of epoxy resin composition that will resist decomposition products in contact with moisture.

f. Gas Monitoring Devices :-

Gas density or pressure monitoring devices shall be provided for each gas compartment. The devices shall provide continuous and automatic monitoring of the state of the gas. The SF-6 gas monitoring device shall have two supervision and alarm settings. These shall be set so that, an advanced warning can be given that the gas density/pressure is reducing to an unacceptable level. After an urgent alarm, operative measures can be taken to immediately isolate the particular compartment electrically by tripping circuit breakers and opening dis-connectors. It shall be ensured that there is no chance of the gas liquefying at The lowest ambient temperature.

The gas monitoring device shall monitor at least the following, locally and on remote.

i) "Gas Refill" Level- This will be used to annunciate the need for gas refilling.

ii) "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 device contact shall trip the breaker and block the closing circuits.

iii) Over pressure alarm level- This alarm level shall be provided to indicate abnormal pressure rise in the gas compartment

g. Conductors :-

The conductors shall be made of aluminum alloy suitable for specified voltage and current ratings. The electrical connections between the various gas sections shall be

made by means of multiple contact connectors (plug-in type) so that electrical connection is automatically achieved when bolting one section to another. Field welding of conductor and continuous bus conductor is not acceptable. The surface of the connector fingers and conductor on such connections shall be silver plated. Both, the conductors as well as the contacts for the conductor connections must be designed for the continuous rated current of the switch gear under the ambient conditions furnished, and shall not exceed the permissible temperature rise."

Design of bus conductor shall be such that during removal of any bay, only affected portion of conductor shall be disconnected from plug-in type connectors keeping adjacent bays and remaining portion of bus shall be in intact position.

h. Enclosures :-

The enclosure shall be of continuous design and shall meet the requirement as specified IEEE : 80 2013 (special considerations for GIS).

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.

- The metal enclosures for the SF-6 gas insulated equipment modules shall be made from Aluminum alloy. Suitable anti corrosive paints shade 631 of IS : 5 or equivalent must be applied on the exterior of the enclosures. The enclosure shall be separate phase wise in case of 400 kV class GIS and shall be with Single Enclosure for three phases in case of 132 KV & 66 KV class GIS, while for 220 KV class enclosure shall be either single OR phase wise separate metallic type. The external fixtures should be made of corrosion-resistant material and should be capped wherever required.

- Bidder shall provide adequate number of internal UHF sensors in the all offered 66 KV class GIS for PD measurement even if on line PD system is not in scope of supply and the number and location of these sensors shall be subject to approval of the purchaser. (External UHF sensors are not allowed)"

- The number & location of these sensors shall be based on laboratory test on typical design of GIS as per recommendations of CIGRE Document No. 654 (application guide for sensitivity verification for uhf partial discharge detection system for GIS). Offered numbers and location of UHF sensors shall be submitted based on above said criteria along with attenuation calculation for 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 as per re commendations of above CIGRE Document No. 654. In case during site testing, additional UHF sensors are required, the same shall be supplied & installed to complete the technical requirement.

-The calibration and frequency response of PD couplers shall be as per relevant standard/Technical guideline. Data sheet shall be submitted for the UHF couplers meeting this requirement.

Bellow compensators shall be made of Stainless steel to preserve the mechanical strength of the equipment at the connection portions to deal with the following problems:

a) Expansion and Contraction of outer enclosure and conductor due to temperature variations.

b) Mismatch in various components of GIS.
c) Vibration of the transformer and switching equipment.
d) Dimensional variations due to uneven settling of foundation.
e) Seismic forces as mentioned in climatic condition.

i. SF-6 Gas Processing Unit :-

a) An SF-6 gas-processing unit suitable for evacuating, liquefying, evaporating, filling, drying and
purifying SF-6 gas during the initial installation, subsequent maintenance and future extension of GIS shall be provided. The cart shall be equipped with rubber wheels and shall be easily maneuverable within the GIS building.

b) A wheeled maintenance unit shall be supplied which shall be self-contained (except for Additional gas storage bottles and external power supply at 415 V AC, 3-phase, 50 Hz.) and fully equipped with an electric vacuum pump, gas compressor, gas drier, gas filter, refrigeration unit, evaporator, gas storage tank, full instrumentation for measuring vacuum, Compressor inlet temperature, tank pressure and temperature, valving and piping to perform the following operations as a minimum requirement :

i) Evacuation from a gas filled compartment using the vacuum pump,
ii) Transfer of SF-6 gas from a system at some positive or negative pressure to the Storage tank via the gas drier and filter;
iii) Recirculation of SF-6 gas in the storage tank through the drier,
iv) Re circulation of SF-6 gas in any switchgear or bus duct compartment through the drier and filter;
v) Evaporating and filling SF-6 Gas,
vi) Drawing off and liquefying SF-6 Gas,
vii) A combination operation of filling SF-6 gas into a gas system and evacuating a second gas system using the vacuum pump.

c) Adequate length of hoses with necessary adaptors shall be provided for filling of SF-6 gas in any of the gas compartment with the help of gas cart.

d) GA drawing and Schematic drawing for gas processing unit shall be submitted for approval

j. Auxiliary Equipment :-
The following items shall be included for a complete installation:
a) Control system including local control cubicles.
b) Cable and wiring between individual items of supplier supplied equipment.
c) Name plates.
d) All ladders, platforms, stairs, walkways, and supports necessary to operate and maintain all equipment safely and efficiently.
e) Special tools and tackles for installation.
f) Special tools and tackles for maintenance

k. Safety Precautions :-

k.1 The switch-gear must provide a maximum degree of safety for the operators and others in the vicinity of the switch gear under all normal and fault conditions. The safety clearances of all live parts of the equipment shall be as per relevant standards.
k.2 It must be made impossible to touch any live part of the switch-gear unwillingly, i.e. without use of tools or brute force.
k.3 An operator standing in the normal operating position should not be endangered by any moving external part of the switch-gear.
k.4 Interlocks: Mechanical & electrical interlocks must be provided to ensure absolute and reliable protection against potentially harmful Mal-operation of the switchgear. All interlocks that prevent potentially dangerous mal-operations shall be so constructed such that they cannot be defeated easily, i.e. the operator must use tools and/or technique to over-ride them only in case of emergency.

The following functions shall be provided :
1) The operator must be forced in to the only safe and logical sequence to actuate the circuit breakers, dis-connectors & earthing switches.
2) The actual, completely closed or completely opened position of all switching devices must be checked before and after each move.
3) Implementation of logic checks and issuing the resultant signals Enabled or Blocked for the switching device.
Each gas compartment must have its own *automated external* pressure relief device to provide instant and safe discharge of accidental overpressure during internal arc. Rupture diaphragms shall be preferably used as pressure relief mechanisms. The bursting pressure of relief device should be effectively coordinated with the rated gas pressure and the pressure rise due to arcing. PRD shall have

- All earthing connections must remain operational.

- The enclosure of the switch gear must withstand the thermal effects of an arc at the full rated short circuit current until the nearest protective relay has acted and tripped the breaker.

To limit the effects of an internal arc the switch gear shall be suitably subdivided into individual arc and gas-proof compartments, preferably for

- Bus-bar together with bus-bar isolator and earthing switch
- Circuit breaker
- Line isolators and earthing switch, (Line, transformer)
- Instrument transformers.
- Intermediate compartment

l. Special Tools, Tackles and Equipment :-

Special tools, tackles and equipment that are required to perform installation, commissioning, Operation & maintenance of the gas insulated switch gear.

1. Dew point measurement meter
2. SF-6 gas leakage detector
3. Precision pressure gauge
4. Gas recovery unit with required accessories
5. On line PD monitoring system for 66 KV GIS modules.

6. SF-6 gas purity detector / analyzer for SO_2, H_2O, CF_4, AIR etc.
7. Portable hand held PD measurement kit suitable for GIS along with required accessories
8. Air / gas humidity tester,
9. Breaker timing measurement kit

m. Grounding of GIS :-

m.1 GIS will be housed on GIS floor. The bidder will provide under-ground mat below the substation. The bidder shall also provide adequate number of Galvanized steel risers to be connected to grounding mat, as per relevant standards and in consultation with GETCO during detailed engineering

m.2 The bidder shall supply entire material for ground bus of GIS such as conductor, clamps, joints, operating and safety platforms etc. to be laid / embedded in GIS floors. The bidder is also required to supply all grounding connectors and associated hardware material for :
i) Connecting all GIS equipment, Bus duct, enclosures, control cubicles, supporting structures etc. to the ground bus of GIS
ii) Connecting ground bus of GIS to the ground mat risers

m.3 The grounding arrangement of GIS shall ensure that touch and step voltages are limited to safe values as per IEEE std. 80-2000. The enclosures of the GIS shall be grounded at several points such that there shall be a grounded cage around all live parts. The ground continuity between each enclosure shall be affected over flanges, with or without links or straps to bridge the flanges. Copper/Aluminum straps shall however bridge the metallic expansion bellows. The grounding switches shall be connected to ground through the enclosure.
Individual ground leads for the ground switches are not allowed. The inductive voltage against ground in each part of the enclosure shall not be more than 65 Volts

m.4 Where operating mechanism cubicles are mounted on the switchgear, the grounding shall be made by separate conductor. Bay control cubicles shall be grounded through a separate conductor.

m.5 All conduits and control cable sheaths shall be connected to the control cubicle rounding bus. All steel structures shall be grounded

m.6 Each removable section of catwalk shall be bolted to the support structure for ground Continuity

m.7 The enclosure grounding system shall be designed to minimize circulating currents and to ensure that the potential rise during an external or internal fault is kept to an acceptable level. The guidelines of IEEE Std. 80-2000 on GIS grounding, especially the transient ground potential rise caused by high frequency phenomena, shall be taken into consideration while designing the grounding system for GIS

m.8 The manufacturer shall furnish readily accessible connectors of sufficient mechanical strength to withstand electromagnetic forces as well as capable of carrying the anticipated maximum fault current without overheating by at least from two paths to ground from the main ground bus

m.9 Provisions of IEC : 517 & 694 regarding safeguards in grounding of connected cables, testing during maintenance and other safety measures shall be ensured.

n. Gas Insulated Bus :-

GIB shall be designed based on the following criteria.
(1) Maximum weight of gas in a gas tight section of GIB shall not exceed 250 Kg.
(2) GIB shall be generally in horizontal layer. However, in exceptional circumstance GIB in vertical layers can be provided with the approval of employer.
(3) The minimum vertical ground clearance of GIB at road crossing shall be 8 meters.
(4) The horizontal clearance between GIB and GIS building /any other building Wall shall be minimum 3 meters.
(5) 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.
(6) The GIB clear height outside the GIS hall in switchyard area shall be minimum 4 meter, so as not to obstruct easy access to GIB, movement of crane for maintenance work.
(7) For the maintenance of GIB of one circuit, only that circuit shall be isolated.

o. Service Conditions :-

Climatic Conditions:
The equipment and the accessories to be supplied against this technical specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

Max ambient temperature	:	50°C
Min. ambient temperature	:	-5°C
Max daily average ambient temperature	:	38°C
Max relative Humidity (%)	:	As per IEC
Max altitude above M.S.L. (meters)	:	<1000
Average Annual Rainfall (mm.)	:	1000
Max wind pressure (Kg./Sq. mtr.)	:	130
level(days/yr.)	:	50
Average no. of rainy days/annum	:	120
Condensation	:	Occasional
Induced electromagnetic disturbance	:	1.6 KV
Cree page distance	:	31 mm./kV
Seismic Zone	:	Zone-V

Acceleration due to gravity, g	:	0.5
Max ambient temperature	:	50°C
Min. ambient temperature	:	-5°C
Max daily average ambient temperature	:	38°C
Max relative Humidity (%)	:	As per IEC
Max altitude above M.S.L. (meters)	:	<1000
Average Annual Rainfall(mm.)	:	1000
Max wind pressure (Kg./Sq. mtr.)	:	130

p. Standards :-

p.1 Reference Standards :-

The GIS offered shall confirm to IEC : 62271-203 and other relevant IEC standard except to the extent explicitly modified in the specification and shall be in accordance with requirement specified in GTP.
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 as on date of bid

High voltage switchgear& Control gear	:	IEC 60694
High voltage metal enclosed switch gearfor 72.5 KV &above	:	IEC 62271-203
Specification for acceptance of new Sulphur Hexafluoride	:	IEC 60376
Guide to checking of Sulphur Hexafluoride Taken from Electrical equipment	:	IEC 60480
Surge Arresters	:	IEC 60099
Overhead line, Cable and Transformer Terminals Bushings for alternating voltages above1000V	:	IEC 60137
Cable connections for gas insulated metal enclosed Switchgear for rated voltages of 72.5 KV and above	:	IEC 60859
High voltage test techniques	:	IEC 60060
Insulation coordination	:	IEC 60071
Electrical Relays	:	IEC 60255
High voltage switches	:	IEC 60265
Partial discharge measurement	:	IEC 60270
Degree of protection	:	IEC 60529
Pollution levels	:	IEC 60815
EMC	:	IEC 61000
Use and handling of SF-6 gas	:	IEC 61634

p.2 Instrument Transformers : : IEC 61869

(a) Circuit Breaker

High voltage Alternating current circuit Breakers : IEC 62271-100

Report on Synthetic testing of high voltage alternating Current Circuit breakers : IEC 60427

(b) Dis-connectors and earthing Switch

Alternating current Dis-connectors : IEC 60129

Alternating current earthing switches, Induced current Switching : IEC 60129

Artificial pollution test on HV insulators to be used on ac system : IEC 60507

Gas insulated metal enclosed switchgear for rated voltages of 72.5 kV and above : IEC 60517

Classification of degree of protection provided by enclosures : IEC 60529

q. Electrical Data :-

Rated System Voltage/ Highest System/Equipment Voltage	kV	33/36	66/72.5	132/145	220/245	400/420
One min. Power frequency withstand voltage	Kvrms	70	140	275	460	610
Across open isolator	kVrms	80	160	315	530	610
Across the open gaps of CB	kVrms	70	140	275	460	520
Phase to phase	kVp	170	350	650	1050	1425
Phase to earth	kVp	170	350	650	1050	1425
Across open isolator	kVp	195	375	750	1200	1425 kVp+ 240kVpoopp polarity
Across the open gaps of CB	kVp	170	350	650	1050	1425

Rated Frequency	Hz	50	50	50	50	50
Rated Continuous current at 50°C ambient temperature Bus-bar	Amps	3150	2000	2000	3150/2500	4000
Feeder and Transformer Bay	Amps	2500	1600	1600	3150/2000	3150
Rated Short circuit With stand current for 3 seconds	kA	40	40	40	50	63
Rated dynamic with stand current	kAp	100	100	100	125	157
Maximum Partial Discharge (at 1.1 Un)	pico-coulombs	5	5	5	5	5
System Neutral earthing		Solidly earth	Solidly earth	Solidly earth	Solidly earth	Solidly earth
Maximum SF-6 Gas leakage rate peryear	per year					

r. Detailed technical requirements for GIS Components :-

r.1 Circuit Breaker:

1) The GIS Circuit breaker shall be **C2 – M2** class and comply with the following general Requirements for circuit breakers and the latest revisions of the relevant IEC-62271-100 specifications

2) Circuit – breakers shall be of single pressure, single break, self-compression self-blast /Auto puffer type with SF6 as arc quenching & insulation medium and with a minimum maintenance Contact system

3) 66 kV breakers shall be of separate phase wise enclosure whereas 66/11 kV breakers shall be of three phase encapsulated type. For 66 kV Circuit breakers are to be supplied with Controlled Switching Device (CSD) compatible to SCADA remote operation with IEC 61850 protocols OR with PIR OR as indicated in BOQ of respective tender.

4) 66 kV Circuit breakers shall be Gas insulated type only, Vacuum type Interrupter shall not be allowed.

5) Ratings of the circuit breaker shall be as per enclosed technical parameters.

6) They should be shipped as a completed three-phase unit within a complete bay module.

7) Each circuit-breaker shall have spring/Hydraulic/ combined drive mechanism ensuring proper closing and opening, and shall permit checking of adjustments and opening/closing

characteristic. The ON/OFF latches shall be mechanically interlocked with each other. The circuit breaker shall be completely factory assembled, adjusted and tested.
8) The total break time from energizing the trip coil at rated control voltage to final arc extinction shall be as short as possible, but in any event not greater than 3 cycles i.e. 60 ms.
9) The circuit breaker shall be capable of breaking all currents from zero up to the specified maximum fault current in accordance with the relevant IEC recommendations.
10. The circuit breaker shall be capable of interrupting the steady and transient magnetizing current as per follows:

Voltage level	Transformer rating	Rating in MVA
66KV	220kV/66kV	50to160
	132kV/66KV	150to100
	66kV/11KV	5to20

r.2 Contacts

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. Breakers shall be so designed that when operated within their specified rating, 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. Provisions shall be made for attaching an operational analyzer to record travel, speed and making measurement of operating timings etc. after installation at site. The contractor shall supply three set of transducers.

r.3 Closing Devices

a) The closing coils shall be suitable for operation at any voltage between 110% and 85% of the nominal control voltage measured at the device terminals
b) The breaker shall close correctly when an electrical closing pulse of 50 msec. Duration is applied to the closing coil.

r.4 Tripping Devices

a) All electrical tripping coils shall be suitable for operation at any voltage between 110% and **70%** of the nominal control voltage measured at the device terminals.
b) Each circuit-breaker shall be equipped with two shunt trip system. The one shunt trip system shall be electrically separated from the other system.
c) An emergency hand tripping (mechanical) device shall be provided in the operating mechanism

r.5 Operating Mechanism

The breaker shall include suitable spring/Hydraulic/combined operating mechanism to assure proper opening & closing operations. The provision shall be made for checking adjustments

and opening characteristics. The mechanism shall be capable of re-closing within the range specified in the applicable standards. The mechanism shall include dual trip coils. Charging of opening mechanism shall be possible in the event of failure of the motor drive

Spring Operated Mechanism:

a) Spring operated mechanism shall be complete with motor, opening spring, closing spring with limit switch for automatic charging and all necessary accessories to make the mechanism a complete operating unit.
b) As long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible.
c) After failure of power supply to the motor, at least O-C-O operations of the circuit breaker shall be possible.
d) Breaker operation shall be independent of the motor which shall be used solely for compressing the closing spring.
e) Motor rating shall be such that it requires only about 30 seconds for fully charging the closing spring.
f) Closing action of the circuit breaker shall compress the opening spring ready for tripping.
g) 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 control cabinet & SAS

r.6 Auxiliary Switches

Each breaker shall have auxiliary switches with adequate number of NO and NC contacts all wired to terminals located in the local control cubicle of the circuit breaker bay. Additional 10 NO (Normally open) & 10 (Normally Close) auxiliary contacts for future use should be provided & wired up to terminal block of LCC.

r.7 Indication Devise

a) Position indicators shall be provided to clearly indicate whether a circuit-breaker is open or closed.

	Status	Colour
Open position	Open	Green
Closed position	Closed	Red

b) Each circuit-breaker shall be provided with an operation counter to record the number of tripping operations performed. The counter may be located at the local control cubicle.

c) All position indicators and counters shall be readable at a convenient elevation i.e. from the place of operation.

s. Principal Parameters :-

The Circuit Breakers of GIS equipment shall confirm to the specific technical requirements given as under.

Sr. No.	Particulars	33KV/66KV/132KV/(220KV)/400KV
1)	Enclosure	Single/Single/Single/(Single or separate phase wise)/separate
2)	Enclosure material	Aluminum Alloy
3)	Rated voltage	36KV/72.5KV/145KV/245KV/420KV
4)a	Rated current(Line, Trans & Reactor)	2500A/1600A/1600A/3150or2000A /3150A
b	Rated current (Bus-bar & Bus coupler)	3150A/ 2000A/ 2000A/ 3150A or 2500A/4000A
5)	Rated frequency	50 Hz.
6)	Rated short-circuit breaking current/ Duration	40/40/40/50/ 63 KArms 3 sec
7)	Rated break-time	3cycle
8)	Rated short-circuit making current	100/100/100/125/157 KAp
9)	Rated operating sequence	O-0.3s-CO-3min-CO
10)	Type of operating mechanism for circuit Breaker	Spring–Spring/hydraulic/combined
11)	Rated control voltage - Closing coil - Tripping coil	110/220 VDC 110/220 VDC
12)	Mechanical Endurance class	M2
13)	Electrical Endurance class	E1
14)	Characteristic for short line Fault related to rated short circuit breaking current	As per IEC : 62271-100
15)	TRV characteristics	As per IEC : 62271-100
16)	Inductive current breaking capability	Switching No Load current of transformer
17)	First pole to clear factor	As per IEC : 62271-100
18)	Opening time in ms	Notmorethan40
19)	Closing time in ms	Notmorethan100
20)	Noise level base of CB	As per NEMA standard
21)	No of tripping coils per breaker	2
22)	No of closing coils per breaker	1
23)	Restricting probability class	C2

24)	Rated line charging breaking Current	10/10/50/125/400A (Max. over breaking capacity voltage factor 1.5PU)
25)	Rated cable charging breaking current	50/125/160/250/400A
26)	Rated capacitor bank Switching current	400/400/400/400/400A
27)	Rated out of phase making And breaking current in %of rated short circuit breaking current	As per applicable IEC

Controlled switching shall be provided for GIS as per indicated in BOQ of respective tender. The circuit breaker shall be suitable for the application

a. Switching Off & On of the Line
b. Switching Off & On of the Transformer
c. Switching Off & On of the Shunt Reactor

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

Calculations and related test reports of scheme proving rating for duties specified above shall be furnished in the bid. The calculations shall take care of requirements of programming etc. for setting switching for various duties like long line, Shunt reactor, power transformer and time setting.

The proposed scheme should be designed keeping in view all the system parameters of GETCO and applicability with various operations. Circuit Breaker on which CSD is to be provided along with all the other connected equipment's, Transformer, reactor, CT-PT, LA Dis-conenctor CVT, wave trap etc. is not supposed to be Mal functioned or failed due to this scheme. The CSD supplier shall be responsible for any such unwanted event. The very advantage of provision of controlled switching should not be spoiled due to any design defect. All the preliminary literatures on this scheme should be provided with the bid. Bidder shall provide all the detailed documents, function diagrams, calculations and design criteria etc.

t. Technical Requirement for controlled switching device :-

a) CSD shall be designed to operate correctly and satisfactorily with the excursion of auxiliary A/C & DC voltages and frequency as specified.
b) The CSD shall have functions for switching ON & OFF the circuit breakers.
c) The CSD shall get command to operate the breakers manually. The controller shall be able to analyze the current and voltage waves available through the signals from secondary's 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 CSD 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 CSD must consider all factors that may affect the operating time of the breaker such as, but not limited to, ambient temperature, control voltage

variation, SF6 gas density variations etc. Schematic drawing for this purpose shall be provided by the contractor. The accuracy of the operating time estimation by the controller shall be better than ± 0.5 ms.
e) The CSD should have display facility at the front for the display of settings and measured values.
f) The CSD shall 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 be suitable for current input of 1 ampere from the secondary of the CTs. and 110 V or 220V (Ph to Ph) from the PTs or CVTs. The CSD shall withstand transient and dynamic state values of the current from the secondary of the CTs and CVTs.
h) The CSD shall have time setting resolution of 0.1 ms or better.
i) The CSD 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 of the scheme.
j) The CSD shall also record and monitor the switching operations and make adjustments to the switching instants to optimize the switching behavior as necessary. It shall provide self-diagnostic facilities, signaling of alarms and enable downloading of data captured from the switching events.
k) The provision for bypassing the Controlled switching device shall be provided through BCU and SCADA both so that whenever, the CSD is not healthy due to any reason (including auxiliary supply failure), uncontrolled trip/close command can be extended to the circuit Breaker. Alternatively, in case of any non-operation of the CSD after receiving a close/trip command after a pre- determined time delay, the CSD should automatically be bypassed so as to ensure that the trip and close commands are extended to the Trip/Close coils through subsequent command.

u. Tests :-

Type Tests
All the CSDs offered shall be fully type tested for following, as per relevant standard latest Editions at the NABL accredited or Government approved laboratory of the eligible country.

