MAHAVITARAN
Maharashtra State Electricity Distribution Co. Ltd.

SPEC. NO. CE/Testing/ MSC-I/ 11kV Indoor Switchgear/2020

SPECIFICATION

FOR

11 kV 25 kA INDOOR SWITCHGEAR

INTEGRATED WITH ASSOCIATED CONTROL AND RELAY PANELS

AND

CONTROL DESK FOR REMOTE OPERATION

FOR

VARIOUS 33/11 kV SUBSTATIONS

IN

MAHARASHTRA

INDEX

SPECIFICATION FOR
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1.0 Scope

1.1. This Specification covers the basic requirements in respect of 11 kV, 25 kA (with highest system voltage of 12 kV) indoor switchgear integrated with associated indoor Control desk/ Control and Relay (C&R) panels for installation at various sub-stations in Maharashtra. Clause 5 of the Specification covers the requirements of indoor switchgear with relays & controls. The control and relay panel should form integral part of the switchgear (i.e. should be physically integrated into one unit). In addition to this an operator's supervisory control desk with interconnecting equipment viz. control cables, connectors etc. should be provided having facility of remote closing, tripping of every switchgear panel and a repeat annunciation and indication system showing status of the circuit breaker.

1.2. The equipment offered shall be complete with all parts necessary for their effective and trouble-free operation. Such parts will be deemed to be within the scope of the supply irrespective of whether they are specifically indicated in the commercial order or not.

1.3. The respective drawing alongwith notes and specification attached hereto form an integral part of this specification for all purposes.

1.4. It is not the intent to specify herein complete details of design and construction. The equipment offered shall conform to the relevant standards and be of high quality, sturdy, robust and of good design and workmanship complete in all respects and capable to perform continuous and satisfactory operations in the actual service conditions at site and shall have sufficiently long life in service as per statutory requirements. In actual practice, not withstanding any anomalies, discrepancies, omissions, in-completeness, etc. in these specifications and attached drawings, the design and constructional aspects, including materials and dimensions, will be subject to good engineering practice in conformity with the required quality of the product, and to such tolerances, allowances and requirements for clearances etc. as are necessary by virtue of various stipulations in that respect in the relevant Indian Standards, IEC standards, I.E. Rules, I.E. Act and other statutory provisions.

1.5. The Tenderer/supplier shall bind himself to abide by these considerations to the entire satisfaction of the purchaser and will be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.

2.0 Tolerances:

Tolerances on all the dimensions shall be in accordance with provisions made in the relevant Indian/IEC standards and in these specifications. Otherwise the same will be governed by good engineering practice in conformity with required quality of the product.

3.0 SERVICE CONDITIONS:

3.1. System particulars:

a. Nominal system voltage ... 11 kV

b. Corresponding highest system voltage ... 12 kV

c. Frequency ... 50 Hz±3%

d. Number of phases ... 3

e. Neutral earthing ... Solidly grounded

f. Short Current Rating ... 25 kA

3.2. Equipment supplied against the specification shall be suitable for satisfactory operation under the following tropical conditions:-

a. Max. ambient air temperature : 50 Deg. C

b. Max. relative humidity : 100 %

c. Max. annual rainfall : 1450 mm

d. Max. wind pressure : 150 kg/sq.m.

e. Max. altitude above mean sea level : 1000 mtrs.

f. Isoceraunic level : 50

g. Seismic level(Horizontal acceleration) : 0.3 g.

h. Climetic condition Moderately hot and humid tropical climate conducive to rust and fungus growth.

i. Reference Ambient Temperature for temp. rise : 50 deg C

The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.

3.3. Auxiliary supplies available at the various sub-stations are as follows:-

3.3.1. Rating:

i.	A. C. Supply	240 volts with ± 10% variation
ii	D.C. Supply	30 V DC with +10% to – 15% variation
iii	Frequency	50 Hz with ± 3% variation

4.0 **Codes and Standards**

4.1. The design, manufacture and performance of the equipment shall comply with all currently applicable statutes, regulations and safety codes. NOTHING IN THIS SPECIFICATION SHALL BE CONSTRUED TO RELIEVE THE TENDERER OF THIS RESPONSIBILITY.

IEC/ISO/BS	IS	Subject
IEC:56 IEC:62271-100 & 200		High Voltage alternating current circuit breaker general requirement
IEC:694	IS : 12729	Common clauses of high voltage switch-gear and control gear standards (for voltage exceeding 1000 V).
IEC:60	IS : 9135	High Voltage testing techniques.
IEC:427	IS:13516	Method of synthetic testing of HV .A.C circuit breakers.
IEC: 1233		HV. AC. Circuit breakers- inductive load switching.
IEC: 17A/CD:474		HV. AC. Circuit breakers- capacitive switching.

