

STANDARD TECHNICAL SPECIFICATION COVER SHEET

Specification No. : ENG-HV-2008 (R01)

Specification Name : Specifications for 11KV Indoor Switchgear Panel

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1. SCOPE

This specification covers the technical requirements of Design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading at site/store and performance of 11 kV Indoor switchgear complete with all accessories for trouble free and efficient performance. The equipment offered shall be complete in all respects.

Any material or accessories, which may not have been specifically mentioned in the specifications but which are usually necessary for satisfactory, safe, trouble free, operation shall be provided without any extra charges. Vendor shall ensure the quality of workmanship for manufacture of equipment. The equipment shall be supplied as per the latest applicable standards and as stipulated in this specification.

2. APPLICABLE STANDARDS

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with latest editions of the following standards and shall conform to the regulations of local statutory authorities. For standards related to protection & Automation, kindly refer the protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL.

SL. No.	Code	Detail
1	IS 3156/ IEC 60044-2	Voltage Transformers
2	IS 2705/ IEC 60044-1	Current Transformers.
3	IS 3427/IEC 62271-200	HV Switchgear and control gear
4	IS 694-1990	PVC insulated cables
5	IS 2629	Recommended practice for hot dip galvanized
6	IS 2633	Tests for uniformity of zinc coating
7	IS 5578	Guide for making insulated conductors
8	IEC 62053-22	Static meters for active energy (Class 0.2 S and 0.5 S)
9	IEC 62052-11	Electricity metering equipment
10	IEC 60282	High voltage fuses
11	IEC 60529	Ingress Protection

12	IEC62271-10/100	High voltage alternating current
13	IEC 61010-1	Safety requirement for electrical equipment for measurement and laboratory use
14	IEC 61000	Electromagnetic compatibility (EMC)
15	IEC 60947	Low voltage switchgear and control gear
16	IEC 60815	Pollution levels
17	IEC 60694	Common specifications for high voltage switchgear and control gear standards
18	IEC 60255-3	Electrical relays
19	IEC 60255-27	Measuring relays
20	IEC 60060	High voltage test techniques
21	IEC 60364 / 60479 / 60621 / IEEE STD.80	Standards for station grounding
22	IS 11353	Guide for uniform system of marking and identification
23	IEC 60270	Partial discharge measurement
24	IEC 60265	High voltage switches relays with dependent or independent time
25	IEC 60255-3	Electrical relays- Single input energizing quantity measuring relays with dependent or independent time
26	IEC 60255-27	Measuring relays and protection equipmentPart-27 Product safety requirements
27	IEC 60255	Electrical relays
28	IEC 60137	Bushings for Alternating Voltage above 1000V
29	IEC 60099-4	Surge Arrestor: Metal Oxide surge arrestors without gaps for ac system
30	IEC 60060	High voltage test techniques
31	CENELEC/SVDB	Pressure Vessel Codes

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

1	Maximum ambient temperature	50 deg C
2	Max. Daily average ambient temp	35 deg C
3	Min Ambient Temperature	0 deg C
4	Maximum Humidity	95%
5	Average Annual Rainfall	150cm

6	Average No. of rainy days per annum	120
7	Altitude above MSL not exceeding	1000m
8	Wind Pressure	300 Km/hr
9	Earthquakes of an intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
10	Earthquakes of an intensity in vertical direction	equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)

TPCODL/TPNODL/TPSODL/TPWODL service area has heavy saline conditions along the coast and High cyclonic Intensity winds with speed upto 300 Kmph. The atmosphere is generally laden with mild acid, dust in suspension during the dry months, and is subjected to fog in cold months.

4. Guaranteed Technical Requirement

S.No	Description	Requirement
4.1	SWITCHGEAR PANEL	
4.1.1	Architecture	Metal-clad-air insulated
4.1. 2	No. of Phases	Three
4.1.3	Rated Capacity	500 MVA
4.1.4	Rated Voltage	12 kV
4.1.5	Service Voltage	11 kV
4.1.6	Rated Frequency.	50 Hz
4.1.7	Rated impulse withstand voltage	75 kVP
4.1.8	Rated Power Frequency Withstand Voltage	28kV(rms)
4.1.9	Rated short time withstand current	25 kA for 3 seconds.

4.1.10	Peak withstand current rating	62.5 kA
4.1.11	Bus bar continuous rated current	1250 A
4.1.12	Bus bar material	Copper with Silver coated (On Joint Areas)
4.1.13	Internal Arc Protection	IAC-A FLR as per IEC 62271-200, shall withstand 25 kA for 1 sec
4.1.14	Degree of protection for enclosure / partitions/ for meters, relays and BCU	IP 4X/IP 4X/IP 5X or equivalent to completely protect against dust ingress
4.1.15	Normal service condition	Indoor
4.1.16	Temperature Rise	The maximum permissible temperature for bus bar shall be 90 deg C at an ambient temperature not exceeding 50 deg C, . However, the temperature rise for accessible enclosures and covers shall not exceed 30K and in case, they are not required to be touched during normal operation, the limit shall be raised by 10K.
4.2	Circuit Breaker	
4.2.1	Type	Vacuum (VCB)
4.2.2	Rated Capacity	500 MVA
4.2.3	Rated voltage	12 kV
4.2.4	Service voltage	11 kV
4.2.5	Short circuit breaking current	25 kA
4.2.6	Short Time withstand capacity	25 kA for 3 sec.
4.2.7	Peak withstand current rating	62.5 kA

4.2.8	Rated current for Incomer & Bus Coupler VCB	1250 A (For 12.5/16 MVA PTR) 800 A (For 5/8 MVA PTR)
4.2.9	Rated current for Outgoing & Capacitor feeder VCB	630 A
4.2.10	Isolation	Horizontal
4.2.11	Mechanical endurance	10,000 operations
4.2.12	AUXILIARY VOLTAGES	
	For circuit-breaker charging	240V AC
	For protection relays	48/24 VDC (TBD During Detailed Engineering)
	For anti-condensation Heaters	240V AC

Item/Panel reference			Incomer	Bus-coupler
4.3	Circuit Breaker Type/Rating(A)		VCB 1250A VCB 800A	VCB 1250A VCB 800A
4.4	Copper Busbar Rating (A)		1250A	1250A
4.5	Details of XLPE cables		2/3 runs of single core 630 Sqmm per phase. TBD during detail engg.	
4.6.1	CTs (Cast Resin type)	Quantity	3 Nos.	3 Nos.
		Thermal Withstand Capacity	25 kA for 3 sec	25 kA for 3 sec
		Ratio (TBD During Detailed Engineering)	800-1200/5-5A (16MVA PTR)	800-1200/5-5A (16MVA PTR)
			400-800/5-5 A (5/8MVA PTR)	400-800/5-5 A (5/8MVA PTR)