A. Dielectric withstand test (IEC-60255-5)
1. Power frequency voltage withstand
2. Impulse voltage withstands

B. Electromagnetic immunity tests
1. 1 MHz burst (IEC- 60255-22-1)
2. Electrostatic discharge (IEC- 60255-22-2)
3. Radiated electromagnetic field (IEC- 60255-22-3)
4. Fast transient / burst immunity test (IEC- 60255-22-4) /IEC61000-4-4)
5. Surge immunity test (IEC- 61000-4-5)
6. Conducted disturbances induced by radio frequency fields (IEC- 61000 6)
7. magnetic field test (IEC- 61000-4-8,9 & 10)
8. Ripple on Dc power supply (IEC 61000-4-17

C. Electromagnetic interference tests (IEC 60255-25)

1. Conducted emission test
2. Radiated emission test

D. Mechanical test

1. Vibration test (IEC- 60255-21-1)
2. shock test (IEC- 60255-22-2)
3. bump test (IEC- 60255-22-2)
4. Seismic test (IEC- 60255-22-3)

E. Environment test

1. Cold test (IEC-60068-2-1)
2. dry heat test (IEC-60068-2-2)
3. Damp heat test steady state (IEC-60068-2-3)
4. Damp heat cyclic(IEC-60068-2-30)

The Bidder shall furnish ONE set of all above type test reports for the offered CSD along with the offer.
The type test reports shall not be older than 15 (Fifteen) years and shall be valid as on the last date
of submission of bid.

v. Dis-connector Switches and Maintenance Grounding Switches: -

v.1 The GIS dis-connector switches and grounding switches shall comply with the following general requirements of disconnect switches and the latest version of the relevant specifications IEC 60129, 61128, 61129, 61259.

v.2 Disconnect switches shall be gang operated and separate phase wise for 66 kV, Single or separate phase wise for 66 kV and three phase encapsulated for 66 kV/11 kV, group operated, no break, with one common motor operated mechanism for all the three poles. They shall also have facilities for emergency manual operation and necessary handles shall be provided.

v.3 Maintenance earthing switches shall be gang operated and separate phase wise for 66 kV, Single or separate phase wise for 220 kV and three phase encapsulated for 66 kV/11 kV, group operated, no break, with one common motor operated mechanism for all the three poles. They shall also have facilities for emergency manual operation and necessary handles shall be provided.

v.4 Disconnect switches and grounding switches shall have electrical and Mechanical interlocks to prevent grounding switch from closing on an energized section. OR Disconnect switches and grounding switches shall have electrical interlocks to prevent grounding switch from closing on an energized section. However, pad locking arrangement shall be provided to have mechanical interlock manually.

w. Interlocks :-

Interlocking devices must provide absolute and positive protection against potentially harmful mal-operations of the switchgear. The following functions shall be assured:
a) Forcing the operator into the only safe and logic sequence to actuate breakers, switches, isolators and grounding switches.
b) Checking the actual fully closed or fully open position of all switching elements before and after each move.

c) Providing the logical checks and issuing the resulting PERMISSIVE or BLOCKED signals for the switchgear.
d) Indicating positively the absolute condition/position of the supervised equipment.
e) Local manual and remote electrical operation of all essential functions.
f) Local emergency unlocking facilities via safety-key switches under the full responsibility of the operator.
Intraday and interlay interlocking shall be provided. Electrical interlocking arrangement shall be fail-safe type. Mechanical interlocks for isolator & Earthing Switch shall be fail-safe type.

w.1 All main contacts, male and female, shall be silver plated.

w.2 Each disconnect switch and grounding switch shall open or close only due to motor driven or manual operation independently. The switch contact shall not move due to gravity or other means, even if a part fails. Once initiated, the motor mechanism shall complete an open or close operation without requiring the initiating contact be held closed. Operation of respective end position limit switches shall only disconnect the motor mechanism. There should also be a pre-set timer in motor circuit for protection against time over –run in case of inadvertent failure of drive mechanism in any intermediate position of the dis-connector travel path.

w.3 The disconnect switches and grounding switches shall be located as shown in the Single Line Diagram.

w.4 The disconnect switches shall be capable of interrupting the charging current of the connected GIS bus & associated components.

w.5 Duty requirements: The disconnecting switches shall have breaking capabilities as per IEC requirements. Contact shielding shall be designed to prevent restrikes and high local stresses caused by the transient recovery voltages when currents are interrupted. The bus disconnecting switches shall reliably handle capacitive currents due to the making and breaking of switchgear components as well as commutation currents due to bus bar reconfiguration. The fast acting ground switches, used for overhead double circuit lines and underground cable feeders shall be capable of switching induced current as per IEC requirement.

x. Short Circuit Requirements :-

The rated peak short- circuit current or the rated short time current carried by an isolator or earthing switch for the rated maximum duration of short circuit shall not cause:
a) Mechanical damage to any part of the isolator or earthing switch.
b) Separation of the contacts or contact welding.
c) A temperature rise likely to damage insulation.

y. Operating Mechanism :

y.1 Mechanism shall be arranged mechanically, electrically, so that all three phases of any particular disconnect switch or grounding switch operate simultaneously.

y.2 All mechanisms shall be suitable for electrical motor operation to achieve a fully automatic operation. For emergency situations manual operation shall be possible. Handles or hand cranks

shall be provided, together with all necessary operation rods and rod guides. Manual operation shall be prevented if the interlocking system does not allow the operation of the switch.

y.3 The auxiliary supply shall be electrically decoupled from the motor when the switch is operated manually.

y.4 The mechanisms shall be arranged for locking in the open and in the closed position. Facility shall be available to allow the switch to be padlocked in any position.

y.5 Disconnecting operating mechanism of all disconnector/ isolator & earth switches shall be at easy operable height.

y.6 The isolator shall be provided with positive continuous control throughout the entire cycle of operation.

y.7 The operating pipes and rods shall be sufficiently rigid to maintain positive control under most adverse conditions and when operated in tension or compression for isolator closing. They shall also be capable of withstanding all torsional and bending stresses due to operation of the isolator.

z. Auxiliary Switches :-

All disconnecting switches shall be provided with electrically independent auxiliary switch, directly driven by the common operating shaft. Each disconnect switch and grounding switch shall furnish with sufficient Nos. of NO – NC as per entire scheme requirement. Additional 6 NO (Normally open) & 6 (Normally Close) auxiliary contacts for future use should be provided & wired up to terminal block of LCC. The auxiliary switches shall indicate the position of the switch contacts, and shall be independent of the motor operation.

aa. Position Indicators :-

Mechanically connected position indicators shall be provided externally to permit observation of close/open position of the disconnect switch and grounding switch. The place of Position Indicators should be easily visible from the place of operation of respective equipment.

Position Indicator	Status	Color
Open position	Open	Green
Closed position	Closed	Red

ab. Technical Data Requirements for Disconnector :-

Sr. No.	Particulars	Parameter
1	Enclosure	Single/Single/Single/(Single or separate Phase wise) /separate phase wise
2	Enclosure material	Aluminum Alloy
3	Rated voltage	36/72.5/132/245/420kV

4	Rated current (A)(Feeder)	2500/1600/1600/**3150or2000A**/3150A
5	Rated current(Bus bar &Bus coupler)	3150A/2000A/2000A/3150Aor2500/4000A
6	Rated short-time current Duration	40/40/40/50/ 63kArms 3sec
7	Rated control and operating voltage	Asperclause2.3.1
8	Type of operating mechanism	Motor operated
9	Type	Mechanically & electrically ganged operated
10	Rated insulation level	
a)	Power frequency with stand voltage	
	-phase to phase, between phases	70/140/275/460/520kVrms
	-Across the isolating distance	80/160/315/510/610 kVrms
b)	Lightning impulse withstand	
	-phase to phase, between phases	170/350/650/1050/1425kVpeak
	-Across the isolating distance	195/375/750/1200/1665kVpeak
11	Mechanical Endurance Class	M2
12	Bus transfer switching capability	80%(max.1600A)
13	Rated bus charging current	0.1A/0.2A/0.25A/0.3A

ac. Low-voltage test provision :-

A low-voltage test provision may be supplied with a grounding switch to permit test voltages of up to 10kV (optional 2.5kV) and up to 200 A to be applied to the conductor without removing SF6 gas or other components, except for ground shunt leads.

ad.1 Fast Acting Grounding Switches :-

ad.1 Fast acting grounding switches can be located at the terminal of HV/EHV overhead line/ cable. They shall be able to switch safely load currents of overhead lines. They must have fault making capability and be able to switch on a live line. Applicable standards are IEC 60129, 60517, 61129. The fast acting grounding switches shall comply with the following general requirements of fast acting grounding switches and the latest revision of the relevant IEC specifications.

ad.2 Fast acting grounding switches shall be of three phase, encapsulated, three phase linkage group operated by a maintenance-free self contained electrical motor. They shall also have facilities for emergency manual operation and the necessary operating handles or hand cranks shall be supplied.

ad.3 Fast acting grounding switches shall be electrically or mechanically interlocked with related disconnector, to prevent the fast acting grounding switch from closing on an energized bus section.

ad.4 All main contacts, male and female, shall either be silver plated or shall have silver inserts.

ad.5 Each fast acting grounding switch shall open or close only due to motor-drive or manual operation but shall be operable from local only. The switch contact shall not move due to

gravity or other means, even if a part fails. Once initiated, the motor mechanism shall complete an open or close operation without requiring the initiating contact to be held closed.

ad.6 Each fast acting grounding switch shall be fully insulated and connected to ground by a removable bolted link in order that the grounding switch may be used for various test purposes. The insulation shall be capable of withstanding an applied power frequency voltage of 5 KV

ad.(a) Operating Mechanism :-

- Mechanisms shall be coupled either mechanically or electrically or by both, so that all three phases of any particular fast acting grounding switch operate simultaneously without any discrimination.

-All mechanisms shall be equipped with a motor suitable for operation from the auxiliary supply, and a set of springs so arranged that energizing of the motor will cause the springs to be charged and then released. The springs in turn shall close the fast acting grounding switch.

- Motors shall be suitable for operation at any voltage between 85% and 110% of the rated auxiliary voltage, measure at the motor terminals.

- For emergency situations manual operation shall be possible. Handles or hand cranks shall be provided, together with all necessary operation rods and rod guides.

- The auxiliary energy shall be electrically uncoupled from the motor when the switch is operated manually.

-The mechanisms shall be arranged for locking in the open and in the closed position.

ad.(b) Auxiliary Switches :-
Each of the fast acting grounding switch shall be furnished with sufficient Nos. of NO – NC as per entire scheme requirement. Additional 6 NO (Normally open) & 6 (Normally Close) auxiliary contacts for future use should be provided & wired up to terminal block of LCC. The auxiliary switches shall indicate the position of the switch contacts, and shall be independent of the motor operation.

ad.(c) Position Indicators :-

Mechanically connected position indicators shall be provided externally to ascertain the open/close position of the grounding switch. It should be easily visible from the place of operation of equipment.

Position Indicator	**Stat**	**Color**
Open position	Open	Green
Closed position	Close	Red

ae. Technical Data Requirement :-
High Speed Earthing Switch

Sr. No.	Particulars	33kV/66kV/132kV/(220kV)/400kV
1)	Enclosure	Single/Single/ (Single or separate phase wise)/separate phase wise
2)	Enclosure material	Aluminum Alloy
3)	Rated voltage	36/72.5/145/245/420kV
4)	Rated short-time current	40/40/40/50/ 63kArms3sec
5)	Rated peak with stand current	100/100/100/125/157kAp
6)	Type of operating mechanism	Motor operated
7)	Rated control and operating voltage	Asperclause2.3.1
8)	Power frequency with stand voltage across the open gap	70/140/275/460/520kVrms 80/160/315/510/610 kVrms
9)	Lightning impulse with stand voltage across the open gap	170/350/650/1050/1425kVpeak 195/375/750/1200/1665kVpeak
10)	Electrical Endurance class	E1
11)	Rated induced current switching capability	AsperIEC62271–102classB

ae.1 Current Transformers:

ae.1.1 The current transformers provided for each phase shall be supplied in accordance with the following general requirements and the latest revisions of the relevant IEC- 61869 specifications.

ae.1.2 The current transformers must be suitable for continuous operation when installed on the conditions.

ae.1.3 The current transformer shall be ring / toroid type, multi ratio with fully distributed secondary windings with relay accuracy as per IEC : 60185, incl. IEC : 61869, multi core as per requirement and shall be mounted inside the high voltage enclosure. The secondary terminals of current transformers shall be placed outside the high voltage enclosures, mounted in suitable, accessible terminal boxes and the secondary leads of all the current transformers shall be wired to shorting type terminals.

ae.1.4 It shall be possible to test each current transformer without the removal of gas through the insulated grounding switches.

ae.1.5 The number and position of the current transformers shall be relative to the circuit breakers, disconnecting switches and ground switches as detailed in the attached single line diagram.

ae.2 Rating and Diagram Plates

Rating and diagram plates shall be provided. The information to be supplied on each plate shall be as specified in the relevant IEC specification, which shall be given for the tap for which the rated performance is specified and for each transformer core.

66 KV class CT-Bay wise core requirement considering 12.5 MVA 66/11 KV Transformer								
Core No.	**Purpose**	**Ratio**	**Out putburden**	**Accuracy class**	**Instrument security factor**	**Min. Knee point voltage at highest rated current**	**Max. excitation current at KPV**	**Max. CTR ct Sec. at highest ratio**
	Feeder-bay							
1	Metering	600 - 300/1	15 VA	0.5	≤5	--	--	--
2	Dir. O/C-E/F Protection	600 - 300/1	10 VA	5P	10	--	--	--
3	Spare	600 - 300/1	10 VA	5P	10	--	--	--
	12.5 MVA, 66/11 KV Transformer Bay (HV)							
1	Metering	200 - 100/1	15 VA**	0.5	≤5	--	--	--
2	Non-Dir. O/C-E/F Protection	200-100/1	10 VA**	5P	10	--	--	--
3	Differential Protection	200 - 100/1	--	PS	--	100 to 400 V	100 mA (at 100 V) to 200 mA (at 400 V)	<5Ω
4	Spare	200 - 100/1	--	PS	--	100 to 400 V		<5Ω
	Bus Coupler Bay							
1	Metering	600 - 300/1	15 VA	0.5	≤5	--	--	--

2	Non-Dir. O/C- E/F Protection	600 - 300/1	10 VA	5P	10	--	--	--
3	Spare	600 - 300/1	10 VA	5P	10	--	--	--

ae.3 Voltage Transformer:

SF-6 insulated: Each voltage transformer shall be metal enclosed, SF6 insulated inductive type in accordance with relevant IEC 61869 The location, polarity, ratios, and accuracy shall be as specified.

ae.3.1. Construction:

VTs should be in segregated compartment and not forming a part of bus bar. Transformers should be of either plug-in construction or the disconnect-link type, and be attached to the gas-insulated system in such a manner that they can be easily disconnected while the system is being dielectrically tested Alternately, a voltage transformer designed so that it does not have to be disconnected during dielectric testing may be specified. The metal housing of the transformer should be connected to the metal enclosure of the GIS with a flanged, bolted, and gasket joint so that the transformer housing is grounded to the GIS enclosure. Adequate measures shall be provided to prevent any unacceptable impact on the secondary control and protection circuits, which might result from fast transients (VFT) or Ferro-resonance.

ae.3.2. Covers and shields :

Special covers and any necessary corona shields should be supplied so that the system can be pressurized and dielectrically tested after removal of the transformer. Primary and secondary terminals: Primary and secondary terminals should have permanent markings for identification of polarity, in accordance with IEC. The secondary terminals of voltage transformers shall be placed outside the high voltage enclosures, and the secondary leads of all the voltage transformers shall be wired up to terminals mounted in suitable & accessible terminal boxes. Test condition for tests at site: Power frequency tests for the completed GIS at site shall be possible without removing the VT. The primary and secondary neutral terminal points, intended to be earthed, should be insulated and shall withstand power frequency voltage of 3 KV rms for 1 minute. The VT shall be capable to withstand discharge current arising from capacitance of underground cable circuits.

Technical Data Requirement :-

SN	Particulars	Parameters
1	Rated voltage	33/66kV/132/220kV/400 KV
2	Highest system voltage	36/72.5/145/245/420 KV
3	Rated frequency	50 Hz.
4	PF(dry)with stand voltages	70/140/275/460/610 KV
5	Voltage factor	1.2 continuous
6	1.2/50microsec.lightningimpulsewithstandvoltage	170/350/650/1050/1450/KV

7	Earthing	Effective

66 KV class Bus PT Core Details				
Core	Purpose	Ratio	**Burden**	Class of accuracy
1	Metering	6KV/√3/110V/√3	50VA	0.5
2	Protection	6KV/√3/110V/√3	50VA	3P
3	Spare	6 KV/√3/110V/√3	50 VA	3P

af. Bushings :-

- Outdoor bushings shall be provided for connection of conventional external conductors to SF-6 GIS if asked in general layout plan. Bushing shall be polymer type only. Necessary valid type test reports as per relevant applicable standards shall be submitted. Suitable clamp & connectors shall be supplied with bushing. The dimensional and clearance requirements for the metal clad enclosure shall be maintained as per requirement of relevant standards.

- All the bushings shall have an impulse & power frequency withstand level that is higher or equal to the level specified in cl. 2.3. Only SF-6 insulated composite silicon bushings will be accepted. The terminals on the outdoor bushings shall be a solid stem with dimensions specified.

ag. Metal-Enclosed Surge Arresters :-

- 66 KV, 20 KA, Cl-4 / 198 KV, 10 kA, Cl-3 / 120 KV, 10 kA, Cl-3 / 60 KV, 10 kA, Cl-3 / 30 KV, 10 KA, CL-2 hermetically sealed, Gapless, ZnO, Surge arrestor, suitable for use with GIS, for each phase, at the 66kV line underground cable entry terminals of GIS shall be provided, if indicated in SLD/BOQ of respective tender. Each Surge Arrester shall be provided with self-leakage current monitoring device at convenient elevation. Location of SF-6 Surge Arrester shall be as per tender drawings.

- They shall have adequate thermal discharge capacity for severe switching surges, long duration surges and multiple strokes. The surge arresters when provided with pressure relief devices shall be capable of withstanding the internal pressures developed during the above discharges without operation of the pressure relief devices. Surge Arresters, if any provided, shall be of either the "plug-in" construction or the disconnect link type and be attached to the gas-insulated system in such a manner that they can be readily disconnected from the system while the system is being dielectrically tested. The metal housing of the arrester shall be connected to the metal enclosure of the GIS with a flanged, bolted joint.

-The ground connection shall be sized for the fault level of the GIS. It shall be insulated from the GIS-enclosure and grounded externally to permit periodic maintenance and monitoring of the leakage current.

-If the arresters are not equipped with removable links, special covers and any necessary corona shields should be supplied so that the system can be pressurized and dielectrically tested after removal of the arrester.

ah. Insulating Gas and Gas Leakage Rate :-

The GIS shall be furnished with sufficient sulfur hexa-fluoride (SF-6) gas to pressurize the complete system in a sequential approach, one zone or compartment at a time to the rated nominal density. The guaranteed leakage rate of each individual gas compartment and between compartments must be less than 0.5% p.a. for the service life of equipment.

The quality of new filled-in SF-6 gas shall meet the following requirements in line with IEC : 60376.

Content	**Specification**	**Analytical methods (for indication only, not exhaustive)**	**Precision**
Air	2 g/kg. [note1]	Infrared absorption method	35 mg./kg.
		Gas-chromatographic method	3–10 mg./kg.
		Density method	10 mg./kg.
CF_4	2400 mg./kg. [note2]	Gas-chromatographic method	9 mg./kg.
H_2O	25 mg./kg. [note3]	Gravimetric method	0.5 mg./kg. [note3]
		Electrolytic method	2–15 mg./kg.
		Dew point method	1°C
Mineral oil	10 mg./kg.	Photometric method	<2 mg./kg.
		Gravimetric method	0.5 mg./kg. [note5]
Total acidity expressed in HF	1 mg./kg. [note4]	Titration	0.2 mg./kg.
$S0_2$	<1 ppmv		

The supplier should provide guidelines or recommended practices for the reuse or recycling of SF6 gas removed from the equipment. These guidelines should be consistent with current industry practices, as they pertain to the effect of SF6 on global warming; i.e. SF6 gas should be reused and recycled whenever possible and never be unnecessarily released into the atmosphere. Clear instructions shall be provided by bidder about handling, recycling & treatment of new and used SF6 gas.

SF6 gas shall be tested for purity, dew point, air, hydrolysable fluorides, and water contents as per IEC:60376, 60376A & 60376B and test certificates shall be furnished to the Employer indicating all test results as per IEC standards for each lot of SF6 gas.

ah.1 Gas sections :-

- The GIS enclosures shall be divided into several gas sections separated by gas- tight barriers. Each section shall be provided with necessary valves to allow evacuation and refill of gas without evacuation of any other section. Location of gas barrier insulators is to be clearly discriminated outside the enclosure by a band of distinct colour normally used for safety purposes.

- The gas system proposed shall be shown on a "gas single line diagram" and submitted with the technical bid and in the event of an order for approval. It should include the necessary valves, connections, density monitors, gas monitor system and controls, indication, orifices, and isolation to prevent current circulation. Means of calibrating density monitors without de-energizing the equipment should be specified by the supplier.

-For the purpose of gas monitoring and maintenance, the GIS shall be divided into various individual zones in each bay. The CB gas zone shall be independent from all other gas compartments and shall meet the requirement of relevant IEC. Each gas zone shall be furnished with a gas monitoring system consisting of a gas density continuous monitoring device provided with two electrically independent contacts which
operate in two stages as follows :

a) First alarm : At a gas density normally 5 to 10% below the nominal fill density.
b) Second alarm : Minimum gas density to achieve equipment ratings.

ai. GIS Connection :-

ai.1 GIS to Transformer/Reactor :-

1) For 66/11 kV Transformers (As specified in SLD / SECT DRG / BOQ):

66 KV side : by GIS SF-6 to air bushing to OIP condensers bushing of transformer by conductor. GIS SF-6 to air bushing shall be polymer type only.

ai.2 GIS to Line:

66 KV class: by GIS SF-6 to air bushing to line termination gantry by conductor. GIS SF-6 to air bushing shall be polymer type only. (As specified in SLD / SECT DRG / BOQ.) or 66 KV class: by GIS to XLPE cable (66 KV – single or twin, 1C, 630 mm.², 66 KV - single or twin, 1 C, 630 mm.²,
66 KV - single or twin, 1C, 630 mm2) as per BOQ and SLD)

ai.3 SF6 GIS to XLPE Cable Termination:

Cable termination kit (CSE) shall be supplied by GIS OEM/EPC contractor. This interface section shall be designed in a manner which will allow ease of operation and maintenance.
The SF-6 GIS to XLPE cable termination shall conform to IEC : 859 (latest edition). 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. All supporting structures for the SF-6 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. 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. A separate cable basement is provided for cable entry, its distribution and installation.

The design of the cable end box shall fully comply with the IEC standard. The type and size of cable is specified. All end cable modules shall be suitable for connecting single core, XLPE specified cable. Necessary provision for termination of specified nos. of such power cables shall be made in GIS.

GIS supplier shall either carry out the work of termination or coordinate with cable terminator for such connection as specified in schedule of requirement. Provision shall be suitable for terminating GETCO Approved cable.

aj. GIS SF-6 SCADA :-

For Total control, monitoring, supervision and operation from SCADA system potential free contacts shall be provided for each and every interface of Switchgear status, Control, Monitoring, Interlocking, Alarms, Troubles etc. and all other interfaces considered in LCC which are mandatory.

66 KV, 11 KV Circuit Breaker :
1) Pressure switch shall be provided with following minimum numbers of potential free contacts for breaker gas monitoring in SCADA / Control Panel status; over and above provided for Scheme.
(a) SF-6 gas pressure normal – minimum 1 NO or 1 NC plus one spare
(b) SF-6 gas pressure low – minimum 2 NO or 2 NC plus one spare
(c) SF-6 gas pressure lockout - minimum 2 NO or 2 NC plus one spare

2) Following minimum numbers of potential free contacts are required to be provided for breaker Monitoring in SCADA / control panel; over and above provided for breaker scheme:

(a) Breaker spring charge – minimum 2 NO or 2 NC plus one spare
(b) Control supply DC-1 & DC-2 fail, Motor MCB Trip, CB AC supply fail indication contacts Plus one spare.
(c) Local remote switch – minimum 1 NO or 1 NC plus one spare for each position i.e. Local & Remote
(d) CB ready status for Auto reclose for 145 KV - minimum 1 NO or 1 NC plus one spare
(e) Other interfaces if any SCADA

3) Similarly, potential free contacts for SF-6 Gas monitoring of other switchgears and compartments as per requirement. i.e. Local & Remote

4) Other interfaces if any

Similarly, potential free contacts for SF-6 Gas monitoring of other switchgears and compartments as per requirement in future scope.

ak. Wiring Requirements :-

Each circuit breaker shall have control suitable for operation on 110 V/220 V DC with two electrically independent trip circuits. The miniature circuit-breakers (MCB) shall be provided for the closing circuit and an independent separate switch fuse unit of suitable rating shall be provided for the primary and back up trip circuits.

