18.03.2026

Corrigendum No. – 1

Tender Enquiry No- TPSODL/OT/2025-26/2500001151

Work Description - Rate contract for Engineering, Supply, Erection and Commissioning of new 33/11KV PSS along with associated 33KV Lines &11KV Lines under Govt Funded Scheme ODSSP Phase -VI at location- Gaiba, PKED division, Rayagada Circle.

The technical specification of **33kV & 11kV indoor switchgear panel** has been revised and the revised technical specifications are attached herewith for reference. These technical specifications shall supersede the earlier shared technical specifications in tender document.

Warms Regards,

Shubhranshu Shekhar Sahu

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Note-This document does not require signature.

STANDARD TECHNICAL SPECIFICATION COVER SHEET

Specification No. : ENG-EHV-1011-R1

Specification Name : Specification of 33KV Indoor Switchgear Panel-R1

R1

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18-03-2026	18-03-2026	18-03-2026	18-03-2026

TPCODL TPNODL TPWODL TPSODL	**Specification No: ENG-EHV-1011-R1** **Specification Name: Technical Specification of 33KV Indoor Switchgear Panel -R1**

CONTENTS

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 33 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 the latest editions of the following standards/IEC and shall conform to the regulations of local statutory authorities. For standards relevant to Automaton Philosophy & protection philosophy, kindly refer the TPCODL/TPNODL/TPSODL/TPWODL, " Automation specifications & Protection specification ".

APPLICABLE STANDARDS		
a	IS 2705/IEC 60044-1	Current Transformers
b	IS 3156/IEC 60044-2	Voltage Transformers
c	IS 3427/IEC 62271-200	HV switchgear and control gear —AC Metal Enclosed switchgear and control gear for voltages above 1 kV and up to and including 52 kV
d	IS 694	PVC insulated cables for working voltage up to and including 1100V
e	IS 2629	Recommended practice for Hot Dip Galvanizing of Iron & Steel.
f	IS 2633	Tests for uniformity of zinc coating
g	IS 5578	Guide for marking of insulated conductors

h	IS 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals
i	IEC 60060	High-voltage test techniques
j	IEC 60255-3	Electrical relays-Single input energizing quantity measuring relays with dependent or independent time
k	IEC 60255-27	Measuring relays and protection equipment-Part-27 Product safety requirements
l	IEC 60265-1	High voltage switches-Part 1: Switches for rated voltages above 1 kV and less than 52 kV
m	IEC 60282-1	High voltage fuses
n	IEC 60529	Degrees of protection provided by enclosures (IP Code)
o	IEC 60694	Common specifications for high voltage switchgear and control gear standards
p	IEC 60947	Low voltage switchgear and control gear
q	IEC 61010-1	Safety requirement for electrical equipment for measurement and laboratory use
t	IEC 62271-10	HV Switchgear and Control Gear- Alternating current disconnector and earthing switches
u	IEC 62271-100	High Voltage alternating current circuit breaker

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 and dust in suspension during the dry months and is subjected to fog in cold months.

4. GENERAL TECHNICAL REQUIREMENTS

GENERAL TECHNICAL REQUIREMENTS		
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	1500 MVA
4.1.4	Rated Voltage	36 kV
4.1.5	Service Voltage	33 kV
4.1.6	Rated Frequency	50 Hz
4.1.7	Rated Lightning Impulse withstand voltage	170 kVP
4.1.8	Power Frequency Withstand voltage	70 kV rms
4.1.9	Rated short time withstand current	25 kA for 3 sec
4.1.10	Peak withstand current rating	62.5 kA
4.1.11	Normal service condition	Indoor
4.1.12	Internal arc Protection	IAC-A FLR as per IEC 62271-200, Shall withstand 25 kA for 1 sec
4.1.13	Degree of Protection for enclosure/Partitions /For meters , relays and BCU	IP4X/IP4X/IP5X or equivalent to completely protect against dust ingress. Protected in such a way that meters/relay performance shall not be affected due to small dust also.

4.2	**BUS BAR**	
4.2.1	Type	Extensible on both sides
4.2.2	Bus bar continuous rated current	1250 A
4.2.3	Bus bar material	Copper with Silver Coated (On joint Areas)
4.2.4	Rated short time withstand current	25 kA for 3 sec
4.2.5	Max current Density for Bus bar	1.6 A/Sq mm
4,2.6	Max. Permissible temp. rise at rated normal current	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 enclosure and covers shall not exceed 30 K and in case, they are not required to be touched during normal operation, the limit shall be raised by 10 K.
4.2.7	Minimum Clearance	Phase to phase-320 mm Phase to earth – 240 mm
4.2.8	Material for Busbar Support: Bidder to Specify	To be provided by Bidder
4.2.9	Material for phase barriers	To be provided by Bidder
4.3	**CIRCUIT BREAKER**	
4.3.1	Application/Class	Indoor
4.3,2	Type of circuit	Vacuum ,draw out type
4.3.3	No. of poles	3
4,3.4	Rated voltage	36 kV rms
4.3.5	Rated Insulation Level	
4.3.5.1	Lighting impulse	170 kV peak
4.3.5.2	One minute power frequency withstand	70 kV rms
4.3.6	Rated Frequency	50 Hz
4.3.7	Rated normal current	1250 A
4.3.8	Rated operating sequence	O-t-CO-T-CO (t=0.3sec , T=3 min)

4.3.9	Max. Spring Charging Time of Motor	10 sec
4.3.10.	Max. Power consumption of Trip &close coils	200 W
4.3.11	Rated load breaking current (sym)	25 kA rms
4.3.12	Rated short circuit withstand current	25 kA (rms) for 3 sec
4.3.13	Rated short circuit making current	62.5 kA
4.3.14	Breaker Duty	M2,E2,C2
4.4	**OPERATING AUXILIARY VOLTAGES**	
4.4.1	Trip Coil	48/24 V dc (TBD during detailed Engg.)
4.4.2	Closing Coil	48/24 V dc (TBD during detailed Engg.)
4.4.3	Spring Charging Motor (Universal Motor)	240 V AC
4.4.4	No. of spare auxiliary contacts	6N0 + 6NC

4.5	**VOLTAGE TRANSFORMER**			
4.5.1	Location	Each bus-section		
4.5.2	Type	Draw Out ,		
4.5.3	Ratio	33/rt3 /110/rt3-110/rt3-110/rt3		
4.5.4	Core Details	Core-I	Core-II	Core-III
i)	Accuracy Class	3P	3P	0.2
ii)	Burden	50 VA	50 VA	30 VA
4.6	**CURRENT TRANSFORMER**	Note: CT Ratio subject to change during detailed Engineering		
4.6.1	Location	Line , B/C and Transformer		
4.6.2	Ratio	200-400-800/1-1-1 A or 100-200-400/1-1-1A (TBD during detailed engg.)		
4.6.3	Burden & Class(Metering and Protection)			
i)	Core-I	0.2S , 10VA; Isf<16		

ii)	Core-II	5P20 , 10VA
ii)	Core-III	PS; Vkp>=250 at Centre Tap V; Im<=100mA at Vkp/2; Rct<6 ohm

5.GENERAL CONSTRUCTIONS

5.1.1. 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 bracing. The switchboard panels should comply with relevant 15/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, 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 .The switchgear shall be complete with all necessary wiring fuses, auxiliary contacts terminal boards etc.

5.1.2. Panels shall have structural steel frame-work 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

5.13. Panels shall consist of a front portion with equipment mounted on it and wiring access from rear. All doors, cutouts and removable covers shall be gasketed all round by neoprene cork gaskets. Each panel section shall be provided with Hygrotherm with space heater (in breaker, bus bar, LT chamber and cable compartment).. with ON/OFF switch. Hygrotherm shall be communicable type with Temperature & humidity data on central server through RS485 port and one 15A single phase plug point with ON/OFF switch. LED lamp shall be provided with door switch for each panel for cubicle interior illumination.

5.1.4. 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 3 mm in thickness, for fixing the cable glands, the size of which shall suit the purchaser's external cables to the panels. Cable glands shall be Double Compression type and made of brass.

5.1.5 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 900mm from the bottom of the panel. The center lines of relays, meters shall not be 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.

5.1.6 All components of the same rating and construction which may need 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.

5.1.7 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 non draw-out type and safeguarded 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.

5.1.8. All the HV design shall ensure conformity to IES-62271-200 Appendix 'A' and must be Type tested for Internal Arc Test. It shall withstand 25 kA for 1 sec. The suppliers shall submit Type Test report from CPRI/ERDA to prove the above.

Auxiliary and control equipment installed on the panel shall be suitably protected against disruptive discharge from main circuit. Buses shall be insulated with heat shrinkable insulating sleeves, wherever bare conductor is employed.

5.1.9. 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.

5.1.10. All indicating lamps shall be provided with suitable series resistors and bulbs shall be replaceable from the front of the panel. 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 color caps shall be furnished 10% in excess of actual numbers used for each color.

5.1.12 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 at the panel as well as at the SCADA. All the relays and auxiliaries shall have DC auxiliary supply. Identification of components shall be in agreement with the indication on the winding diagrams and drawings. If a component is of the plug-in type, an identification mark should be placed in trunking and it should be suitable to accommodate 20% wiring for future modifications.

5.1.11 Control supply in individual bay have to be distributed through MCBs of suitable rating for individual control function like:

- Protection Relay
- Trip circuit -1
- Trip circuit -2
- Close circuits
- Spring charging Circuit
- Heating and Lighting Circuit

- Indication circuit
- Annunciation circuit

5.1.12. MCB shall be rated for 10kA short circuit rating. It shall be quick make, quick break, independent manual type with trip free feature. The DC MCBs and AC MCBs ratings shall be separately mentioned and the panel having AC MCB of higher in lieu of DC MCB shall not be accepted.

MCB shall have the following:

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

5.1.13. 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 (+1-) 10% continuously.

5.1.14. 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.

5.1.15 Capacitor bank switching device shall be provided with suitable gate interlock mechanism with castle key along with timer to ensure safety.

5.1.16 Each switchgear panel shall have 20% spare terminals. All equipment 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.

5.1.17 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 to ENG-Automation specifications & protection specifications for constructional and other requirements.

5.1.18 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.

5.1.19 PQM meter to be considered of suitable class in section excluding bus coupler.

5.2 Circuit Breaker

5.2.1 The Circuit breakers shall be Vacuum, 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 switchgear panels are accessible. Withdrawal of the breaker shall 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 all the 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. The spare contact of breakers, Test/ service switches to be wired up to terminals.

5.2.2 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 10 sec in case of Vacuum Circuit Breaker. 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.

5.2.3 The Breakers shall be capable of Making & Breaking the short time current in accordance with the requirement of IEC 62271-100 and latest amendment thereof and shall have 3 phase short circuit current capacity of 1500 MVA. The continuous current rating of breaker shall not be less than 1250A. For each switchboard one no. 1250 A CB handling trolley shall be supplied.

5.2.4 Comprehensive interlocking system to prevent any dangerous or inadvertent operation shall be provided. Isolation of circuit breaker from bus bar or insertion into bus bar shall only be possible when the breaker is in the open position.

5.2.5 Vacuum Interrupter, Breaker and Switchboard should be of same make.

5.3 BUS BARS AND CONNECTORS

5.3.1 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 bars 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 provided in the switchgear. The bus bars shall be extensible on both sides.

5.3.2 Adequate clearance between phases and between phase & earth 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-62271/60060 and the amendments thereof.

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

5.3.4 All bus bar joints and all tap-off connections from the main horizontal bus bars shall be provided with removable FRP shrouds.

5.3.5 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.

5.3.6 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 1500 MVA and be of the single-phase type , with separate core for metering, protection and differential . For CT/PT circuits, drop type links to be provided and lugs shall be ring 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 Transformers

The Voltage Transformer shall be of epoxy cast resin type and mounted horizontally on a draw-out type trolley and protected by HRC fuses on both primary and secondary sides. Bus VTs shall be provided in each bus section. The VT shall have Metallic safety shutters, which will close in the event of VT withdrawal and ensure that no live components inside the 33 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

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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 Purchaser. 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.

e) BCPU Relay should have at least 24BI and 10BOs.

f) Two number of TCS to be provided / should be included in the Numerical relay.

g) An ANSI 81 frequency relay shall initiate the trip, which must drive an ANSI 86 master-trip (lock-out) relay to ensure breaker remains open until manual reset.

The bidder shall further refer to Purchaser's protection and automation philosophy.

5.7 DC SELECTION 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 scope. DC MCB OF 25 A rating with 'C/K' characteristics shall be preferred.

5.8 TERMINAL BLOCKS

5.8.1 The terminal blocks shall be 1100 V grade, 10A rated, one piece moulded, complete with insulated barriers, stud type terminals, washers, nuts. and identification strips. The terminal blocks for CT shall be of disconnecting type. 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,

5.8.2 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 150 mm.

5.8.3 All spare contacts and terminals of the panel mounted of the panel mounted equipment and devices shall be wired to terminal blocks. All the TB's shall be of single Decker type

The bidder shall further refer to Protection specifications & Automation specifications.

5.9 ANTI-CONDENSATION:

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1) Strip type space heaters of 100 W capacity 1 nos shall be provided in breaker compartment, and 200 W capacity 1 nos shall be provided in cable compartment, busbar chamber, LV chamber in each panel to prevent moisture condensation on the wiring and panel mounted equipment. Space heaters shall be rated for 240 V +/- 10 %, 1 phase, 50 Hz supply. Heaters inside the panels shall not be mounted close to the wiring or any panel mounted equipment. Heaters shall be complete with either miniature circuit breakers or with isolating switches, HRC fuse on phase and link on the neutral of the heater supply. Adjustable type thermostat to be supplied too (30 to 110 deg Celsius)
2) An adjustable type hygrotherm (0 to 100% Humidity) shall be provided in the heater control circuit. The indication shall be provided for monitoring the healthiness of Space heater. Heater shall have humidity control and shall be arranged to cut off when cubicle internal humidity exceeds safe value. 'Heater ON' indication shall be also provided. Also, door limit
switch and internal lighting shall be provided for LV compartment

5.10 INTERIOR LIGHTING AND RECEPTACLES

Each panel shall be provided with a compact fluorescent lighting 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.