		Core-1 (metering)	10VA, Isf<5, 0.5S	10VA, Isf<5, 0.5S
		Core2 (protection)	10VA, 5P20	10VA, 5P20
		Separate CT Class PS	PS, Vk>500V,	-
			Imag<=30mA at Vk/2	-
			Rct< 6 Ohm	-
4.7	CB control switch, ON/OFF push buttons Indication lamps, Auto trip, L/R switch, TNC switch, Heater, Trip Coils X 2 Nos, Closing coils, Operation counter & spring charged mechanism etc.	To be provided for each Switchgear Panel		
4.8	Bay Control & Protection Unit .(BCPU) CB Control function and. Measurement of Three phase currents & voltages, PF, Active, Reactive (Import & export Lag & Lead) & Apparent energy and power, Frequency etc .	1 no. as per: Specification of Substation automation System. Provision to install Energy meter with TTB provided.	1 no. Combined BCPU as per Specification of Substation & Automation System	
4.9	Digital Multi Function Meter	1	-	

4.10.	Protection relays (TCS Pre Close /Post Close Supervision) For 2 Trip Circuits.	Numerical communicable relay with over current, earth fault, sensitive earth fault, breaker failure, negative sequence current and overload	Required	Required
		DC fail back-up with additional trip coils in CB	1	-
		Anti-pumping relay	1	1
		Electrically reset type high' speed relay for tripping. (The trip relay Shall be supervised).	1	1
4.11	Trip Alarm scheme with Hooter, Accept/Reset PB		-	1
4.12	Cable charged indication		To be provided by the Bidder	To be provided by the Bidder
4.13	Panel illumination in Relay compartment		To be provided by the Bidder	To be provided by bidder
4.14	Circuit Name-Plate		To be provided by the Bidder	To be provided by bidder
Bus PT Panel				
4.15	Bus PT	Quantity	3 Nos. (1-ph)	

		Primary windings	11000V/rt3	
		Secondary winding(s)	110V/rt3-110V/rt3	
		Core-1	110V/rt3, 50VA,3P	
		Core-2	110V/rt3,50VA,0.5	
Item / Panel reference			Outgoing Feeder	Capacitor Bank
4.16	Ckt. Breaker Type/Rating(A)		VCB 630A	VCB 630A
4.17	Copper Bus bar - Rating(A)		1250A	1250A
4.18	Details of XLPE cables		During detailed Engineering	During detailed Engineering
4.19	CTs (Cast Resin type)	Quantity	3 Nos.	3 Nos
		Thermal withstand capacity	25 kA for 3sec	25 kA for 3sec
		Ratio	600-300 /5-5A (TBD during detail engg.)	600-300 / 5-5A (TBD during detail engg.)
		Burden/Class		
		Core-1	15VA, Isf<5, Class 0.5s	15VA, Isf<s, class 0.5s
		Core-2	10VA, 5P20	10VA, 5P20
4.2	LV components - CB control switch, ON/OFF push buttons Indication lamps, Auto trip, L/R switch, TNC switch, Heater, Trip Coils x 2nos, Closing coils, Operation counter & spring charged mechanism etc		To be provided by the Bidder	

4.21	Bay Control & Protection Unit (BCPU) CB control and protection function & Measurement of Three phase currents & voltages, PF, Active, reactive (Import & export Lag & Lead) & Apparent energy and power, Frequency etc		As per Specification of Substation & Automation System. Provision to install Energy meter with TTB provided.	As per Specification of Substation & Automation System. Provision to install Energy meter with TTB provided.
4.22	Analog Ammeter			1
4.23	Protection relays	Numerical communicable relay with over- current, earth fault, sensitive earth fault, breaker failure, negative sequence & Overload.	1 (Combined BCPU as above)	1 (Combined BCPU as above) Also: Under voltage, over voltage, neutral current unbalance & delay timer shall be provided.
		Anti-pumping	1	1
		Electrically reset type: high- speed relay for tripping. (The trip relay shall be supervised).	1	1
4.24	Cable charged indication		To be provided by Bidder	
4.25	Panel illumination in Relay Compartment		To be provided by Bidder	
4.26	Circuit Name-Plate		To be provided by Bidder	

5 GENERAL CONSTRUCTION

5.1 SWITCHGEAR

- a) The switchgear panel shall be of sheet steel construction and shall be dust and vermin proof. The panels shall be of Metal Clad compartmentalized design with all the High voltage compartments viz, circuit breaker, bus bar, current transformers and voltage transformers separated by metallic partitions. These compartments must have pressure relief flaps for the exit of gas due to internal arc to ensure operator's safety. The switchgear panels shall be rigid without using any external bracing. The switchboard panels should comply with relevant IS/IEC

and revision thereof and shall be designed for easy operation maintenance and further extension. Bus bar, metering, circuit breaker chamber, cables and cable box chamber should have proper access for maintenance, proper interlocks should be provided. Metal enclosed switchgear shall be so designed that normal service, inspection and maintenance operations including visual checking of phase sequence, earthing of connected cables, locating of cable faults, voltage tests on connected cables can be carried out safely.

b) Panels shall have structural steel framework enclosed on all sides and top by CRCA sheet steel of minimum thickness as specified below:

- Frame: 3 mm
- Doors & Covers: 2 mm
- Removable gland plate: 3 mm

c) Panels shall consist of a front portion with equipment mounted on it and wiring access from rear. All doors, cut outs and removable covers shall be gasketed all round by neoprene cork gaskets. Each panel section shall be provided with thermostat-controlled space heater with ON/OFF switch and 5 A single phase plug point with 'ON/OFF switch, LED Lamp shall be provided with door switch for each panel for cubicle interior illumination.

d) Panels shall be mounted and bolted to a common base channel. The channel in turn shall be fixed to the foundation bolts at site. All foundation equipment, anchor bolts etc. including the supporting channel shall be furnished by successful bidder in advance for completion of Civil Works prior to dispatch of panels. The bottom plates of the panels shall be fitted with removable gland plates of not less than 3mm in thickness, for fixing the cable glands, the size of which shall suit the purchaser's external cables to the panels. The gland plates for the panels with Single core cables shall be made of Aluminum with split arrangement so as to avoid eddy currents. Cable glands shall be of double compression type 'and made of brass.