IEC:529	IS: 13947	Degree of protection provided by enclosure.
IEC:137	IS: 2099	Insulating bushing for A.C. voltages above 1000V
IEC:233	IS : 5621	Hollow insulators for use in electrical equipment & testing.
IEC:273	IS: 5350	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
IEC:815	IS: 13134	Guide for selection of insulators in respect of polluted conditions.
IEC: 34	IS : 996	A.C motors
ISO:1460 BS:729	IS:2629	Hot dip galvanizing
	IS:2633	Method of testing uniformity of zinc coated articles.
	IS: 5	Colour for ready missed paints and enamels
	IS: 6005	Code of practice for phosphating or iron and steel.
IEC: 227	IS:1554	P.V.C Insulated cables for voltages up to and including 1100 Volt.
IEC:269	IS:13703	Low voltage fuses for voltages not exceeding 1000volt.
ISO:800	IS:1300	Phenolic molding materials.
	IS:13118	Guide for uniform marking and identification of conductors and apparatus terminals.
IEC: 185	IS: 16227 part I &II	Current transformers.
IEC:186	IS: 16227 Part I & III	Potential Transformers
	IS:14697, ,IS:15959	Specification for TOD DLMS Energy Meter (C1 Category) as per latest MSEDCL tech spec.
	IEC-60870-5- 103 IEC60255/IS 3231	Specification for 3 O/C +1 E/F Numerical Protection Relay

Unless otherwise specified, the equipment offered shall confirm to the latest applicable Indian, IEC, British or U.S.A Standards and in particular, to the following:-

4.2. In the event of offered equipment confirming to standards other than the above, the salient points of comparison between the standard(s) adopted and the relevant IS shall be indicated in the technical offer. Copies of the standard adopted shall be invariably furnished with the offer.

5.0 GENERAL TECHNICAL REQUIREMENTS

5.1. 11KV INDOOR SWITCHGEAR

5.1.1. Switchgear for Indoor installation shall be metal clad, draw-out type and fully compartmentalized having 25 kA short time current rating. All panels shall be of unitized construction providing facility for extensions on both sides. Three types of switchgear panels are required, viz. the incomer panel, the bus section panel and the feeder (outgoing) panel.

5.1.2. The switchgear will be installed in a separate switchgear room, but the controls under normal conditions will be from the 11 kV remote supervisory control desk installed in the main control room.

5.1.3. Circuit Breakers used shall be VCBs of specified rating for the various types. The design of the breaker truck shall be such that there will be flexibility of interchanging between incomer, bus-section and feeder trucks, where similar rated breakers are offered.

5.1.4. Bill of materials :

Bill of materials for the incomer, bus section and feeder panels shall be as follows :

5.1.4.1. Incomer panel

i. One draw out type Vacuum circuit breaker having 800 Amps. Continuous current rating and 25 kA for 3 sec. short time current rating, complete with operating mechanism and accessories.

ii. 3 nos. Current Transformers of ratio 800-400 /5-5 A.

iii. 3 nos. single phase PTs of ratio $\frac{11KV/110V}{V3/V3}$ connected to the incomer with proper fuse protection arrangement.

iv. One mechanical ON/OFF indicator

v. One mechanical 'spring charged' indicator.

vi. One T-N-C control switch for circuit breaker.

vii. Remote-Local switch for circuit Breaker

viii. Relay instruments etc. as per clause 5.7

ix. Set of MCBs, stud type terminals and control wiring.

x. Fuse and link for Motor Starter

xi. Three nos. of space heaters with thermostat control, one each for the breaker chamber, bus bar chamber and the CT/cable chamber alongwith a common MCB mounted inside LT control wiring.

5.1.4.2. Bus-section panel

i. One draw-out type vacuum circuit breaker having 800 Amps continuous current rating and 25 kA for 3 sec. short time current rating, complete with operating mechanism and accessories.

ii. 3 nos. CTs of ratio 800-400/5-5 A

iii. One T-N-C control switch for circuit breaker.

iv. Remote-local switch for circuit Breaker.

v. One mechanical ON/OFF indicator

vi. One mechanical 'spring charged' indicator

vii. Three nos. space heaters with thermostat control, one each for the breaker chamber, bus bar chamber and the CT/cable chamber along with a common MCB mounted inside the L.T. control cubicle.

viii. Set of MCBs, stud type terminals, and control wiring.

ix. Fuse and link for Motor Starter

x. All Relay and instruments etc. as per clause 5.7

5.1.4.3. Feeder (outgoing) panel

i. One draw-out type vacuum circuit breaker having 400 Amps continuous current rating and 25 kA for 3 sec. short time current rating, complete with operating mechanism and accessories.

ii. 3 nos. CTs of ratio 400-200/5-5 A

iii. One T-N-C control switch for circuit breaker.

iv. Remote-local switch for circuit Breaker.