1. Wiring shall be complete in all respects to ensure proper functioning of the control, Protection and monitoring and interlocking schemes.
2. DC circuit for trip coil 1 & 2 shall be wired separately.
3. Wiring shall be done with flexible 1100V grade, FRLS, PVC insulated, switchboard wires with minimum

1.5 mm.2 stranded copper conductor however, based on functional requirement higher size shall be provided. The control wire in a grouped environment shall not convey flame, continue to burn. Wiring between equipment and control cubicle shall be routed through energized parts.

4. Each wire shall identify at both ends with permanent markers bearing wire numbers as per Contractor's wiring diagram.
5. Minimum 1 set of spare contacts as utilized contacts shall be provided for each and every component of LCC whose contacts are utilized in schematics.
6. All spare contacts of relays, push buttons, auxiliary switches etc. shall be wired up to terminal blocks in the control cubicle.
7. Terminal blocks shall be 1100V grade, stud type with engraved numbers suitable for termination of at least two numbers of 2.5 mm2 stranded copper conductor. Terminal blocks for CT, PT, and auxiliary AC & DC supply shall be disconnecting link type.
8. Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished.
9. Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
10. Terminal connectors that carry power supply should be shrouded from adjoining connectors.
11. Manufacturer shall provide all control wiring and terminations internal to the switchgear, and connecting the switchgear to the bay control cubicles.
12. All control cables shall be shielded. Cable shields shall be grounded. Grounding connections shall be as short and direct as possible and shall terminate at the point of entry to cubicles or terminal boxes.
13. Co-axial type cable glands suitable for use with shielded cables shall be used at each termination.
14. All control cables shall be installed and terminated in such a manner as to limit the effects of transient electromagnetic voltages on the control conductors to an acceptable level.
15. Any cabling within GIS shall be supported on cable tray. No cable shall be in hanging position.
16. Insulator cones shall be embedded in full return current carrying metal fixing rings in order to avoid mechanical stresses to the cast resin part and to impart full conductivity across

the flange connection. Earthing of different gas compartments/enclosures is not allowed with cross bonding with any metal strips.

al. Connections within the GIS and their LCCs :-

All cable connections between the various GIS modules and the LCC's shall be made by prefabricated multi-core cables with multipoint plug in connections on both the ends. PTs & CTs circuit shall be wired with crimped type copper lugs. All cables shall be shielded and adequate for their application (indoor / outdoor). The cables shall be fire retardant low smoke. The length and the number of terminal points of control wiring & SF6 gas connections shall be minimized.

The electrical connections between the various gas sections shall preferably be made by means of multiple contact connectors so that electrical connection is automatically achieved when bolting on section to another. The surface of the connector fingers and conductor tubes on such connections shall be silver plated.

am. Name plates :-

Name plates of the following types shall be furnished in a convenient central location to provide information for operation and maintenance.

a) Gas Single Line Diagram showing all HV devices in a single line diagram with the gas sectionalizing of the GIS indicated. Also shown shall be the GIS nomenclature, a legend, Manufacturer's type and serial number and year of manufacture.

b) GIS Rating / Name plate:
Manufacturer's name & address, type & designation, Sr. No, Maximum ambient temperature, System frequency, Maximum continuous voltage, Maximum continuous current at 40oC ambient temperature, Basic Impulse Level, Power Frequency one- minute voltage, Short circuit current, rms., symmetrical Short time (rms.) current & duration, symmetrical Momentary current, peak, Total weight of gas at rated density, Rated gas pressure at 20°C. Opening pressure of the bursting disc, recommended moisture limits of insulation gas (PPMV), Auxiliary voltages, Contract/Purchase Order numbers, Total weight of the equipment

c) Equipment nameplate containing nameplate rating information for all HV modules (like circuit breaker, disconnect switches, current transformer, voltage transformer,
surge arrester, etc.) as required in relevant IEC.

d) Nameplates showing serial numbers and similar data specific to individual components shall be mounted on the components. Each instrument transformer must have its own rating plate mounted adjacent to each terminal box cover, will all terminal

an. Type Tests :-

Following type test reports from NABL laboratory, as specified in IEC standard 62271 – 203 & 62271-100 (amended up to date) shall be submitted for the offered type, rating of GIS invariably with the technical bid. Bid without type test reports will not be considered for evaluation. The type test reports shall not be older than 15 (Fifteen) years and shall be valid as on the last date of submission of bid.

1. Tests to verify the insulation level (Lightning impulse, switching impulse and power frequency withstand test with PD) test On Each device of GIS (CB, DS, CT, Bus etc…) in line with IEC : 62271-203.
2. Dielectric tests on auxiliary circuits.
3. Tests to prove the radio interference voltage (RIV) level (66 KV to 11 KV class)
4. Tests to prove the temperature rise of any part of the equipment and measurement of the resistance of the main circuit.
5. Tests to prove the ability of the main and earthing circuits to carry the rated peak and the rated short time withstand current.
6. Tests to verify the making and breaking capacity of the included switching devices.

A. Circuit breakers

i. Basic Short circuit duty tests (T10, T30, T60, T100a, T 100 s)
ii. Short line fault test (L60, L75, L90)
iii. Single phase test
iv. Out of phase making & breaking test
v. Capacitive current switching test
vi. Shunt reactor current switching test (For 66 KV Class)

B. Dis- connectors

i. Bus Transfer Current Switching Test

C. Fast acting earth switch

1. Short circuit making test
2. induced current switching test
3. Tests to prove the satisfactory operation of the included switching devices.
4. Tests to prove the strength of enclosures.
5. Verification of the degree of protection of the enclosure.
6. Gas tightness tests
7. Electromagnetic compatibility tests (EMC).
8. Additional tests on auxiliary and control circuits.
9. Tests on partitions.
10. Tests to prove the satisfactory operation at limit temperatures.
11. Tests to prove performance under thermal cycling and gas tightness tests on insulators.
12. Corrosion test on earthing connections (if applicable).
13. Tests to assess the effects of arcing due to an internal fault.
14. Tests on solid dielectric components (operating rods, spacers, etc.)
15. Seismic test / Calculation
16. Test on Auxiliary switches (Electrical & Mechanical Endurance, Heat run, IR & HV test)
17. Tests on CTs and PTs (On Primary & secondary) as per IEC : 61869
18. Test on surge arresters
19. Test on control switching devices/PIR

an.1 Test Certificates:

a. Certified reports of all the tests carried out at the works shall be furnished in required number copies for approval of the Owner.

b. The equipment shall be dispatched from works only after receipt of Owner/Purchaser's written dispatch clearance & approval of the test reports.
c. Routine test certificates of bought out components shall be furnished.
d. Type test certificate on any equipment or component if so desired by the Owner shall be furnished. Otherwise the equipment shall have to be type tested, free of charge, to prove the design.

an.2 Tests after installation of complete GIS at Site:

After installation and before being put into service, the GIS shall be tested in order to check the correct operation and dielectric integrity of the equipment as laid down in IEC : 62271-203. The successful bidder shall furnish a commissioning test plan and a statement method for the tests on site.
Tests shall include the following :
1. Dielectric tests on the main circuits.
2. Dielectric tests on auxiliary circuits.
3. Measurement of the resistance of the main circuit.
4. Gas tightness tests.
5. Checks and verifications.
6. Gas quality verifications.
7. On site power frequency voltage withstand test with PD test.
8. Tests as per IEEE C37.122.1 clause 4.10.5.
9. Functional & interlock tests for all items.
10. Demonstration of operational compatibility with SCADA
11. Visual inspection, checks & verifications.
12. Mechanical operation tests of circuit breakers, Dis-connectors and earthing switches and high-speed earthing switches
13. Insulation resistance measurement
14. Tests on CTs and PTs
15. Test on control switching devices/PIR
16. DCRM test (as per Clause 3.15.3 A & B)
17. PD sensor sensitivity check for each PD sensor during commissioning before HV & PD test.

an.3 Drawings, Data, Manuals & calculations:

Drawings, Data, calculations and Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions on Contract and/or elsewhere in this specification for approval and subsequent distribution after the issue of Letter of Intent.
To be submitted with the Bid :

1. Schedule of Guaranteed Technical Particulars
2. All the type test reports as per specification.
3. Typical general arrangement drawings of the equipments indicating space requirement, room dimensions, crane capacity etc.
4. Technical Specifications of equipment and special tools explaining construction features, principle of operation, special features etc.
5. Comprehensive QAP, FQP, SLD, Gas Schematic diagram, Technical brochures, building requirements, Earth mat design, List of recommended spares, special tools or fixtures, O&M manuals, environmental guide for handling SF6 gas & decommissioning, estimated time

schedule for installation & commissioning, bill of materials, and any other documents required for successful commissioning & operation of complete GIS.
6. Control and protection: Block & principle diagram showing proposed scheme, layout & equipment arrangement drawings, catalogues & brochures of offered devices. In absence of above technical documents, bid shall be evaluated accordingly. Successful bidder shall submit 3 sets of spiral bound volume of following drawings & data for approval/ information before commencement of supply:

1. A comprehensive Manufacturing Quality assurance plan with effective quality assurance system. (MQP)
2. Field Quality plan indicating instruction & procedures sequenced for storage, assemble, maintenance and disassembly. (FQP)
3. Gas Schematic diagram (GAS SLD)
4. GIS general arrangement drawings (Plan & section view) including 3D drawing
5. GIS component drawing
6. Interface modules drawing for GIS extension
7. Rating and name plate drawing
8. SF-6 to air bushing /Cable termination drawing
9. Bay wise Bus duct drawings including 3D drawing (Plan & Section views for all offsets/bends)
10. LCC GA & Schematic drawings
11. GIS support structure drawing
12. GIS platforms & walkway drawings
13. GIS key diagram enlisting and marking each and every GIS module clearly & separately identifiable (Indoor & Outdoor)
14. Method Statement along with sequential instruction for dismantling and assembling of all major components of GIS exhibiting service continuity requirement
15. Conductor detachment procedure for GIS and Bus-bar.
16. Capacity calculation of EOT crane for GIS hall
17. Method statement/ procedure of ON SITE high voltage testing with PD measurement and Switching Impulse test
18. Seismic Analysis Report

an.4 Maintenance :-

The operational integrity of the GIS switchgear shall not subject to external influences, such as pollution, moisture, dust etc. As a consequence of this GIS switchgear should be practically maintenance free; however, the details of inspection required at regular interval shall be indicated in the offer. Visual inspection shall be required not below 2 (two) years interval. Inspection shall not be required often than every 10 years. During inspection it must not be necessary to open the switchgear enclosures for interrupt operation of substation. Provision of functional testing of the close and trip coils, auxiliary switches, pressure and control switches etc. shall be provided. Following minimum Maintenance period shall be accepted.
(a) Circuit breaker : 5000 closing and opening or 20 interruptions at max rated current
(b) Disconnector : 5000 closing and opening operations.
(c) Fast acting earth switch: 2000 closing and opening operations or 2 making operations on to max rated fault current. The bidder shall provide the services of experienced persons, supervisors, engineers, experts, etc., for complete specified work for satisfactory operation. Successful bidder shall depute his expert to site annually for the period of Five years from the

date of commissioning, to inspect GIS for carrying out status evaluation of GIS performance. This is intended to share the operational challenges and confirm the maintenances followed by GETCO. The bidder shall have dedicated localized after sales & service team which should be capable any activity to operate complete GIS satisfactorily.

ao. GIS Building :-

The GIS building, if it is a part of schedule of requirements, shall comply with the requirements of Civil specifications.
For 66/11 KV sub-station, One GIS buildings are required.
For 66/11 KV sub-station, only one GIS room is required.
The proposed arrangement of building and positions in which the switchgears shall be installed relative to lines, transformers, cable circuit and any other switchgear of any other voltages will be indicated in general arrangement layout. The overall height of building shall allow for overhead traveling crane.

ao.1 Training :-

Training to Ten (10) persons of GETCO on construction, installation, commissioning and O&M shall be imparted by bidder free of cost. Duration of the complete training shall be 7 working days, covering minimum below specified curriculum. Any other specific area may be brought to notice and included.

1. General Explanation for GIS
2. Layout and Architecture of GIS
3. Gas Sectionalisation of GIS
4. Construction of CB
5. Operating Mechanism of CB
6. Maintenance of CB
7. Overhaul of CB (Interrupting chamber)
8. Overhaul of CB (Operating Unit)
9. Construction of DS/ES
10. Maintenance of DS/ES
11. Overhaul of DS/ ES
12. Construction of Bus/ Cable head/ SF-6 – air bushing
13. Maintenance of Bus/ Cable head/ SF-6 – air bushing
14. Overhaul of Bus/ Cable head
15. Overhaul of various transformer connections
16. Operation of GIS with SCADA
17. Construction & Maintenance of Lightning Arrester
18. Construction & Maintenance of VT/CT
19. Construction & Maintenance of Local control panel
20. Erection of GIS at site.
21. Installation & Testing of GIS at site
22. Type tests of GIS
23. Routine tests of GIS
24. Faults simulation of GIS
25. Localization of GIS fault.

Bidder shall at his cost arrange for the above training facilities and in addition shall bear all living expenses plus inland travel expenses of all the trainees. The Purchaser shall only pay to and fro passage of the trainees.

ap. Shipment storage and installation :-

The contractor shall be responsible for the loading, transport, handling and offloading of all equipment and materials from the place of manufacture or supply to site. The contractor shall be responsible to select and verify the route, mode of transportation and make all necessary arrangement with the appropriate authorities as well as determining any transport restrictions and regulations imposed by the government and other local authorities. All equipment shall be suitably packed in wooden box with proper marking on each item (Bay & phase wise) and protected during shipment/transportation. Each shipping unit shall be sealed in a clean dry condition with leak-tight shipping covers securely mounted for shipment. All covers to be removed during installation shall be clearly marked. Each shipping section shall be carefully sealed and filled with dry gas to a slightly positive pressure to prevent the entrance of moisture and contamination.

The packing method for the GIS equipment shall be standard and it shall be guaranteed that each component of the equipment will not be damaged, deformed or lost. The storage instructions shall be submitted by bidder for long term storage. Component requiring indoor storage shall be so identified. Gas insulated switchgear (GIS) shall be properly packed to protect during ocean shipment, inland transport, carriage at site and outdoor storage during transit and at the site. Completely assembled bays (subject to transport limitations) of the GIS shall be transported as one shipment unit. Packing materials shall be dust and waterproof. All packages shall be clearly, legibly and durably marked with uniform block letters on at least three sides. Fragile items like bushings, CTs, VTs, Las and fully assembled bays shall be securely packaged and shipped in containers. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment wherever necessary. As far as possible, transshipment should be avoided.

Impact recorders (Accelerometers) shall be provided on the packages to confirm that GIS has not suffered any shocks during shipment, transport, handling, etc. The impact recorders readings are to be noted on receipt of equipment at site and reported to user & manufacturer, in case the readings are exceeding the permissible values. It shall be at discretion of user to accept or reject the same. Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. This applies particularly to the metal clad equipment of which each gas section shall be sealed and pressurized prior to shipping. Either dry nitrogen/air or dry SF-6 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. Blanking plates, caps, seals, etc., necessary for sealing the gas sections during shipment to site which may on later stage necessarily be used during repair and maintenance shall remain the property of GETCO. Balance blanking plates, caps, seals, etc. shall be returnable to the contractor.

If considered necessary, blanking plates or other sealing devices shall be provided with facilities for

measuring the gas pressure and recharging at any time during the transport period. Any seals, gaskets, 'O' rings, etc. that may 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.

Identification numbers shall be stamped into the blanking plates, etc., and on the switchgear equipment to which they are fitted so that they can easily be identified and refitted should it ever be necessary to ship sections of the switchgear back to the manufacturer's works for repair.
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 fungal growth. The scope of providing the necessary protection, storing on raised platform, as required etc. is included in the works to be performed by the contractor. Cost of the raised platform for temporary storage is deemed to be included in overall cost. The raised platform needs to be made ready before arrival of GIS equipment at site. The contractor may use the available storage areas at site with permission of site in charge. The equipment shall be unpacked immediately before Installation. 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 or SF6 gas until required.
For the purpose of release of payment linked to receipt and physical verification; in case of GIS equipment it shall mean random opening and physical verification of one number of packing unit of each type of main equipment (i.e. GIS CB/ISO/ES/PT/LA etc.) for each voltage level. Thereafter proper re-packing of the GIS unit shall be ensured as per manufacturer recommendation.

ap.1 Installation

During Civil works of GIS Hall including internal cable trench shall be completed along with GIS hall sealing in all respects before taking up the installation and it shall be ensured that Ventilation System is operational and all dust and dirt in the hall are removed. The GIS hall needs to be in positive pressure before starting Installation.
The installation area shall be secured against entry of unauthorized personnel. Only certified manufacturer's engineer and supervisor shall undertake the erection works. Engineers and supervisors of the manufacturer shall submit authorization and competency certificate to GETCO. Un-packaging of GIS modules shall be done outside the GIS hall and in no case module to be taken inside GIS hall with packing.
All assembly work shall be done by qualified personnel only who are to be identified and list submitted to GTECO site before starting of erection work. Assembly drawing for GIS erection for the section under progress shall be available and displayed in GIS hall at the time of erection work.
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.
Installation of flanges shall be done immediately after removal of transport covers and 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. Bus duct exits in the GIS hall's wall shall be kept covered by suitable means until permanent cover is provided after installation of bus ducts. Approved Field Quality Plan shall be followed during site work

ap.2 Quality Assurance:

i) Superior quality control system shall be adopted to assure high product quality. Raw materials of the best commercial grade quality and high reliability shall be used in the manufacture of GIS. High reliability of materials shall be ensured so as to keep maintenance work to a minimum.
A quality assurance plan for major components such as breakers, disconnecting switches, lightning arrestors, earth switches, etc. with in-process inspection methods, tests, records, etc. shall be submitted with the technical bid. Customer hold points will also be included in the plan, which shall be mutually agreed by the purchaser and manufacturer, and approved.

aq. Technical Particulars of 66 KV GIS Switchgear :-

Sl. No.	Particulars	66 KV GIS (Cubicle type)
1.a	Type (Model No.)	To be specified by the bidder.
1.b	Standard Applicable	IEC : 62271-100/ IEC : 62271-200
2.	Service	Indoor
3.a	Enclosure-Tank	Stainless steel
3.b	Enclosure- Panel	CRCA
4.	Nominal System Voltage	66 KV
5.	Highest System Voltage	75 KV
6.	No. of phases and frequency	3 ph.50 Hz.
7.	Bus-bar material	Copper
8.	Bus Color code	RYB
9.	System Earthing	Impedance earthed
10.	Circuit Breaker Rating	1600 A (IC,OG & BC)
10.1	Continuous Current Rating at 50°C	1600 A for BusBar
10.2	Short Circuit Rating	31.5 KA
10.3	Short Circuit duration	3 sec
10.4	Internal Arc Rating	31.5 KA
10.5	Internal Arc Duration	1 sec.
11.	Rated making Current	As per IEC : 62271
12	Operating duty	O-0.3sec-CO-3minutes-CO
13	Leakage rate per year in gas	Less than0.2%
14.	Bus bar rating	1600 A
15.	Outgoing feeder rating	1600 A
16.	Power Frequency Withstand voltage	66 kV for 1 minute
17.	Impulse withstand voltage (1.2/50 microsec)	75 KV
18.	Control Voltage	110/220 V DC
19	Spring charge motor voltage	110/220 V DC
20.	CT Ratio	300 -150/1-1 (during detail engineering)
21.	PT ratio-STAR/ STAR	(11/√3)/ (.11/√3)/ (.11/√3)
22.	Aux. Contacts	6 NO + 6 NC
23.	Termination	
23.1	Incomers	XLPE Cables as specified
23.2	Outgoings	XLPE Cables as specified
24.	Degree of protection (HV equipment)	IP-65 for Gas Compartment
25.	Dimensions in mm.	1785 (D) X 800 (W) X 2600 (H)

2. Technical Specification of Item No. 2

This includes Supply, Installation, Testing and Commissioning of 25 Way 11 KV indoor type GIS Panel Board of approved make as per following details.

Incomer : 06 (Six) Nos. of 2500 A, i.e. 03 (Three) from Transformer, 02 (Two) for Bus-coupler and 01 (One) from HT DG Set.

Outgoing : 19 (Nineteen) Nos. of 1250 A, i.e. 03 (Three) Nos. for Old 66 KV Substation; 03 (Three) Nos. for Capacitor Bank; 01 (One) No. for Station Transformer; 02 (Two) Nos. for DC-1 & DC-2; 04 (Four) Nos. for 13TH, 14th, 15th & 16th Berths and 06 (Six) Nos. as Spare.

The GIS outgoing feeder shall be of 1250 A, 26.1 KA GIS 11 KV Board Panel circuit breaker horizontally insulated horizontal draw out type, electrical motor Operated, spring charged with facility of manual closing. Incomer feeder shall be suitable to terminate 3R X 3C X 300 Sq. mm. cable per phase

3 Nos. of CT 300/1+1+1+1+1 A (PS class/PS class/5P20/0.2/PS class) 20 VA burden CT with 0.2 accuracy, PS class for differential, PS class for REF, 5P20 for over current and earth fault, 5P20 protection class for metering, one no PS class as spare.

Bus Coupler : 02 (Two) Nos. of 2500 A, 26.1 KA VCB circuit breaker horizontally insulated horizontal draw out type, electrical motor operated, spring charged with facility of manual closing as bus coupler with protections of over current and earth fault.

1 No. 3 phase 11 KV/√3 /110 V/√3/110 V/√3 draw out PT with burden and class 0.2/3P accuracy. This shall be suitable for resistively earthed system & PT shall with duty cycle of 1.9 times for 30 Sec.

This shall consist of the followings.

- 01 (One) No. Digital MFM.
- 01 (One) No. Local / Remote switch for operation
- 01 (One) No. emergency OFF push button outside
- Spring charge status with Indication
- Annunciator window with minimum 8 windows (or as per requirement as directed) with hooter.
- Auto / Manual switch. In Manual mode, it shall have local TNC switch for operation.
- Separate indication for each electrical fault.
- Minimum 8 windows (or as per requirement as directed) Annunciator for all electrical faults.
- Buzzer

General :-

This specification covers the design, manufacture, assembly, testing at manufacture's works before dispatch and delivery of metal clad partitioned, SF6 gas insulated, switchboard panel confirming to IEC-62271-200.

The switchboard panels for incoming bays, outgoing bays, bus coupler/Bus-section bays, etc. shall be fitted with Vacuum circuit breakers, three position disconnecting and earthing switches, voltage transformers, current transformer, metering instruments, protection relays, cable terminal ends for incoming & outgoing cable feeders etc. as per foregoing specification.