e) Indicating instruments and meters shall be at a suitable height so that the lettering on the dials can be easily read. Control switches/push buttons and relay resetting knobs shall be conveniently located for ease of operation. The center lines of the switches, push buttons and indicating lamps shall be not less than 900 mm from the bottom of the panel. The center lines of relays, meters etc. shall be not less than 450 mm from the bottom of the panel. Top lines of relays,

meters shall be matched. Isolating switch fuse units shall be provided at the panel for incoming AC and DC supplies. Push buttons shall be made of non-hygroscopic material with shrouds. All other insulators shall also be made of non-hygroscopic material.

f) All components of the same rating and construction which may be needed to be replaced shall be interchangeable. If there are removable parts with different ratings and if parts are interchangeable within the assembly of metal enclosed switchgear and control gear, any possible combination of removable and fixed parts shall withstand the rated insulation level specified for fixed parts concerned.

g) Interlocks between different components shall be provided for safety and ease of operation. The withdrawal or engagement of a circuit breaker shall be impossible unless it is in open position. All instruments shall be non draw-out type and safeguard in every respect from damages. The operation of a circuit breaker shall be impossible unless it is in service, disconnected, removed, test or earthing position. It shall be impossible to close the circuit breaker in service position unless it is connected to auxiliary circuit.

h) All the HV design shall ensure conformity to Annex- A of IEC-62271-200 and must be Type tested for Internal Arc Test. The supplier shall submit Type Test report from CPR I/ERDA to prove the above. Auxiliary and control equipments installed on the panel shall be suitably protected against disruptive discharge from main circuit. Buses shall be insulated with insulating sleeves, wherever bare conductor is employed. The switchgear panel shall be IAC- AB as per IEC 62271200 and shall withstand 25kA for 1 sec.

i) Degree of Protection for the enclosure and the partitions shall be IP4X. The covers and doors should only be opened when the part of main circuit contained in the compartment being made accessible is dead. Partitions of metal-clad switchgear and control gear shall be metallic and earthed. All the meters, detachable units of relays, relays and BCU shall be minimum IP5X or with an equivalent provision to completely protect it against dust ingress. Meters/ relay shall be protected in such a way that the performance does not get affected due to small dust also. Provision of louvers for air circulation shall be provided.

j) It is preferred to have condition based monitoring in switchgear using Heat and Humidity sensors in Bus-Bar , Breaker and Cable Compartments. These sensors should be integrated with RTUs/ SCADA using wireless communication.

k) All indicating lamps shall be provided with suitable series resistors and bulbs shall be replaceable from the front of the panel. All indicating lamps shall be of LED type and suitable for continuous operation at 85% to 110% of their rated voltage. The following indicating lamps with color shall be mounted over switchgear to indicate important status/alarm of breaker:

- 'Breaker close- Red
- Breaker open - Green
- DC Healthy -Yellow.
- Space heater not healthy-Blue
- Spring Charge - White
- Trip coil healthy- Blue
- Auto trip -Amber

All color caps shall be Similar and interchangeable and all LEDs shall be of same type and ratings. The LED lamps shall be furnished 20% in excess of actual numbers required and colour caps shall be furnished 10% in excess of actual numbers used for each colour.

l) DC fail supervision relay (80) shall be provided on all control and relay panels. DC fail annunciation shall be provided 'on each panel and loss of DC & trip circuit fail alarm will be suitably annunciated and spare contact of the same should be wired to SCADA. Arrangement for inter-tripping wiring from primary side of transformer to 11 kV, incomer switchgear and vice versa should be there. Identification of Components shall be in agreement- with the indication on the wiring diagrams and. drawings. If a component is of the plug-in type, an identification mark should be placed on the component and on the fixed part where it is to be plugged-in. Control cables are to be placed in trunking and it should be suitable to accommodate 20% wiring for future modifications

m) Control supply in individual bay shall to be distributed through MCBs of suitable rating for individual control function like:

- Protection Relay
- Trip circuit
- Close circuits

- Spring charging circuit
- Heating and lighting circuit

n) MCB shall be rated for 10kA short circuit rating. It shall be quick make, quick break, and independent manual type with trip glee feature. PCB shall have the following:

- Over current protection
- ON/OFF Trip position indicators
- Auxiliary contact block (Wherever required)

o) Wherever CB contacts are to be multiplied, latch type relay shall be used for contact multiplication. Auxiliary contact multiplier relays shall be reputed make and selected on the basis of continuous current carrying capacity and rated voltage. The fluctuation in voltage level shall be accounted for (4-1) 10% continuously.

p) Fuse failure relay and trip circuit supervision relay shall be suitably selected, considering burden and auxiliary voltage. External circuitry like compensating resistances will not be accepted

q) Capacitor bank switching device shall be provided with suitable gate interlock mechanism with castle key along with timer to ensure safety. Provision of 0-500 mA analog ammeter on Capacitor Bank along with Push Button shall be made for monitoring 'Unbalance Capacitor Current

r) Each switchgear panel shall have 20% spare terminals. All equipment's mounted on front side of panel shall have individual nameplates with equipment designation engraved. Alarms for. Trip & non-trip should be separate. The termination links for cables shall be segregated in vertical plane. The bidder shall deliver to site completely assembled, wired, tested panels and only the interconnecting cables shall be connected at site.

s) The bidder shall deliver to site completely assembled, wired, tested panels and only the interconnecting cables shall be connected at site. The bidder shall further refer protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL for constructional and other requirements.