Each panel shall be provided with a 240 V, 1 phase, 50 Hz, 15 A, 5 pin receptacle with switch.

The receptacle with switch shall be mounted inside the panel at a convenient location.

5.11 POWER AND 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 and space heater circuits. The incoming and sub-circuits shall be separately provided with MCBs. Supply monitoring arrangement shall be provided. Selection of the MCB ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall also be protected by MCBs.

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 invert/converter, etc . However it is desired that no other control voltage shall be prevalent in the panel.

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. Fuse carrier base shall have imprints of the fuse rating and voltage.

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. 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 sqmm per lead ii) CT circuits : 4 sqmm per lead iii) PT circuits : 4 sqmm per lead

c. Longitudinal troughs extending throughout the full length of the panels shall be provided for Inter panel winding, for AC and DC supplies, PT circuits, annunciator 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 soldieries crimping type of (ring type lugs for all CT & 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 BCU/BCPU or DC as per the requirement. Network cable required to communicate

BCU/BCPUs 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 1/Ts 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.

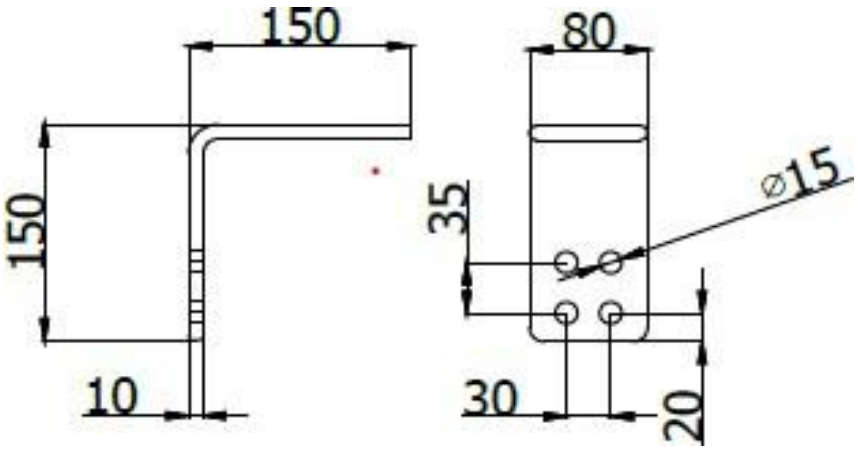
Switchgear shall have 20% terminals as spare terminals in each panel & should be uniformly distributed in all the terminal blocks.

5. 13 CABLE TERMINATION

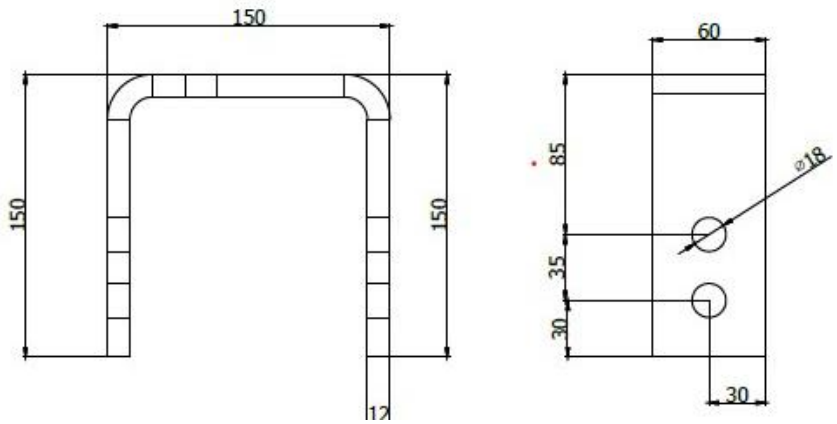
POWER Cable –

a) There should be provision of connecting cables back-to-back with necessary clearances in outgoings.
b) There should be provision of connecting cables back-to-back with necessary clearances in each of Incomer.
c) There should be proper approach for manpower to work inside the cable compartments of incomer and outgoing section. Ample space for connection for these cables shall be provided at the rear of the switchboards.
d) In order to avoid accidental contact in the cable compartment while carrying out inspection by opening the rear cover, a removable expanded metal barrier shall be provided in the cable compartment.
e) Unless otherwise specified, the power cable shall enter the switchboard from the bottom.
f) Non-magnetic cable gland plates shall be provided for feeders wherever single core cables are used.
g) 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.
h) The switchboard shall be supplied complete with supports for clamping outgoing and incoming cables. The head-room shall be available between cable gland plate and terminal lugs.
i) In case the standard panel depth cannot accommodate the specified no. of cables, a rear extension panel of full height shall be provided. An earth strip shall also be brought to this extension panel.
j) A rear viewing window shall be provided on the cable chamber rear cover to inspect cable connection without opening rear cover. The material of this window shall be the same as that used in breaker chamber. Rear side of switchgear panel shall have bolted covers in sections.
k) Extension cable chamber to accommodate 3 run 1CX1000 cable for incomer panel and shall be openable from 3 sides in order to access cables.
l) Incomer panel and bus section panel cable termination shall be suitable for 3Rx1Cx1000 Sq.mm per phase & Outgoing 2Rx3Cx400, (Cable size to be as per tender BOQ only/to be provided during detailed engineering only)
m) Cable dropper details shall be as per below:

Incomer / Bus coupler with cable termination:



Outgoing / Capacitor / Local transformer:



n) No Cable dropper shall foul with base frame / panel joints.

Control Cable –

a) The purchaser's 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 and crimp type tinned copper lugs, supporting clamps and brackets wiring troughs, etc. for cables shall be included in the bidder's scope of supply.

b) All color 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 color caps shall be furnished 10% in excess of actual numbers used for each color.

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 with equipment designation engraved with tag numbers corresponding to the ones shown in the panel internal wiring to facilitate easy tracing of the wiring.

c) Each lED 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 Al anodized one. Labels shall have white letters on black background. The lettering size shall be subject to **P**urchaser'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 defined. If any switch device doesn't bear this inscription for each position indication e.g. 'Trip-Neutral-Close', 'ON-OFF', 'R-Y-B-OFF' etc.

f) Danger notice plate as per IS to be provided on each panel.

Section differentiation marking, bus differentiation and phase differentiation marking shall be provided a visible colour coding as per Indian coding will be preferred.

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 40*10 sq mm Cu (min) 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. Bidder shall provide separate electronic earthing for all LED's. Separate

earth bus bar to be run along switchgear for protecting earthing of relays and communication equipment and LEDs and shall be insulated from the frame.

c) Earthing trolley shall be provided separately to earth the bus bar and cables adequate interlocking facilities such that earthing trolley can't be 'ON' when bus bar/cable is energized and it should have only mechanical closing facility. The offered trolley shall be of sufficient capacity to carry the peak fault 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 equipment shall be connected to the earth bus by independent copper wires of size not less than 4.0 rnm for VT and CT secondary neutral or common lead shall be earthed at one place, preferably at the terminal blocks where they enter the panel. The color coding for earthing wires shall be given. 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 connections between equipment to provide alternative paths to earth bus shall be provided.

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 swarf 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 coating shall be sealed with application of two cots of ready mixed, staved . 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 hot dip process, in accordance with IS 2629/ ISO 1460 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/BS 729 amended to date.

5.18 SYSTEM ARCHITECTURE AND COMMUNICATION

The bidder shall refer to Automation specifications for System architecture and communication requirements.

5.19 DATA CONCENTRATOR

The bidder shall refer Automation specifications 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.

Purchaser's SCADA on IEC-61850 protocol without any change & modification of hardware. The bidder shall further refer to Automation specifications for Control , metering and protection requirements. Energy Meter is not in scope of the bidder. A space of 500x350x 250 to be provided for fixing of smart energy meter.

5.21 TRANSFORMER MONITORING UNIT

Please Refer Automation specifications. Space for TMU to be provided in transformer outgoing panel.

5.22 REMOTE MONITORING AND MAINTENANCE STATION

Please Refer Automation specifications

5.23 CONTROL PHILOSOPHY

The bidder shall refer to Automation specifications for Control philosophy requirement.

5 24 OPERATIONAL PHILOSOPHY

The bidder shall refer Automation specifications for Control philosophy requirement.

5.25 PROTECTION PHILOSOPHY

The bidder shall refer to Please Refer Protection specifications for protection philosophy requirement.

5.27. PQM Meter

PQM meters shall be provided by bidders in Transformer outgoing panel. Separate droppable links shall be provided in Metering circuit and space on front door to be provided. Power Quality Meter make are A-Eberle, METRUM, UNIPOWER, Elspec. Communication Port as per the BCPU's communication port. The PQM meter needs to be connected in switch network so that data can be transferred to the central system

5.27. **Asset monitoring system:**

The Asset Monitoring System shall be as per the requirement of the tender. If this system is required a separate line item shall be added in the BoQ, else this system shall not be required. Asset Monitoring System is for Condition Based Predictive Maintenance for the Switchgear Panels. It should have interoperability with other make panels & relays, cyber security, user licenses etc.

Sensor Based Remote Maintenance Care system shall have following sensors:

Sensor Type	Sensor Location
Temperature Sensor	Bus Bar Compartment, Breaker Compartment (Upper Arm and Lower Arm), Cable Compartment
Partial Discharge Sensor	Cable Compartment
Humidity Sensor	Cable Compartment
Arc Sensor	Arc Chamber
Room Temperature and Humidity Sensor	Outside the Panel Board inside the Switchgear room
Pollution or Dust Sensor	Outside the Panel Board inside the Switchgear room

Online condition monitoring, asset health monitoring, data storage, reporting and maintenance support, health prediction of electrical distribution network assets, allow engineers/ managers to gather data and insight that allows them to make more informed

decisions about asset health. It should have Circuit Breaker Parameter Monitoring (Input through protection relay), Substation Monitoring Device/Data Concentrator Unit, Data usage & Analytics with inbuilt algorithm.
All the accessories required for successful operation of this system shall be in the bidder's scope. Bidder has to submit BoQ for this system along with tender bid. The license of this system shall be provided for at least 5 years to minimum 10 persons. The complete architecture shall be as per the requirement of DISCOM.

6. MARKING

AII the components and operating devices of the switch gear shall be provided with durable and legible nameplates containing all technical parameters. Name plate shall be embossed with "RC & PO no. with date", " PROPERTY OF TPCODL/TPNODL/TPSODL/TPWODL " along with the following information

a) Manufacturer's Name
b) Serial Number
c) Type designation or serial number
d) Applicable rated values
e) No. of the relevant standard
f) Warrantee/guarantee clause
g) Scheme name (in case of Govt. funded project)

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 part is in removed position.

7. TESTS

All the Routine and acceptance tests shall be carried out in accordance with the relevant IEC standards. All routine/acceptance tests shall be witnessed by the Purchaser/his authorized representative. All the components should also be type tested as per the relevant standards. All meters and metering elements in KU shall also be routine and type tested as per the relevant standards and shall further be tested at site by the successful bidder. For Type test of Numerical relays , control IEDs , and communication equipment and Factory acceptance test, Hardware Intelligence test and Integration System tests kindly refer Automation specifications & Protection specifications For type tests of meters, relevant IS has to be followed Following tests shall be necessarily conducted on the switchgear in addition to the others specified in IS/IEC :

Routine Test :

1. Dielectric Test on main and control circuits.
2. Dimensional and visual checks
3. Mechanical Operation tests
4. Tests of auxiliary electrical devices
5. Verification of correct wiring
6. Measurement of resistance of main circuit
7. Partial Discharge Measurement
8. Tests after erection on site

Type Tests:

1. Tests to verify the insulation level of the equipment including tests at power frequency test voltages on auxiliary circuits (Dielectric Tests)
2. Tests to prove the temperature rise of any part of the equipment and measurement of resistance of the main circuit
3. 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
4. Tests to prove the making and breaking capacity of the included switching devices
5. Tests to prove the satisfactory operation of the included switching devices and removable parts (Mechanical Operation tests)
6. Tests to verify the protection of persons against approach to live parts and contact with moving parts
7. Tests to verify the protection of persons against dangerous electrical effects
8. Electromagnetic Compatibility — Emission and Immunity tests (for secondary system)

Type Tests for Numerical Relays/ Devices :

1. Dielectric Withstand Test IEC60255-5
2. High Voltage Impulse Test , class Ill IEC 60255-5
3. DC Supply Interruption IEC 60255-11
4. AC Ripple on DC Supply IEC 60255-11
5. Voltage Dips and Short Interruptions IEC 61000-4-11

6. High Frequency Disturbance	IEC 60255-22-1, Class Ill
7. Fast Transient Disturbance	IEC 60255-22-4 Class IV
8. Surge Withstand Capability	IEEE/ANSI C 37.90.1(1989)

Special Test

1) Tests to verify protection of the equipment against external effects due to weather.
2) Tests to verify the protection of the equipment against mechanical damage
3) Tests to assess the effects of arcing due to an internal fault. It shall withstand fault current of 25 kA for 1 sec.
4) Tests to detect certain defects in the solid insulation of the equipment by the measurement of partial discharges.

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.