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 relevant standards, specification and codes of practices, referred to herein and shall be the latest editions including all applicable official amendments and revisions as on the date of opening of bid. In case of conflict between this specification and those (IS Codes, Standards etc.), the former shall prevail. In addition to relevant standards specified in Section-GTR, following standards shall also be applicable :

IEC : 62271-200	Gas insulated metal-enclosed switchgear for rated voltage above 1 KV and up to and including 52 KV
IEC : 62271-1	High-voltage switchgear and control gear – Part 1: Common specifications
IEC : 62271-100	High-voltage alternating-current circuit-breakers
IEC : 62271-102	A.C. dis-connectors (isolators) and Earthing switches for voltages above 1000 V
IEC : 62271-207	Seismic qualification for gas-insulated switchgear assemblies for rated voltages above 52 kV
IEC : 62271-1	High-voltage switchgear and control gear – Part-1: Common specifications
IEC : 62271-100	High-voltage alternating-current circuit-breakers
IEC : 60376	New Sulphur hexafluoride
IEC : 62271-4	Use and handling of sulphur hexafluoride (SF-6)
IEC : 61243- 5	Voltage Detecting Systems
IEC : 60376	New Sulphur hexafluoride
IEC : 62271-4	Use and handling of sulphur hexafluoride (SF-6)
IEC : 61243- 5	Voltage Detecting Systems
IEC : 60262, IEC : 60529	Degree of Protection
IEC : 60071	Insulation coordination
IEC : 61936-1	Power Installations exceeding 1 KV
IEC : 60721-3-3	Classification of environmental conditions
IEC : 60044-1	Current Transformers
IEC : 60044-2	Voltage Transformers
IEC : 60262, IEC : 60529	Degree of Protection
IEC : 60071	Insulation coordination
IEC : 62271-209	Cable connections for gas-insulated switchgear
IEC : 61 936-1	Power installations exceeding 1 kV
IEC : 60 721-3-3	Classification of environmental conditions
EN : 50110	Operation of electrical installations

<u>Equipment Specifications</u> :-

Switchgear Panel :-

Gas insulated Metal clad switchgear shall be complete with all the accessories for efficient operation. The equipment offered shall be safe, reliable and compact to install. The circuit breaker, switches and protective device etc. shall be latest design so as to ensure rapid and efficient interruption of fault current low arc energy, small arching time and freedom from fire hazards.

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.

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.

The switchgear panel shall be free standing, floor mounted, fully compartmentalized, metal enclosed, of uniform width not exceeding 500 mm irrespective of feeder rating to ensure neat aesthetic uniform foundation civil layout construction and complying good engineering practices.

The adjacent panels shall preferably be completely separated by steel sheets as per manufacturer's standard switchgear design, however bus-bar compartment housing silicone insulated touch proof bus-bars shall be common which may run along the entire length of board.

The SF-6 gas insulated metal enclosed switchgear shall be totally safe against inadvertent touch of any of its constituent live parts.

The Service Class Continuity of Switchgears shall be LSC - 2 (as per IEC : 62271-200, latest standard).

Bus-bar compartment to have suitable baffle arrangement with very fine GI mesh screen. Relays shall be fully flush mounted on the switchgear panels at a suitable height from operator point of view.

Switchgear shall have an Internal Arc Classification of IAC-A-FLR 26.3 KA, 1 Sec. The rated short – time withstand current is 26.3 KA. The short-circuit duration is 3 sec. The test report must be shown with the offer. The internal arc classified switchgear enclosure consists of the following assemblies :

- Three-part panel front
- Floor cover in cable compartment
- Rear wall with gas flow path and top explosion provision
- Bus-bar cover with integrated expanded metal to reduce the pressure and cool down the hot gases.

The switchgear construction shall be such that the operating personnel are not endangered by breaker operation and internal explosions, and the front of the panels shall be specially designed to withstand these. All operations of circuit breaker, Dis-connector, earthing, switches, spring charging etc. and viewing of all status, shall be done from front of GIS without opening any additional front panel door to ensure complete safety of operator, including internal arc compliance.

Gas Pressure relief device/Explosion Vent shall be provided for each compartment, so that in case of a fault in any of the compartment, the gases produced are safely vented

out from top of the panel. During Internal arc, the hot gases from circuit breaker or cable compartment should not affect or travel through the bus-bar compartment in any manner. The pressure relief device/Explosion Vent shall not however reduce the degree of protection of panels under normal working conditions.
The switchgear shall be cooled by natural air flow.
A standard user interface ergonomically Positioned at a convenient height shall be provided. It must be visible directly without opening of doors etc. The user interface comprises all the mechanical, panel- related interfaces and continuous interrogating interlocks.
All the basic mechanical ON/OFF of CB, Isolator & earth switch operation, manual spring charge of CB must be possible without opening the door to ensure the operator safety.
Mechanical mimic directly linked to mechanism shall be provided at the panel front door. The basic switchgear unit is to be designed for suitable freestanding installation within a switch room.
The Interlocking shall be provided, so that under no condition an earthed cable is charged.
Suitable interlock & Indications shall be provided to prevent access to cable compartment doors, in case the incoming supply is ON.
The switch board shall have the facility for extension on both sides and no gas work should be required for extensions or panel replacement.
SF-6 gas leakage rate should not exceed 0.1% per annum. The gas enclosures should therefore be manufactured according to the latest state of the art technology. The GIS should be tested for its basic insulation level (28kV Power Frequency and 75 KVP Lightning impulse) voltage at 1 Bar gas pressure.
Thermostatically controlled space heater with common MCB shall be provided in required compartments.

Special Switchgear Features :-

Operational Reliability :-
Consistent hermetically welded enclosure excludes any external influence on the primary part. Due to the welded stainless-steel enclosures, loss of SF-6 gas is impossible.
Long-time proven components like welded-in bushings, welded-in bellows and the Siemens vacuum switching technology are integrated in this innovative global concept.

Personal Safety :-
Internal enclosure of components, internal arc resistant design and a complete interlocking concept - all this guarantees a maximum degree of personnel safety.

Climatic and Environmental Independence :-
Hermetically welded stainless-steel enclosure make the switchgear insensitive to any environmental influences. The primary part is therefore consistently protected against external influences such as humidity, pollution, dust, aggressive gas, small animals, etc.
These reasons make the offered switchgear also suitable for application in extreme climates or under aggressive environmental conditions.

Compactness :-

SF-6 insulation enables very compact dimensions, offering at the same time a high switchgear performance. This provides an economical utilization of surface and space, especially in cities and conurbation, both for existing set up and for new buildings.

Maintenance-Free Design :-

The offered switchgear is maintenance-free for life due to the following features:

- No repair and maintenance cycles required.
- Hermetically welded stainless-steel enclosure, with maintenance-free vacuum switching technology and maintenance-free three-position switches,
- Maintenance-free operating mechanisms for circuit-breakers and three-position switches,
- No need to check the gas quantity and quality due to the welded stainless-steel enclosures.

Ergonomic Design :-

The switchgear stands out for a user-friendly and functional industrial design. All switching devices are operated from the switchgear front. Control elements and indicators are located at an ergonomic height and are optimally integrated in the overall design.

Installation Friendliness :-

Switchgear installation and extension as well as panel replacement is done without SF6 gas work. The switchgear can be installed without special tools and instruments. Busbar interconnection from panel to panel is made through bolted busbar units.
For more information regarding installation and operation, please refer to our operating and installation instructions.

Circuit Breakers :-

a) The circuit breakers shall be of Vacuum type with vertically mounted interrupters. They shall comprise of three pole interrupting units, operated through a common shaft by a sturdy operating mechanism.
b) Circuit breaker shall be re-strike free, stored energy operated and trip free type. Motor wound closing spring charging shall only be acceptable. Anti-pumping features shall be provided for each breaker.
c) Circuit breaker shall be provided with two trip coils
d) Painted Mimic shall be provided on the front of panel to indicate Open/Closed conditions of the circuit breaker and Charged/Discharged conditions of the closing spring. All the positions via mimic shall indicate true positions of the switching devices linked mechanically with the device operation. Mimic should not be dependent on any auxiliary supply voltage.
e) The rated control supply voltage shall be 110 or 220 V DC or as mentioned elsewhere under Technical parameters. The closing coil and spring charging motor shall operate satisfactorily at all values of control supply voltage between 85 – 110 % of the rated voltage. The trip coil shall operate satisfactorily under all operating conditions of the circuit breaker upto its rated short circuit breaking current at all values of control supply voltage between 70 – 110 % of the rated voltage. The trip coil shall be so designed that it does not get energized when its healthiness is monitored by indicating lamps and trip coil supervision relay

f) The time taken for charging of closing spring shall be within 15 Seconds. The spring charging shall take place automatically preferably after a closing operation. Breaker operation shall be independent of the spring charging motor which shall only charge the closing spring. Opening spring shall get charged automatically during closing operation. As long as power supply is available to the charging motor, a continuous sequence of closing and opening operations shall be possible. One open-close- open operation of the circuit breaker shall be possible after failure of power supply to the motor. Spring charging motors shall be capable of starting and charging the closing spring twice in quick succession without exceeding acceptable winding temperature when the control supply voltage is anywhere between 85-110% of rated voltage. Spring charging motor shall be of universal type.
g) Motor windings insulation shall be given tropical and fungicidal treatment for successful operation of the motor in a hot, humid and tropical climate
h) Circuit breaker operating mechanism will be outside the SF-6 tank, manually and electrically operated. The operating mechanism should consist in the following items:

- Spring system that stores the necessary energy for opening and closing operation.
- Spring charging system (motor operated) that automatically recharges the springs after the main contacts of the CB have closed.
- Mechanical "charged-discharged" position indicator for CB opening and closing springs.
- Manually operated spring charging system (in case of lack of auxiliary power supply).
- Electrical system including:
- Tripping coil
- Anti-pumping relay
- Mechanical emergency trip pushbutton.
- Operation counter
- Spring charging indication contact.
- Mechanical indicator for Open / Closed position
- Minimum CB position auxiliary contacts

The operating system shall be with Motor operating stored-energy spring mechanism. The maintenance-free operating mechanism shall have the following features :

- "Trip-free" according to IEC : 62271-100
- Auxiliary switch contacts for control and signalling
- Operations counter
- Circuit-breaker tripping signal through Relay
- Closing solenoid
- Releases equipped according to typical
- 'Spring charged' indication
- Mechanical position indicator
- Mechanical OFF pushbutton
- Mechanical ON pushbutton

In all circuit-breaker panels, the feeder is make-proof earthed by closing the circuit-breaker additionally.

Endurance class of circuit-breaker :

Function	Class	Standard	Property of Switchgear	
BREAKER	M2	IEC : 62271-100	10,000 X	mechanically without maintenance
	E2	IEC : 62271-100	10,000 X rated normal current without maintenance	
	C2	IEC : 62271-100	Very low probability of restrikes	

Three Position Switch (ON-OFF-EARTH)

Each bay shall have three position switch (ON-OFF-EARTH) mounted inside the same SF-6 compartment which is also housing circuit breaker.

a) Each Switchgear Panel shall be provided with three position switch (ON-OFF-EARTH) of required rating.
b) It shall be possible to control these switches from front of the panel, both manually and should also be completely motorized operation for all three ON-OFF-EARTH positions.
c) Padlocking facility shall be provided for all three switch position (ON-OFF-EARTH).

The dis-connector shall be placed between the CB and the bus-bar system in order to isolate the bus-bar system from the circuit side and earth the CB side terminals. The Earthing Dis-connector shall operate always de-energized and the design for making capacity is to be provided in the circuit-breaker.
The indication of the position of the Dis-connector shall preferably be mechanical. The Operating mechanism shall be outside the SF-6 atmosphere and preferably accessible from the front. The Dis-connector shall preferably have single common rotation-driving axis for both the Dis-connector and the Earthing switch. It is mandatory that the operation from "closed to open (ready to earth)" and "open (ready to earth) to earthed" is made in two separate operations. These are two completely independent operations, with two separated operating access.

Endurance class of three-position dis-connector :-

Function	Class	Standard	Property of Switchgear
Disconnecting	M1	IEC : 62271-102	2,000 X mechanically without maintenance
Ready-to-Earth			2,000 X mechanically without maintenance
Earthing	E2	IEC : 62271-102 & IEC : 62271-200	5 X rated short-circuit making current $I_{max.}$ through CB without maintenance

Control and Interlocks :-

The mechanical operating lever actuation type interlocking system must be designed according to the interrogation interlock principle. This means that an operating lever can only be inserted or that actuating forces may only act on the components if this is permitted by the appropriate operating condition of the functional unit in question. Digital switchgear interlock units are not accepted due to their high costs and as these systems depend on the switchgear's auxiliary voltage.

a) The circuit breaker shall normally be controlled through closing and trip coils. However, it shall also be designed to control locally from front of the panel.
b) Facilities shall be provided for mechanical tripping of the breaker in an emergency. Facility shall also be provided for manual charging of the stored energy mechanism for a complete duty cycle.
c) Necessary logical mechanical interlocks shall be provided between CB and three switch position (ON-OFF-EARTH) and cable compartment for failsafe operation.
d) Each CB and three switch position (ON-OFF-EARTH) shall have 2 NO + 2 NC Auxiliary spare contacts for future use by owner.

Functional compartments :-

Each GIS panel shall be having following functional compartments:

- Bus-bar compartment (accessible tool based) containing:
  - Silicone-insulated, screened, touch proof type bus-bars (outside SF-6 Gas)
- SF-6 filled switching compartment (fixed type, non-accessible) containing:
  - Three position dis-connector (On-Off- earth)
  - Vacuum Circuit Breaker
- Cable connection compartment (Air insulated and interlocked based) containing:
  - Cable Terminations
  - Line CT's (as applicable)
  - Line VT's (as applicable)
- Low-voltage compartment (Air insulated) containing:
  - Numerical Protection Relays, LED indications, TNC switches (as applicable)
  - Multi-Function Meter (as applicable)

Bus-bars and Insulators :-

Bus-bar shall be of Electrolytic Copper with 99.9 % purity of adequate size for specified current ratings. The bus-bar itself is made of round-bar copper, the length of which depends on the panel width. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit currents.

Bus-bar is plugged onto the switchgear vessels from above and screwed tight. The bus-bars are flat at ends, making it easy for extension in future for any switchgears. Bus bar cross-section shall be uniform throughout the length of switchgear board. The bus-bar shall be touch proof screened silicone insulated placed outside the gas compartment of switchboard in-order to :

- Reduce amount of SF-6 gas for better sustainable design.
- Maintenance free life cycle.

- Perform under harsh environmental conditions.

Bus-bar insulators shall be of arc and track resistant, high strength, non-hygroscopic, non-combustible type and shall be suitable to withstand stresses due to over-voltages, and short circuit current.
All bus-bars shall have suitable phase identification. Bus switching scheme shall be as per Single Line diagram attached with bidding documents.
The temperature of the bus-bars and all other equipment, when carrying the rated current continuously shall be limited as per the stipulations of relevant Standards, duly considering the specified design ambient temperature.

Earthing and Earthing Devices :-

a) The grounding system for GIS 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.
b) A copper earthing bus shall be provided at the bottom and shall extend throughout the length of each switch board. It shall be bolted/ welded to the framework of each panel and each breaker earthing contact bar. The earth bus shall have sufficient cross section to carry the momentary short-circuit and short time fault currents to earth without exceeding the allowable temperature rise.
c) Suitable arrangement shall be provided at each end of the earth bus for bolting to station earthing grid. All joint splices to the earth bus shall be made through at least two bolts and taps by proper lug and bolt connection.
d) All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical continuity of the whole switchgear enclosure frame work shall be maintained even after painting.
e) All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 Sq. mm. Insulation color code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors and soldering shall not be acceptable. Looping of earth connections which would result in loss of earth connection to other devices, when a device is removed is not acceptable. However, looping of earth connections between equipment to provide alternative paths of earth bus is acceptable.
f) VT and CT secondary neutral point earthing shall be at one place only on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit may be removed without disturbing the earthing of other circuits.
g) The Panel shall have Voltage Presence Indicator (VPI) to warn the operator against earthing of live connections.
h) All hinged doors shall be earthed through flexible earthing braid.

Capacitive Voltage Presence Indicator :-

Capacitive layers are integrated in the bushings.

Capacitive voltage detection is performed with an LRM socket module (LRM = low resistance modified). In this LRM socket module, fixed voltage indicators are mounted to verify safe isolation from supply phase by phase.

Surface Treatment :-

The material used for sheet metal shall be CRCA Grade-D as per IS-513 (From reputed manufacturers like Tata Steel, JSW, Essar Steel etc.) with robust surface

finish, having lower strain hardening coefficient and improved planar anisotropy (improved drawability). The switchgear structure having CRCA sheets shall be powder coated (both inside and outside) providing optimal surface protection with long life properties enabling easy maintenance and cleaning. The sheet metal shall be pre-treated using 7-Tank process and then epoxy powder coated with paint shade of RAL-7035. Thickness of paint shall be 100 (+/-20) micron average.

Instrument Transformers :-

All current transformers shall be low voltage cast resin ring core type whereas voltage transformers shall be cast resin insulated type. Tape wound CT's are not acceptable. Current/voltage sensors, Rogowski coil and or other non-standard arrangement are not acceptable

Instrument transformers shall be suitable for continuous operation at the ambient temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated load and the outside ambient temperature is 45°C.

Voltage transformers shall withstand the power frequency and impulse test voltage specified for the switchgear assembly. The current transformer shall further have the dynamic and short time ratings at least equal to those specified for the associated switchgear and shall safely withstand the thermal and mechanical stress produced by maximum fault currents specified when mounted inside the switchgear for circuit breaker modules. Access to Line VT shall be possible only after it is earthed thus providing operator's safety.

The parameters of instrument transformers specified in this specification are indicative and shall be finalized during detailed engineering, considering the actual burden of various relays and other devices finally selected.

All instrument transformers shall have clear indelible polarity markings. All secondary terminals shall be wired to separate terminals on an accessible terminal block.

Current & Voltage Transformers shall be located in metal enclosed cable compartment and mounted outside SF-6 gas tank. All CT/VT shall be single phase type.

All voltage transformers shall have suitable HRC current limiting fuses (if applicable) on primary side and MCB on secondary sides. Line Voltage transformers shall be removable for maintenance without removal of power cables.

Bus voltage transformer shall be provided in a separate Bus PT panel with a SF-6 insulated disconnecting switch (ON-EARTH) for ease of maintenance at site. Bus PT shall be outside SF-6 compartment.

Low-voltage compartment :-

The low-voltage (IP4X) compartment must be at top and operated from the front.

The control and signaling circuit wiring must be flexible and of cross-section 1.0 $mm.^2$; for transformer circuits the figure is 2.5 $mm.^2$. The signaling and control leads must be led to a terminal block via plug connectors in which they are grouped together according to function.

There shall be numerical protection relay(s) (50, 50 N, 51, 51 N, 95, 86) in each incomer and outgoing feeder confirming to communication protocol IEC : 61850

There shall be Auxiliary relays for transformer faults (OTI, WTI, Bucholz) in each transformer feeder

Metering equipment's to be considered as per SLD

Other standard accessories like TNC switches, TTB, illumination lamp, thermostat with heater, aux contactors, indication lamps, L/R switch, MCB, control switch etc. shall be integral part of LV chamber as per SLD requirement.

Numerical Protection Relays :-

Indoor switchgear panels shall have communicable numerical protection relays (IEDs) complying with IEC-61850 edition 2 on all feeders which shall be networked on Ethernet to communicate with substation SAS/SCADA system on IEC : 61850. These IEDs shall also be used for control & monitoring the switchgear from SAS. In addition to status of devices (CBs/Isolators/Earth Switches) equipment alarms and use defined alarms from GIS shall also be made available to SAS/SCADA station from protection IEDs. Further, multifunction meters with Modbus protocol are also envisaged, which will be connected in daisy-chain-link to communicate to station SAS. Modbus to IEC : 61850 converter OR Serial Server shall be provided for integration with SAS, 3rd Party converter / serial server may need to be considered.

The Bidder's scope shall include the followings :

a) Communicable Numerical Protection Relays (with Redundant site selectable PRP & HSR feature) shall be provided in each of the feeders & Bus-section/Bus coupler.

b) IED's/Numerical Relays shall have large SLD based display to facilitate settings, relay operations and to view measurement, fault event and alarm etc.

c) Relays shall be SCADA compatible & shall have built in Local/Remote Selector Switch OR function keys which can be set as Local/Remote or shall have option to select local remote from relay HMI display.

All Numerical relays shall be latest & shall be of proven design for the application satisfying requirements specified elsewhere and shall be subject to Employer's approval. Numerical Relays shall have very high setting ranges, accuracy, resetting ratio, transient overreach and other characteristics to provide required sensitivity for the intended application.

All numerical relays shall be rated for control supply voltage 24 V to 250 V DC and shall be capable of satisfactory continuous operation between 80 – 110 % of the rated voltage. Making, carrying and breaking current ratings of their contacts shall be adequate for the circuits in which they are used. Heavy duty binary output contacts of IEDs to be used for breaker close and trip commands shall be so rated as to be used directly used in the closing and tripping circuits of breaker without the need of any interposing / master trip Relays.

Threshold voltage for binary inputs shall be site selectable to ensure avoidance of mal-operation due to stray voltages.

The device shall be equipped with graphical multi page LCD display so that operator can access all the necessary information without using any complex sequence of buttons in the relay HMI. Relay shall have minimum 18 tricolored LEDs. Parameters shall be set via an integrated keypad and an USB front interface using a user-friendly parameterization tool.

Failure of a control supply and de-energization of a relay shall not initiate any circuit breaker operation.

Relays shall have event recording feature with time stamping. Minimum 3000 Nos. of event records shall be stored in Non-volatile memory and failure of control supply shall not result in deletion of any of these data. Relay shall also store 20 Nos. of

disturbance records. Minimum total storage time for 20 Nos. of disturbance records shall be 200 Seconds.

All Numerical relays shall have features for electrical measurements including Voltage, Current, Power (active & reactive), Frequency, Power Factor etc. Incomer and Bus-coupler Relays shall have Voltage related measurements, whereas outgoing Transformer feeders shall have Current measurements.

All Numerical Relays shall have built-in key pad / keys to allow relay setting from relay front. Resetting of relay shall be possible from remote SCADA.

Relays shall have suitable output contact for circuit breaker failure protection (LBB) logic.

Relays shall have self-diagnostic feature with continuous self-check for power failure, program routines, memory and main CPU failures and a separate output contact for indication of any failure.

Contractor shall submit applicable Type Test reports for Numerical relays as per IEC : 255 from accredited lab and KEMA Level A certification for IEC : 61850 edition 2.

All PCB used in relays shall be assembled in the Indian facility of OEM's. The PCB should have harsh environmental/conformal coating as per standard IEC : 60068 to increase the particle repellency and thereby increasing the life of relay under harsh environmental/moisture conditions.

Necessary user-friendly configuration tool shall be provided to configure the relays. It should be compatible with SCL/SCD files generated by a third-party system.

The IEDs temperature dissipation should be such that no intrusion of insects or any tiny living things is possible by any means. If the construction design is such, then OEM has to provide additional arrangement to prevent the intrusion of any tiny living organism and its excretion. This arrangement is necessary to prevent relay failures.

Control & Protection System :-

All numerical relays shall communicate to station SCADA / SAS on IEC : 61850 communication protocol. It is envisaged that these protection IEDs shall be used for CB control & monitoring of bay equipment.

Numerical Outgoing feeder Protection Relay :-

Numerical relays for Outgoing feeders shall have provision current (4 CT) inputs for protection & measurement purposes using protection cores.

The relay shall have instantaneous as well as time delayed three over current (50) and one earth fault (50 N) protection elements.

The over current element should have the minimum setting adjustable between 20 – 200 % of CT secondary rated current and high set setting 500 - 2000 %.

The earth fault element of relay shall be suitable for detection of earth fault currents in the range of 5 % to 80 % of the CT rated current (IDMT) and high set 100-1000 %.

They relay shall also have following protection & supervision features :

- Negative phase sequence over current protection (46)
- Broken conductor (I2/I1)
- CB Trip counter
- CB monitoring

Trip circuit supervision shall be provided to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions.

Relay shall have Minimum 22 Binary inputs to take care of status of all devices, trip circuit supervision inputs and Auxiliary fault alarms. Relay shall have minimum 10 Binary outputs.

Numerical Incomer and Bus coupler Protection Relay :-

Numerical Relays for Incomer and Bus sectionaliser shall have provision of both current (4 CT) & Voltage (4 VT) inputs for Protection & Measurement purposes.

The Relay shall have instantaneous as well as time delayed directional over current (67) and earth fault (67 N) Protection elements.

The over current element should have the minimum setting adjustable between 20 - 200 % of CT secondary rated current.

The earth fault element of relay shall be suitable for detection of earth fault currents in the range of 5 % to 80 % of the CT rated current.

They relay shall also have following protection & supervision features :

- Over & Under voltage protection 27/59
- Over & under frequency protection 81 U/81 O
- Negative phase sequence over current protection (46)
- Broken conductor (I2/I1)
- Voltage vector Shift (78 VS)
- Low impedance REF protection (87 NL)
- Check synch (25)
- VT fuse fail detection
- CB Trip counter
- CB monitoring

Trip circuit supervision shall be provided to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions.

The relay shall have selectable directional and Non directional feature for overcurrent function.

Relay shall have Minimum 24 Binary inputs to take care of status of all devices, trip circuit supervision inputs and fault alarms. Relay shall have minimum 12 Binary outputs.