5.2 CIRCUIT BREAKER

- a) The circuit breaker shall be VCB, draw out type in horizontal position. The circuit breaker chamber shall have metallic safety shutters, which will close in the event of breaker withdrawal and ensure that no live components inside the 11 kV switchgear panels should be accessible. Withdrawal of the breaker should not be possible in ON position. CB shall have TEST & SERVICE positions. it shall be possible to test the circuit breaker in "TEST' position inside the panel with the entire auxiliary and control circuit connected and Power contacts isolated. Comprehensive interlocking system to prevent any dangerous or inadvertent operation shall be provided. Isolation of CB from bus bar or insertion into bus bar shall only be possible when the breaker is in the open position. Control switch for circuit breaker shall be of spring return to normal type with pistol grip handle. The CB chamber & other live parts accessible from a distance are to be provided with suitable locking arrangement. The circuit breakers compartment is to be provided with hinged doors and proper access to be provided for racking mechanism without opening the CB compartment door. For Safety Purpose, Breaker rack-in/ Rack-out (Isolation) shall be possible with closed door only. The spare contact of breakers, Test/ service switches to be wired up to terminals.
- b) The CB shall be spring operated, motor charged, and manually released spring closing mechanism with three pole simultaneous operations. The speed of closing operation shall be independent of the hand-operating lever. The indicating device shall show the OPEN and CLOSE position of breaker visible from front of the cubicle. The spring charging time of the motor shall not exceed 15 sec. The "TRIP™ and "CLOSE' coils shall be of reliable design and low consumption preferably less than 200W. Anti-pumping relays & T-N-C switch shall be provided for each panel.
- c) The CB shall be capable of making & breaking the short time current in accordance with the relevant IS/ IEC and shall have 3 phase rupturing capacity of 500 MVA at 11kV. It shall be possible to Interchange vacuum interrupters of incomer CB with other outgoing CB & vice versa. For each Switchboard one no.1250A &.one no, 630A CB handling trolleys shall be supplied.
- d) Vacuum Interrupter, Breaker and Switchboard should be of same make.

5.3 BUS-BARS

Bus bars and all other electrical connections between various components shall be made of copper of rectangular cross-section. The bus bars shall be insulated with heat shrinkable insulating sleeves, except at the points of connections. The bus bar section shall be of ample capacity to carry the rated current of 1250A continuously without excessive heating and for adequately meeting the thermal and dynamic stresses in the case of short circuit in the system up to full MVA. All bus bars shall be rigidly and firmly mounted and shall be capable of withstanding short circuit stresses and vibrations. Bidder should specify current density for Cu bus bars. The bus bars shall be extensible on both sides depending upon layout.

Adequate clearance between 11 kV point and Earth and between phases shall be provided to ensure safety as per provision in Indian electricity rule 1956 and its amendment thereof and also in accordance with the relevant latest Indian standard specification. The same shall be capable of withstanding the specified High Voltage tests as per IEC-62271/ 80060 and its amendments thereof.

The interlocking facility should be provided between incomers and Bus couplers. Scheme will be finalized during detail engineering. The insulators shall be made of non-hygroscopic material.

All bus bar joints and all tap-off connections from the main horizontal bus bars shall be provided with removable FRP shrouds. Bus bars shall be prominently marked with Red, Yellow and Blue color rings for easy phase identification at regular interval and at every power tap off point. Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers shall be used for all bus bar joints and supports.

5.4 CURRENT TRANSFORMER

The Current Transformers shall be of Epoxy Cast Resin Type with Window type construction and rated for 25 KA (3 sec) with details as per General technical requirements of Clause no. 4.0. For CT/PT circuits, drop type links to be provided and lugs shall be round type. The control wiring shall be of 4 sq. mm. multi stranded copper with 1.1 kV insulation grade. The physical location of CT core for differential protection shall be near BUS to have overlapping protection different zone. The additional auxiliary CTs and related wiring work required to match existing Trf. Differential Protection shall be part of this tender specification. All current transformers shall be designed to carry continuously a current of 120% of the rated current.

5.5 VOLTAGE TRANSFORMER

The Voltage Transformer shall be of Epoxy cast resin type with details as per General technical requirements of clause no 4.0. It shall be mounted on a draw-out type trolley and protected by HRC fuses on both primary and secondary sides. VT's mounted on circuit breaker truck shall not be accepted. Bus VT shall be provided in each section. In addition VTs shall be provided on incomer lines as per TPCODL/TPNODL/TPSODL/TPWODL requirements. The VT shall have Metallic safety shutters, which will close in the event of VT withdrawal and ensure that no live components inside the 11 kV switchgear panels are accessible. The VT shall be of the single phase type, with separate core for metering and separate core for protection. The control wiring shall be of 4 sq. mm. multi stranded copper with-1.1 kV grade insulation. All voltage transformers shall be designed to carry continuously 1.2 times the normally rated voltage and 1.9 times the normally rated voltage for continuous operation upto 30 sec.

5.6 RELAYS

- a) The switchgear shall have numerical communicable relays designed to disconnect fault circuits with speed and discrimination and shall confirm to IEC 60255-3/IS 3231 or latest revision thereof regarding accuracy and other features.
- b) The relay resetting should be such that resetting of the main protection relay should reset all the other auxiliary relays. All the relays shall be communicable with suitable protocol so as to provide all the I/O signals required by the Purchaser
- c) Relays shall support Purchaser's protection philosophy as per protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL. However, the substation operation shall comply to the integrated automation requirements with the MASTER SCADA.
- d) All plugs in heavy current modules that carry CT circuits shall be equipped with CT shorting features when the module is withdrawn. Suitable facilities shall be provided on each measuring relay to' disconnect trip outputs and then short and disconnect the IT circuits.

The bidder shall further refer to TPCODL/TPNODL/TPSODL/TPWODL protection and automation philosophy.

5.7 DC SELECTOR SWITCH

There shall be three position DC selector switch i.e neutral, DC1 &DC2. In normal supply condition the left side panel & bus section is fed by DC1 Source .and right side panel is fed from

DC2 Source. In case of failure of DC2 source, all panels will be fed by DC1 source. Similarly In case of failure of DC1 source, all panels will be fed by. DC2 source. Cabling required from DCDB to DC selector switch is included in vendor serve. DC MCB of 25 A rating with 'CAC characteristics shall be preferred

5.8 TERMINAL BLOCKS

- a) The terminal blocks shall be 1100 V grade, 10 Amps rated, one piece moulded, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts and identification strips. Markings on the terminal strips shall correspond to wire numbers on the wiring diagrams. The terminal blocks shall be fully enclosed with easily removable covers and made of moulded non-inflammable plastic material.
 - b) A minimum clearance of 250 mm between the first row of terminal blocks and the associated cable and plate shall be ensured. Also the minimum clearance between two rows of terminal blocks shall be 150mm.
 - c) All spare contacts and terminals of the panel mounted equipment and devices shaft be wired to terminal blocks. All the TB's shall be of single Decker type.
- The bidder shall further refer to TPCODL/TPNODL/TPSODL/TPWODL protection and automation philosophy.