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8. TYPE TEST 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 Lab 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. The bidder shall grant free access to the places of manufacture to the Purchaser's representatives at all times when the work is in progress. Inspection by the Purchaser or its authorized representatives shall not relieve the bidder 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 the Purchaser. Following documents shall be sent along with material

a) Test reports
b) MDCC issued by TPCODL/TPNODL/TPSODL/TPWODL
c) Invoice in duplicate
d) Packing list
e) Drawings & catalogue
f) Guarantee / Warrantee card
g) Delivery Challan
h) Other Documents (as applicable)

10. INSPECTION AFTER RECEIPT AT STORES

The material received at the Purchaser's 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

Bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this 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 Purchaser up to a period of at least 54 months from the date of commissioning or 60 months from the date of last supplies made under the contract whichever is later, Bidder shall be liable to undertake to replace/rectify such defects at its own costs, within mutually agreed time frame , and to the entire satisfaction of the Purchaser, failing which the Purchaser will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the Purchaser's own charges (@ 20% of expenses incurred) , from the Bidder or from the "Security cum Performance Deposit" as the case may be.

Also refer Please Refer Automation specifications & Protection specifications.

12. PACKING

Bidder 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 : NA

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 engineer or its nominated representatives shall have free access to the manufacturer/sub-supplier's works to carry out inspections.

15. MINIMUM TESTING FACILITIES

Bidder 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 BOQ attached with the tender. a) Trip Coil

b) Closing Coil
c) Spring charging motor
d) T-N-C Switch
e) Local remote selector switch
f) Tulip/Finger contact
g) Indication lamps
h) Auxiliary switches
i) 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 Automation specifications.

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 month 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 specifications, 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 AND DOCUMENTS

Following drawings & documents shall be prepared based on TPDDL 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.
i) Drawings/documents to be submitted after the award of the contract, please refer below table

The bidder shall further refer Automation specifications & Protection specification for providing documents after award of contract.

Instruction Manuals : Supplier shall furnish two softcopies (CD) 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 . Bidder shall also submit one no. soft copy of as-built drawings in pdf. Format

Sr. No.	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	✓		✓
2	General Arrangement drawings	✓		✓
3	Single Line Diagram	✓		✓
4	Typical Mimic diagram	✓		✓
5	Schematic/Inter logic diagrams	✓		✓
6	Bill of Material	✓		✓
7	Foundation Plan & loading details	✓		✓
8	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 & interconnection diagram		✓	✓
12	Programming language manual		✓	✓
13	Details of the Communication protocol & interoperability list for the future interfacing		✓	✓
14	Equipment wise detailed circuit diagram		✓	✓
15	Electronic earthing scheme		✓	✓
16	Configuration diagram with functional write up		✓	✓
17	I/O mapping		✓	✓
18	3 nos. of working drawings		✓	✓
19	6 nos. of as-built drawings		✓	✓
20	Relay co-ordination scheme		✓	✓

21	Installation / commissioning manual		✓	✓
22	Instruction for Use		✓	✓
23	Transport / Shipping dimension drawing		✓	✓
24	QA & QC Plan	✓	✓	✓
25	Routine , Acceptance & Type Test Certificates	✓	✓	✓

19. GUARANTEED TECHNICAL PARTICULARS

S.No.	Description	Units	To be Furnished by Bidder
1	SW1TCHBOARD		
a)	Architecture		
b)	Applicable standard		
c)	Dimensions (in mm) W*D*H		
d)	Internal Arc Protection		
e)	Normal Service conditions		
f)	Service Voltage	kV	
g)	Rated Voltage	kV	
h)	Rated capacity	MVA	
i)	Rated power frequency withstand voltage firms)	kV	
j)	Rated impulse withstand voltage (1.2 , 50us)	kVP	
k)	Rated Short time withstand current	kA	
I)	Rated Peak withstand current	kA	
m)	Busbar material		
n)	Main busbars insulation		
o)	Busbar rated continuous current	A	
p)	Max current Density for Bus bar	A/sq. mm	
q)	Max. Permissible temp. rise at rated normal current		
r)	Degree of Protection for enclosure / Partitions / for meters , relays and BCU		

2	CIRCUIT BREAKER		
a)	Standard		
b)	Type		
c)	No. of poles		
d)	Rated load Breaking current	kA	
e)	Rated short circuit withstand current	kA	
f)	Rated short circuit making current	kA	
g)	Isolation		
h)	Rated Voltage	kV	
i	Service voltage	kV	
j)	Rated frequency	Hz	
k)	Rated Insulation level		
i)	Lightning impulse withstand voltage	kVP	
ii)	One min. power frequency withstand voltage	kV (rms)	
l)	Rated operating sequence		
m)	Opening time	msec	
n)	Arcing time	msec	
o)	Total break time	msec	
p)	Making time	msec	
q)	Temperature Rise		
r)	Breaker Duty		
3	**OPERATING AUXILIARY VOLTAGES**		
a)	Control and signaling voltage		
b)	Spring Charging Motor (Universal Motor)		
c)	Heater and lighting circuits		
d)	No. of spare auxiliary contacts		
4.1	**CURRENT TRANSFORMER**		
a)	Type		
b)	Short circuit withstand		
c)	Location		
d)	Ratio		
e)	Burden & Class (Metering and Protection)		
i)	Core-I		

ii)	Core-II		
h)	Core-III		
5	**VOLTAGE TRANSFORMER**		
a)	Make		
b)	Location		
c)	Mounting arrangement		
d)	Ratio		
e)	Burden & Class		
i)	Core-I		
ii)	Core-il		
iii)	Core-III		
6	Protection ,Control , Metering & Communication		
7	MIMIC Diagram on Relay		
8	Provision of flag indications and contacts for remote annunciation for Self powered backup relay for incomers		
9	Electricity reset type , High speed relay for tripping		
10	Anti-pumping Relay		
11	Makes for Auxiliary Relays		
12	Provision of DC fail Relay for each panel		
13	**OTHERS**		
a)	Cable charge indication for all panels		
b)	Cable side earthing arrangement		
c)	Busbar side earthing arrangement		
d)	TNC Switch	.	
e)	Local / Remote switch		
f)	Indication Lamps CB ON/OFF		
g)	Indication Lamps CB Auto Trip		
h)	Indication Lamps for CB Test/Service positions		
i)	Spring charged indication		

j)	Trip ckt. supervision scheme		
k)	MCB for AC		
l)	MCB for DC		
m)	MCB for space heater		
n)	MCB FOR VTs		
o)	Trip alarm scheme with hooter, Accept/ Reset PB etc		
P)	Panel anti- condensation heater with Hygrothermostat		
q)	Panel illumination		
***	Schematic Drawings		

20. SERVICE LEVEL AGREEMENT:

1) Vendor Has To Submit Standard Technical Parameters With Following Details of Spares Mentioned In The BOM & Technical Specifications of Each Type Supplied Of Each Rating) Supplied Along With The Tender:
   a) Catalogue of Switchgear Spares/CT Etc.
   b) Material Code
   c) With Guarantee Period
   d) Photographs - For Effective Spare Management Within One Week Of Grid Commissioning End Date

2) Problem Troubleshooting & Restoration in Warranty Period shall be in BA's scope.
   a) Service Engineer Availability To Attend, Identify & Restore Defects (Minor) Of Grid Equipment's Under Guarantee Period Within 48 Working Hours (Exclusion of Material Support
   Cases)
   b) Spare Material Delivery For Restoration Of Grid Equipment (Major Defect) Under Guarantee Period Within Two Weeks. BA Must Keep Requisite Inventory Of Critical Switchgear Spares & Other Equipment's Covered In Guarantee Period To Restore Equipment Within Two Weeks.
   c) In Case Of Complete Replacement of Equipment, Complete Equipment To Be Replaced within A Period Of 4 Weeks

3) Spare Material Continuity & Availability After Expiry Of Warranty Period:

a) All Switchgear Spares Must Be Made Available By BA For at Least 15 Yrs. post guarantee Period Expiry.

b) Other Grid Equipment Spares Must Be Made Available By BA For At Least 5 Yrs. Post Guarantee Period Expiry.

c) Lead Time For Spare Delivery Post GP Expiry Must Be Within Four Weeks of Fault Reporting To Business Associate

21. 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

ANNEURE -I

BCPU BI/BO list
For incoming/ outgoing/Bus coupler unit

BCPU RELAY			
Binary Inputs		**Binary Outputs**	
BI1	TRIP RELAY (F86) OPTD.	BO1	SPARE
BI2	LRS IN REMOTE	BO2	UNDER VOLTAGE TRIP TO TC-1
BI3	CONTROL DC MCB FAIL	BO3	RELAY HEALTHY/WATCH DOG
BI4	VT MCB TRIP (PT FAIL)	BO4	PROTECTION TRIP TO MASTER RELAY
BI5	INCOMING DC SUPPLY FAIL	BO5	F86 TRIP RELAY RESET REMOTE
BI6	CB STATUS OPEN	BO6	33/11kV FEEDER REMOTE CLOSE COMMAND
BI7	CB STATUS CLOSE	BO7	VCB OPEN COMMAND FROM REMOTE
BI8	CB SPRING CHARGED	BO8	UNDER VOLTAGE TRIP TO TC-2
BI9	LINE ISO CLOSE	BO9	CLOSE COMMAND FROM HMI
BI10	LINE ISO OPEN	BO10	LINE ISO CLOSE CMD
BI11	EARTH SWITCH CLOSE	BO11	LINE ISO OPEN CMD
BI12	EARTH SWITCH OPEN	BO12	SPARE
BI13	MASTER TRIP RELAY SUPERVISION		
BI14	TC-1 HEALTHY		
BI15	TC-2 HEALTHY		
BI16	TNC CLOSE		
BI17	TNC OPEN		
BI18	AC FAIL		
BI19	SPARE		
BI20-24	SPARE		

BCPU BI/BO list (for Transformer control)

Binary Inputs		**Binary Outputs**	
BI1	TRIP RELAY (F86) OPTD.	BO1	SPARE
BI2	LRS IN REMOTE	BO2	SPARE
BI3	CONTROL DC MCB FAIL	BO3	RELAY HEALTHY/WATCH DOG
BI4	VT MCB TRIP (PT FAIL)	BO4	PROTECTION TRIP TO MASTER RELAY
BI5	INCOMING DC SUPPLY FAIL	BO5	F86 TRIP RELAY RESET REMOTE
BI6	CB STATUS OPEN	BO6	33/11kV FEEDER REMOTE CLOSE COMMAND

BI7	CB STATUS CLOSE	BO7	VCB OPEN COMMAND TO TC-1 FROM REMOTE
BI8	CB SPRING CHARGED	BO8	VCB OPEN COMMAND TO TC-2 FROM REMOTE
BI9	LINE ISO CLOSE	BO9	CLOSE COMMAND FROM HMI
BI10	LINE ISO OPEN	BO10	LINE ISO CLOSE CMD
BI11	EARTH SWITCH CLOSE	BO11	LINE ISO OPEN CMD
BI12	EARTH SWITCH OPEN	BO12	SPARE
BI13	MASTER TRIP RELAY SUPERVISION		
BI14	TC-1 HEALTHY		
BI15	TC-2 HEALTHY		
BI16	TNC CLOSE		
BI17	TNC OPEN		
BI18	AC FAIL		
BI19	F87T RELAY FAULTY		
BI20-24	SPARE		

Differential Relay

Binary Inputs		**Binary Outputs**	
BI1	TR MECH. MOG ALARM	BO1	F86 TRIP
BI2	TR MECH. BUCHHOLZ TRIP	BO2	F87T RELAY FAULTY
BI3	TR MECH. WIND TEMP TRIP	BO3	F87T OPERATED
BI4	TR MECH. OIL TEMP TRIP	BO4	TO CB TC 1
BI5	TR MECH. PRV TRIP	BO5	TO CB TC 2
BI6	TR MECH. BUCHHOLZ ALARM	BO6	SPARE
BI7	TR MECH. WIND TEMP ALARM	BO7	SPARE
BI8	TR MECH. OIL TEMP ALARM	BO8	SPARE
BI9	TR MECH. OSR TRIP	BO9	SPARE
BI10	OLTC PRV TRIP	BO10	SPARE
BI11	TR MECH. PRV ALARM		
BI12	TRIP RELAY (F86) OPTD.		
BI13	BCPU PROTN. RELAY FAULTY		
BI14	SPARE		
BI15	SPARE		
BI16	BCPU TRIP		

STANDARD TECHNICAL SPECIFICATION COVER SHEET

Specification No.: ENG-HV-2008-R1

Specification Name: Specification of 11KV Indoor Switchgear Panel-R1

R1

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18-03-2026	18-03-2026	18-03-2026	18-03-2026

CONTENTS

1. SCOPE

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply at site/store and performance of 11kV, Indoor Switchgear panels complete with all accessories for trouble free and efficient performance. It is not the intent to specify completely herein all details of the equipment nevertheless it is expected that equipment shall comply in all respects to high standards of engineering, design and workmanship according to Indian Standards / IEC and shall be capable of performing in continuous commercial operation in manner acceptable to the Purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith The scope also covers installation, testing, commissioning of 11KV panels at site along with associated earthing, inter-panel wiring. The bidder shall be responsible for engineering and functioning of the complete system, meeting the intent and requirement of this specification and data sheets. Bidder should depute project manager at site for monitoring and coordinating commissioning activity.

The offered material shall be complete with all components necessary for their effective and trouble-free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

Note: Bidder shall be OEM of 11kV Breaker Panel and VI as well.

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/IEC and shall conform to the regulations of local statutory authorities.