Power Cable Termination :-

Cable termination compartment shall receive the Al / Cu conductor, XLPE insulated, shielded, armored, PVC jacketed, single core/three core, unearthed/earthed grade HT power cable(s).

Adequate clearance shall be kept between the cable lug bottom ends and gland plates for stress cone formation for XLPE cables. Inter-phase clearance in the cable termination compartment shall be adequate to meet electrical and mechanical requirement besides facilitating easy connections and disconnection of cables.

Cable termination compartment shall have provision for termination of power cables of sizes indicated in the bidding documents with removable undrilled gland plates as applicable for standard design of GIS manufacturer. Cable entry shall generally be from the bottom.

Cable termination compartment shall be accessible from front end. Cable termination required will be conventional heat shrinkable type. Access to cable termination compartment shall be possible only in case of feeder is earthed.

Type Tests :-

The switchgear should have been subjected to all type tests at an internationally recognized testing lab, like PEHLA, KEMA, ERDA or equivalent. The vendor shall also submit type test certificates covering the proposed switchgear components.
The GIS offered should be fully type tested, in the type test reports the GIS manufacturing location should be same as the location from where complete GIS is offered and shall be supplied by the manufacturer for this project. Any local manufacturing or assembling of the SF-6 vessel or complete GIS panel in India and same not type tested from recognized labs shall not be acceptable.
Manufacturer shall offer the circuit breaker along with their own make vacuum interrupter manufactured in India and which was originally type tested in panel.
Type tests certificates/reports shall be considered acceptable if they are in compliance with the latest applicable relevant Standards and the following:
If the presented type test reports are not in accordance with the above requirements, Owner reserves the right to ask for the type tests to be repeated in the international lab/independent test lab subject to the approval of Company/Purchaser and at no additional cost. The recognized laboratory shall issue the relevant type test certificates upon successful test.
The manufacturer shall submit the reports for the following type tests on Switchgear Panel with Circuit Breaker installed (as applicable) :

a. Short circuit duty test
b. Short time and peak withstand current test
c. Power frequency withstand test
d. Lightning impulse withstand test
e. Temperature rise test
f. Internal Arc Test AFLR 26.3 KA, for 1 second
    a. Cable compartment
    b. Gas vessel
    c. Bus Bar Compartment
g. Measurement of resistance of main circuit
h. Short circuit withstand test of earthing device
i. Verification of protection (IP coding) :
    a. IP : 67 Test for SF-6 compartment
    b. IP : 4X Test for enclosure
j. Seismic Test
k. Pressure withstand test for gas filled compartment.
l. Out of phase breaking capacity test

Routine Tests :-

All acceptance and routine tests as per the specification and relevant standards IEC : 62271-200 & IEC : 62271-100 shall be carried out. Charges for these shall be deemed to be included in the equipment price.
The manufacturer shall furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
Routine test certificates shall be submitted for Company/Purchaser's review and approval before shipment of the switchgear components.

The routine tests for the switchgear shall also include the functional tests for the associated protection panels.

The following tests shall be performed as routine tests in addition to the standard tests:

Partial discharge measurements (during manufacturing stage and report shall be submitted)

Functional Tests for all components and for all panels, including Protection and interlocking functionality, inter-tripping, mechanical and electrical operations, etc.

- Dielectric Test on the Main Circuit
- Tests on Auxiliary and Control Circuits
- Measurement of the Resistance of the Main Circuit

Switchgear Ratings :-

Sl. No.	Description	Units	Technical Data
A	**System Parameters**		
1	Nominal System voltage	KV	11
2	Highest System voltage	KV	12
3	Phases		3
4	Frequency	Hz.	50
5	System Neutral Earthing		As per vector group of Transformer
6	Short time withstand current rating for 3 Sec.	KA	26.3
7	Rated peak withstand current	KA Peak	65.75
8	Rated Short Circuit PF withstand Voltage	kV RMS	28
9	Rated Lightning impulse withstand Voltage	kV peak	75
10	IAC AFLR Rating (CB compartment, Bus Bar compartment & Cable Compartment) for 1 Sec	kA	26.3
11	Design Ambient Temperature	°C	40°C
12	Maximum Relative Humidity	%	0.95
B	**General DATA for 12 KV Switchgear**		
1	Type of Breaker		Vacuum Circuit Breaker
2	Type of Insulation		
a)	For Vacuum Circuit Breaker cum dis-connector compartment		SF-6
b)	For Bus-bar		Touch proof screened silicone insulated
3	Degree of Protection:		
a)	Gas encapsulated chamber		IP-67
b)	Low voltage compartments		IP-4X
4	Gas Leakage rate per annum	%	0.10%

5	Type of Pressure Relief		Rupture disc
6	Gas filling Arrangement via NRV		Yes
7	Gas Monitoring Arrangement for Circuit Breaker cum dis-connector Compartment		via Manometer
8	Mechanical indication for CB, Dis-connector and Earthing Switch position		Yes
9	Cable entry		Bottom with front access
10	No gas handling at site during installation/ extension of GIS panel		Yes
C	**Panel Enclosure**		
1	Type of Arrangement		Free Standing
2	Powder Coating thickness		100 microns (+/-25 micron)
3	Indoor/Outdoor		Indoor
4	Material of Gas enclosure		Stainless Steel SS-304 grade
5	Enclosure Ingress Protection Class		IP-4X
D	**Bus Bar Information**		
1	Material		Copper
2	Material Purity		0.999
3	Bus-bar Insulation		Touch proof screened silicone insulated
4	Main Bus Bar Rating	A	1250
5	Rated Continuous Current @ Design Ambient temp. 40°C	A	1250
E	**Power Cable Compartment**		
1	Power Cable entry		Bottom with front access
2	Cable bushings		Outer cone type
F	**Circuit Breaker**		
1	Type of Breaker		Vacuum Circuit Breaker
2	Rated Nominal Voltage	KV	11
3	Maximum Voltage	KV	12
4	Rated Short-Circuit withstand current	KA	26.3
5	Short circuit-Current Withstand Time	Sec.	3 Sec.
6	CB rated Current		
a)	Incomer	A	1250
b)	Outgoing feeder Breaker	A	1250
c)	Bus Sectionaliser & Bus-coupler Breaker	A	1250

7	Power Frequency Withstand Voltage	KV rms	28
8	Lightning Impulse Withstand Voltage	KV peak	75
9	First pole to clear factor		1.5
10	Closing Time	ms	<60 ms
11	Opening Time	ms	<60 ms
12	Arcing Time	ms	<15 ms
13	Spring Charged after CO		Yes
14	Rated Operating duty cycle		O – 0.3 Sec. – CO – 3 min – CO
15	Trip Coil Operating Voltage	V DC	110
16	Trip Coil Operating Voltage Range	%	70 % - 110 %
17	Closing Coil Operating Voltage	V DC	110
18	Closing Coil Operating Voltage Range	%	85% - 110%
19	Spring Charging Motor Voltage	V AC	230 V
20	Spring Charging Motor Voltage range	%	85% - 110%
21	Rated filling pressure of insulating gas	bar	1.5
22	Minimum functional pressure of insulating gas	bar	1.3
23	Endurance Class Classification		M2/E2/C2
24	Auxiliary contacts		4 NO + 4 NC for Employers future use besides scheme requirement
25	Operating Mechanism		Motor wound spring charged stored energy type
G	**Three Position Disconnector**		
1	Type of Dis-connector		3 Position Switch
2	Manual/Motor Operation		Manual + Motor
3	Dis-connector position indication		Mechanical
4	No. of mechanical operation without any maintenance	Nos.	2000
5	Type of Interlocking		Electrical and Mechanical
6	Auxiliary Contacts		5 NO + 5 NC
7	Dis-connector motor Voltage	V AC	230V AC
H	CONTROL WIRING		
1	Type:		PVC
2	Insulation Grade	V	1100
3	Auxiliary Bus wire Size (minimum)	mm.	Min 2.5 Sq. mm.

4	Control circuit (Ac/DC) wire size (minimum)	mm.	Min 1.5 Sq. mm.
5	CT Circuit wire size (minimum)	mm.	Min 2.5 Sq. mm.
6	PT Circuit wire size (minimum)	mm.	Min 2.5 Sq. mm.
I	**Panel Dimensions**		
1	Incomer (Width x Depth)	mm.	500 X 1100
2	Outgoing (Width x Depth)	mm.	500 X 1100
3	Bus coupler (Width x Depth)	mm.	1000 X 1100
4	Bus PT (Width x Depth)	mm.	500 X 1100
J	**Painting / Finishing**		
1	Color		RAL : 7032
2	Paint thickness		100 microns (+/-25 micron)
K	**Current Transformers**		
1	Rated primary voltage		0.72 kV
2	Type of CT		1 - Phase
3	Max temp rise		As per IEC : 61869-2
4	Class of Insulation		Class - B
5	One minute power frequency withstand voltage between secondary terminal & earth		2kV
6	Accuracy class		Metering : 0.5 Protection : 5P10
L	**Voltage Transformer**		
1	Rated primary Voltage		11kV
2	IEC Standard		IEC : 61869-3
3	Type		1-phase
4	Voltage ratio (KV)		$(11/\sqrt{3})/(0.11/\sqrt{3})$
5	Rated Voltage Factor		1.2 continuous and 1.5 for 30 seconds
6	Nos. of Secondary cores		2
7	Accuracy of Secondary core		Metering Protection 0.5 3P
8	Class of insulation		Class - B
9	Rated output burden (Minimum)		50 VA

Metering Devices :-

Incomer and Outgoing feeder must have Multifunction meter. The Multifunction meter shall have feature to measure KV, I, MW, MVAR, PF, MWhr, MVARhr with accuracy class of 0.5. Further, multifunction meter shall have bi-directional feature to register/record MWhr values. Bus coupler must have digital volt meter.

Site Tests :-

On-site primary and secondary injection tests shall be carried out an all protection relays and metering, together with their associated current transformers, to prove correct phasing, polarity and operating values. On-site functional testing shall be

carried out on the complete set of new panels, including circuit breakers, auxiliary equipment and circuits.

Also following tests shall be carried out after installation at site:

The site tests shall include the following:

- Power frequency withstand test (at 80% of the rated power frequency withstand voltage)
- Insulation resistance
- Functional test of the fully installed and wired equipment delivered.

Gas leakage test on each bay with hand held gas leakage detector on all seals.

Documentation :-

Bidder to submit detailed General Arrangement drawings of GIS switchboards along with the tender documents. The GIS dimensions shall be in line with layout drawings for respective substations attached with the tender. No deviation shall be entertained. On award of contract the General Arrangement & schematic drawings shall be approved by consultant, thereafter, the bidder can go ahead with procurement of GIS Panel. Bidder shall also submit Installation Manuals for GIS Panels, relays or any other equipment installed in panel along with the supply of material at site.

Configuration of 11 KV GIS Typicals :-

Sl. No	Equipment	Incomer Feeder	Outgoing Feeder	Bus Sectionaliser	Bus PT Panel
1	CB, Three position Switch (ON-OFF-EARTH)	1	1	1	-
2	Two position Switch (ON-Earth)	-	-	-	1
3	CB Spring charge mimic indicator	1	1	1	-
4	ON/OFF mimic indicator for CB	1	1	1	-
5	ON/OFF/EARTH mimic indicator for Three position Switch	1	1	2	-
6	CT (1-Phase)	3	3	3	-
7	BUS PT (1-Phase)	-	-	-	3
8	Multi-Function Meter	1	1	-	-
9	Digital Voltmeter	-	-	-	1
10	Control switch for breaker (T-N-C)	1	1	1	-
11	Control Switches for Disconnector	1	1	2	-
12	LED lamps (lot)	1	1	1	-
13	SF6 Gas Manometer	1	1	1	1
14	LRM Capacitive Voltage Detection system (CVD)	1	1	-	-
15	Mechanical Mimic to represent SLD	1	1	1	1
16	Numerical protection relay (IED)	1	1	1	-
17	Cable Termination (as per BOQ)	1	1	-	-

Technical Particulars for 11 KV GIS Numerical Relays

01.	Manufacturer's Name and country of origin	SIEMENS/ABB/GE

02.	Manufacturer's design Ref/Type		--
03.	Applicable Standards		GIS 11 KV Panel Board
04.	Current setting range for		
	(a)Over current relay	IDMTL Instantaneous	0.05,0.06…..50 X In
	(b)Earth-fault relay	IDMTL Instantaneous	0.05,0.06……50 X In (Derived) 0.005….25 X In (Measured)
	(c)Contact Rating		4 A
05.	Indication of Nos. in Master Trip Relay		16 LEDs
06.	Whether High Set is Transient free		----
07.	Whether separate Time setting for IDMTL/ Instantaneous Elements available		----
08.	DC Auxiliary voltage 3 O/C + 1 E/F Relay		110 V DC
09..	Make of high speed Master Trip relay		Function is part of 7SR220 Relay
10.	Whether settings site selectable and HMI provided		YES
11.	Whether Alpha Numeric LED display		YES
12..	Whether Compatible for 110 VDC		YES
13.	Whether Compatible for 1A CT Secondary		5A
14.	Whether Self diagnostic features available		
15.	Whether Communication Port RS485 Compatible for IEC61850		YES
16.	Non-direction 3 O/C +1 E/F Relay		K55
17.	Number of N/O And N/C contacts provided for High speed Master Trip Relay		Above 22 BI & 12 BO
18.	Time Setting of High Speed Master Trip Relay		<20ms
19.	Frequency of High speed Master Relay		50 HZ
20.	Reset time		0.02 sec.
21.	DC Auxiliary Voltage of high Speed Master Trip Relay		110/220 V DC

11KV GIS TECHNICAL SPECIFICATION

01.	Manufacturer's Name and Country of origin	SIEMENS/ABB/GE
02.	Manufacturing Facilities for GIS in INDIA	YES
03.	Manufacturing Location	---
04.	Manufacturer's Design/type Ref	11 KV GIS / 8DJH ST E

05.	Frequency	50 HZ.
06.	Rated Voltage	11 KV
07.	Highest system voltage	12 KV
08.	Rated current	1250 A
09.	Short Circuit current rating with duration	26.1 KA/ 3 Sec
10	Certificate or report of short circuit type test	YES
11.	Rated operating duty cycle	0-0.3 sec-CO-3 min-CO
12.	Short Circuit Breaking Current: (a)Symmetrical (b)Symmetrical at rated voltage (c) Asymmetrical at rated voltage (1)Per Phase (2)Frequency d) D.C. Component	a) 65.7 KA b) 75 KV 1) 11-12.5 KV 2) 50 Hz. 3) 110/220 V DC, 140W
13.	Arcing time (at rated breaking current) in ms.	0-0.3 Sec.
14.	Current density	1.6
15.	Circuit Breaker	
	Power Frequency withstand voltage for 1 min of circuit breaker	28 KV
16.	Current transformer ratio	400-200/5 A
17.	Potential transformer ratio	11KV / √3 /110V/√3
18.	Bus Conductor rating	800 – 1250 A
19.	Control Circuit Voltage DC	110/220 V
20.	Power required for Closing Coil at 110 V	YES
21.	Power required for Tripping Coil at 110 V	YES
22.	Whether Trip free or not	YES
23.	Whether all the interlocks provided	YES
24.	Voltmeter/Energy meter/TNC/Relay	YES (As Per Specification)
25.	Total weight of one complete Breaker	150 Kg.
26.	Space between bus-bar in mm.	Phase to phase -78 mm.

03. Technical Specification of Item No. 3

This includes Supply, Installation, Testing and Commissioning of a Newly Manufactured Outdoor type 12.5 MVA Power Transformer, 66 KV/11.55 KV, 50 Cycle 3 Phase Delta/Star, KNAN, Double Copper wound Power Transformer conforming to IS : 2026 and IEC : 62770 standard with Natural Ester Oil filled and shall have following specifications : This specification covers design, engineering, manufacture; shop testing, inspection, painting, packing, and supply of Power Transformers complete with all accessories for efficient and trouble-free operation.

The design, manufacture and performance of equipment shall comply with all currently applicable statues, regulations and safety codes to suit with the local situation where the equipment will be installed. Nothing in this specification shall be construed to relieve the Bidder of this responsibility. The Quality of Raw material, manufacturing process & design parameters should meet the requirement to ensure quality of transformers. The transformer shall be with Heavy Duty Automatic and Manual On Load Tap Changer with RTCC and AVR, Heavy Duty NGR with SS-304 Box, NIPS, including all standard fittings, accessories and instruments along with providing of suitable Sump complete as per specifications and as required with latest technology as per approved make. Transformer shall be provided with Open Air Bushing with Arching Horn on 66 KV suitable for Panther conductor and 11 KV side cable box with aluminum gland plate for 2 X 1C X 300 Sq. mm. aluminum armoured XLPE (UE) cable. The transformer shall have 20% voltage variation 16 steps with 4 taps. The Transformer shall be provided with all types of latest numeric protection Relays.

The transformer shall have magnetic oil level gauge with trip & alarm contacts, air cell conservator, surge relay with trip & alarm contacts, buchholz double float relay, winding temp. Meter with trip & alarm contacts, oil temp. Meter with trip & alarm contacts for 12.5 MVA rating during ONAF condition. This shall have neutral CT on LV star side with 2 neutral CT's ratio 300/1 PS class /5P20. The transformer will have Al. gland plate on 11 KV side for terminating single core 11 KV (UE) Cables. This installation shall include all supply, installation and termination of control cables between transformer OLTC & RTCC along with Installation of 11 KV NGR for 12.5 MVA Transformer suitable for Outdoor installation as directed.

The equipment shall conform to the latest applicable standards. In case of conflict between applicable standards and this specification, this specification shall govern.

- IS : 2026, for Tests & tolerance on Guaranteed Particulars
- IS : 3639 for Fittings and Accessories
- IS : 2099 for Bushings > 1000 V
- IS : 7421 for Bushings < 1000 V
- IS : 1271 for Electrical Insulation classified by Thermal stability

General Construction : -

All material used shall be of best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions, overloads, over excitation, short-circuits as per specified standards, without distortion or deterioration or the setting up of undue stresses in any part, and also without affecting the

strength and suitability of the various parts for the work which they have to perform.

Tank :-

The exterior of tank and other steel surfaces exposed to the weather shall be thoroughly cleaned and have a priming coat of zinc chromate applied. The second coat shall be of an oil and weather-resistant nature, preferably of distinct color from the prime and finish coats. The final coat shall be of a flossy, oil and weather resisting non-fading paint of specified shade. The interior of the tank shall be cleaned by shot blasting and painting with two coats of heat resistant and oil insoluble paint.

a) Steel bolts and nuts exposed to the atmosphere shall be galvanized.
b) Unless otherwise stated, the tank together with radiators, conservator, bushings and other fittings shall be designed to withstand without permanent distortion the following conditions:
c) Full vacuum of 760 mm. of Hg., for filling with oil by vacuum.
d) Internal gas pressure of 0.35 Kg./Cm.^{2} (5 lbs./Sq. inches) with oil at operating level.
e) The tank cover shall be suitably sloped so that it does not retain rain water.
f) The material used for gaskets shall be cork neoprene or approved equivalent.

Core : -

Transformer shall be double wound, core type with low loss, non-ageing, high permeability PRIMEGRADE, CRGO with M4 Grade or Better, perfectly insulated and clamped to minimize noise and vibrations. Followings should be Mandatory for any Manufacturer: -

a) Transformer shall be of Boltless core design
b) Core shall be purchased Directly from Manufacturer or from their accredited Marketing organization of Repute & not through any agent. Bidder must submit manufacturer's name during bidding having sufficient credential & Core must be purchased from the approved manufacturer.
c) Stage inspection of the core shall be done at manufacturer's premises & inspection call shall be given with following Documents
   i) Invoice of the supplier
   ii) Mill's test certificate
   iii) Packing list
   iv) Bill of landing & Bill of Entry certificate by customs
d) Transformer manufacturer should have in-house core cutting facilities for proper control & monitoring of quality & to avoid mixing of Prime core with Second grade /defective core materials. Transformer Manufacturer should have in-house slitting Machine so that the core is cut to width & stacked with minimum air gap thus ensuring Burr level less than 10Microns.
e) Core shall be procured from one of these reputed Manufacturers – Posco/Nippon/ Novex/Ak Steels.
f) The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand a voltage of 2000 V for one minute.

Windings : -

a) Winding shall be made with 99.9% pure electrolytic grade copper, insulated with thermally upgraded paper (Insulation Class-A/Conductor Turn Insulation Class-E). The HV & LV winding should be able withstand thermal and mechanical stress in the event of short circuit.

b) Winding shall be carried in dust free area

c) The completed core and coil assembly shall be dried in vacuum and shall be immediately impregnated with oil after the drying process to ensure elimination of air and moisture within the insulation.

Temperature Rise

With the given climatic conditions, the transformer shall be capable of operating continuously on any tap at their normal rating without exceeding following temperature rises:

a) 45° C above ambient temperature for oil.

b) 55° C above ambient temperature for winding.

The temperature of a hot spot in winding shall not exceed 110°C when calculated over max. Annual weighted average temperature of 50°C.

Oil :-

Transformer oil shall be as per IEC : 62770 - Natural Ester vegetable oil. Oil should be Environment friendly, Green & Biodegradable. It should also exhibit safety against fire hazards.

Conservator Tank :-

Oil preservation shall be done by means of conservator tank arranged above at the highest point of the oil circulating system. Connections into the main tank shall be at the highest point to prevent trapping of air or gas under the main tank cover.

Temperature Indicator :

One set of winding temperature indicators with necessary current transformer, heating coil and a detector element and one set of oil temperature indicator with maximum reading pointer shall be mounted locally to be readable at a standing height from ground level. Each of the above indicators shall be provided with necessary contacts for alarm and trip.

Buchholz Relay :-

The Buchholz relay shall be provided with two floats and two pairs of electrically separate contacts for alarm and trip. The relay shall have facility for testing by injection of air by hand pump and with cock for draining and venting of air. The location of the relay shall be such that all rising gas will readily reach it.

Bushings :-

i. All bushings shall be homogenous, solid porcelain oil commissioning type, uniformly glazed and free from blisters, burns and other defects and shall be furnished complete with suitable terminal connectors of adequate

capacity. The bushings shall be located so as to provide necessary electrical clearances between phases and also between phase and ground as specified in relevant standards.

ii. Bushings rated for 400 A and above shall have non-ferrous flanges and hardware.

iii. All bushings shall have puncture strength greater than the dry flashover value.

iv. Neutral CTs shall be furnished with its secondary leads wired upto the terminal blocks. The terminals for CT secondary leads shall have provision for shorting. The arrangement shall be such that the CT can be removed from the transformer without removing the tank cover.

Terminal Arrangement :-

i Low voltage terminals of Power transformer shall be brought out to bushing inside Cable Box

ii. High voltage terminals of Power transformer shall be bare busing.

iii. The cable box shall be suitable for cable termination kits and shall be self-supporting, weather proof, air filled type, complete with all hardware such as gland plate, brass glands, tinned copper lugs, armour clamps etc.

Marshalling Box :-

i. A sheet steel weather proof marshaling box of IP-55 construction, shall be mounted on the tank of transformer and shall accommodate all auxiliary devices except those which must be located directly on the transformer. All terminal blocks for external cable connections shall be located in this box.

The terminal block shall be Elmex or Phoenix 10 mm2.

ii. The marshalling box shall have the following as a minimum

a. Load disconnect switch for incoming power supply for auxiliaries.

b. All outgoing connections from transformer viz. buchholz relay, temperature indicators, fault contacts for annunciation system etc.

c. Wiring and termination points individually of the following trip contacts for remote alarm and trip.

- Winding temperature high / very high
- Oil temperature high / very high
- Buchholz relay Alarm / Trip
- Oil level low

iii. Cubicle illumination lamp with door switch and space heater with thermostat and ON/OFF switch shall be provided.

iv. Marshalling box shall be designed to facilitate external cable entry from bottom. Removable gland plates shall be furnished with double compression type brass cable glands.

v. Sufficient space shall be provided to avoid sharp bending and for easy connection of cables. A minimum space of 200 mm from the gland plate to the nearest terminal block shall be provided.

vi. Wiring shall be done with HR PVC 650 V grade wires. The wire size for CT circuits shall be 4 mm.² copper and for other circuits shall be a minimum of 2.5 mm.² copper. Not more than two (2) wires shall be connected to a terminal. 10% spare terminals shall be provided.

vii. All devices and terminal blocks within the marshalling box shall be identified by symbols corresponding to those used in applicable schematic or wiring diagrams.