5.9 SPACE HEATERS

- a) Strip type space heaters of adequate capacity shall be provided inside each panel to prevent moisture condensation on the wiring and panel mounted equipment. Space heaters shall be rated for 240 V, 1 phase, 50 Hz supply. Heaters inside the panels shall not be mounted close to the wiring or any panel mounted 'equipment. Heaters shaft be complete with either miniature circuit breakers or with isolating switches, HRC fuse on phase and link on the neutral of the heater supply
- b) An adjustable type thermostat shall be provided in the heater control circuit with temperature range of 0-90 degree C.

5.10 INTERIOR LIGHTING AND RECEPTACLES

- a) Each panel shall be provided with a LED fixture rated for 240 V, 1 phase, 50 Hz supply for the interior illumination of the panel during maintenance. The fitting shall be complete with switch fuse unit and the switching of the fitting shall be controlled by the respective panel door switch.

d) Each panel shall be provided with a 240 V, 1 Phase, 50 Hz, S Amps, S Pin receptacle with switch. The receptacle with switch shall be mounted inside the panel at a convenient location.

5.11 POWER & CONTROL SUPPLIES

a) Each control panel shall be provided with necessary arrangement for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signaling, lighting and space heater circuits.. The incoming and sub-circuits shall be separately provided with switch-fuse units. Supply monitoring arrangement shall be provided. Selection of the main and sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by fuses. DC MCB of 25 A rating with "C/K" characteristics shall be preferred.

b) If auxiliary voltages other than those specified are required, then necessary arrangement shall be made by the bidder within the panel to obtain the desired voltages by providing step-down transformers and inverter/converter, etc.

c) All fuses shall be HRC cartridge type conforming to relevant standards, mounted on plug-in type fuse bases and Siemens type of bases and cover with locking arrangement for fuse link. All accessible 'live connection to fuse bases shall be adequately 'shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

d) DC Power Pack to be given to 2 Incomer Panel.

5.12 PANEL WIRING

a) Panels shall be supplied completely wired internally to equipment and terminal blocks and ready for the Purchaser's external cable connections at the terminal blocks. Panel wiring shall be securely supported, neatly arranged by lacing and tying, readily accessible and connected to equipment terminals and terminal blocks. Flame retardant, plastic wiring channels/troughs with strap on plastic covers shall be used for this purpose. When panels are arranged to be mounted adjacent to each other all inter-panel wiring and connections between panels shall be provided by the Bidder.

b) All wiring shall be carried out with 1100 V grade, single core stranded copper conductor wires with PVC insulation. The minimum number of strands per conductor shall be seven. Extra flexible wires shall be used for Wiring of devices mounted on moving parts such as swinging

panels and doors. The minimum size of the stranded copper conductor used for panel wiring shall be as follows:

- i) All circuits except CT circuits: 2.5 sq mm per lead
- ii) CT circuits: 2.5 sq-mm per lead
- iii) PT circuits: 2.5 sqmm* per lead

c) Longitudinal troughs near the top, extending throughout the full length of the panels shall be provided for inter panel wiring, for AC and DO supplies, PT circuits, and other common services. Interconnections to adjacent panels shall be brought out to a separate set of terminal blocks located near the slots or holes meant for taking the interconnecting wires. Arrangements shall permit easy inter-connections to adjacent panels at site and wires for this purpose shall be provided by the bidder looped and bunched properly inside the panels.

d) If accidental short circuiting of certain wires is likely to result in malfunction of equipment, such as closing or tripping of a breaker or positive and negative wires, these wires shall not be terminated on adjacent terminal blocks. The unused instrument space on the front or rear of the panels shall be kept clear of wiring, to facilitate addition of devices without rewiring associated portion of the panels.

e) Wire terminations shall be made with solder less crimping type of (ring type lugs for all CT and PT circuits and pin type lugs for other circuits) tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules, marked to correspond with panel wiring diagram shall be fitted at both ends of each wire: Ferrules shall fit tightly on the wires and shall not fall off when the wire is disconnected. Lock in type ferrule shall be provided.

f) Bidder shall be solely responsible for looping all protection relays up to the Bat or DC as per the requirement. Network cable required to communicate BCIPBCPUs with DC shall be under bidder's scope. Looping and networking cable shall be CAT-5 type. The Bidder shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment. In case the cables are to be routed through trenches, necessary metal clad conduits shall be used.

g) Internal wiring to be connected to external equipment shall terminate on terminal blocks. The terminal blocks for CTs and PTs shall be provided with test links and isolating facilities. The CT terminal blocks shall be provided with short circuiting and earthing facilities. Change of CT cores should be possible by linking & delinking of terminals. Switchgear shall have 20% terminals as spare terminals in each panel & should be uniformly distributed in all the blocks,

5.13 CABLE TERMINATION ACCESSORIES

- a) The purchasers external cable connections will be terminated on the terminal blocks provided in the control panel. All necessary cable terminating accessories such as gland plates, cable glands, crimp type tinned copper lugs, supporting clamps and brackets, wiring ° lugs and gutters etc. for cables shall be included in the bidder's scope of supply.
- b) All cater caps shall be similar and interchangeable and all lamps be of same type and ratings lamps shall be furnished 20% in excess of actual numbers required and colour caps shall be furnished 10% in excess of actual numbers used for each colour.

5.14 LABELS

- a) All equipment mounted on front and rear side as well as equipment mounted inside the panels shall be provided with individual labels with equipment designation engraved. Also on the top of each panel on front as well as rear side, large and bold nameplates shall be provided for circuit/ feeder designation. The labels shall be mounted directly below the respective equipment.
- b) All front mounted equipment shall be provided, at the rear also with individual labels engraved with tag numbers corresponding to the ones shown in the panel internal wiring to facilitate easy tracing of the wiring.
- c) Each IED and meter shall be prominently marked. All relays and other devices shall be clearly marked with manufacturer's name, type, serial number and electrical rating data.
- d) Labels both external & internal shall be made on non-rusting metal preferably Aluminium anodized one. Labels shall have white letters on black background. The lettering size shall be 6 mm for panel designation and minimum 3mm for device labels. The label designations shall be subject to the Purchaser's approval.
- e) Each switch shall bear clear inscription identifying its function e.g. 'BREAKER' 52A' etc. Similar inscription shall also be provided on each device whose function is not otherwise defined.