Ref. IS	Description
IEC 60068-1:2013	Environmental testing - Part 1: General and guidance
IS 16227	Current Transformers
IS 16227	Voltage Transformers
IS 16227-1	Instrument Transformers
IEC 62271-200	High Voltage Switch gear and control gear
IS 694	PVC insulated cables for working voltage up to and including 1100V
IS 2629	Recommended Practice for Hot Dip Galvanizing of Iron & Steel
IS 2633	Test for Uniformity of Zinc Coating
IS 5578	Guide for making insulated conductors
IEC 60445:2021	Identification of equipment Terminals, conductor terminations and conductors
IEC 62052-11	Electricity metering equipment
IEC 60255	Measuring relays and Protection equipment
IEC 60529	Degrees of protection Provided by enclosures (IP Code)
IEC 60282	High voltage fuses
IEC 62271-100	High Voltage Switch gear and Control gear: alternating current circuit breakers

IEC 62271-200	High Voltage Switch gear and Control gear: metal enclosed switch gear and control gear
IEC 62271-1	High Voltage Switch gear and Control gear: Common specifications
IEC 61010-1	Safety requirement for electrical equipment for measurement and laboratory use
IEC 61000	Electromagnetic compatibility (EMC)
IEC 60815	Pollution levels
IEC 60694	Common specifications for high voltage switchgear and control gear standards
IEC 60947	Low voltage switchgear and control gear
IEC 60364 / 60479 / 60621 / IEEE STD.80	Standards for station grounding
IS 11353	Guide for uniform system of marking and identification
IEC 60270	Partial discharge measurement
IEC 60265	High voltage switches relays with dependent or independent time
IEC 60137	Bushings for Alternating Voltage above 1000V
IEC 60099-4	Surge Arrestor: Metal Oxide surge arrestors without gaps for ac system
IEC 60060	High-voltage test techniques
CENELEC/SVDB	Pressure Vessel Codes
IS 12615	LINE OPERATED THREE PHASE A.C. MOTORS (I E CODE) "EFFICIENCY CLASSES AND PERFORMANCE SPECIFICATION"
IS/IEC 60168	TESTS ON INDOOR AND OUTDOOR POST INSULATORS OF CERAMIC MATERIAL OR GLASS FOR SYSTEMS WITH NOMINAL VOLTAGES GREATER THAN 1 000 V
IS 62155	HOLLOW PRESSURIZED AND UNPRESSURIZED CERAMIC AND GLASS INSULATORS FOR USE IN ELECTRICAL EQUIPMENT WITH RATED VOLTAGES GREATER THAN 1 000 V
IEC 60664-1	Insulation coordination for equipment within low-voltage supply systems - Part 1: Principles, requirements and tests
IS/IEC 61439	Low-Voltage Switchgear and Controlgear Assemblies Part 0 Guidance to Specifying Assemblies

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

S.NO	CONDITIONS	VALUES
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/TPDDL/TPC service area has heavy saline conditions along the coast and High cyclonic Intensity winds with speed up to 300 Kmph. The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months.

4. GENERAL TECHNICAL REQUIREMENTS:

S.NO	DESCRIPTION	REQUIREMENT
1.0	**SWITCH GEAR PANEL**	
1.1	Architecture	Air Insulated Metal enclosed
1.2	No. of Phases	Three
1.3	Rated Voltage	12 KV
1.4	Service Voltage	11KV
1.5	Rated Frequency	50 HZ
1.6	Rated Lightning Impulse withstand voltage	75 KVP
1.7	One Minute Power Frequency Withstand Voltage	28 KV RMS
1.8	Rated short time withstand current	31.5 KA for 3 Sec
1.9	Peak withstand current rating	78.75 KA
1.10	Normal ser condition ice	Indoor
1.11	Internal Protection arc	IAC-A FLR as per IEC 62271-200, Shall withstand 31.5 kA for 1 sec

1.12	Degree Protection Enclosure Partitions meters, relay & BCU of/ for	IP4X – Enclosure IP2X – Partitions IP5X or equivalent to completely protect against dust ingress for LV Cabinet.
2.0	**BUS BAR**	
2.1	Type	Extensible on both sides
2.2	Bus bar continuous Rated current	1250 or 2000 A (2000 A for TPDDL)

2.3	Bus bar material	Insulated EC Copper busbar with silver coating on joint area PVC insulating sleeves with R, Y, B, colour marking. and
2.4	Rated short time withstand current	31.5 kA for 3 sec
2.5	Max. permissible temperature rated normal Current	The maximum permissible current temperature for bus bar shall be as per IEC62271
3.0	**CIRCUIT BREAKER FOR IC/BC/OG (INCOMER, BUS COUPLER AND OUTGOING FEEDER)**	
3.1	Application /Class	Indoor
3.2	Type of circuit	Vacuum (VCB)
3.3	No. of poles	3
3.4	Rated Voltage	12 kV rms
3.5 a	Rated Insulation Level	11 kV / 12 kV
3.5 b	Service Voltage	11 kV
3.6	Lighting impulse	75 kV peak
3.7	One minute power frequency withstand	28KV RMS
3.8	Rated frequency	50 Hz
3.9	Rated normal current	1250 A, 1600 A, 2000 A (Incomers, Bus coupler), 630 A, 800 A (outgoing)
3.10	Rated operating sequence	O-t-CO-T-CO (t=0.3sec, T= 3 min.)
3.11	Max. Spring Charging Time of Motor	Shall not exceed 15 sec or shall be as per type test report

3.12	Max. Power consumption of Trip & close coils	100 W or (As per type test report of panels)
3.13	Short circuit breaker current	31.5 KA rms
3.14	Rated short circuit withstand current	31.5 kA rms for 3 sec
3.15	Rated short circuit making current	78.75 kA peak
3.16	Isolation	Horizontal
3.17	Mechanical Endurance e	10,000 operations (M2)
3.18	Busbar current density	Max 1.6 A / sq.mm

3.19	Insulationresistance e	> 50 M Ohms
4.0	**OPERATING AUXILIARY VOLTAGES**	
4.1	For Protection relays	48/24 V or 110/220 V DC with tolerance of +/- 10 % (TBD During Detailed Engineering)
4.2	For Trip Coil	48/24 V or 110/220 V DC (TBD During Detailed Engineering)
4.3	For Closing Coil	48/24 V or 110/220 V DC (TBD During Detailed Engineering)
4.4	For Anti condensation Heaters	240V AC +/- 10 %
4.5	Spring Charging Motor (Universal Motor)	230 V AC / 220 V DC / 240 V AC with tolerance of +/- 10 %
4.6	No. of spare auxiliary contacts with contact multipliers and wired	8NO + 8 NC
5.0	**VOLTAGE TRANSFORMER**	
5.1	Location	Access from Front side of the panel and should be for incomer side
5.2	Type	Plug In type, Single ratio, single phase 3 nos
5.3	Ratio	VT ratio should be 11KV/√3 / 110/√3 -110/√3-110/3

5.4	Core details	Core I	Core II	Core III
i)	Accuracy class	0.2 or 0.5	3 P	3 P
ii)	Burden	50 VA	50 VA	50 VA

6.0	**CURRENT TRANSFORMER**						
6.1	For Metering and Protection	Resin cast type					
6.1.1	Ratio (TBD During Detailed Engineering)	Sr. No.	I/C	B/C	Capacitor Bank	O/G	Station Transformer
		TPCM	1000-2000/5-5-1 A	1000-2000/5-5 A	--	300- 600/5-5 A	
		TPDDL	2000 /5-5 A	2000 /5-5 A	400-600/5-5 A	400- 600/5-5 A	60-30/5-5A
		TP Odissha	800-1200/5-5-5 A/1-1-1/1-5-1 A	800-1200/5--1 A	300-600/5--1 A	300- 600/5 1 A	
			400-800/5- 5 A/1-1-1/1-5-1 A	400-800/5- -1 A	300- 600/5--1 A	300-600/5 -1 A	
6.1.2	Burden & Class for Outgoing, Bus-coupler & Incomer						
i)	Core I (metering)	Sr. No.	I/C	B/C	Capacitor Bank	O/G / Station transformer	
		TPCM	0.2S, Isf < 5, 15 VA,	0.2S, Isf < 5, 15 VA,	--	0.2S, Isf < 5, 15 VA,	
		TPDDL	0.5S, Isf < 5, 15 VA,	0.5S, Isf < 5, 15 VA,	0.5S, Isf < 5, 15 VA,	0.5S, Isf < 5, 15 VA,	
		TP Odissha	0.2S, Isf < 5, 15 VA,	0.2S, Isf < 5, 15 VA,	0.2S, Isf < 5, 15 VA,	0.2S, Isf < 5 5, 15 VA,	
ii)	Core II (protection)	Sr. No.	I/C	B/C	Capacitor Bank	O/G / Local transformer	
		TPCM	5P20, 10 VA	5P20, 10 VA	--	5P20, 10 VA	
		TPDDL	5P20, 10 VA	5P20, 10 VA	5P20, 10 VA	5P20, 10 VA	
		TP Odisha	5P20, 10 VA	5P20, 10 VA	5P20, 15 VA	5P20, 15 VA	

6.1.3	For Differential Protection in Incomer (Combined 3 core CT to be taken instead of separate PX core)	
iii)	Core- III Class PX (5A or 1 A to be decided)	PX, Vk>500V, Imag<=30mA at Vk/2 Rct< 6 Ohm
6.1.4	Thermal withstand capacity	31.5 KA for 3 sec
7.0	Bay Control & Protection Unit (BCPU)	
7.1	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

8.0	Cable Charged Indication	To be provided by Bidder
9.0	Mechanical Test service Indication	To be provided by Bidder
10.0	Panel Illumination in Relay Compartment	To be provided by Bidder
11.0	Circuit Name-Plate	To be provided by Bidder
12.0	Phase to phase clearance in busbar, cable chamber t o b e mentioned	For all panels.
13.0	Class 3 Surge Arrester to be provided	To be provided in Incomer and Capacitor Bank Panels
14.0	LLI indicator	To be provided

15.0	Power Pack with additional trip coils in CB to be provided in Incomer panel.	To be provided (Backup time to be specified as well)
16.0	Numerical Communicable Relay with Over Current, Earth Fault, Sensitive Earth Fault, Breaker Failure, Negative Sequence Current and Overload. (For details Protection Philosophy Specification To be followed)	Incomer (BCPU)- 2 nos. Capacitor – 2 nos. Bus coupler / Bus section (BCPU) 1nos. Outgoing (BCPU)- 1nos, rating to be specified Local Transformer (BCPU)-1 nos, rating to be specified
17.0	Digital ammeter & Voltmeter to be supplied with panels as well.	To be supplied
18.0	LV Components: CB Control Switch, ON/OFF Push Buttons, Indication Lamps, Auto Trip, UR Switch, TNC Switch, Space Heater, Trip Coils & Closing coils, Operation Counter Spring Charged Mechanism etc.	To be provided in each panel.

5. GENERAL CONSTRUCTIONS

5.1 : SWITCHGEAR

1) All supplied Units shall be fitted with engraved metallic logo of "Tata Power" on the front side as per Annexure.
2) The High Voltage Switchboard shall be metal enclosed and shall comprise of standard prefabricated, Alu zinc sheet units assembled to form a rigid, freestanding, and dead-front

structure without any external bracing. As a minimum, 2mm Alu zinc shall be used for all front and rear doors and covers, and 2 mm Alu zinc steel for inter-panel partitions, Frame 3 mm, Removable Gland plate 3 mm, Frame 3 mm, Removable Gland plate 3 mm Wherever required, stiffeners shall be provided to increase stiffness of large size doors and covers.

3) Vertical panels shall be assembled to form a continuous line-up of uniform height.
4) The switchboards shall be totally enclosed and vermin-proof. The enclosure shall have complete protection against approach to live parts or contact with internal moving parts. Panels shall be designed for ease of operation maintenance and further extension.
5) All doors, cut-outs and removable covers shall be gasketed all round by neoprene cork gaskets.
6) Each unit of the switchgear shall have necessary internal sheet metal barriers to form separate compartments for circuit breaker, bus bars, instruments and relays, cable connections etc. Compartments for cable connections shall allow cable termination and connection work with switchgear energised.
7) Independent pressure flaps shall be provided for all HV compartments, i.e., bus bar, cable and breaker compartments and each compartment for exit of gas due to internal arc shall have type test certificate for withstanding internal arc fault.
8) Each chamber shall be designed such that in case of internal arc, gas from one chamber shall not move to other chambers. There should not be any opening, perforation, mesh between different chambers.
9) Insulated separator sheet to be provided between each panel in busbar chamber.
10) 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.
11) Safety barriers or shutters shall be provided to permit personnel to work safely within an empty compartment with the bus bars energised. The shutters should block the bus & cable compartments.
12) 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 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.
13) The opening of shutter shall be prevented when the breaker truck is racked out & either main bus or cable compartment is energised.
14) The draw out carriage on the switchboard shall have three positions: "Service", "Test" and "Draw out" viz:
15) "Full in" or "Service" position - In this position both power and control circuits shall be connected. This shall be the normal operating position of the circuit breaker.
16) "Test" position - The power contacts shall be disconnected in this position but the control connections shall not be disturbed, it shall be possible to close and trip the breakers in this position.
17) "Draw out" Position - both power and control circuits shall be disconnected in this position.
18) The circuit breaker shall be lockable in "service" and "test" positions. Automatic safety shutters shall be provided to ensure the inaccessibility of all live parts after the carriage is drawn out.
19) There shall be a distinct overall door for the breaker compartment, which can be closed with the carriage in draw out position and it shall be lockable type. All openings on the door shall be with a provision of padlock.