Grounding :-

i. Two Grounding Pads, located on the opposite sides of the tank, shall be provided for connection of Switchyard Ground Mat for each Transformer. Grounding Pads shall have clean buffed surface with tapped holes. M-10 G.I. bolts, nuts and spring washer shall be provided.

ii. 2 Nos. of Ground Terminals each shall also be provided on Marshalling Box, Cable Box & OLTC Panel to ensure effective earthing.

iii. The Neutrals of the windings shall be brought out through neutral bushings at suitable location. The neutrals shall be suitable for connecting 75 X 10 mm. Copper flat.

iv. For conductivity of earth connection, all gasket joints shall be provided with minimum 02 Nos. of copper strips of adequate size.

ON Load Tap Changing Mechanism :-

a) OLTC In Tank Type, with heavy duty Easun MR India make, Range: +5% to -15% @ 1.25%, No. of Steps: 16, with On HV for HV variation (CFVV)

b) RTCC & AVR to be supplied along with the OLTC.

c) The RTCC panel shall be supplied with master follower logic control system and an out of state relay for synchronization of tapping position.

d) Master/Follower/Independent/Off mode Master/Follower/Independent/Off mode is required in Digital RTCC relay for parallel/group operation of transformers. Master-follower scheme implies that controlled decision shall be taken by the Master and control actions (Raise/Lower tap position) shall be executed simultaneously by Master & Follower units. Same logic needs to be implemented in digital RTCC relays.

Master Position: If the digital RTCC relay is in master position, it shall be possible to control the OLTC units of other parallel operating transformers in the follower mode by operation from the master unit. Follower Position: If the digital RTCC relay is in Follower position, control of OLTC shall be possible only from panel where master mode is selected. Independent Position: In independent position of selector switch, control of OLTC shall be possible only from the panel where independent mode is selected. Suitable interlock arrangement shall be provided to avoid unwanted/inconsistent operation of OLTC of the transformer.

a) Valves :-

i. Valves shall be of forged carbon steel above 50 mm and of gun metal for sizes upto 50mm. They shall be of full way type with screwed ends. They shall be opened byturning counter clock-wise when facing the hand wheel. There shall be no oil leakage when the valves are in closed position.
ii. Every valve shall be provided with open/close position indicators. The valves shall be suitable for pad locking in open/close positions. All screwed valves shall be furnished with pipe plugs for protection.
iii. All valves shall be provided with flanges having machined faces drilled to suit the applicable requirements.
iv. Oil tight blank flanges shall be provided for the following.

- Valves opening to atmosphere.

- For each connection for use when any radiator is detached.

v. Any special radiator valves tools required shall be supplied by the bidder.

The Transformer shall provide with Nitrogen Fire Protection system to envisage complete safety from Fire Hazards.

Transformer Losses :-

The transformers are to be designed with maximum permissible losses as indicated below:

No Load Losses : 8.5 KW at rated voltage & frequency.

Load Losses : 60 KW at rated current & 75°C

Impedance: 9% at 75°C, rated current & Freq. (± 10% tol.)

However, for all the above losses, permissible tolerances will be accepted as per relevant IS Standards.

Tests :

i) Routine Tests – As derived in Special Condition of Contract.

ii) Type Tests – The following type tests shall be performed at manufacturer's work shop.

a) Full wave Lightning Impulse withstand test on one limb of HV & LV.
b) Temperature rise test.
c) Zero phase sequence impedance measurement.
d) Measurement of acoustic noise level
e) Measurement of harmonics in no load current
f) Tank Pressure & Vacuum test.
g) Capacitance & Tan Delta Measurement.
h) Dissolve Gas Analysis test before & after HRT

Note :- Dynamic/Thermal Short Circuit Test : Type Test report of nearest rating shall be submitted.

a) All the measurement of losses shall be carried out by digital meters of class 0.5 or better accuracy and should be certified by the manufacturer. If the losses measured are found to be out of tolerance band as stated in Standard and guaranteed losses declared by manufacturer, the same shall be attributed to the manufacturer as per capitalization formula till the end of warranty period.

b). Oil Leakage test for acceptance shall be conducted at pressure of 0.35 Kg./Sq. Cm. for one hour.
c). Checking of weights, Dimensions, fitting and accessories, tank sheet thickness, oil quantity, material, finish and workmanship, Physical verification of core coil assembly and measurement of flux density on one unit of each rating of the offered lot regarding the GTP and contract drawings.

d). Temperature rise test on transformer shall carried out at manufacturer's work shop.

Rejection :-
DPA may reject the Transformer, if during tests or service, any of the following conditions arises :
No load loss exceeds the guaranteed value, greater than the tolerance limit mentioned in IS : 2026

i) Load loss exceeds the guaranteed value greater than tolerance limit mentioned in IS : 2026

ii) Impedance value differs the guaranteed value by + 10% or more

iii) Winding Temperature rise exceeds the specified value by 5°C

iv) Transformer fails on Impulse Test

v) Transformer fails on power frequency voltage withstand test

vi) Transformer is proved to have been manufactured not in accordance with the agreed specification.

vii) The DPA reserves the right to retain the rejected transformer and take it into service until the Bidder replaces, at no extra cost to DPA, the defective transformer by a new acceptable transformer.

The GTP to be filled by the bidder :

1	Name of Manufacturer	
2	MVA Rating	12.5
3	No. of Phase & Rated Frequency	
4	Rated Voltage	
	HV	
	LV	
5	Connection	
	HV	
	LV	
6	Winding	
	HV	
	LV	
7	Insulation Level (Impulse Withstand) KV Peak	
	HV	

	LV	
8	Insulation Level (Power Frequency Withstand) (KV rms)	
	HV	
	LV	
9	Tapping	
a	Range	
b	No. of Steps	
c	On HV	
d	Tap Changer Type	
10	Temperature rise of winding over design ambient temperature of 50˚C	
11	Hot spot temperature rise over maximum yearly weighted temperature of 32˚C	
12	Short Circuit Thermal withstand time Seconds	
13	% Impedance at 75˚C, rated current & Frequency (subject to IS Tolerance.)	
14	No load losses at rated voltage & frequency KW	
15	Load loss at rated current & 75˚C	
16	Efficiency %	
a	100 %	
b	75 %	
c	50 %	
17	% efficiency at which maximum load occurs %	
18	Maximum Efficiency %	
19	Regulation at Full Load 0.8 p.f. %	
20	Regulation at Full Load Unity p.f. %	
21	Bushings	
a	Reference standard	
b	Type of Bushing	
c	Voltage Rating KV	
d	Current rating Amps	
22	Weight in Kgs. (Approximate)	
a	Core & Windings	
b	Tank & Fitting	
c	Oil	
d	Total Weight	
23	Approximate overall dimension in mm	
a	Overall length	
b	Overall breadth	
c	Overall height	
24	Approximate weight of Heaviest package (Kg.)	
25	Approximate Transport Dimension L X B X H (mm.)	
26	Fitting & Accessories as per specification	
27	Reference Standard	
28	Termination	

	HV	
	LV	

Installation of RTCC Panel 12.5 MVA Transformer according to rating with auto/ manual Switch Operation with Panel with Meter, alarm with Indicator in Latest Standard.

The Transformer shall be installed at least 1.5 Meters above the Ground Level with proper Foundation and securing the it properly considering the place is under high Seismic Zone (Zone - 5) and Cyclone Prone Area.

3.1. Performance

i) Transformer shall be capable of withstanding for two seconds without damage to any external short circuit, with the short circuit MVA available at the terminals.

ii) The maximum flux density in any part of the core and yoke at rated Voltage and frequency shall be such that the flux density with +12.5% combined voltage and frequency variation from rated voltage and frequency shall not exceed 1.9Tesla.

iii) Transformer shall under exceptional circumstances due to sudden disconnection of the load, be capable of operating at the voltage approximately 25% above normal rated voltage for a period of not exceeding one minute and 40% above normal for a period of 5 seconds.

iv) The transformer may be operated continuously without danger on any particular tapping at the rated MVA ± 1.25% of the voltage corresponding to the tapping.

v) The thermal ability to withstand short circuit shall be demonstrated by calculation.

Transformer shall be capable of withstanding thermal and mechanical stress caused by any symmetrical and asymmetrical faults on any winding.

3.2. Drawings/Documents Incorporating the following particulars shall Be submitted with the Bid

a) General outline drawing showing shipping dimensions and overall dimensions, net weights and shipping weights, quality of insulating oil, spacing of wheels in either direction of motion, location of coolers, marshalling box and tap changers etc.

b) Assembly drawings of core, windings etc. and weights of main components / parts.

c) Height of center line on HV and LV connectors of transformers from the rail top level.

d) Dimensions of the largest part to be transported.

e) GA drawings / details of various types of bushing

f) Tap changing and Name Plate diagram

g) Illustrative & descriptive literature of the Transformer.

i) Maintenance and Operating Instructions.

3.3. Miscellaneous

i) Padlocks along with duplicate keys as asked for various valves, marshalling box etc. shall be supplied by the contractor, wherever locking arrangement is provided.

ii) Foundation bolts for wheel locking devices of Transformer shall be supplied by the Contractor.

3.4. Name Plate

Transformer rating plate shall contain the information as given in clause 15 of IS-2026 (Part-I). The details on rating plate shall be finalized during the detailed engineering. Further, each transformer shall have inscription of Employer's name. The name plate shall also include (i) The short circuit rating, (ii) Measured no load current and no load losses at rated voltage and rated frequency, (iii) measured load losses at 75°C (normal tap only), (iv) DC resistance of each winding at 75°C.

The bidder shall offer the core, windings and tank of each transformer for inspection by the Employers representative(s). During stage Inspection, all the measurements like diameter, window height, leg Centre, stack width, stack thickness, thickness of laminations etc. for core assembly, conductor size, Insulation thickness, I.D., O.D, winding height, major and minor insulations for both H.V and L.V windings, length, breadth, height and thickness of plates of Transformer tank, the quality of fittings and accessories will be taken / determined. The supplier can offer for final inspection of the transformers subject to clearance of the stage Inspection report by the Employer.

3.5. Transformer Condition :-

- In case of any defect/ defective workmanship observed at any stage by the purchaser's Inspecting officer, the same shall be pointed out to the Bidder in writing for taking remedial measures. Further processing shall only be done after clearance from the inspecting officer / purchaser.

- All tests and inspection shall be carried out at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and bidder at the time of purchase/tender.

-The manufacturer shall offer the inspector representing the Purchaser all reasonable facilities, without charges, to satisfy him that the material is being supplied in accordance with this specification. This will include Stage Inspection during manufacturing stage as well as during Acceptance Tests.

-The bidder shall provide all services to establish and maintain quality of workmanship in his works and to ensure the mechanical/electrical performance of components, compliance with drawings, identification and

acceptability of all materials, parts and equipment as per latest quality standards of ISO - 9000

-Fire protection scheme to the power transformer should have authentic certification regarding performance similar to one issued by LAPEM (MEXICO)/TAC/RDSO /any other approved standard laboratory.

-The power transformer shall be of following make.

SIEMENS, SCHNEIDER, GE.

4. Technical Specification of Item No. 3.2

This includes Disconnection, Removal, Shifting from existing position to new Substation, Installation, Testing and Commissioning of 02 Nos. (1 No. 10 MVA & 01 No. 12.5 MVA) of 66/11 KV Power Transformers with NGR, NIPS, RTCC and other accessories including Oil Sump, Oil Filtration, Refilling including tope up complete in all respect earthing, protection etc. as per requirement & as directed.

The Transformer shall be installed at least 1.5 Meters above the Ground Level with proper Foundation for securing the Transformer considering the place is under highly Seismic Zone (Zone-5) and Cyclone Prone Area.

5. Technical Specification of Item No. 3.3

This includes Supply, Installation, Testing and Commissioning of a Newly Manufactured Outdoor cubicle type neutral isolator cum NGR as per IEEE norms and shall be of 11/√3 KV, 656 A & rated for 9.68 Ohms, 1656 A for 30 Sec. with suitable space for 11O KV (UE) cable terminations. The NGR panel shall be made of SS-304.

Supply, Installation, Testing and Commissioning of NGR of 11/√3kV, 656A, 9.68 ohm Suitable for Outdoor installation as per the specifications.

Technical Specification of Neutral Ground Resistor (NGR) suitable for supplied12.5 MVA Power Transformer as per following technical specifications as per GETCO norms.

Perforated bottom sheet with wire mesh shall be made from S. S. Neutral Grounding Resistor shall be formed of non-aging (grade ASTMA240/AISI-304 or better) corrosion resistant punched stainless steel elements. Resistance material shall have high electrical resistivity and low temperature co-efficient of resistance.

The resistor unit shall consist of suitable no. of elements. All the elements shall be mounted inside the cubicle so as to ensure ease of inspection and replacement of individual element.

All the resistor elements consisting the NGR shall be assembled and supported inside the cubicle in such a way that no distortion or breakage will occur during the passage of specified fault current to earth.

Wet process type brown glass porcelain insulators shall be used for supporting resistor elements and used to insulate the resistor element from enclosure. Porcelain insulators shall have high creep age value suitable for heavily polluted atmosphere charged with dust particles.

Enclosure:

Each neutral grounding resistor shall be housed in weather-proof enclosure having Degree of Protection IP - 55.

Enclosure shall be Stainless Steel having a minimum thickness of 2 mm. Suitable ventilating louvers shall be provided on sides to ensure proper ventilation. The louvers shall be provided with fine wire mesh to makeover min proof.
The terminals for neutral and earthing connections shall be housed in separate vermin-proof, weather-proof terminal box with min. IP-55 degree of ingress protection.
A separate canopy shall be provided above enclosure roof with a suitable air gap between them. It shall also cover the terminal compartment. Suitable lifting arrangement shall be provided to lift the canopy.
The bottom of the enclosure shall be provided with a drain plug to remove water that may get collected in the enclosure.
The enclosure shall be supported on insulators placed on mounting structure in such a fashion that it is not easily accessible for man standing on ground level. Any part of insulator shall be at a height 2500 mm. aboveground/plinth.
Each cubicle shall be complete with front access door with handles, lock and also a removable bolted cover. All doors and removable covers shall be properly gasketed with good quality neoprene/synthetic rubber gaskets.
All the external hardware shall be S.S.
All cubicle door hinges shall be concealed type. Each cubicle shall be complete with suitably mounted cable box fitted with removable gland plate of Aluminium of suitable thickness for fixing cable gland.

6. Technical Specification of Item No. 3.4

This includes Supply, Installation, Testing and Commissioning of a Newly Manufactured Nitrogen Injection Fire Protection System suitable for 12.5 MVA Power Transformer as per latest standards as directed.

7. Technical Specification of Item No. 5

Design, Manufacture/Assemble, Supply, Installation, Testing and Commissioning of Control Relay Panel with associated equipment/accessories and shall comply with the latest editions (including amendments thereto) of all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable standards. Nothing in this specification shall be construed to relieve the Contractor from his responsibility.
The contractor shall also note that the list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC.
IS - 3231 : Electrical Relays for Power System Protection.
IS - 3842 : Application of Relays for Protective Relays.
IEC - 60255 : Electrical Relays.
IEC - 61850 : Automation Design & Communication Protocol.
IEC 60529: Degree of protection provided by enclosures.
IS 11353: Guide for uniform system of marking and identification of conductors and apparatus terminals.
The Control & Relay Panel (CRP) shall be considered as a Protection and Back up control panel to SCADA system. In case of SCADA system fails or is not available, then these panels shall be used for all the required functionalities. The various

functionalities such as control etc. shall be achieved by using Numerical Relays in addition to interlocking scheme, annunciation, indications, Mimics, Local / Remote selection for protection and data communication functions. Separate auxiliary relays, Annunciator, hardwired control and interlocking scheme, mimics, indicating meters, Control / Selector switches, Push buttons, indicating lamps etc. are not envisaged. Minimum hardware shall be used to achieve the required functionalities. Only separate electronic Load Manager as indicating meter, is envisaged. The panel shall mainly comprise of Load Manager and advance version of Numerical Relays for protection and control of bay equipment's. Communication protocol for Numerical Relays shall be IEC : 61850 and all inter bay interlocks shall be through GOOSE signals. All C & R, IEC : 61850 IED's should Time Synchronise through TPL GPS over WAN Network, via SNTP Protocol. All the Numerical Relays shall be designed for open architecture philosophy. The Relay protocol shall be IEC : 61850 only. Relays with proprietary or other protocol shall not be considered. Use of protocol converter is not acceptable. Numerical Relays shall be suitable for flush mounting. The relay enclosure shall be of transparent and dust proof having minimum degree of protection of IP : 54. Numerical relays shall have front keypad/keys to allow Relay settings from Relay. All the Relays shall also have the hand-reset button on Relay front. Relay to be self-reset or hand reset shall be software selectable. Relays shall also have facility to reset from remote command from SCADA IEC : 61850 protocols. Numerical relays shall have self-diagnostic feature with indication of Relay failure on Relay front. Relay failure signal shall be communicated through communication link to SCADA system. Numerical relay shall have minimum four sets of setting group (banks) for multipurpose usage. All the setting groups shall be independently programmable. Switching over from one group to another/other shall be by 1) the Relay keypad & 2) the SCADA system. Numerical relays shall have other functions like metering and control apart from the protection functions. Control function shall be through 1) the Relay keypad, 2) the SCADA system on IEC protocol as well as through 3) the Relay setting tool. Numerical Relays shall preferably have inbuilt LCD type Mimic and user define Mimic generation facility. Numerical Relays shall have an interlocking and control function for circuit breaker, isolator, earth switch etc. according to the requirement. The Relays shall have the interlock override features as well as the force/bypass facility for user-selected signals. The same shall be possible through 1) the Relay keypad 2) the SCADA system on IEC protocol 3) the Relay setting tool. The Relays shall have settable, self-powered internal clock with HH:MM:SS facility and provision for time synchronization. The Setting of Relay Clock Time shall be possible with the GPS, the Laptop and the SCADA System. All display values shall be actual primary values for the parameters displayed and not in the percentage values. The Relays shall be provided with suitable security like password protection against unauthorized access for change in Relay settings. However, it shall be possible to view metering, protection setting, status and event data as 'Read Only' without password protection. All Relays shall have LCD display for display of settings, status, faults, and events. The Relays shall have LED-indicating lamps for Fault trip, Relay healthy, Relay failure, Aux. Supply ON. Each Relay shall have status; data and events shall be stored in non-volatile memory or battery backup memory. Unless otherwise specified, it should be possible to save minimum 50 Disturbance records and 2000 Sequence of Events in a First-in-First-out - FIFO configuration. All disturbances

records and events shall be stored & displayed with time resolution & accuracy of 1 ms. The Trip circuit supervision relay shall be part of Numerical Relay.

Protection Requirement :-

66 KV Power Transformer Numerical Differential Protection :

Numerical Differential Relay :-

It shall consist of fully numerical/digital type, variable percentage, biased type differential relay. It shall be triple pole type, with faulty phase identification/indication. The Relay shall have 8 number of site selectable 1A/5A current inputs. The Relay shall remain stable under initial magnetizing inrush current, sympathetic inrush when adjacent transformers are charged, through fault stability and over fluxing conditions. The relay shall have second harmonic restraint feature. The Relay shall be very fast in operation with an operating time not greater than 30 milli-seconds at 5 times setting. The Relays shall have 9 programmable function keys. The bias setting of the Relay shall be adjustable with range of 5 – 100 %. The relay shall offer a USB serial port as standard on the front of all units. All of the Relay's functions can be set on a PC using suitable software via the USB port. The connection is made with a USB cable and operates with a 'plug and play' connection; so, no pre-setting of the Relay is required. The Relay shall support user selectable communications protocols DNP-3.0, MODBUS-RTU, IEC : 60870-5-103 with RS-485 connection possibility or shall support IEC : 61850 edition 2 protocol with either electrical or optical redundant ports. Relay with IEC : 61850 ports shall support site selectable Parallel redundancy protocol (PRP)/ High-availability Seamless Redundancy (HSR) shall be provided for rear communication. The Relay shall have a disturbance feature to record graphic form of instantaneous values of current in all two/three winding transformer analog channels, during faults and disturbances for pre-fault and post -fault period.

Fault records & Disturbance analysis :

Event Logs > 1000

Trip Logs / Fault records >100

Oscillograph Fault recordings > 50.

The maximum fault recording with total capacity minimum 100 sec. Site selectable sampling rate up to 1/2 Kilo Hz. The disturbance recorder shall have the facility to record the following external digital channel signals apart from the digital signals pertaining to differential relay.

1) REF Protection operated. 2) HV & LV breaker status. 3) Buchholz /OLTC surge relay alarm / trip. 4) WTI/OTI/PRD alarm/trip of transformer necessary hardware and software for downloading the data captured by disturbance recorder to personal computer available in the Sub-station automation system is in the scope of the contractor. 5) The Relays should be modular in construction with possibility of future addition of BI, BO's , protection functions by using additional sub modules / cards without complete replacement of the main relay / base module of the relay. 6) All protection Relays shall have graphical Large Screen display with dedicated open & close control keys. 7) The Relay shall be Cyber Secured according to IEC : 62443 and BDEW Whitepaper. 8) The Relay shall be suitable for simulated testing of various protection functions via Relay configuration software without actual secondary injection kit. 9) Easy access to process and device information via a standard WEB-Browser for displaying operational measuring values, operational and fault logs, setting values and device

information. 10) Upgradable to process bus in future as per IEC : 61850-9-2 standard. 11) Relay shall be conformal coated as per ISA : 71.04, IEC : 60068-2-42, IEC60068-2-43 and IEC : 60068-2-60 suitable for G3 environment.

Restricted Earth fault Protection:

The restricted earth fault protection shall be 1) Numerical type; 2) of high speed, instantaneous current operated and high impedance type; 3) having a current setting range of 5-200% of 1 Amp.; 4) tuned to the system frequency. It shall have high rejection of DC component of fault current; 5) having suitable non-linear resistor to limit the peak voltage to 1000 Volts.

Over fluxing protection :

The relay shall monitor the voltage (volts)/frequency (Hertz) and shall have a continuous adjustable setting between 100 to 130% of nominal volts/ hertz ratio. Relay shall have inverse time characteristic compatible with transformer over fluxing. The Relay shall be energized by two separate time delay Relays to work in two stages for a time delayed alarm and time delayed trip. The variable time setting of alarm shall be in the range of 2-5 secs. and that for trip in the range of 5-30 secs. The Relay shall have a high resetting ration of 98% or better.

Transformer overload relay :
Transformer overload relay shall be provided with two stages. One stage as non-trip alarm & the second stage is to extend trip command to breakers to have required load relief.

Auxiliary Relay :

The transformer protection panel shall be wired for buchholz alarm and trip, oil temperature alarm and low oil level. The auxiliary flag relays shall be provided for contact multiplication wherever they are needed for buchholz alarm/trip, winding temperature alarm/trip, oil temperature alarm/trip, pressure relief device trip, oil surge relay trip. Current operated relays shall be preferred to voltage operated relays.

Note : REFT, Over flux Relay & auxiliary Relays can ne inbuilt features of differential Relay.