If any switch device doesn't bear this inscription, separate name plate giving its function shall be provided for it. Switch shall also have clear inscription for each position indication e.g. 'Trip-Neutral-Close', 'ON-OFF', 'R-Y-B OFF'

5.15 EARTHING

a) All panels shall be equipped with a separate earth bus securely fixed along with the inside base of panels. When several panels are mounted adjoining each other, the earth bus shall be made continuous. Provision shall be made for future extension of the earth bus. Provision shall be made on the earth bus bars of the end panels for connecting the same to the earthing grid.

b) An earthing conductor of 40x10 sq mm Cu (minimum), shall be provided extending the whole length of switchgear and control gear to sustain the Rated short time withstand current. Each equipment mounted in the panel shall be directly earthed to this earth bus by distinct connections. Separate earth busbar to be run along switchgear for protection earthing of relays and communication equipments and to be insulated from the frame.

c) Earthing trolley shall be provide separately to earth the bus bar and cables adequate interlocking facilities such that earthing trolley can't be 'ON' when bus bar I cable is energized and it should have only mechanical closing facility. The offered trolley shall be of sufficient capacity to carry the current. One bus bar earthing truck & one cable earthing truck shall be supplied per switchboard. In case the sizes are different for Incoming and Outgoing, separate earthing trucks shall be provided.

d) All metallic cases of relays, instruments and other panel mounted equipments shall be connected to the earth bus by independent copper wires of size not less than 2.5 sq.mm. The colour code for earthing wires shall be green. VT and CT secondary neutral or common lead shall be earthed at one place only or the terminal blocks where they enter the panel. Bidder shall provide separate electronic earthing for all IEDs.

e) Looping of earth connections, which would result in loss of earth connection to the other devices when the loop is broken, shall not be permitted. However, looping of earth connections between equipment to provide alternative paths to earth bus shall be provided. -

The bidder shall further refer to protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL.

5.16 PAINTING

All sheet steel work shall be phosphate in accordance with the IS: 6005 "Code of practice for phosphating iron and steel". It should follow the seven tank process. Oil, grease, dirt and scarf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water rinsing with a slightly alkaline hot water and drying. After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate waling shall be sealed with application of two coats of ready mixed, stoved type zinc chromate primer. The first coat may be "flash dfied" while the second coat shall be stoved. Thereafter an established painting procedure like electrostatic painting shall be followed for powder coating the panel. The colour shade shall be Siemens grey RAL 7032.

5.17 GALVANIZING

- a) All galvanizing shall be carried out by the hot dip process, in accordance with Specification ISO:1460 or IS: 2629 amended to date. However, nut, bolts, washer made of stainless steel of grade: 304. . The zinc deposition should not be less than 705 grams/meter square of the galvanized surface area/100 microns/6 dips .The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the galvanic bath, which could have a detrimental effect on the durability of the zinc coating,
- b) After galvanizing no drilling or welding shall be performed on the galvanized parts of the equipment except that nuts may be threaded after galvanizing.
- c) To avoid the formation of white rust, galvanized material shall be stacked during transport and stored in such a manner as to permit adequate ventilation. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization. The galvanized steel shall be subjected to tests as per IS-2633 and BS:729 amended to date.

5.18 SYSTEM ARCHITECTURE AND COMMUNICATION -

The bidder shall refer to protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL for new grids based on IEC-61850 protocol for System architecture and communication requirements.

5.19 DATA CONCENTRATOR



Specification No: ENG-HV-2008 (R01)

Specification Name: Technical Specifications for 11KV Indoor Switchgear Panel

The bidder shall refer protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL for new grids based on IEC-61850 protocol for Data concentrator requirements.

5.20 CONTROL, METERING AND PROTECTION

Incomer switchgears should be provided with separate protection unit and separate metering & control unit. Outgoing feeder switchgears (including switchgears for capacitor & local transformer) should be provided with combined protection, metering & Control unit. All these units shall be communicable with Purchaser's SCADA on IEC-61850 protocol without any change & modification of hardware,

The bidder shall further refer protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL for new grids based on IEC-61650 protocol for Control, metering and protection requirements.

5.21 REMOTE MONITORING AND MAINTENANCE STATION

The bidder shall refer to protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL for new grids based on IEC-61850 protocol for Remote monitoring and maintenance requirement

5.22 CONTROL PHILOSOPHY

The bidder shall refer to protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL for new grids based on IEC-61850 protocol for Control philosophy requirement.

5.23 OPERATIONAL PHILOSOPHY

The bidder shall refer to protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL for new grids based on IEC-61850 protocol for Control philosophy requirement.

5.24 PROTECTION PHILOSOPHY

The bidder shall refer to protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL for new grids based on IEC-61850 protocol for Protection philosophy requirement.



Specification No: ENG-HV-2008 (R01)

**Specification Name: Technical
Specifications for 11KV Indoor
Switchgear Panel**

6. NAMEPLATE & MARKINGS

All the component and operating devices of the switchgear shall be provided with durable, and legible nameplates containing all technical parameters. Name plate shall be embossed with "PO no. with date, "Property of TPCODL/TPNODL/TPSODL/TPWODL", along with the following information:

- i) Manufacturer's Name or Trade Mark ii)
Type designation or serial no.
- iii) Applicable rated values iv)
No. of the relevant standard..
- v) Name of the substation and feeder and reference drawing number

The name plate of each functional unit shall be legible during normal service. The removable parts, if any shall have a separate nameplate with the data relating to the functional units they belong to, but this nameplate need only be legible when the removable parts is in removed Position.

CT & PT details to be mentioned at the rear cover of the switchgear panel

7. TESTS

All the Routine and acceptance tests shall be carried out in accordance with the relevant IS/IEC standards. All routine/acceptance tests shall be witnessed by the Purchaser / his authorized representative, Also all components & tools should have been type tested as per relevant IEC/IS. All the Type Tests as per latest IS / IEC should have been carried on the switchgear. For Type test of Numerical relays, control IEDs, and communication equipment, and Factory acceptance test, Hardware Integration test and Integration System tests, kindly refer Clause No- 19, 25, 26, 27 and 28 of Automation Philosophy for new grids based on IEC-61850 protocol', Document no- W03-Aut- Gen- 61650-01. For type tests of meters, relevant IS has to be followed. Following tests shall be carried out on the switchgear in addition to any other specified in the IS/IEC:

Routine Test:

Dielectric Test on main and control circuits.

Dimensional and visual checks Mechanical

Operation tests:

Tests of auxiliary electrical devices

Verification of correct wiring
Measurement of resistance of main circuit
Partial Discharge Measurement Tests
after erection on site.