20) All circuit breaker modules of the same rating shall be inter-changeable. Suitable interlocks shall be provided to prevent the following operations.
    - Plugging in" or "drawing out" of a closed breaker.
    - Pulling out the auxiliary circuit plug with the breaker in the service position.
    - Pushing in the breaker to the service position, with the auxiliary circuit plug not in position.
    - All operations behind closed doors.
    - It should not be possible to open front door when circuit breaker is in service position.
    - Mimic to be provided on front fascia of panel.
    - The back door opening shall be possible only when cable is in dead condition.
    - Castle key interlock or mechanical interlock to be provided in such a way that for opening of back door castle key shall be required.
    - Cable back charge indicating LED on front & rear side of panel is to be provided
21) All hardware should be corrosion resistant. All joints and connections of the panel members shall be made by zinc-passivated, or cadmium-plated, high-quality steel bolts, nuts and washers, secured against loosening.
22) Suitable removable type eyebolts shall be provided for the lifting of the panel/shipping section. These bolts, when removed shall not leave any opening in the panels.
23) Switch board shall be designed for IP 4X. 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 BCPU shall be minimum IP5X (For Low voltage) or with an equivalent provision to completely protect it against dust ingress.
24) The overall dimension of each switchgear bay should not exceed 1.6 M X 0.8 M X 2.8 M (DXWXH) for Incomers, Bus Riser, Bus Coupler, Bus PT, Adaptor panels and 1.6 M X 0.65 M X 2.6 M (DXWXH) for outgoing panels. Dummy panel if required as per site conditions shall be included at the time of quoting.
25) All foundation equipment, anchor bolts etc. including the supporting channel shall be furnished by successful bidder along with dispatch of panels. The bottom plates of the panels shall be fitted with removable gland plates not less than 3mm in thickness.
26) Indicating instruments and meters shall be at a suitable height so that the values 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 LEDs shall be not less than 900 mm from the bottom of the panel. The centre lines of relays, meters etc. shall be not less than 450 mm from the bottom of the panel 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 insulator shall also be made of non-hygroscopic material.
27) All the HV design shall ensure conformity to IEC-62271-200 and must be Type tested for Internal Arc Test. It shall withstand 31.5 kA for 1 sec. The suppliers shall submit Type Test report from CPRI/ERDA accredited laboratory or international laboratories to prove the above. Auxiliary and control equipment installed on the panel shall be suitably protected against disruptive discharge from main circuit. Buses shall be insulated with heat shrinkable insulating sleeves, wherever bare conductor is employed
28) All indicating lamps shall be of LED type and suitable for continuous operation at 85% to 110% of their rated voltage LED and replaceable from the front of the panel.

    The following indicating lamps with colour shall be mounted over switchgear to indicate important status/alarm of breaker

    a. Breaker ON ---------- Red
    b. Breaker OFF ---------- Green

c. DC Fail ---------- Yellow
d. Space Heater not healthy ------- Blue
e. Spring Charge ---------- Blue
f. Trip coil healthy ---------- White
g. Auto trip ---Amber --------
h. Breaker in service ---------- Red
i. Breaker in Test ---------- Green

PT back charge AC lamps should be provided.

i. R ph Healthy LED ------ RED
ii. Y ph Healthy LED ------ YELLOW
iii. B ph Healthy LED ------ BLUE

All colour 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 colour caps shall be furnished 10 % in excess of actual numbers used for each colour. Separate DC MCB should be provided for LEDs to avoid tripping of main DC supply due to any failure of LED's.

29) All grounding system, special tools and tackles, O&M manuals etc. required for erection, operation, testing and maintenance of switch gear shall be supplied within the quoted price

30) The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered. Bidder shall ensure availability of spare parts and maintenance support services for the offered equipment for at least for 15 years from the date of supply. Bidder shall give a notice of at least one year to us before phasing out the product/spares to enable the end user for placement of order for spares.

31) DC fail supervision relay (80) shall be provided on all relay / LV chamber of panels. DC fail annunciation shall be provided on each panel and loss of DC & trip circuit fail alarm will be suitably annunciate at the panel as well as at the SCADA. Arrangement for inter-tripping wiring from primary side of Transformer to 11 kV Incomer Switchgear and vice versa should be there. All the relays and auxiliaries shall have DC auxiliary supply. 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 trucking and it should be suitable to accommodate 20% wiring for future modifications. The disconnection type details are as follows. All control cables shall be laid in metallic trunking arrangement and no control / signal cables shall pass through busbar chamber.

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

1. Protection Relay (BCPU)
2. Trip circuit
3. Close circuits
4. Spring Charging Circuit
5. Heating and Lightning circuit
6. Annunciation Circuit

b) MCB shall be rated for 10kA short circuit rating. It shall be quick make, quick break, and independent manual type with trip free feature. The DC MCBs and AC MCBs ratings shall be separately mentioned. MCB shall have the following

1. Over current protection
2. ON/OFF Trip position indicators
3. Auxiliary contact block (wherever required

32) 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 (+/-) 10% continuously.
33) 12 number of window annunciators with hooter for I/C & Cap Bank, 8 number of window annunciators with hooter for O/G & B/C along with data fetching facility with RTU to be provided.
34) 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.
35) 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'.
36) Each switchgear panel shall have 20% spare terminals. The terminals should be droppable type. All equipment mounted on front side of the 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 Bay Control unit shall have the provision to communicate with the future data concentrator in IEC 60870 -5-103 VDW implementation without any additional hardware
37) Feeder protection relays shall be considered along with the switchgear panel
38) CT, PT, TRIP, CLOSE CT links shall be different coloured coded for easily identification in breaker panels for all Incoming and Outgoing panels
39) CT, PT, breaker name plate details shall be embossed on front, back side of breaker Panel.
40) Separate doors section shall be provided for cable and bus compartment separately with handle arrangement.
41) LOTO lock arrangement shall be provided for Cable compartment, Bus compartment and breaker compartment separately.
42) LOTO lock arrangement to be provided on rear side of the panel.
43) Cable back charge indication shall be provided on Front & Rear side of Cable compartment. 44) The back door opening shall be possible only when cable is in dead condition.
45) Castle key interlock or mechanical interlock to be provided in such a way that for opening of back door castle key shall be required**.**
46) **VPIS indication required at rear and front side.**
47) All TBs in breaker control panel shall be DISCONNECTING Type
48) Extender of breaker plug is required which is used for breaker test in removed position
49) Hygrotherm with space heater to be provided in breaker, bus bar, LT chamber and cable compartment. Hygrotherm shall be communicable type with Temperature & humidity data on central server through RS485 port.
50) Provision of mounting of ethernet switches to be provided in Adaptor panel, Bus PT/ Bus riser PT. All auxiliary relays like contact multiplier, Lock-out relay shall be fast acting relays with flag indication.
51) Status/indication of all draw out type power equipment's to be made available locally.
52) RYB Nomenclature/paint marking required on all Bus Bar and accessible location.
53) Status contact shall be used for only one application in control schematics.
54) Direct trip from relay BO to Trip coil also to be configured & indicated in the drawing for all panels.
55) Cut off timer to be considered for spring charging motor. Soft drop off timer required in CFC logic in series with Spring Charging Bl to keep the Close permissive High till the time spring remains discharged.
56) Separate Status contact shall be used for relay Bl's and local indication Lamp.

57) Relay DC supply and Trip Circuit Supervision shall not be under the same DC MCB. Separate MCB for relay to be provided.
58) The shutter mechanism in the breaker cubicle shall operate automatically i.e., when the breaker truck is racked in or out. Shutters provided shall comply with IP2X.
59) The Bidder can also consider Centralised protection system with intelligent merging unit
60) 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 Purchaser for constructional and other requirements.
61) Switchgear shall be so designed that normal service, inspection, operation and maintenance including visual checking pf phase sequence, earthing of connected cables, locating of cable faults, voltage tests on connected cables can be carried out safely.
62) Switchgear Panel shall consist of a front portion with equipment mounted on it and wiring access from rear of front upper door. All doors, cut-outs and removable covers shall be gasketed all round by polyurethane / EPDM gaskets having a single cut only.
63) Adaptor panel, Bus PT cum Bus riser panel front side & back side should have removable FRP sheet / wire mesh to avoid direct access.
64) Shrouds shall be present on all bus bar joints and insulated separator sheet between inter panel bus bars. In all panels, panel back door limit switch should be of push button type.
65) Access of busbar chamber from back side is preferred instead of access from top.
66) In all Panel, Ensure shroud cover on Emergency trip button. 67) Emergency trip button shall be mechanical.

5.2 : Circuit Breaker:

1) Vacuum circuit breakers shall be used in the switchboard. Breaker transport trolleys required for cassette mounted breakers shall be provided for each switchboard.
2) The breaker shall be of class M2, E2 [with auto reclosing duty], C2. The breaker shall be encapsulated with no live part exposed within breaker chamber.
3) Vacuum circuit breakers shall be designed to have low switching-over voltage levels and with a long switching life. The interrupter shall be leak-free.
4) The breakers shall have at least 4 normally open (NO) and 4 normally closed (NC) spare auxiliary contacts for purchaser's use. If these are not available, auxiliary relays shall be used to multiply the auxiliary contacts of the breakers.
5) Vacuum Interrupter, Breaker and Switchboard should be of same make. Made in India VI to be preferred.
6) The breakers shall have a motor-operated, spring-charged mechanism. It shall also be possible to charge the springs manually. The closing spring shall get re-charged (for subsequent closing) soon after a closing shot and prior to breaker tripping. In case the limit switch fails to cut out the spring charging motor with the springs fully charged, the motor shall be automatically decoupled.
7) The control circuit shall be suitable for local as well as remote control. Breakers shall be trip-free and shall have an anti-pumping device. The breaker operating duty shall be O-0.3 sec-CO-3 min CO.
8) Operating Mechanism: Electric power operating mechanism shall be motor wound spring charged stored energy type. However, manual-operating mechanism may be of the spring charging stored energy type or the spring assisted type. For circuit breakers with electrical power operating mechanism, provision shall also be made for manual spring charging. Closing time of circuit breakers with manual operating mechanism shall be independent of the speed of the operating handle.
9) All stored energy operating mechanism shall be equipped with following features.

- Failure of springs, vibrations or shocks shall not cause unintended operation of breaker or prevent intended tripping operation.
- Closing of circuit breakers shall be prevented unless the spring is fully charged.

10) All electrical power operating mechanisms shall be suitable for remote operation and shall be equipped with following features.
    - Provided with universal motor operable on AC or DC control supplies.
    - Provided with emergency manual charging facility. The motor shall be automatically, decoupled (mechanically) once the manual-charging handle is inserted.
    - Closing operation of circuit breaker shall automatically initiate charging of the spring for the next closing operation without waiting for tripping of circuit breaker.
    - Closing operation shall be completed once the closing impulse is given and the first device in the control scheme has responded even though the control switch / Push Button is released provided no counter trip impulse is present.
    - Control switch for circuit breaker shall be of spring return to normal type with pistol grip handle.
11) Circuit breaker trip and closing coils in case of electrically operated breakers and trip coil in ease of mechanically operated breakers and circuit breaker indication shall be suitable for satisfactory operation on a control supply system indicated in data sheets/job specification.
12) All circuit breakers shall be provided with mechanically operated emergency trip device. This device shall be available on the front of the panel. Mechanically operated 'closing' device shall be provided for all breakers. However mechanical closing shall be inhibited for all circuit breakers in service position.
13) The breakers shall be provided with anti-pumping & trip free provision. Each breaker shall be also provided with an operation counter.
14) Line PT shall be mounted in a separate draw out carriage. In case of truck mounted breaker, line PT shall be provided in a separate panel/ compartment.
15) The complete breaker assembly should have inter-changeability with breakers of identical ratings.
16) Breaker, Busbar & cable compartments shall be with temperature sensor for monitoring the temperature and humidity sensors for monitoring humidity. These sensors should be integrated with RTUs/ SCADA using wireless communication.
17) The Limit switch base in breaker shall have better material having long life.
18) 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.
19) All the arms bus bars of Circuit Breaker should have insulated with heat shrinkable sleeves. The design of these arms and other shall be such that there should not be any bare part visible.
20) Vacuum Interrupter should be Vertical Type.
21) Breaker should have trip count provision.

5.3 : BUS BAR CONNECTORS:

1) The switchboard shall comprise of 3-phase bus bars which shall extend through all units of the switchgear line-up. The main bus bars shall have uniform cross-section throughout their length and shall be sized to carry continuously the rated current specified in the data sheet.
2) Bus bars shall be of high conductivity electrolytic copper supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that defined in Indian standards.
3) Bus bars shall be housed in a separate chamber and shall be accessible for inspection. Wire guards shall be provided inside the enclosure to allow visual inspection of bus bars, to avoid accidental contact when the cover is removed.

4) Both bus bars and the supports shall be adequately sized and braced to withstand the specified short-circuit current for 1 second. Dynamic stresses shall be calculated on the basis of the specified peak short-circuit current. All bus supports shall be of non-carbonising material, resistant to acids and alkalis.
5) Bus bars shall be insulated by using heat-shrinkable sleeves. The sleeves shall be rated to withstand the system line-to-line voltage for 1 minute. This shall be verified by a type test in which the line voltage will be applied between the sleeved main bus bar and an aluminium foil wrapped closely around the insulation over a length of at least 500mm. All bus bars shall be insulated with heat shrinkable, colour-coded PVC insulating sleeves.
6) The bus bar section shall be of ample capacity to carry the rated current 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.
7) All bus bar joints and all tap-off connections from the main horizontal bus bars shall be provided with removable FRP shrouds.
8) Bus bars shall be **prominently marked** with Red, Yellow and Blue colour rings for easy phase identification at regular interval and at every power tap off point.
9) The thermal design of the bus bars shall be based on installation of the switchgear in poorly ventilated conditions. The cooling air volume shall take into account only the bus bar enclosure.
10) The hot spot temperature for bus bars including joints at design ambient temperature shall not be formed and shall be as per IEC for normal operating conditions.
11) Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers shall be used for all bus bar joints and supports.
12) The current rating as defined for switchboard and components in data sheet/job specification are for design ambient temperature at site conditions and for being inside the cubicle at fully loaded condition. The vendor shall suitably derate the nominal rating to suit the above condition.
13) It shall be possible to earth all busbar sections in make-proof way.
14) 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.
15) The interlock 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.
16) The Bus Bars shall run in a separate chamber using suitable Bus Bar support of Non-Hygroscopic, Non-Combustible material such as DMC at sufficiently close intervals to prevent Bus Bar Sag.