Numerical Back-up Over Current & Earth fault protection scheme with high set feature for Power Transformer :

It shall have1) Three over current and one earth fault element (s) which shall be either independent or composite unit (s); 2) The scheme shall include necessary VT fuse failure relays for alarm purposes; 3) Over current Relay; 4) Relay Shall have threshold setting range of 1-35% of rated current; 5) The Relay shall have a settable characteristic angle of -180 to 180 degree in step of 1 degree; 6) Includes hand reset flag indicators or LEDs; 7) Earth fault Relay; 8) The Relay Shall have threshold setting range of 3-35% of rated current; 8) Relay shall have a settable characteristic angle of -180 to 180 degree in step of 1 degree; 9) Include hand reset flag indicators or LEDs; 10) Include necessary separate interposing voltage transformers or have internal feature in the relay for open delta voltage to the relay; 11) The relay shall offer a USB serial port as standard on the front of all units. All of the relays functions can be set on a PC using suitable

software via the USB port. The connection is made with a USB cable and operates with a 'plug and play' connection, so no pre-setting of the relay is required. The relay shall support user selectable communications protocols DNP-3.0, MODBUS-RTU, IEC : 60870-5-103 with RS-485 connection possibility or shall support IEC : 61850 edition 2 protocol with either electrical or optical redundant ports. Relay with IEC : 61850 ports shall support site selectable Parallel redundancy protocol (PRP)/ High-availability Seamless Redundancy (HSR) shall be provided for rear communication. 12) The relay shall have a disturbance feature to record graphic form of instantaneous values of current in all two/three winding transformer analog channels, during faults and disturbances for pre fault and post fault period. 13) The Fault records & Disturbance analysis : a) Event Logs > 1000, b) Trip Logs / Fault records >100, c) Oscillograph Fault recordings > 50; 14) The maximum fault recording with total capacity minimum 100 sec. Site selectable sampling rate up to 1 / 2 Kilo Hz.; 15) Relay shall have 9 programmable function keys; 16) The Relays should be modular in construction with possibility of future addition of BI, BO's , protection functions by using additional sub modules / cards without complete replacement of the main relay / base module of the Relay; 17) All the protection relays shall have graphical Large Screen display with dedicated open & close control keys; 18) The Relay shall be Cyber Secured according to IEC : 62443 and BDEW Whitepaper; 19) Relay shall be suitable for simulated testing of various protection functions via Relay configuration software without actual secondary injection kit; 20) Easy access to process and device information via a standard WEB-Browser for displaying operational measuring values, operational and fault logs, setting values and device information; 21) Upgradable to process bus in future as per IEC : 61850-9-2 standard; 22) The Relay shall be conformal coated as per ISA-71.04, IEC: 60068-2-42, IEC : 60068-2-43 and IEC : 60068-2-60 suitable for G3 environment.

66 KV Line Panel :-

Directional Overcurrent and Earth fault protection scheme for 66kV Lines :

1) Shall have three over current and one earth fault element (s) which shall be either independent or composite unit (s); 2) Shall be of Numerical type; 3) Over current relay; 4) The Relay Shall have threshold setting range of 1-35% of rated current; 5) The Relay shall have a settable characteristic angle of -180 to 180 degree in step of 1 degree; 6) Include hand reset flag indicators or LEDs; 7) Earth fault Relay; 8) The Relay Shall have threshold setting range of 3-35% of rated current; 9) The Relay shall have a settable characteristic angle of -180 to 180 degree in step of 1 degree; 10) Include hand reset flag indicators or LEDs; 11) Include necessary separate interposing voltage transformers or have internal feature in the relay for open delta voltage to the relay; 12) The relay shall offer a USB serial port as standard on the front of all units. All of the relays functions can be set on a PC using suitable software via the USB port. The connection is made with a USB cable and operates with a 'plug and play' connection, so no pre-setting of the relay is required. The relay shall support user selectable communications protocols DNP-3.0, MODBUS-RTU, IEC : 60870-5-103 with RS-485 connection possibility or shall support IEC : 61850 edition 2 protocol with either electrical or optical redundant ports. Relay with IEC : 61850 ports shall support site selectable Parallel redundancy protocol (PRP)/ High-availability Seamless Redundancy (HSR) shall be provided for rear communication; 13) The relay shall have a disturbance feature to record graphic form of instantaneous values

of current in all two/three winding transformer analog channels, during faults and disturbances for pre fault and post fault period; 14) Fault records & Disturbance analysis : a) Event Logs > 1000, b) Trip Logs / Fault records >100, c) Oscillograph Fault recordings > 50; 15) The maximum fault recording with total capacity minimum 100 sec. Site selectable sampling rate up to 1 / 2 Kilo Hz.; 16) The Relay shall have 9 programmable function keys; 17) The Relays should be modular in construction with possibility of future addition of BI, BO's , protection functions by using additional sub modules / cards without complete replacement of the main relay / base module of the relay; 18) All the protection Relays in shall have graphical Large Screen display with dedicated open & close control keys; 19) The Relay shall be Cyber Secured according to IEC : 62443 and BDEW Whitepaper; 20) The Relay shall be suitable for simulated testing of various protection functions via Relay configuration software without actual secondary injection kit; 21) Easy access to process and device information via a standard WEB-Browser for displaying operational measuring values, operational and fault logs, setting values and device information; 22) Upgradable to process bus in future as per IEC : 61850-9-2 standard; 23) The Relay shall be conformal coated as per ISA-71.04, IEC : 60068-2-42, IEC : 60068-2-43 and IEC : 60068-2-60 suitable for G3 environment.

66 KV Bus Coupler Panels :-

Overcurrent and Earth fault protection scheme for 66kV Bus Coupler:

A) Numerical Back-up Protection Relays shall have the following features :

1) Shall be microprocessor-based design, fully Numerical, programmable/ configurable & having self-supervision (monitoring) feature with watch dog contact for alarm; 2) Shall be configurable for BI/BO, LEDs, functional settings etc.; 3) Shall comprise of three O/C elements and one E/F element; 4) Shall have total Four independent stages of O/C protection, out of which 3 stages shall be of definite time Directional O/C and One Stage shall be of IDMT directional O/C with standard IEC and user defined curves. Further relay should have total four Stages of E/F protection out of which 3 stages shall be of definite time directional E/F protection and One stage shall be of IDMT directional E/F with standard IEC and user defined curves. Measured and calculated earth fault stages shall be separately available; 5) The Relay shall have 4 CT , 4 VT and user configurable a) 18-DI b) 11-DO inclusive of watchdog c) 14 LED's; 6) Shall be function independent of the main protection and shall be capable of clearing the fault correctly even when the main protection fails to operate; 7) Shall have facility for enabling/disabling any functions & directional feature; 8) Shall be compliant to site selectable IEC-61850 edition1 & edition 2 communication standard; 9) Shall have front USB port for local communication & rear redundant RJ-45/ FO ports for Remote communication on IEC : 61850 supporting site selectable Parallel redundancy protocol (PRP) and High-availability Seamless Redundancy (HSR). Goose transmission time between two IED's shall be <10 milli-sec; 10) The Relay shall support at least 6 IEC : 61850 clients; 11) Shall have front graphical HMI for Single line diagram or minimum 8-line alphanumeric display see with clearly visible various measurements e.g. Primary/secondary values and access to settings etc.; 12) The Relay Shall have 4 stages under voltage; 13) The Relay shall have 4 stage overvoltage; 14) The

Relay shall have 6 stages for under and over frequency selectable; 15) The Relay shall have 6 stages for rate of change of frequency protection; 16) The Relay shall have voltage dependent overcurrent protection; 17) The Relay shall have undercurrent; 18) The Relay shall have Power Protection (under Power & overpower); 19) The Relay shall have vector shift; 20) The Relay shall have Power factor protection; 21) Relay shall have CBF with 2 times; 22) The Relay shall have Broken conductor based on NPS/PSS ratio; 23) The Relay shall have I2t based wear monitoring for breaker shall be possible; 24) The Relay shall have load blinder feature used with directional overcurrent protection elements to block tripping during sustained heavy reverse load current flow in networks; 25) The Relay shall also have site-selectable High impedance and low impedance Restricted earth fault; 26) The Relay shall have fault locator feature; 27) The Relay shall have 4 setting group; 28) 1A/5A shall be site selectable; 29) The Relay shall have suitable per defined site selectable Binary input threshold selection options; 30) The Relay shall have minimum heat dissipation levels. Ventilation holes in relay top & side surfaces are not acceptable.

66 KV Bus-bar Protection :

Numerical Centralized, low Impedance biased Busbar Differential Relay :

1) The Bus-bar protection scheme shall be fully numerical, phase segregated type & site selectable IEC : 61850 edition 1 &2 compliant. It shall be capable of providing extensive protection for the busbar irrespective of the CT location; 2) The Bus-bar protection scheme shall be suitable for accommodating all the existing bays with provision for future bays in the substations. The scheme shall be capable of accommodating different types of Bus-bar arrangements/ configurations used in the substations. Provision of adding new bays in future shall be possible, i.e. the system shall be scalable. The scheme should have provision for easy adaptation for different bus configurations; 3) The Bus-bar protection shall be high speed, low impedance, Centralized, biased differential type and shall provide protection for all types of phase & ground faults selectively for each zone of protection. The operating speed shall be independent of the no. of bays and the protection functions/features configured in the Busbar protection system; 4) The Relay shall be of modular construction, having features of self-monitoring, supervision and diagnostic capabilities to ensure maximum availability of the scheme. Continuous self-diagnostics tests shall be carried out by the relay(s) & watchdog contact should be made on any abnormalities; 5) It shall be possible to include future bays as and when they are added. In such cases, the system shall be easily extendable by adding modules module for the new bays and activating the same in the Bus-bar protection; 6) The scheme shall be of centralized architecture only. Phase wise bus-bar Protection relays are not acceptable The Bus-bar protection scheme shall include protection "IN/OUT" switch for each zone. The scheme should have facility to block zone/feeder during maintenance; 7) To enhance security, the Bus-bar protection scheme shall have at least two independent measurement & tripping criteria (Check Zone and Bus Zone). A trip signal shall be initiated only if the criteria are simultaneously satisfied. Neither criterion

(for tripping) shall be voltage dependent; 8) The protection scheme shall be able to accommodate different/heterogeneous CT classes, constructions, secondary resistances, saturation factors, ratios etc. without the need of auxiliary CTs for ratio matching; 9) The scheme shall incorporate continuous phase wise supervision of CT secondaries against any possible open circuit and if it occurs, scheme shall render the relevant phase of protection inoperative, shall also indicate phase segregated LED/Alarm on the relay & give facia annunciation; 10) The scheme shall be insensitive to transients & harmonics, be fully reliable & selective even under CT saturation conditions; 11) The main current transformer secondary circuits should not be switched. The scheme shall not include any external CT switching relays or additional module for completion of the scheme; 12) No region within the Bus-bar zone should be left un-protected by the offered scheme. Fault between breaker & CT in bus section or in any feeder during breaker open condition should be detected by the scheme. The scheme thus should have capability to detect & clear the fault in dead/end zone dynamically depending on system condition. The scheme should also send inter-trip command to the other end of the line when Bus-bar protection operates; 13) The Bus-bar protection scheme shall have built in LBB protection for each feeder. The built-in LBB feature should be phase segregated & have a provision of single-phase initiation with alarm. The protection shall have the option to take LBB trip from external discrete/the built-in LBB of other protective Relays in the feeder. It shall be ensured that even when the Bus-bar protection is kept 'out' due to any reason; the operation of LBB (which are part of Bus-bar protection) will not be hampered. Furthermore, under the 'BBP blocked/out' mode also, the operation of LBB trip, if any coming from the external LBBs shall be selectively extended to all the breakers of concerned zone through the trip bus of BBP. External wiring, if any required to achieve this shall be provided. This may be achieved through 'Goose' logic, if required & feasible; 14) At least 32 programmable LEDs for various protection functions should be available; 15) Relay shall have graphical HMI which shall also permit reading of important parameters/information etc. such as currents, zone differential current, zone bias current, alarm conditions, trip conditions, setting values etc.; 15) The maximum operating time up to initiation of trip relay should be 10 milliseconds or less; 16) Shall have front USB port for local communication & rear redundant RJ-45/FO ports for Remote communication on IEC : 61850 supporting site selectable Parallel redundancy protocol (PRP) and High-availability Seamless Redundancy (HSR). Goose transmission time between two IED's shall be <10 milli-sec.; 17) The Relay shall support at least 6 IEC : 61850 clients; 18) The Relay shall have suitable per defined site selectable Binary input with threshold selection options; 19) The Relay shall have minimum heat dissipation levels. Ventilation holes in relay top & side surfaces are not acceptable.

General Points for all the Numerical Relays :

1) The Manufacturer should have service and repair center in India for analysis & repair of relays. 2) The Manufacturer of Relays shall have min. 10 years experience in implementation of 61850 protocol-based protection and automation systems in India.

2) The Relay shall have web monitor/browser feature to get connected to relay via ethernet port from SCADA system to access important data in device.

3) The Certified Service center must be located within India.

Tripping Relay :

Each panel shall be provided with instantaneous DC operated tripping Relay. The relay shall have adequate number of normally open and normally close contacts to meet the requirement of scheme, other functions like auto re-closing relay, LBB relay, fault locator disturbance recorder, event logger wherever applicable. The maximum operating time of the relay shall not exceed ten milliseconds and reset within 20 milliseconds. Relay shall be provided with operation indicator for each element coil.

Tripping Circuit Supervision Relay :

1) Each trip coil of circuit breaker shall be provided with an independent trip circuit supervision relay. These relays shall be mounted in the control panel associated with the circuit breakers.

2) These relays shall monitor the healthiness of each phase of the trip circuit while the breaker is in open or closed position and give an alarm for the loss of DC supply or for faults in the trip coil or for faults in the trip circuit such as leads, auxiliary contacts. The relay shall have a time delay on drop off of not less than 200 milliseconds and be provided with operation indication.

3) Trip supervision relay shall be located in the panel.

The relay shall have adequate contacts for providing connection to alarm and event logger.

DC Supply monitoring relay :

The relay shall be capable of monitoring the failure of DC supply to which it is connected. Separate DC supply monitoring relay shall be provided for DC main circuit, control circuit of tripping relay and protection circuit of each panel. It shall have adequate potential free contact to meet the scheme requirement. The relay shall have a time delay on drop off of not less than 100msecs and be provided with operation indicator/flag. Indicating lamp and separate alarm for DC fail shall be provided and shall be operated by 230V AC single phase supply. Push buttons for test and accept shall be provided.

A) Specification for a IEC 61000-4-30 compliant Multifunctional Power Meter :

The multifunctional device is used to collect, display, and transmit measured electrical variables such as AC current, AC voltage, power types, harmonics, etc.

It shall have below features.

- Comprehensive acquisition of relevant network parameters for early identification of supply quality problems.
- Measured value acquisition according to the IEC 61000-4-30 power quality measurement standard.
- Easy operation via integrated web server for parameterization, diagnosis, evaluation, and reporting.
- Interoperability is guaranteed by using standard interfaces and IEC : 61850 protocol and standard data (PQDiff, Comtrade).
- Memory capacity of 2 GB for storage of the data.
- Use in the IT, TT and TN power systems.
- External time synchronization via the Network Time Protocol (NTP).

Housing :
It shall be Flush mounting devices with graphical display and size of 96 mm. X 96 mm.

Basis function :

The following measurements shall be collected or calculated by the device from the measured variables:
- True RMS AC voltage and AC current
- 2,048 sampled values per 10 / 12 system periods
- Line frequency
- Active, reactive and apparent power
- Active, reactive and apparent energy
- Power factor and active power factor
- AC voltage and AC current unbalance
- Harmonics of AC voltage and AC current are stored up to the 40th order for evaluation
- THD (Total Harmonic Distortion) of AC voltage and AC current
- Phase angle.

8. Technical Specification of Item No. 6

This includes Supply, Installation, Testing and Commissioning of SCADA System with large monitor, switches, PLC, office furniture etc. complete in all respects, as per requirement and as directed. The SCADA System shall be associated with latest state of art technology and shall be user friendly. One expert shall be kept for 06 (Six) months after commissioning the system. It shall cover the existing 11 KV GIS with new 11 KV & 66 KV GIS with supply & laying of mono-mode OFC with a spare. There shall be redundancy in all the layers, i.e. hierarchies. The PLC System should be modular and shall have future expandability with addition of module. The system protocol shall be such that, it shall match with any protocol for having accessibility. Also, if any upgradation happens in the Software/Hardware within 05 (Five) years, the same shall be arranged by the contractor free of cost to DPA. Further, the contractor shall supply all kind of spares with their required quantities, as recommended by the manufacturer. However, the system shall comply with the latest Cyber Security norms/rules/directions with time to time upgradations.

9. Technical Specification of Item No. 12

This includes Supply, Installation, Testing and Commissioning of CCTV System with large monitor, switches, PLC, office furniture etc. complete in all respects, as per requirement and as directed. The system protocol shall be such that, it shall match with any protocol for having accessibility. However, the system shall comply with the latest Cyber Security norms/rules/ directions with time to time upgradations.

10. Structure Work at the 66 KV Yard :-

This includes Supplying, Installation, Connection, Tapping, erection, making, grouting and commissioning of galvanized steel structure for following items mentioned below and structure shall be as per GETCO practice (All foundation drawing will be given by contractor as per GETCO specifications and same will be approved by structure & electrical consultants). Steel structure drawing shall be given by vendor for approval by structural consultants giving wind pressure, bending moment etc. with proper drawings.

11. 66 KV Metering side Equipment :-

Installation of outdoor type 60 KV, 10 KA Lightning Surge Arrestor (1 Phase) complete in every way with outdoor junction boxes suitable, connectors, hardware, accessories, terminals for LV wiring complete in every way.

12. Installation, of outdoor type 66 KV (3 Phase) double Break Isolator :-

1250 A, 26.1 KA, Isolator with one E/S complete in every way with outdoor junction boxes, terminals for LV wiring, all suitable connectors, hardware, accessories complete in every way.

Installation of Indoor type 72 KV SF-6 Circuit Breaker (3 phase)

1600 A, 31.5 kA SF-6 CB complete in every way with operating kiosk, complete pedestal and mounting supports, terminals for LV wiring inside kiosk, suitable connectors, hardware, and accessories complete in every way.

Installation of outdoor type 66 KV (3 core) Current Transformer (1 Phase)

150/1 A, 31.5 KA 10 VA CT class 0.2 S for metering class complete in every way with outdoor junction boxes, terminals for LV wiring. (suitable for 12.5 MVA), connectors, hardware, accessories complete in every way.

150/1+1+1+1 A, 30 VA 31.5 KA CT 5P20 protection class for main protection, PS class for differential, PS class for distance protection, 5P20 class as spare complete in every way with outdoor junction boxes, terminals for LV wiring. suitable connectors, hardware, Accessories complete in every way.

Installation of outdoor type Potential Transformer (1 Phase).

66 KV/√3/110 V/√3/110 V/√3 outdoor type single phase PT class 0.2/3P, 100 VA burden complete in every way with outdoor junction boxes, terminals for LV wiring, suitable connectors, hardware, accessories complete in every way.

- 2 sets of outdoor Current Transformers (6 Nos.)
- 2 sets of outdoor Potential Transformer (6 Nos.)
- 2 sets outdoor Isolators with earthing blades.
- 2 sets Lightning Arrestor

13. 66 KV Switchyard Civil Work :-

New Substation 66 KV Gas Insulation Switchgear Civil Work with Material Supply and Working of all Foundations, Fabrication, Contraction, Beam/Row Colum, Plaster, Fencing,

Pluming, Painting, RCC Road Work by Contractor as per direction of Engineer-In-charge of DPA.

1	GIS, AHU, SCADA, Office, Control Room, Auxiliary Tr. Room, DG Room, Diesel Storage, Meter Room etc. complete in all respects.	1	No.
2	66/11 KV Transformer Foundation	3	Nos.
3	Oil Sock Pit	2	Nos.
4	RCC Fire Wall	2	Nos.
5	NIFPS Foundation	4	Nos.
6	NGR Foundation	3	Nos.
7	66 KV LA Foundation	23	Nos.
8	66 KV CT Foundation	6	Nos.
9	66 KV PT Foundation	6	Nos.
10	66 KV PI Foundation	2	Nos.
11	66 KV Isolator Foundation	2	Nos.
12	Underground Water Tank	1	No.
13	Septic Tank	1	No.
14	Metal Spreading	930	SMT
15	Compound Wall-cum-Retaining Wall	140	RMT
16	Main Gate & Wicket Gate	15	RMT
17	RCC Road	420	RMT
18	Lighting Mast Foundation	3	Nos.
19	Storm water Drainage for Switchyard	60	RMT
20	Cable Trench 1200 X 1200 mm.	50	RMT
21	Cable Trench 900 X 1000 mm.	60	RMT
22	RCC NP-3 Hume Pipe 300 mm.	20	RMT
23	Earth Filling in the Yard from Outside	1800	CMT
24	Survey the Site Preparing & Leveling	1	JOB
25	Soil Classification	1	JOB
26	11 KV 2 Tier RCC Cable Trench 1.0 X 1.0 Mtrs. Outside the Yard	1100	RMT

14. Station Transformer 500 KVA

Disconnection, Removal, Loading, Shifting, Unloading, placing, erection on foundation, testing and commissioning of 500 KVA oil filled, 11 KV/415 V, copper wound outdoor type, weather proof type transformer (Impedance 4%-5%) with bushing & terminal on HT & LT side and with +5% to -10% tap on HT side. HT side will have bushing and LT side will have cable box.

This shall have oil temperature gauge along with all safeties and provide all protection control wiring working by contractor given direction of Engineer-in-charge of DPA.

15. LT Panel for Station Transformer

Supply, Installation, Testing and Commissioning of Main LT Panel. This will be installed in

the First floor, free standing, indoor duty, Dust & Vermin proof. The Main LT Panel shall be suitable for 415 V AC, 50 Hz., 3 phase 4 wire supply. Each incoming & outgoing breaker shall have microprocessor based releases & provide all Indication and protection relay & control system with energy meter. LT Panel connection of DG Incomer and UPS/Inverter & all outgoing Feeders.

Cable :
2R X 3 C X 400 Sq. mm., 1100 V AL. XLPE Cable

The Panel will be made as per detailed specifications & drawings forming part of this document.

LT Panel Out Goings Feeder Details

1. GIS Hall Crane
2. Fire Panel
3. Control Relay
4. General Lighting
5. AHU or VRF System
6. Battery Charger Supply
7. UPS or Inverter System
8. PLC, SCADA, RTU
9. Camera Network Server
10. DG Room Supply
11. Filtration Machine Supply
12. Spare Feeder

16. LT DG 150 KVA

Supply, Installation, Connection, Testing and Commissioning of 150 KVA LT DG with AMF Panel, Protection & LT Panel including providing of Foundation.
DG have to provide all interlock system and meter voltmeter ammeter diesel Engine HMI to be Controlled by remote/local system to be provide by contractor as per guide line Engineer-in-Charge.

17. 11 KV HT Capacitor Bank

Supply, Installation, Connection, Testing and Commissioning of 03 (Three) Nos. of 11 KV, 400 kVaR Indoor Fixed Type Capacitor Bank complete with Disconnecting Isolator, HT Contactor, Series reactor, RVT with Auto/Manual Control Power Factor Correction to be connected with HT GIS 11 KV Panel Board HMI Control Panel with all meter/protection.

18. DC Distribution Board

Supply, Installation, Testing & Commissioning of DC Distribution board with 01 (One) set of 63 A, MCB as incomer and 06 (Six) Nos. of suitable rated MCBs (as per coil rating of SF-6) on outgoing side enclosed in metal sheet enclosure of 2 mm. thick and suitably painted. The unit will be complete with bus bars, accessories, links, terminal strip, clamps etc along with cables up to incoming & outgoing to GIS panel board complete with all

indication /Control Relay / Circuit Breaker. Connection of DCDB Panel shall be with Protection & all Metering.
Supply Voltage : 110 V/48 V/24 V DC

19. Cable Trench

Supply, installation of 11 KV, 2 Tier Cable Trench of 1.0 X 1.0 MT Outside the Yard.
One side of the wall or on two sides of the wall or at other places and paint with one coat
of red oxide primer and two coats of synthetic enamel paint grey afterward
L = 3000 mm.
W = 900 mm.
H = 50 mm.
T = 2 mm.

New to Old 66 KV Substation distance: 1100 Meter

[Cable Size : 3R X 3C X 300 Sq. mm. XLPE Al., i.e. 09 (Nine) Nos.

20. EOT Crane 5.0 Ton

Supply, Installation & Commission of 5.0 Ton EOT Crane in the 66 KV GIS Hall with all Protections and Indication Lamps. EOT Crane can be Controlled by Remote/Local System provided with Main Hoist/LT/CT Auxiliary Motor and connection shall be made by the Contractor with Bus-bar Protection in EOT crane.

21. Battery & Battery Charger

Supply, Assembling, Installation, Electrolyte filling, carrying out the recommended cycles of charges and discharges before final charging, connecting up, battery bank forming, testing, rectification and commissioning of all the equipment for the 110 V DC. The rated voltage output equals to 110 V DC consisting of lead acid cell of 2 V each and shall be provided with specific gravity tester.