Type Tests

- a) Tests to verify the Insulation level of the equipment including tests at power frequency test voltages on auxiliary circuits: (Dielectric Tests)
- b) Tests to prove the temperature rise of any part of the equipment and measurement of resistance of the main circuit.
- c) Tests to prove the capability of the main and earthing circuits to be subjected to the rated peak and the rated short-time withstand currents.
- d) Tests to prove the making and breaking capacity of the included switching devices.
- e) Tests to prove the satisfactory operation of the included switching devices and removable parts. (Mechanical Operation tests)
- f) Tests to verify the protection of persons against approach to live parts and contact with moving parts.
- g) Tests to verify the protection of persons against dangerous electrical effects.
- h) Electromagnetic Compatibility- Emission and Immunity tests (for secondary system)

Special Type Test

- a) Tests to verify protection of the equipment against external effects due to weather.
- b) Tests to verify the protection of the equipment against mechanical damage.
- c) Tests to assess the effects of arcing due to an internal fault. It shall withstand fault current of 25 kA for 1 sec.
- d) Tests to detect certain defects in the solid Insulation of the equipment by the measurement of partial discharges.
- e) However, in case any type test is not carried out/ carried out at In-house laboratories, the same shall be decided for acceptance as per the mutual agreement between the Purchaser and Bidder

8. TYPE TESTS CERTIFICATES

The bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI/ ERDA/International Labs as per the relevant standards. Type test should have been conducted in certified Test Laboratories during the period not exceeding 10 years from the date of opening the bid. In the event of any discrepancy in the test reports i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to TPCODL/TPNODL/TPSODL/TPWODL.

9. PRE-DISPATCH INSPECTION

Equipment shall be subject to inspection by a duly authorized representative of the purchaser. Inspection may be made at any stage of manufacture at the option of the purchaser and the equipment if found unsatisfactory as to workmanship or material is liable to rejection. Supplier shall grant free access to the places of manufacture to Purchaser's representatives at all times when the work is in progress. Inspection by the Purchaser or its authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by Purchaser.

Following documents shall be sent along with material

- i. Test reports
- ii. MDCC issued by Purchaser
- iii. Invoice in duplicate
- iv. Packing list
- v. Drawings & catalogue
- vi. Guarantee / Warrantee card
- vii. Delivery Challan
- viii. Other Documents (as applicable)

10 INSPECTION AFTER RECEIPT AT STORE

The material received at Purchaser store will be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Project Engineering department.

11 GUARANTEE

Supplier shall stand guarantee towards design, materials, workmanship & quality of process/ manufacturing of items under the contract for due and intended performance of the same, as an integrated product delivered under this contract. In the event any defect is found by the Company up to a period of 48 months from the date of commissioning or 60 months from the date of last supplies made under the contract, whichever is later, supplier shall be liable to undertake to replace/rectify such defects at his own costs. within mutually agreed timeframe, and to the entire satisfaction of the Company, failing which the Company will be at liberty to get it replaced/rectified at supplier's risks and costs and recover all such expenses plus the Company's own charges(20% of expenses incurred), from the supplier or from the "Security cum Performance Deposit" as the case may be.

Supplier shall further be responsible for free replacement for another period of THREE years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by the Company. Also refer protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL for new grids based on IEC-61850 protocol

12 PACKING

Supplier shall ensure that all equipment covered under this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit

13 TENDER SAMPLE

Not applicable.

14 QUALITY CONTROL

The bidder shall submit with the offer Quality assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and fully assembled component and equipment after finishing. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. •The Purchaser's/ Consultant's engineer shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.

15. MINIMUM TESTING FACILITIES

Supplier / Manufacture shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards.

16. MANUFACTURING ACTIVITIES

The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer. This bar chart will have to be submitted within 15 days from the release of the order.

17. SPARES, ACCESSORIES AND TOOLS

17.1 SPARES:

Bidder should quote unit rates for following mandatory spares along with the bid. However, the exact quantity of these shall be as per the BOO attached with the tender.

Description

- a) Trip Coil
- b) Closing coil
- c) Spring charging motor
- d) Vacuum interrupter
- e) T-N-C Switch
- f) Local / remote selector switch
- g) Tulip/ Finger contact
- h) Indication lamps
- i) Auxiliary switches
- j) LED for cable charge indication

In addition to above bidder shall submit recommended list of spares for 3 years of operation, if any with unit prices and recommended quantity.

For other requirements of Training, Support, Services, Maintenance and Spares, bidder shall refer protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL for new grids based on IEC-61850 protocol

17.2 SPECIAL TOOLS & GAUGES:

A list of complete set of special tools and gauges required for erection & maintenance and installation procedure should be submitted.

The Bidder shall give an assurance that special maintenance tools & tackles and spares will continue to be available through the life of the equipment, which shall be 25 years minimum. However, the supplier shall give a minimum of 12 months notice in the event of plan to discontinue manufacture of any component used in this equipment.

Any special maintenance tools & tackles apparatus, parts or tools shall be subject to the same specification, tests and conditions as similar material supplied under the Contract. They shall be strictly interchangeable and suitable for use in place of the corresponding parts supplied with the plant and must be suitably marked and numbered for identification. Spanners and other maintenance equipment provided under this contract shall not be used for the purpose of erection

18 DRAWINGS:

Following drawings & Documents shall be prepared based on Purchaser's specifications and statutory requirements and shall be submitted with the bid: a) Completely filled-in Technical Parameters.

- b) General description of the equipment and all components including brochures
- c) General arrangement drawings
- d) Single Line Diagram
- e) Bill of material
- f) Type Test Certificates
- g) Experience List
- h) Foundation fixing drawings.