5.4 : CURRENT TRANSFORMERS:

1) Current transformers shall be epoxy cast resin insulated. The primary and secondary terminals shall be marked indelibly and easily approachable for termination and testing etc.
2) The short-time rating of Current transformers shall be equal to that of the switchboard. They shall be mounted on the stationary part of the switchboard. Protective CTs shall have an accuracy class of 5P and an accuracy limit factor greater than 10. CTs for instruments shall have an accuracy class of 0.2S and an instrument safety factor less than 5.0. One leg of the CTs shall be earthed.
3) Separate CT core of Class PS shall be provided for Differential protection.
4) All CTs shall be star connected.
5) Proper access to each set of CTs shall be provided for repair / maintenance.
6) The polarity of the primary and secondary windings of each transformer shall be clearly indicated at the respective terminals and in addition labels shall be fitted in a readily accessible

position to indicate the ratio, class duty of each transformer. The CT ratios shall be as per the details specified in this specification's; secondary shorting shall be done by black colour 2.5 sq mm black wires.

7) The TTB should be provided for metering core with droppable links for PQM and Energy meter requirement.
8) The TTB details are as follows: DAV make 50 Amps, Screw type, front connection disconnecting type.
9) All the wires should be connected from top and bottom side and fixed top mounted on door.
10) Secondary terminal shall be on P2 side.
11) The Current Transformers shall be of Epoxy Cast Resin, Window type construction and rated for 500 MVA (3 sec) with details as per General technical requirements of clause no 4.0. For CT 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 1.1kV 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 Transformer Differential Protection shall be provided. All Current Transformers shall be designed to carry continuously a current of 120% of the rated current.

5.5 : VOLTAGE TRANSFORMERS:

1) Voltage transformers shall be cast resin insulated. The voltage transformers shall be of draw out type and shall be provided with 4 pole MCB with auxiliary contacts on the secondary side & Fuse on primary side.
2) The draw out mechanism shall disconnect the VT from the bus bars. The primary connection shall be disconnected before the VT become accessible. Neutral point of the star connected VTs both on the primary and secondary sides shall be earthed in test position also.
3) The VTs shall have an over-voltage factor of 1.2 times Continuous & 1.9 times for 8 hours, and an accuracy class of 0.2 from 10% to 120% of normal voltage. VT selected shall be compatible with system grounding.
4) The primary rated voltage shall be equal to V/~3 (phase and neutral).
5) If not otherwise specified, the secondary voltage shall be 110 / √3 V. The burden and class of accuracy shall be as specified in GTP.
6) A separate truck should be provided for easy racking out/racking in the VT unit.
7) VPIS 2NO+2NC shall be present in each Outgoing feeder with 230V (±) 10% DC aux voltage.
8) VT back charging lamp shall be provided on backside of individual breaker panel.
9) The VTs in the panels & Spare VTs shall be applied with silicone paint.
10) The VT shall be of the single-phase type, with separate core for metering and separate core for protection.
11) 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 up to 30 sec
12) VT's mounted on circuit breaker truck shall not be accepted. Bus VT shall be provided in each section. 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.

5.6 : PROTECTION METERING & CONTROL:

1) All the Bays (Incomer / Outgoing feeder / Capacitor bank / Local transformer switchgears) shall be provided with Integrated Bay Control, Protection & metering Unit (BCPU).

2) The BCPUs shall communicate at station level on IEC 61850 protocols and with local and existing remote master on IEC-104 protocol.
3) The BCPU shall support fibre-optic port (In and Out) for fault-tolerant fibre optic ring or RJ-45 port for making star connection at switch. Also, the BCPU should support centralized parameterization and DR files downloading from remote.
4) The BCPUs shall have capability to communicate with multiple masters on independent network and shall be IEC61850 compatible.
5) Web browsing feature should be available in BCPU.
6) Provision of space to be made with respect to future revenue meter installation in all the outgoing panels. All the metering CTs/PTs to be wired up to TTB for revenue meter installation. The meter size is 500x350x250.
7) Bidder to provide all necessary configuration, testing, health monitoring tools (Hardware & Software) for the proposed system.
8) All droppable type links of Connect well or Elmex to be provided in the panels.
9) The Multi-Function Meters shall be Communicable to RTU on Rs485 MODBUS excluding bus coupler. This can be eliminated by taking analog data from BCPU, current can be viewed in the BCPU itself & huge cabling work can be avoided. Aux supply shall be 220 V DC
10) The Multi-Function Meter to be considered for all I/C & O/G feeders except Bus coupler compartment.
11) The buses to be supported with suitable insulators in order to avoid the vibrations.
12) Overall design should be such that the Bay Control function is handled by the individual relays provided on the respective bays.
13) Adequate spare DI /DO provision of BCU should be there for future station miscellaneous signals.
14) Separate AC and DC MCB of 16 A to be provided for AC and DC for individual bus section.
15) Extendable Circuit Breaker Test Plug for test purpose length of 10 meters
16) Locally copper bar to be installed in Control Panel as an extension of main Earth Bus. All peripherals body earthing are connected to copper bar through green colour 2.5 sq.mm wire.
17) All CT Neutrals shall be grounded individually to the Copper Strip.
18) The Metering architecture shall be as per the Tata Power-DDL metering philosophy. All required accessories, like communication cables (Cat-6 or FO), Splitters, Moxa converters shall be provided by Bidder for successful communication of meter to the existing system. Metering Software (if required) to be provided by the bidder.. Supply of Energy Meter is not the scope of bidder.

5.7: PQM Meter

PQM meters shall be provided by bidders in 11kV incomers. Separate droppable links shall be provided in Metering circuit and space on front door to be provided. Power Quality Meter make are A-Eberle, METRUM, UNIPOWER, Elspec. Communication Port as per the BCPU's communication port. The PQM meter needs to be connected in switch network so that data can be transferred to the central system.

5.8: AUXILIARY SWITCHES AND CONTACTORS

Auxiliary switches shall be provided on all circuit breakers for local, remote & SCADA indication, control and interlocking. With each circuit-breaker there shall be supplied all necessary auxiliary switches, contactors and mechanisms for indication, protection, metering, control, interlocking, supervisory and other services. All such auxiliary switches shall be enclosed in dust free housing. Not less than four spare auxiliary switch ways shall be provided with each circuit breaker. All auxiliary switches shall be wired up to a terminal board on the L.V panel of the switchgear whether they are in use or not in the first instance and shall be arranged in the same sequence on all equipment.

5.8: 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 Purchaser. 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.

e) BCPU Relay should have at least 24BI and 10BOs.

f) Two number of TCS to be provided / should be included in the Numerical relay.

g) An ANSI 81 frequency relay shall initiate the trip, which must drive an ANSI 86 master-trip (lock-out) relay to ensure breaker remains open until manual reset.

The bidder shall further refer to Purchaser's protection and automation philosophy.

5.8: 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

5.9: TERMINAL BLOCKS

1) The terminal blocks shall be 1100 V grade, 10 A rated, one piece molded, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts and identification strips. The terminal blocks for CT shall be of disconnecting type. 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 molded non- inflammable plastic material.
2) A minimum clearance of 250 mm between the first row of terminal blocks and the associated cable and plate shall be ensured. CT PT & tripping droppable type. Also, the minimum clearance between two rows of terminal blocks shall be 150mm.
3) All spare contacts and terminals of the panel mounted equipment and devices shall be wired to terminal blocks. All the TBs shall be of single Decker type.
4) Acrylic cover for all the TTB's to be provided.

5) The bidder shall further refer to Purchaser protection and automation philosophy.

5.10 : ANTI-CONDENSATION HEATERS

1) Strip type space heaters of 100 W capacity 1 nos shall be provided in breaker compartment, and 200 W capacity 1 nos shall be provided in cable compartment, busbar chamber, LV chamber in each panel to prevent moisture condensation on the wiring and panel mounted equipment. Space heaters shall be rated for 240 V +/- 10 %, 1 phase, 50 Hz supply. Heaters inside the panels shall not be mounted close to the wiring or any panel mounted equipment. Heaters shall be complete with either miniature circuit breakers or with isolating switches, HRC fuse on phase and link on the neutral of the heater supply. Adjustable type thermostat to be supplied too (30 to 110 deg Celsius)
2) An adjustable type hygrotherm (0 to 100% Humidity) shall be provided in the heater control circuit. The indication shall be provided for monitoring the healthiness of Space heater. Heater shall have humidity control and shall be arranged to cut off when cubicle internal humidity exceeds safe value. 'Heater ON' indication shall be also provided. Also, door limit switch and internal lighting shall be provided for LV compartment

5.11 : INTERIOR LIGHTING AND RECEPTACLES

1) Each panel shall be provided with a compact LED lighting fixture rated for 240 V +/- 10 %, 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.
2) Each panel shall be provided with a 240 V +/- 10 %, 1 Phase, 50 Hz, 5/15 A, 5 Pin receptacle with switch. The receptacle with switch shall be mounted inside the panel at a convenient location.

5.12 : POWER AND CONTROL SUPPLIES

1) 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 MCBs. Supply monitoring arrangement shall be provided. Selection of the MCB ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall also be protected by MCBs.
2) 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. However, it is desired that no other control voltage shall be prevalent in the panel.
3) All fuses shall be HRC cartridge type conforming to relevant standards, mounted on plug-in type fuse 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.

5.13 : PANEL WIRING

1) 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.

2) All wiring shall be carried out with 1100 V grade, single core stranded copper conductor wires with PVC insulation. 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 and PT circuits: 2.5 mm^2 per lead grey

   colour ii) CT circuits: 4 mm^2 per lead with colour coded iii) PT

   circuit: 4 mm^2 colour coded

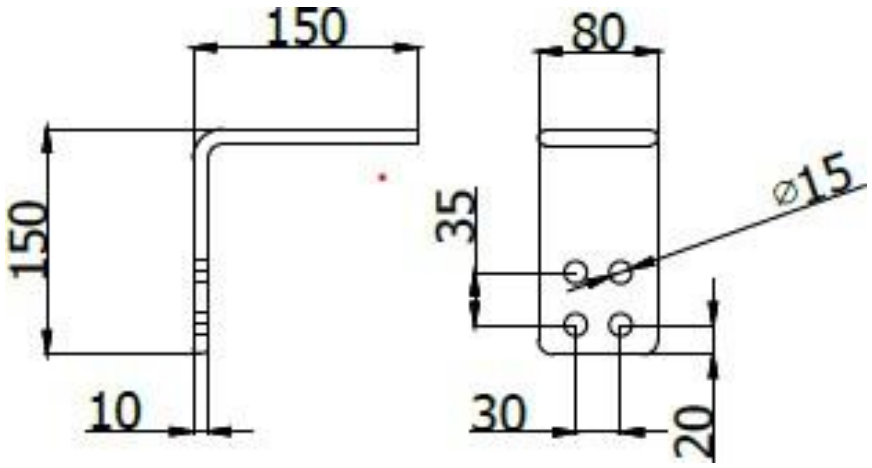
3) Longitudinal troughs extending throughout the full length of the panels shall be provided for inter panel wiring, for AC and DC supplies, PT circuits, annunciator circuits and other common services. Interconnections to adjacent panels shall be brought out to a separate set of terminal blocks located 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.
4) 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.
5) Wire terminations shall be made with soldier less crimping type of (ring type lugs for all CT & 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. There should be provision of cable tray for laying of BCPU looping cable on the top of the switchgear LT compartment.
6) Bidder shall be solely responsible for looping all protection relays with DC as per the requirement. Network cable required to communicate BCU/BCPUs with DC shall be under bidder's scope. Looping and networking cable shall be CAT-5 / CAT-6 type. The Bidder shall be solely responsible for the completeness and correctness of the internal wiring and for the proper
7) Functioning of the connected equipment. In case the cables are to be routed through trenches, necessary metal clad conduits shall be used.
8) Internal wiring to be connected to external equipment shall terminate on terminal blocks. The terminal blocks for CTs and VTs shall be provided with test link 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 terminal blocks and shall be wired.
9) The Power interconnections shall be carried out by means of bolted connections with washers. The wiring shall be terminated by using crimping sockets. Under no circumstances the wiring should be under any kind of stress for which sufficient length of control wiring should be provided. Bimetallic washer to be provided at inter metal joints in panels. **Note:**

1) Two wires shall not be crimped on a single lug.
   CT Ferrules shall have reference of CT Core and CT Taps