- Capacity will be 250 Amp-Hours

- The supply includes treated wooden fabricated free standing floor mounted rack with Acid resistant finished for housing the batteries complete with series connecting electrical leads an output connection box, Electrolyte for the batteries.
- Input supply 230 V AC single phase
- Output suitable to charge lead acid battery bank of 220 V DC
- Maximum current output will be 25Amps trickle charge.
- All necessary indication
- 1 No. of moving coil ammeter and voltmeter
- Indicating light for power On, battery undercharging and trickle charging
- 1 No. DC distribution board with 8 Nos. of DP outgoing MCB's of suitable rating.
- The charger to be housed in sheet steel enclosure with louvers and cooling fans.
- 1 No. of moving coil ammeter and voltmeter
- Indicating light for Power On, battery undercharging and trickle charging

22. Fire /Alarm/Sensor System

The Fire detection system shall be such that all the smoke/fire sensors installed in the system should be given individual ID and if any of the sensors observe any abnormality, its ID should display on LCD screen of detection panel with alarm and annunciation, so that, the operational personnel target that particular place for fire extinction covering all the rooms in GIS Building /Control Room/DG Room/Transformer Sprinkler
- Carbon-di-oxide type fire extinguisher of 2 Kgs. Capacity, CO2 gas as per IS : 15222
- Carbon-di-oxide type fire extinguisher of 4.5 Kgs., Capacity, CO2 gas as per IS : 15222
- ABC powder type fire extinguisher of 6 Kgs./Fire buckets with stand (Set of 4)

23. AHU/VRF System

Ventilation System for 66 KV GIS Hall as per GETCO Specification.
All the Control Room Buildings are to be provided with AHU/VRF System as per Cooling Purpose with all with Motor, duct system and pipe line to be installed by the contractor as per following.
- Control Room Building
- GIS 66 KV Hall Room
- GIS 11 KV Panel Room

24. Inverter with Battery for Emergency Lighting

Installation, Supply, Connection of Inverter system provided with battery bank with 115 Nos. of Batteries to connect in LT Panel supply for Emergency Lighting Failure in all the Control and GIS Panel Rooms for all Breaker/ HT/LT Panel Alarm/Relay/ Indicator System.

25. Lighting

All 66 KV Substation Lightings shall be provided with Connection/Fitting/Mounting/ Foundation work by the Contractor as per the locations shown by Instruction Engineer-in-Charge of DPA.

26. CCTV System :

All the 66 KV Substation Cameras shall be provided with Connection/Fitting/Mounting/ Foundation work by the Contractor as per the locations shown by Engineer-in-charge of DPA.

A. GENERAL DESIGN FEATURES OF CURRENT TRANSFORMERS:

This section covers this design, manufacture, assembly, testing at manufacturer's works, supply and delivery of outdoor, **dead tank type**, oil impregnated paper, single phase, 50 Hz., oil immersed, self-cooled, current transformer suitable for

operation in the climate conditions specified. The current transformers shall be complete in all respects.

STANDARDS:

CURRENT TRANSFORMERS:

SR. NO.	STANDARD NO.	TITLE
1	IS:2165	Insulation co-ordination for equipment of 100 KV and above
2	IS:16227(I to III)	Instrument Transformers
3	IS:2099	High voltage porcelain bushings
4	IS:3347	Dimensions of porcelain transformer bushings
5	IS:2071	Method of high voltage testing
6	IS:335	Insulating oil for transformers and switchgears
7	IEC 60529	Degrees of protection provided by enclosures (IP Code)
8	IEC-61869-1 to 3	Instrument Transformers
9	IEC-61869-1 to 3	Instrument Transformers (VT)
10	IEC-270	Partial discharge measurement
11	IEC-44(4)	Instrument transformer measurement of PDs
12	IEC-171	Insulation co-ordination
13	IEC-60	High voltage testing techniques
14	IEC-8263	Method for RIV test on high voltage insulators
15	--	Indian Electricity Rules 1956
16	IS:16227(I to III)	Voltage Transformer

Equipment meeting with the requirement of other authoritative Standards, which ensure equal or better performance than the standards mentioned above, shall also be considered. When the equipment offered by the Bidder conforms to other standards, salient points of difference between standard adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule. Four copies of such standards with authentic translation in English shall be furnished along with the bid.

All parts of bellow shall be of stainless steel only.

The core of current transformers to be used for metering and instrumentations shall have saturation factor, low enough to avoid damage to the instruments, in the event of maximum short circuit current.

a) The C.T. core, to be used for protective relays shall be of accuracy class, specified or appropriate class suitable for back up, over current and earth fault, differential and bus-bar protection.

b) The tenderer shall give assurance for trouble free and maintenance free performance for a period of 60 months from the date of receipt at store;

during which period, the CTs shall be repaired / reconditioned / replaced free of cost, immediately in case of any trouble. Therefore, the tenderer shall ensure that sealing of current transformer is properly achieved. In this connection, the arrangement provided by the tenderer at various locations including the following ones shall be described supported by sectional drawings.

i) Location of emergence of primary and secondary terminals.
ii) Interface between porcelain housing and metal tank.
iii) Cover of the secondary terminal box.
iv) G.A. drawing complete with details of primary and secondary windings overall dimensions, weight, nameplate, porcelain insulator, primary & secondary terminals, terminal connectors, etc.

c) Nuts and bolts (or screws used for fixation of interfacing porcelain bushings for taking out terminals) shall be provided on flanges, cemented to the bushing and not on the porcelain i.e. Flange type 66 KV bushing for CT, shall be provided.

Winding and Terminals:

The rating of the secondary winding shall be as specified under Section II of this specification. Ratio changing arrangement shall be provided on secondary winding for multi–ratio design, either a number of identical secondary winding may be provided to achieve desired ratios by series / parallel connection for the secondary winding or the secondary winding may be tapped. However, identical secondary's for tapped secondary winding shall meet requirement as specified.

Primary and secondary windings shall be of electrolytic grade copper and shall have continuous thermal rating as specified for all ratios. The primary winding is to be designed for continuous extended primary current at 120 % of rated primary current. The secondary winding wherever tapped, shall be adequately reinforced to withstand normal handling without damage.

The primary terminals shall be of standard size of 30 mm. dia. X 80 mm. length for all CTs rated upto 1200 Amps. For higher values of primary current, each

Terminal shall be made out of two such rods of 30/40/50 mm. dia. (as applicable) X 80 mm. length in parallel. The primary terminals shall be of heavily tinned electrolytic copper. The maximum thickness of tinning shall be 15 microns.

The secondary terminals shall be brought out in a compartment for easy access. Secondary terminal studs shall be provided with at least three nuts and adequate plain and spring washers for fixing the leads. The studs, nuts and washers shall be of brass, duly nickel-plated. The minimum outside diameter of the studs shall be 6mm. The length of at least 15mm shall be available on the studs for inserting the leads. The horizontal spacing between centers of the adjacent studs shall be at least 1.5 times the outside circum dia. of the units.

The current transformer shall be provided with suitable test tap for measurement of capacitance, tan delta as well as partial discharges, in factory as well as at site. Provision shall be made of a screw on cap for solid and secured earthing of the test tap connection, when not in use. **Tan delta test tap shall measure tan delta value of whole mass of insulation.** A suitable caution plate shall be provided duly fixed on the cover of the secondary terminal box, indicating the purpose of the test tap and necessity of its solid earthing as per prescribed method, before energizing the CT.

TERMINAL BOX OF CURRENT TRANSFORMERS:

The exterior of the secondary terminal box shall be hot dip galvanized. A cable box along with necessary glands for receiving control cables suitable for mounting on bottom plate of the terminal box shall be included in the scope of supply. A door with locking arrangement shall be provided on the front of the terminal box. The secondary terminals shall be taken out through composite epoxy or FRP Mould having single gasket packing & shall be provided by suitable link with dummy secondary leads. For control cable connections, separate terminal connector block to be provided. Secondary jumpers shall be terminated at one side of this terminal connector block. The secondary terminal box shall comply with Degree of Protection (IP-55) standards and type test report shall be furnished with technical bid.

TEMPERATURE RISE:

The maximum temperature rise of the current transformer and its oil, winding and external surface of the core and other parts shall be as specified in Table V of IS: 16227(Part I) 2016 with upto date amendment.

BUSHING AND INSULATORS:

The porcelain hollow insulator used shall be homogenous, free from lamination cavities and other flaws or imperfection that might affect the mechanical or dielectric qualities. The hollow insulator shall conform to the latest edition of IS: 62155. The puncture strengths of the hollow insulator shall be entirely free from external and internal corona. The total creep-age distance of the hollow insulator shall be suitable for heavily polluted atmosphere i.e. the total creep-age distance shall be 1810 mm. (minimum).

TESTS AND TEST REPORTS:

Reports of all type tests as stipulated in the latest edition of IS: 16227 & IEC 61869 for current transformers shall be submitted along with the tender.

The type test reports for the type tests carried out as per IS: 16227 (latest edition) & IEC 61869-2 for specified CTs and those for offered insulators shall be submitted. **The type test reports shall not be older than SEVEN years and shall be valid as on the last date of submission of bid.**

Following test reports shall be submitted.

1. Chopped Impulse voltage withstand test on Primary terminal (350kVp)
2. **High voltage power frequency wet withstand test on** Primary winding
3. **Temperature rise test**
4. Short Time Current test
5. Test for Accuracy
6. Measurement of dielectric dissipation factor
7. Degree of protection IP55 for secondary terminal box
8. STC test on primary terminal connector
10. Mechanical tests
11. Thermal stability test (IEEMA-22-2005)
12. **Temperature** coefficient test (IEEMA-22-2005)

INSTRUMENT TRANSFORMERS

a. All current transformers shall be ring type (epoxy/cast resin) whereas voltage transformers (PT) shall be cast resin insulated type. Must provide details of ratio, output, class and accuracy for all CTs & PTs in its supply on the panel itself

b. Instrument transformers shall be suitable for continuous operation at the ambient temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated load and the outside ambient temperature is 50° C. The class of insulation shall be E or better.

CT TECHNICAL PARAMETERS

Sl. No.	ITEM	Core-I	Core-II	Core-III
i.	Purpose	Metering	protection	Special
ii.	Primary Current rating	300-150 Amps	300-150 Amps	300-150 Amps
iii.	Secondary Current rating	1Amps	1Amps	1Amps
iv.	Rated Burden	5 VA	5 VA	5 VA
v	Accuracy Class	0.5 S	5P10	PS Vk 300V, Ie Max 30ma at Vk
vi	Accuracy Limit Factor/ Instrument Security factor	10	10	

PT Technical Parameters

Sl. No.	ITEM	11 KV
i.	Voltage class	11 KV
ii.	Rated primary voltage (kV rms)	11000/√3
iii.	Secondary voltage (volts)	110/√3
iv.	Rated Burden	Core I : 20 VA (metering) Core II : 20 VA (protection)
v	Accuracy Class	Core I : 0.5 Core II : 3P
vi	Class of Insulation	E or better
vii	One minute power frequency withstand voltage for Secondary wiring (kV rms)	1.2 continuous and 1.9 for 30seconds
viii	Method for earthing the system	Impedence earthed

Technical Particulars for 11 KV Current Transformers

01.	Manufacturer's Name and country of origin	SIEMENS/ABB/GE
02.	Manufacturer's design Ref/ Model	T1-T3
03.	Applicable Standards	As Per Specification
04.	Type	Window type LT CT (Ring CT)
05.	Rated Primary current	400-200 A
06.	Rated secondary current	5A
07.	Rated frequency	50 HZ
08.	Transformation ratios	As per Specification
09.	Number of cores	2
10.	Rated Insulation Level of Current Transformer	0.72KV
11.	Class of insulation	Class –E
12.	Class of Accuracy Core1 Accuracy core 2	0.5 5P10
13.	Short circuit current rating and its duration	21KA/ 3Sec.
14.	One minute power frequency dry withstand voltage	
15.	1.2/50 micro sec. Impulse withstand test voltage	12KV
16.	One minute power frequency withstand test voltage on secondary	12KV
17.	Type of Insulation Housing of current Transformer	Resin Cast
18.	Material used for primary/secondary winding	SE Copper

B. Technical Particulars for 11 KV Potential Transformers

01.	Manufacturer's Name and country of origin	SIEMENS/ABB/GE
02.	Manufacturer's design reference	T20-22
03.	Applicable Standards	GIS 11KV Panel
04.	Type	Indoor resin cast
05.	Ratio	11KV / √3 /110V/√3
06.	Rated Primary voltage	11000
07.	Rated secondary voltage	110
08.	Rated frequency	50
09.	Class of accuracy	M1
10.	No. of phase and method of connection	Star-Delta
11.	Type of Contacts	Rotary contact
12.	One min. power frequency dry flash over voltage	28KV
13.	Operating Time	<10 Sec.
14.	Class of insulation	Class- A

C. Technical Specification for Cable termination

C.1 Cable Terminations

Technical Specifications for 66 KV (Cross Linked Polyethylene Insulated) Power Cable :

C.1.1 Scope:

The scope under this section covers design, engineering, manufacture, testing, packing, supply of 66 KV, 630 Sq.mm, XLPE, insulated power cable for use with solidly grounded distribution systems.
The XLPE cable and its accessories shall be complete with all fittings and components necessary for the satisfactory performance and ease of maintenance.

C.1.2 **Standards**:

Unless otherwise specified, the cables shall conform, in all respects, to IEC : 502, IEC : 60840 and IS : 7098 (Part-III) / 1993 with latest amendment or latest edition for cross linked polyethylene insulated Thermoplastic High Density Polyethylene sheathed cable for working voltage of 66 KV.

C.1.3 **Climatic Conditions**:

The climatic conditions under which the cable shall Operate satisfactorily are as follows:

a) Maximum ambient temperature of air in shade : 50°C
b) Minimum ambient temperature of air in shade : 4°C
c) Maximum daily average ambient temperature : 40°C

d) Maximum yearly average ambient temperature : 30°C
e) Maximum relative humidity % : 95
f) Average number of the thunder storm days per annum : 15
g) Average annual rainfall Cm. : 150
h) Maximum wind pressure Kg/m² : 150
i) Altitudes not exceeding above MSL Meter : 1000
j) Max. Soil temp. at cable depth : 30°C
k) Max. Soil thermal resistivity ohm-cm: 150

D. Technical Specification for LT Panel

D.1 Technical Particulars for LT Panel

The design, manufacture, identification, installation, testing and Commissioning of the equipment and materials covered by this Specification shall conform to the latest editions (amended up to date) of the following standards unless otherwise stated in this Specification

1. IS: 3043 - Code of practice for earthing.
2. IS : 4237 - General requirements for low voltage Switch gear and control gear assemblies
3. IS : 2147 - Degree of protection provided by enclosures for L.V. Switch gear.
4. IS : 375 - Marking and arrangements for switchgear bus bars, Main connections and auxiliary wiring.
5. IS: 2208 - H.R.C. Cartridge fuses.
6. IS: 1554 - Part – I: PVC Insulated cables.

D.2 LV Bus-bar

The L.V. side should be designed to the following:
Low voltage Bus bar system
The equipment shall have all the following features

1.	LV bus bar	From transformer LV bushing to ACB and from ACB to MCCBs Feeder
2.	Bus bar size for phase & neutral	Tinned copper bus-bar, size shall be as per manufacturer design. All the phases and neutral bus-bar shall be same rating/size. Bus-bar size for phase & neutral Suitable spreader to be provided at outgoing side of MCCB to connect 185 Sq. mm. cable through aluminum Lug.
3.	Bus bar support	Insulators 1 kV voltage Class, SMC Epoxy
4.	Bus bar sleeve	Insulation Color coded, for 1kv
5.	Bus bar rated current	Suitable for 1000A continuous current rating within the 10 K class enclosure@ 400°C ambient temp.
6.	Bus bar short circuit	Withstand 50 kA for 1 sec.
7.	Make	Siemens ABB Schneider

D.3 LT Panel with ACB 1000 AMP and Feeder & Starter

The equipment shall have all the following features -

1.	Rated operational voltage (V) at 50 Hz.	440V
2.	Rated frequency (Hz.)	50Hz.
3.	Current rating Amps (rms)	1000 Amps
4.	Rated insulation voltage (V) at 50 Hz.	440 V
5.	Number of poles	4
6.	Rated impulse withstand voltage (kV)	8
7.	Rated Ultimate Short circuit breaking capacity at 415 V, 50 Hz (kA rms) Icu	50
8.	Rated Service Short circuit breaking capacity at 415 V, 50 Hz. (kA rms), Ics	50
9.	Rated short circuit making capacity at 50 Hz. (kA peak), expressed as multiples of Icu	105
10.	Rated short time withstand current for1 sec at 50 Hz. (kA rms), Icw, expressed as percentage of Icu	50
11.	Category of utilization	B
12.	Shutterson' Trip'& 'Close' push button with sealing facility	Yes
13.	Accessory mounting	Accessories shall be front accessible plug in type with Energy Meter Accessories namely motor shunt trip & closing coil, UVT etc. should be common for the entire range & shall be suitable for both AC& DC voltage
14.	Operating mechanism	Spring charging stored energy type, manual &Automatic
15.	Minimum Mechanical life (Operating cycles)	20000
16.	Indications	Breaker shall have following mechanical indications: 1. ON, 2. OFF, 3. TRIP 4. SPRING CHARGE STATUS
17.	Sensing	True RMS based
18.	Type	Microprocessor based
19.	Control Terminal	Should be front accessible and minimum NO/NC contacts shall be provided for electrical interlocking.
20.	Protection	Overload protection Pick p 0.4 to 1.0 Time delay 0.2 to 40 sec Short Circuit Pick up 2 to 10 Time delay 20 to 400 Micro sec. Instantaneous Overcurrent Pick up 4 to 16 & OFF Earth Fault Pick up 0.2 to 0.6 & OFF Time delay 100 to 400 m sec

21.	Metering required	Multi-Function meter for measuring 3 Ph current, 3 Ph Voltage, KWH, KVAH, Power Factor, Max Demand (KVA), Fault History of Minimum Events,
22.	Indication	Release shall give individual indication for each type of fault
23.	Feeder Details;	**LT PANEL** 1) ACB Breaker-1000A 2) DG Incomer 3) Building Light 4) CRP Panel Supply 5) Battery Charger Supply 6) Control Room Light Supply 7) VRF / AHU Supply 8) UPS/Inverter Supply 9) PLC, SCADA Supply 10)CCTV Server Supply 11)General Supply 12)GIS Hall Supply 13)Spare Feeder 14)EOT Crane 15)Spare Supply 16)Fire Alarm System 16 bay Feeder as Per Requirement in LT load Connection, Tapping, Lugging
24.	Analog/Digital	Voltmeter, Ammeter
25.	Energy Meter	Elite Secure
26.	Bus bar Capacity	1000 A
27.	Make	Siemens, Schneider

E. DIESEL ENGINE (DG) 150 KVA (ITEM NO. 16 OF BOQ)

The Diesel Engine shall be fully tested for routine tests of regarding capacity.
Diesel Engine with AMF panel and all parameter monitor in display

1.	Diesel Engine capacity	150 KVA
2.	Primary voltage	24 V/DC
3.	Secondary Voltage	380-440 V
4.	Frequency	50 Hz.
5.	No. of Phases	3
6.	Panel	AMF 440 V
7.	Temperature	Max 115 C by RTD
8.	Make	CUMMINS/KIRLOSKAR/SUDHIR/CG

F. ELECTRIC OVERHEAD CRANE (EOT) 5.0 TON (Item No. 17 of BOQ)

The capacity of the crane shall be sized to lift the heaviest GIS switchgear component. The Crane shall be used for the erection and maintenance of the GIS switchgear components installed in the GIS switchgear room. On completion of erection of the switchgear, the Contractor shall completely service the crane before the Taking Over Certificate is issued.

- Crane hook approaches shall be of the minimum possible dimensions to ensure maximum coverage of the GIS building area.

- The crane(s) shall be capable of lifting and accurately positioning all loads ranging from full crane rated capacity to at least 10% rated capacity.

- Crane shall be designed for operation under following variable speeds through VVVF drives at full load:
– Hoisting: 0.3 – 3 Meters per Minute
– Cross Travel: 1.6 – 16 Meters per Minute Long

-The electric overhead cranes shall be provided with walkways, platforms. shall be provided along the bridge rails and on the crab of EOT crane to facilitate cleaning/maintenance of the crane and to give access to the GIS room high bay lighting and ventilation duct and grilles. The platform and walkways shall be designed to support any weight to be imposed upon them during crane overhaul.

-The Capacity of Cranes to be provided for GIS Hall shall confirm following.

-The following tests shall be carried out on EOT 5.0 Ton Crane.

1. The crane shall be tested at manufacturer work under full load and 25 percent overload of hoisting and cross transverse motions as a routine test.
2. Further the following tests may be done at site after installation of the crane at site a) Check all the accessories for proper function
a) No load test
b) Load test as per site conditions

-EOT cranes for 66 kV GIS hall of suitable capacity shall be provided for erection & maintenance of largest/heaviest GIS component/assembly. The crane shall consist of all special requirements for erection & maintenance of GIS equipment.

G. HVAC /VRF System (Item No. 13 of BOQ)

G.1 General

G.1.1. This specification covers supply, installation, testing and commissioning and handing over to
Customer of Air conditioning system for the Local Control rooms & Maintenance Room in the GIS halls.
G.1.2. Air conditioning system shall be designed to maintain the inside DBT below 24°C. Bidder shall submit necessary design calculations for customer's approval.

G.1.3. At least 50 % spare Air-Conditioning capacity shall be provided for Local Control rooms in the GIS
halls.
G.1.4. Controllers shall be provided in Local Control room inside GIS hall for controlling and monitoring the AC units in these rooms.
G.1.5. Each Local Control room inside GIS hall shall be provided with temperature transducer to monitor the temperature of the Local Control rooms in the GIS halls. The Temperature transducer shall have the following specification:
Sensor : Air temperature sensor (indoor use)
Output : 4 to 20mA
Temperature range : - 5°C to 60°C
Resolution : 0.1°C
Accuracy : 0.5°C or better

G.2 Air Conditioning System Requirements

G.2.1. Air conditioning requirement of the buildings shall be met using a combination of following types Air Conditioning units as required.
a) Cassette type split AC units of 3TR.
b) High wall type split AC units of 2TR.
G.2.2. Type & Capacity of air conditioners shall be so chosen such that quantity of air conditioners in the
room is optimized keeping the necessary air flow.

H. DC Voltage System, Battery and Charger (Item No. 8 of BOQ)

H.1 DC Voltage System, Battery and Charger

H.1.1 Batteries

1. Batteries shall be sealed maintenance free type. Each battery shall be rated for 100 % load design margin.110 V DC Batteries shall be sized to meet the load duty cycle requirement below.
2. Momentary loads for 1minute. (Closing/tripping of breakers, starting of emergency loads etc.)
3. Emergency loads for 2 hours. (Emergency DC drives, emergency lighting, etc.)
4. Continuous loads for 5 hours. (Indication lamps, Annunciation, aux relays, etc.)
5. The battery shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuation no float.
6. The Battery shall normally be permanently connected to the loading parallel with a charger and shall supply the load during emergency conditions when AC supply is lost.
7. Batteries shall be suitable for a long life under continuous float operations and occasional discharges.
8. DC system shall operate a sun grounded system.
9. The maximum voltage variation allowed at the loaded shall be + 10 % to - 15% at all operating conditions for 110 V DC system.

10. The battery shall be size accordance with the IEEE : 485-1983 considering temperature correction factor, contingency and ageing factors. Battery shall be suitable for being boost charged to fully charged condition from fully discharged
11. Continuously carrying the 30 minutes discharge current of their perceive batteries and through fault short circuit urgent which the battery can produce and with stand for the period declared, Contractor shall furnish necessary sizing calculations to prove compliance to the same.

H.1.2 Battery Charger

1. The float cum boost charger shall be suitable for float charging as well as boost charging the battery. Battery charger shall be capable off load charging the battery while supplying the station normal DC load. The design shall be such that, in case the load exceeds the charger capacity, the excess load current shall be supplied by the battery.
2. The battery charger shall be suitable or 415 V ± 10 %, 3 phase, 50 Hz. + 3 %, -5 % Incoming supply. The voltage regulation shall be within ± 1 % for 0-100 % load variation and 10% combined Input AC voltage and frequency variation on the AC side. The charger shall be provided with 2 X 100% capacity cooling fans.
3. The ripple content in charger output shall not exceed 1% (rms)
4. The battery in circuit. The charger shall be self-protecting against all AC and DC transients and steady state abnormal currents and voltages

s/d

Signature & Seal
Of the Contractor

Executive Engineer (E)
Deendayal Port Authority