Drawings/documents to be submitted after the award of the contract:

Sl No	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	✓		✓
2	General Arrangement drawings	✓		✓
3	Single Line including Instrument Transformers Diagram	✓		✓
4	Typical Mimic diagram	✓		✓
5	Schematic / inter logic diagrams	✓		✓
6	Bill of Material and description of system components	✓		✓

7	Foundation Plan & loading details	✓		✓
8	Technical Brochures/Manual/Catalogues/drawings for DC, BCU meters, relays, switches, lamps etc.	✓	✓	✓
9	Control and Operational Philosophy of Automation		✓	✓
10	Input / Output List		✓	✓
11	Cable Schedule, Wiring Interface diagrams & interconnection diagram		✓	✓
12	Programming language manual		✓	✓
13	Details of the Communication protocol & interoperability list for the future interfacing,		✓	✓
14	Equipment wide detailed circuit diagram		✓	✓
15	Electronic earthing scheme		✓	✓
16	Configuration diagram with functional write up		✓	✓
17	I/O mapping		✓	✓
17a	Building requirement and earth math design	✓	✓	✓
18	3 nos. of working drawings		✓	✓
19	6 No of as built drawing		✓	✓
20	Relay Coordination Scheme		✓	✓
21	Installation/Commissioning Manual		✓	✓
22	Instruction for use		✓	✓
23	Transport/Shipping dimension drawing		✓	✓
24	QA/QC Plan	✓	✓	✓
25	Routine, Acceptance and Type Test Certificate	✓	✓	✓

The bidder shall further refer protection & automation specifications of TPCODL/TPNODL/TPSODL/TPWODL for new grids based on IEC-61850 protocol for providing documents after award of contract.

All the documents & drawings shall be in English language.

Instruction Manuals: Bidder shall furnish two softcopies and four (4) hard copies of nicely bound manuals (In English language) covering erection and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices.

19. GUARANTEED TECHNICAL PARTICULARS

S.No	Description	To be Furnished by Bidder
19.1	SWITCHGEAR PANEL	

19.1.1	Architecture		
19.1.2	No. of Phases		
19.1.3	Rated Capacity		
19.1.4	Rated Voltage		
19.1.5	Service Voltage		
19.1.6	Rated Frequency.		
19.1.7	Rated impulse withstand voltage		
19.1.8	Rated Power Frequency Withstand Voltage		
19.1.9	Rated short time withstand current		
19.1.10	Peak withstand current rating		
19.1.11	Bus bar continuous rated current		
19.1.12	Bus bar material		
19.1.13	Internal Arc Protection		
19.1.14	Degree of protection for enclosure / partitions/ for meters, relays and BCU		
19.1.15	Normal service condition		
19.1.16	Temperature Rise		
19.1.17	Dimension of Switchboard (Max : W:800mm/D:1850mm		
19.1.18	Internal Arc Protection		
19.1.19	IP Rating (Enclosure/Partition/Meters and Relay)		
Item/Panel reference		Incomer	Bus-coupler
19.3	Circuit Breaker Type/Rating(A)		
19.4	Copper Busbar Rating (A)		
19.5	Detals of XLPE cables		
19.6.1	CTs (Cast Resin type)	Quantity	
		Thermal Withstand Capacity	

		Ratio		
		Core-1 (metering)		
		Core2 (protection)		
		Core 3 (PS Class)		
19.7	CB control switch, ON/OFF push buttons Indication lamps, Auto trip, L/R switch, TNC switch, Heater, Trip Coils X 2 Nos , Closing coils, Operation counter & spring charged mechanism etc.			
19.8	Bay Control & Protection Unit .(BCPU)CB Control function and. Measurement of Three phase currents & voltages, PF, Active, Reactive (Import & export Lag & Lead) & Apparent energy and power, Frequency etc .			
19.9	Digital Multi Function Meter			
19.10.	Protection relays (TCS Pre Close /Post Close Supervision) for 2 Trip Circuits	Numerical communicable relay with over current, earth fault, sensitive earth fault, breaker failure, negative sequence current and overload		
		DC fail back-up with additional trip coils in CB		

		Anti-pumping relay		
		Electrically reset type high' speed relay for tripping. (The trip relay Shall be supervised).		
19.11	Trip Alarm scheme with Hooter, Accept/Reset PB			
19.12	Cable charged indication			
19.13	Panel illumination in Relay compartment			
19.14	Circuit Name-Plate			
Bus PT Panel				
19.15	Bus PT	Quantity		
		Primary windings		
		Secondary winding(s)		
		Core-1		
		Core-2		
Item / Panel reference			Outgoing Feeder	Capacitor Bank
19.16	Ckt. Breaker Type/Rating(A)			
19.17	Copper Bus bar - Rating(A)			
19.18	Details of XLPE cables			
19.19	CTs (Cast	Quantity		
	Resin type)	Thermal withstand capacity		
		Ratio		
		Burden/Class		
		Core-1		
		Core-2		

19.2	LV components - CB control switch, ON/OFF push buttons Indication lamps, Auto trip, L/R switch, TNC switch, Heater, Trip Coils X 2 Nos, Closing coils, Operation counter & spring charged mechanism etc			
19.21	Bay Control & Protection Unit (BCPU) CB control and protection function & Measurement of Three phase currents & voltages, PF, Active, reactive (Import & export Lag & Lead) & Apparent energy and power, Frequency etc			
19.22	TVM Smart Energymeter (Meter not in scope)		Wiring upto TTB	Wiring upto TTB
19.23	Protection relays	Numerical communicable relay with over- current, earth fault, sensitive earth fault, breaker failure, negative sequence & overload		
		Anti-pumping		
		Electrically reset type: high- speed relay for tripping.		
		(The trip relay shall be supervised).		
19 24	Cable charged indication			
19.25	Panel illumination in Relay Compartment			
19.26	Circuit Name-Plate			
19.27	OTHERS			
a)	Cable charge indication for all panels			

b)	Cable side earthing arrangement	
c)	Busbar side earthing arrangement	
e)	Auxiliary Voltages for charging motor, relays & heaters -50 & 220 V DC	
f)	TNC Switch	
g)	Local / Remote switch	
h)	Indication Lamps CB ON/OFF	
i)	Indication Lamps CB Auto Trip	
i)	Indication Lamps for CB Test / Service positions	
k)	Spring charged indication	
l)	Trip ckt. supervision scheme	
m)	MCB for AC	
n)	MCB for DC	
o)	MCB for space heater	
p)	MCB for VT's	
q)	Trip alarm scheme with hooter, Accept/Reset PB etc	
r)	Panel anti-condensation heater with thermostat.	
s)	Panel illumination lamp with switch	
t)	5 A, 3 pin socket.	
u)	Makes of indicating lamps	
v)	Makes of MCB	
w)	Wiring of breaker auxiliary contacts up to terminals	
x)	Makes for Fuses I Fuse bases	
y)	CB handling trolley	

**20. SCHEDULE OF DEVIATIONS
(TO BE ENCLOSED WITH TECHNICAL BID)**

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:

S. No	Clause No.	Details of deviation with justifications

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Signature

Designation