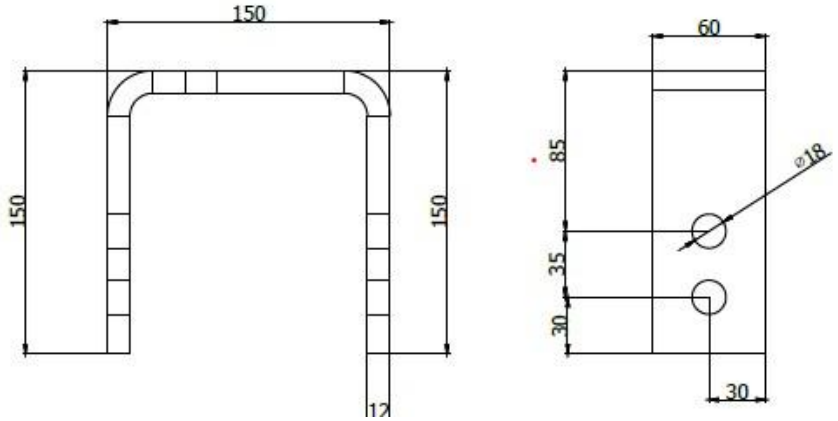
5.14 : CABLES TERMINATION

1) There should be provision of connecting cables back-to-back with necessary clearances in outgoings.
2) There should be provision of connecting cables back-to-back with necessary clearances in each of Incomer.
3) There should be proper approach for manpower to work inside the cable compartments of incomer and outgoing section. Ample space for connection for these cables shall be provided at the rear of the switchboards.
4) In order to avoid accidental contact in the cable compartment while carrying out inspection by opening the rear cover, a removable expanded metal barrier shall be provided in the cable compartment.
5) Unless otherwise specified, the power cable shall enter the switchboard from the bottom.
6) Non-magnetic cable gland plates shall be provided for feeders wherever single core cables are used.
7) 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.
8) The switchboard shall be supplied complete with supports for clamping outgoing and incoming cables. The head-room available between cable gland plate and terminal lugs shall not be less than 800 mm for 11 kV cables.
9) In case the standard panel depth cannot accommodate the specified no. of cables, a rear extension panel of full height shall be provided. An earth strip shall also be brought to this extension panel.
10) Unless otherwise specified, all power cables shall enter the switchgear from the bottom.
11) A rear viewing window shall be provided on the cable chamber rear cover to inspect cable connection without opening rear cover. The material of this window shall be the same as that used in breaker chamber. Rear side of switchgear panel shall have bolted covers in sections.
12) Extension cable chamber to accommodate 3 run 1CX1000 cable for incomer panel and shall be open able from 3 sides in order to access cables.
13) 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.
14) Incomer panel and bus section panel cable termination shall be suitable for 3Rx1Cx1000 Sq.mm per phase & Outgoing 2Rx3Cx400, Capacitor Bank, Local Transformer 1Rx3Cx400 Sq.mm.
15) Cable dropper details shall be as per below:

Incomer / Bus coupler with cable termination:



Outgoing / Capacitor / Local transformer:



16) No Cable dropper shall foul with base frame / panel joints.

5.15 : LABELS:

1) 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.
2) 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.
3) Each LED 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
4) 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.
5) 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' ETC.

6) Danger notice plate as per IS to be provided on each panel.

Section differentiation marking, bus differentiation and phase differentiation marking shall be provided a visible colour coding as per Indian coding will be preferred.

5.16 : EARTHING:

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 and shall be bolted with two bolts. 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. One bus bar earthing truck & one cable earthing truck shall be supplied per switchboard

1) 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 earth pad to this earth bus by distinct connections. Bidder shall provide separate electronic earthing for all LED's. Separate earth bus bar to be run along switchgear for protection earthing of relays and communication equipment and LEDs and shall be insulated from the frame. Two bolts shall be provided for connecting the earthing conductor. Earth bus bar shall be brought out on both left & right ends of the Switchgear Panel to facilitate connection with existing earth connection.
2) The earth bus shall be located at sufficient height from the gland plate & also ensure that it does not foul with switchgear room floor and provide easy connection with existing earthing conductor in trench and shall not be removable from the outside of the cubicle. VT and CT secondary, Neutral or common lead shall be earthed at one place only or at the terminal blocks where they enter the panel.
3) 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. **(Earthing truck not required for TPC Mumbai and TPDDL)**
4) All metallic cases of relays, instruments and other panel mounted equipment 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, preferably at the terminal blocks where they enter the panel. Bidder shall provide separate electronic earthing for all IEDs.
5) 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.
6) Individual Earthing bus shall be extended from main earth bus in each breaker panel for which all peripherals body earthing are connected through green colour 2.5 sq.mm wire.
7) All live/energized equipment shall have body earth and reference ground via copper strip or Copper wires of minimum 6 sq.mm.

The bidder shall further refer to protection & automation specifications of purchaser.

5.17 Asset monitoring system:

The Asset Monitoring System shall be as per the requirement of the tender. If this system is required a separate line item shall be added in the BoQ, else this system shall not be required. Asset Monitoring System is for Condition Based Predictive Maintenance for the Switchgear Panels. It should have interoperability with other make panels & relays, cyber security, user licenses etc.

Sensor Based Remote Maintenance Care system shall have following sensors:

Sensor Type	Sensor Location
Temperature Sensor	Bus Bar Compartment, Breaker Compartment (Upper Arm and Lower Arm), Cable Compartment
Partial Discharge Sensor	Cable Compartment
Humidity Sensor	Cable Compartment
Arc Sensor	Arc Chamber
Room Temperature and Humidity Sensor	Outside the Panel Board inside the Switchgear room
Pollution or Dust Sensor	Outside the Panel Board inside the Switchgear room

Online condition monitoring, asset health monitoring, data storage, reporting and maintenance support, health prediction of electrical distribution network assets, allow engineers/ managers to gather data and insight that allows them to make more informed decisions about asset health. It should have Circuit Breaker Parameter Monitoring (Input through protection relay), Substation Monitoring Device/Data Concentrator Unit, Data usage & Analytics with inbuilt algorithm.
All the accessories required for successful operation of this system shall be in the bidder's scope. Bidder has to submit BoQ for this system along with tender bid. The license of this system shall be provided for at least 5 years to minimum 10 persons. The complete architecture shall be as per the requirement of Tata Power-DDL.

5.18 : PAINTING

All sheet steel work shall be phosphated in accordance with the IS: 6005 "Code of practice for phosphating iron and steel". It should follow the 9-tank process. Oil, grease, dirt and swarf 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 phosphate, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoved type zinc chromate primer. The first coat may be "Flash dried" 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 RAL 7032 (Grey). Bus section panel shall be of 0506 Deep Orange shade. Minimum paint thickness of 120 micron is required.

5.19 : GALVANIZING

All galvanizing shall be carried out by the hot dip process, in accordance with IS 2629/ ISO 1460 amended to date. Nut, bolts, washer made of stainless steel of grade: 304. However, high tensile steel nuts, bolts and spring washers shall be hot dip galvanized to service condition four. 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.

1) 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.
2) After galvanizing no drilling or welding shall be performed on the galvanized parts of the equipment except that nut may be threaded after galvanizing.

3) 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/ BS 729 amended to date.
4) The zinc deposition should not be less than 705 grams / meter square of the galvanized surface area / 100 microns / 6 dips.

5) **Approved Sub-vendor for bought out items: -**

Sr. No	Items	Approved sub vendor
1	Epoxy Resin Cast C.T.	Pragati Make /ECS/Huphen Fabricator/Reputed as per OEM
2	Epoxy Resin Cast P.T.	Pragati Make /ECS/Huphen Fabricator/Reputed as per OEM
3	TTB	DAV make & Model name is SSFS
4	TB	Connectwell/Elmex
5	HRC Fuse	C&S / L&T /Equivalent
6	Space Heater	Girish Make

Approved makes as per approved make list specification

6. NAME PLATE & MARKING: -

The equipment shall be provided with durable and legible name plate. A stainless-steel rating plate, of at least 1 mm thickness, shall be fitted to each all the components and operating devices of the switchgear in a visible position and shall carry all the information as specified in the standards. The terminal markings shall also be in line with relevant standards. The letters on the rating plate shall be engraved black on the white/silver background. Fixing screws for outdoor use shall be of stainless steel or any other corrosion resistant metals. The Name plate shall be embossed with "PO no. with date", "PROPERTY OF TPCODL/TPNODL/TPSODL/TPWODL/TPDDL/TPC" & “CODE NUMBER” along with the following information.

The following information shall be mentioned on the Name Plate

I. Manufacturer's name and Country
II. Type / Model
III. Serial number
IV. Month and Year of manufacture V. Month and year of supply
VI. Rated primary and secondary current
VII. Rated frequency
VIII. Highest system voltage
IX. Service Voltage
X. Rated Voltage
XI. Rated insulation level
XII. Degree of Protection
XIII. Rated short time withstand current for 3 sec

XIV. Rated Impulse withstand Voltage
XV. Warrantee/guarantee clause
XVI. "SAP CODE NUMBER"
XVII. PO no. & date
XVIII. "PROPERTY OF TPCODL/TPNODL/TPSODL/TPWODL/TPDDL/TPC"
XIX. Name of the substation and feeder and reference drawing number
XX. Rated Current of Bus Bar
XXI. Rated Current of Circuit Breaker
XXII. Control Voltage

A Danger plate of appropriate size shall also be provided on the enclosure.

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

In addition to the above Name Plate Details, Bidder to mention the following details on equipment (paint on the equipment): - Equipment Description-

Rating-

Make- Sr.

No.-

YOM-

Equipment ID- (Will be written by Tata Power)

(*Font: Arial: Size 20: Polyurethane paint shall be used.)

7. TESTS:

All the Routine, acceptance and Type 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. All the components should also be type tested as per the relevant standards. All meters and metering elements in BCU shall also be routine and type tested as per the relevant standards and shall further be tested at site by the successful bidder. For Type test of Numerical relays, control IEDs, and communication equipment, and Factory acceptance test, Protection and automation specification to be followed, relevant IS/IEC has to be followed.

Bidder shall also be responsible for conducting point to point testing of all gateway configurations on the site (SAT) after the installation.

Bidder shall ensure integrated FAT of switchgear along with SCADA at one location along with RTU functional tests.

Following tests shall be necessarily conducted on the switchgear in addition to the others specified in IS/IEC.

A) <u>For Breaker panels</u>

I) Type Tests

1. Test to verify the protection of person against dangerous electrical effects.
2. Electromagnetic compatibility Tests of Auxiliary and control circuits (Emission & Immunity test)
3. Dielectric Test: Impulse & Power frequency
4. Internal Arc Test
5. Short-time withstand and Peak withstand current test
6. Verification of Degree of Protection.
7. Verify the Insulation level of the equipment including at power frequency test voltage on auxiliary circuits.
8. Temperature Rise tests / Continuous current test as per IEC
9. Short-circuit current making and breaking tests
10. Test to prove the satisfactory operation of the included switching device and removable parts (Mechanical operation test)

II) Routine Tests

1. Dielectric test on main circuit
2. Tests on auxiliary and control circuits
3. Measurement of the resistance of the main circuit
4. Dimensions and visual checks
5. Mechanical Operation test
6. Verification of correct wiring

III) Acceptance Test

1. Dielectric test on main circuit
2. Tests on auxiliary and control circuits
3. Measurement of the resistance of the main circuit
4. Dimensions and visual checks
5. Mechanical Operation test
6. Automation & Protection Philosophy Test along with RTU

B) <u>For Current Transformers</u>

I) Type Tests

1. Short time current Test
2. Temperature rise Test.
3. Lightning impulse tests / Dielectric test
4. Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class.

II) Routine Tests

1. Verification of terminal marking and Polarity
2. Power frequency dry withstand tests on Primary Windings.
3. Power frequency dry withstand tests on Secondary windings
4. Over Voltage inter-turn test.
5. Partial Discharge tests.
6. Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class.
7. For PS class core – Knee point voltage & Excitation current, Secondary winding resistance, Turns ratio.

C) <u>For Voltage Transformers</u>

I) Type Tests

1. Short time current Test
2. Temperature rise Test.
3. Lightning impulse tests / Dielectric test
4. Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class.

II) Routine Tests

1. Verification of terminal marking and Polarity
2. Power frequency dry withstand tests on Primary Windings.
3. Power frequency dry withstand tests on Secondary windings
4. Partial Discharge tests.
5. Determination of errors or other characteristic according to the requirements of the appropriate designation or accuracy class.

For CTs & PTs routine test reports from the OEM to be provided.

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 TEST 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 laboratories 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 case if type test conducted beyond 10 years, then bidder to certify on letter head of parent OEM that no design change & no manufacturing plant change occurred from type tested product. 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 Purchaser.

Bids without all type test report shall stand disqualified.

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. The bidder shall grant free

access to the places of manufacture to the Purchaser's representatives at all times when the work is in progress. Inspection by the Purchaser or its authorized representatives shall not relieve the bidder 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 the Purchaser.

Following documents shall be sent along with material.

a) Test reports
b) MDCC issued by TPCODL/TPNODL/TPSODL/TPWODL/TPDDL/TPC
c) Invoice in duplicate
d) Packing list
e) Drawings & catalogue
f) Guarantee / Warrantee card
g) Delivery Challan
h) Other Documents (as applicable)

10. INSPECTION AFTER RECEIPT AT STORE / SITE:

The material received at Purchaser Store / site 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 Engineering department.
If any deviation or anomaly observed at this stage same need to be rectified by bidder at bidders' own cost at earliest.

11. GUARANTEE

Bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this 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 Purchaser up to a period of at least 60 months from the date of commissioning or 66 months from the date of last supplies made under the contract whichever is earlier , Bidder shall be liable to undertake to replace/rectify such defects at its own costs, within mutually agreed time frame, and to the entire satisfaction of the Purchaser, failing which the Purchaser will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the Purchaser's own charges (@ 20% of expenses incurred), from the Bidder or from the " Security cum Performance Deposit" as the case may be.
In case of GP failure, BA shall report at site within 48 hours from intimation and arrange for rectification of fault within a mutually agreed time. In case rectification at site is not possible then alternative arrangement (replacement) to be made by BA within 15 days of intimation of failure.

12. PACKING

Bidder shall ensure that all equipment covered by 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. The packing should be in such manner that during storage the Panels and its components should not be damaged.
No single use plastic to be used in packing material. Packing should be done with environment friendly recyclable materials.

13. TENDER SAMPLE

Not applicable.

14. TRAINING

The vendor shall include in his offer Training for Tata Power engineers. The training shall cover development, integration, installation and commissioning of both software & hardware components of the system. The training of 2 days shall be given at site by OEM.

The vendor shall provide hands-on training on the system. All required training materials such as system catalogues, test instruments, demo equipment, and simulation jigs, etc. shall be provided by the vendor. The training shall equip the Purchaser's engineers for installation, commissioning, operation and post-warranty maintenance of hardware, software (Operating System, Administration and Applications), protocols and all third-party systems.

15. QUALITY CONTROL

The bidder shall submit with the offer, 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 after finishing, bought out items and fully assembled component and equipment including drives. 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 or its nominated representative engineer shall have free access to the manufacturer/sub-supplier's works to carry out inspections.

16. TESTING FACILITIES

Bidder shall have adequate in-house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standard.

17. MANUFACTURING ACTIVITIES

The successful bidder will have to submit GTP & Drawing with 15 days from placement of order/OLA for approval. The date of Code-2 / Code-1 / CAT-A / CAT-B approval given by TATA Power DISCOM will be treated as first day for assessment of LD (if applicable).

18. SPARES, ACCESSORIES & SPECIAL TOOLS / GAUGES

18.1 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 BOQ attached with the tender.

Description

a) Trip Coil: Minimum 2 nos or 10 % of tender quantity of breakers
b) Closing coil: Minimum 2 nos or 10 % of tender quantity of breakers
c) Spring charging motor: Minimum 2 nos or 10 % of tender quantity of breakers
d) Vacuum Interrupter: 10 % of tender quantity of breakers
e) T-N-C Switch: Minimum 2 nos or 10 % of tender quantity of breakers
f) Local/remote selector switch: Minimum 2 nos or 10 % of tender quantity of breakers
g) Tulip/ Finger contact: Minimum 6 nos or 30 % of tender quantity of breakers (for I/C & O/G Panel separately)
h) Indication LEDs: 50 nos

i) Auxiliary switches: 10 nos
j) CTs for I/C panel: Minimum 1 nos or 15 % of tender quantity whichever is maximum.
k) CTs for O/G panel: Minimum 4 nos or 10 % of tender quantity whichever is maximum.
l) PTs for I/C panel: Minimum 1 nos or 15 % of tender quantity whichever is maximum
m) Bus PTs: Minimum 1 nos or 15 % of tender quantity whichever is maximum
n) Space heater: Minimum 2 nos or 10 % of tender quantity of breakers
o) Operating mechanism: Minimum 2 nos or 10 % of tender quantity of breakers
p) Panel side contact for incoming: Minimum 2 nos or 10 % of tender quantity of breakers
q) Panel side contact for outgoing: Minimum 2 nos or 10 % of tender quantity of breakers

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 Purchaser for new grids based on IEC-61850 protocol

18.2 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.

19. DRAWINGS & DOCUMENTS

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 Particulars.
b) General description of the equipment and all components with makes and technical requirements 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 along with Foundation Plan and loading details
i) Manufacturing schedule and test schedule

Drawings / documents to be submitted for approval after the award of the contract are as under:

Sr. No.	Description	For Approval	For Review	Final
	Technical Parameters	√		
	General Arrangement Drawings	√		
	Single Line Diagram	√		
	Typical Mimic diagram	√		

1	Schematic / inter logic diagrams	√		√
2	Bill of Material	√		√
3	Foundation Plan & loading details	√		√
4	Manual/Catalogues/drawings for DC, BCU meters, relays, switches, lamps etc.		√	√
5				√
6				√
7				√
8				√
9	Control and Operational Philosophy of		√	
10	Input/output List		√	
11	Cable Schedule & interconnection		√	
12	Programming language manual		√	√
13	Details of the Communication protocol &		√	√
14	Equipment wise detailed circuit diagram		√	√
15	Electronic earthing scheme		√	√
16	Configuration diagram with functional		√	√
17	I/O mapping		√	√
18	3 nos. of working drawings		√	√
19	3 nos. of as-built drawings		√	√
20	Relay co-ordination scheme		√	√
21	Installation / commissioning manual		√	√
22	Instruction for Use		√	√
23	Transport Shipping dimension drawing		√	√
24	QA &QC Plan	√	√	√
25	Routine, Acceptance & Type Test	√	√	√

All the documents & drawings shall be in English language.

After the receipt of the order, the successful bidder will be required to furnish all detailed drawings of components for Purchaser approval.

Instruction Manuals: Bidder shall furnish two (2) soft copies and three (3) hard copies of nicely bound manuals of Switchgear and Relays (In English language) covering erection and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices.

20. GUARANTEED TECHNICAL PARTICULARS

Sr. No	Description	Units	As Furnished by Bidder
1	**SWITCHBOARD**		
a)	Architecture		
b)	Applicable standard		
c)	Dimensions (In mm) WXDXH		
d)	Internal Arc Protection		

e)	Normal Service conditions		
f)	Service Voltage	KV	
g)	Rated Voltage	KV	
h)	Rated capacity	MVA	
i)	Rated power frequency withstand voltage (rms)	KV	
j)	Rated impulse withstand voltage (1.2, 50us)	KVP	
k)	Rated Short time withstand current	KA	
l)	Rated Peak withstand current	KA	
m)	Busbar material		
n)	Main busbars insulation		
o)	Busbar rated continuous current	A	
p)	Max current Density for Bus bar	A/sq mm	
q)	Max. Permissible temp. rise at		
r)	LOTO lock arrangement shall be provided for Cable compartment, Bus compartment and breaker compartment separately.		
s)	Separate doors section shall be provided for cable and bus compartment separately with handle arrangement		
t)	Degree of Protection for enclosure / Partitions / for meters, relays and BCU		
u)	CT, PT, breaker name plate details shall be embossed on front door panel		
v)	Extendable Circuit Breaker Test Plug for test purpose length of 10 Meters		
w)	Size of panel		
x)	Material of Sheet		
y)	Thickness of Enclosure Sheet / Frame		
z)	Thickness of Doors / Covers Sheet		
aa)	Thickness of Gland Plate (Removable)		
2	**CIRCUIT BREAKER**		
a)	Standard		
b)	Type		

c)	No of poles		
d)	Rated load breaking current (sym)	KA	
e)	Rated short circuit withstand current	KA	

f)	Rated short circuit making current	KA	
g)	Isolation		
h)	Rated Voltage	KV	
i)	Service voltage	KV	
j)	Rated frequency	HZ	
k)	Rated Insulation Level		
i)	Lightning impulse withstand voltage	KVP	
ii)	One min. power frequency withstand voltage	KV (rms)	
l)	Rated operating sequence		
m)	Opening time	millisecond	
n)	Arcing time	millisecond	
o)	Total break time	millisecond	
p)	Making time	millisecond	
q)	Temperature Rise		
r)	Minimum Tripping time	millisecond	
s)	Closing time	millisecond	
t)	Time multiplier Setting		
3	**OPERATING AUXILIARY VOLTAGES**		
a)	Control and signaling voltage		
b)	Spring Charging Motor (Universal Motor)		
c)	Heater and lighting circuits		
d)	No. of spare auxiliary contacts		
4	**CURRENT TRANSFORMER**		
a)	Type		
b)	Short circuit withstand		
c)	Location		
d)	Ratio		
e)	Burden & Class (Metering and		
i)	Core –I		
ii)	Core –II		
f)	Ratio		
g)	Burden &Class (Differential)		
i)	Core- III		
ii)	Make of CTs		
5	**VOLTAGE TRANSFORMER**		

a)	Make		
b)	Location		
c)	Mounting arrangement		
d)	Ratio		
e)	Burden &Class		
i)	Core- I		
ii)	Core –II		
Iv)	Ramp provided for rack in/rack out		
6	Protection, Control, Metering & Communication		
7	MIMIC Diagram on Relay		

8	Provision of flag indications and contacts for remote annunciation for Self-powered backup relay for incomers		
9	Electrically reset type, High speed relay for tripping.		
10	Anti-pumping Relay		
11	Makes for Auxiliary Relays		
12	Provision of DC fail Relay for each panel		
13	PT back charging lamp shall be provided on backside of individual breaker panel.		
14	**OTHERS**		
a)	Cable charge indication		
b)	TNC Switch		
c)	Local/Remote switch		
d)	Indication Lamps CB ON/OFF		
e)	Indication Lamps CB Auto Trip		
f)	Indication Lamps for CB Test /Service positions		
g)	Spring charged indication		
h)	Trip circuit. supervision scheme		
i)	MCB for AC		
j)	MCB for DC		
k)	MCB for space heater		
l)	MCB for VT's		
m)	Trip alarm scheme with hooter, Accept/Reset PB etc.		

n)	Panel anti-condensation heater with Hygrotherm		
o)	Panel illumination lamp with switch		
p)	15 A, 3 pin socket.		
q)	Makes of indicating lamps		
r)	Makes of MCB		
s)	Wiring of breaker auxiliary contacts up to terminals		
t)	Makes for Fuses / Fuse bases		
u)	CB handling trolley		
14	**BCPU (Bay Control and Protection Units)**		
14.1	BCPU Functions		
14.2	Accuracy class of internal energy		
14.3	Input / Output capacity per BCPU		
14.4	System Frequency		
14.5	Rated current		
14.6	Auxiliary Voltage		
14.7	Timing Accuracy		
14.8	Sampling Rate:		
14.9	Sequential Events & Recorder memory		
14.10	Environment		
14.11	Ingress Protection		
14.12	Protection functions for BCPU		
14.13	Additional separate protection if any		
14.14	Feeder protection,		
15	**Software tools**		
15.1	Communication Ports		
15.2	Protocols		
15.3	Recording		
15.4	Level & security of Operation		
15.5	Time Synchronisation		
15.6	Adherence to standards		
15.7	Control function		
15.8	Password protection		
15.9	Configuration tool		
15.10	Integrated checks		
17	**Commissioning activity**		
17.1	Integrated FAT considered		

17.2	Deputation of Project Manager at site considered		
18	PQM Meter	Incomer	
19	Castle key interlock to be provided in such a way that for opening of back door castle key shall be required.		
20	The back door opening shall be possible only when cable is in dead condition.		
21	Paint Thickness	120 microns	

21. 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 JUSTIFICATION.

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

Seal of the Company:

Signature

Designation

Annexure 1:

Inspection Testing Plan

Sr. No.	Test name	Specific value		Test method	
		Clause No.	Reference Standard	Clause No.	Reference Standard
Test on Switchgear					
1	Dielectric test on main circuit	Clause No. 7.2.7.2 and 7.2.8.2	IEC 62271-1	Clause No 9	IEC 60060-1
2	Tests on auxiliary and control circuits	Clause No. 6.4.1	IEC 62271-1	Clause No. 7.5.3.2	IEC 62271-1
3	Measurement of the resistance of the main circuit	Table 14	IEC 62271-1	Clause No. 7.4.4	IEC 62271-1
4	Dimensions and visual checks	As per Approved Drawing		IEC 17025	
5	Mechanical operation test	Clause No 7.102	IEC 62271-200	Clause No 7.10	IEC 62271-200

Annexure-2

Tata power Branding Name plate -

Separate metallic name plate with Tata Power Logo of Dimension 12*12 Inches in clear font as shown below.

Relationship between the two marks- size

The Tata and Tata Power Marks are always used in conjunction with each other, never appearing in isolation on Tata Power communication.

The height of the letter T of Tata (T-height) is the basic measure for all sizes and proportions.

The rounded measure 2T in height, is separated from the Tata lettering by a distance of 1/2T.

The T height of both, the Tata and the Tata Power Marks is to be the same, except in exceptional cases on approval from the Corporate Communications team.

Centre aligned - Stacked (Preferred)

Relationship between the two marks- positioning

The two marks can appear stacked, which is the preferred placement, or linear, by the side of one another.

Annexure -3

BCPU DI/DO List

BCPU RELAY			
Binary Inputs		**Binary Outputs**	
BI1	TRIP RELAY (F86) OPTD.	BO1	SPARE
BI2	LRS IN REMOTE	BO2	UNDER VOLTAGE TRIP TO TC-1
BI3	CONTROL DC MCB FAIL	BO3	RELAY HEALTHY/WATCH DOG
BI4	VT MCB TRIP (PT FAIL)	BO4	PROTECTION TRIP TO MASTER RELAY
BI5	INCOMING DC SUPPLY FAIL	BO5	F86 TRIP RELAY RESET REMOTE
BI6	CB STATUS OPEN	BO6	33/11kV FEEDER REMOTE CLOSE COMMAND
BI7	CB STATUS CLOSE	BO7	VCB OPEN COMMAND FROM REMOTE
BI8	CB SPRING CHARGED	BO8	UNDER VOLTAGE TRIP TO TC-2
BI9	LINE ISO CLOSE	BO9	CLOSE COMMAND FROM HMI
BI10	LINE ISO OPEN	BO10	LINE ISO CLOSE CMD
BI11	EARTH SWITCH CLOSE	BO11	LINE ISO OPEN CMD
BI12	EARTH SWITCH OPEN	BO12	SPARE
BI13	MASTER TRIP RELAY SUPERVISION		
BI14	TC-1 HEALTHY		
BI15	TC-2 HEALTHY		
BI16	TNC CLOSE		
BI17	TNC OPEN		
BI18	AC FAIL		
BI19	SPARE		
BI20	SPARE		