v. One mechanical ON/OFF indicator

vi. One mechanical 'spring charged' indicator

vii. Three nos. space heaters with thermostat control, one each for the breaker chamber, bus bar chamber and the CT/cable chamber along with a common MCB mounted inside the L.T. control cubicle.

viii. Set of MCBs, stud type terminals, and control wiring.

ix. Fuse and link for Motor Starter

x. All Relay and instruments etc. as per clause 5.7

5.2. BUSBAR

5.2.1. 11 kV bus bars shall be of electrolytic copper and shall be rated for 2000 Amps continuous current. Cross sectional area shall not be less than 1250 sq.mm. Current density of 1.6 Amps/sq. mm shall be considered for the bus bars. The bus bar edges/ends shall be rounded off/chamfered so that there will not be any sharp edges/projections.

5.2.2. 11 kV bus support insulators and other equipment insulators shall have a minimum creepage distance of 127 mm. These insulators shall be of solid core porcelain or epoxy resin cast, with suitable petticoat design. Insulators shall have cantilever strength of not less than 1200 KgF.

5.2.3. All fasteners (Nuts Bolts) used for bus bar connections shall be of non magnetic stainless steel. Only belleville type washers shall be provided for each nut bolt. If the fasteners used are not of stainless steel the tenderer shall state in their offer the material used and confirm that the same is non-magnetic and is superior to stainless steel.

5.2.4. The bus bars alongwith their supporting insulators etc. shall have a short time current rating of 25 KA for 3 sec. This shall be confirmed by the tenderers in their technical offer.

5.2.5. Clearances between phases and between phase and earth shall be kept liberally so as to obtain high reliability. However minimum clearances as shown below shall be kept.

Sr. No.		for Busbar Chamber	for breaker Chamber
1.	Phase to Phase	127mm	127mm
2.	Phase to earth	77mm	77mm

5.2.6. If any special insulating material is proposed to achieve the effect of above clearances details of the same shall be furnished in the technical offer.

5.2.7. Test certificate of bus bar for rated STC rating shall be submitted, alongwith offer, otherwise necessary confirmation shall be given in the offer for submitting the same for approval of C.E.(Testing) prior commencement delivery.

5.3. CIRCUIT BREAKERS

5.3.1. The circuit breakers offered shall be Vacuum Circuit Breakers and of horizontal draw out Horizontal Isolation type. Breakers shall be of 3 pole design for use in 11 kV indoor switchgear.

5.3.2. The circuit breaker shall have 25 kA for 3 sec. short time current rating. The circuit breaker for incomer and bus section shall have 800 Amps continuous current rating and for feeders shall have 400 Amps continuous rating. Circuit breaker shall be suitable for rapid reclosing cycle. The circuit breaker shall be provided with motor operated spring charged closing. Spring charging motor shall be suitable for 240V, 50 Hz, single phase AC. Suitable rating starter shall be provided for Motor protection. Spring release coil for closing shall be suitable for 30V DC. Provision shall be available for charging the springs manually as well, and to close CB mechanically.

5.3.3. Tripping of the circuit breakers shall be through "Shunt trip" coils rated for 30V DC auxiliary supply. It shall be possible to trip the breaker manually in case of necessity.

5.3.4. All circuit breakers shall have mechanical ON/OFF indicator and spring charge indicator. These shall be visible from the front without opening the panel door. Also there shall be provision for mechanical (manual) tripping and also for manual charging of the springs.

5.3.5. Each operating mechanism of the circuit breaker shall be provided with adequate number of Cam/Snap type auxiliary switches of normally open and normally closed contacts for the control and operation of the equipment with continuous current rating of 10 Amp. The Breaking capacity of the contacts shall be minimum 2 A with circuit time constant less than 20 milli seconds at the rated D.C. voltage. Normal position of auxiliary switches refers to contact position when circuit breaker is open.

5.3.6. Adequate numbers of "NO/NC" contacts of the C.B. shall be wired upto the terminal block for connection to the remote supervisory desk for indication. interlocks, etc., as described under Cl.5.8 of this specification. Following contacts shall be wired up to the terminals and clearly marked up in the relevant drawings.

a. Terminal for remote indication of breaker ON/OFF.

b. Terminal for remote indication of spring charge.

c. Terminal for remote indication of trip ckt. healthy (Pre close and post close)

Minimum 4 pair each of "NO/NC" contacts shall be available as spare for use in the remote control desk for various/interlocks, voltage selection etc.

5.3.7. Insulation level of auxiliary contacts shall be 1100 volts, 2.5 kV for 1 min.

5.3.8. Safety shutters which close automatically to prevent accidental contact with the live bus after withdrawal of the C.B. shall be provided.

5.3.9. The tenderer shall offer suitable earthing trolleys to facilitate earthing of out-going feeder circuits.Unit prices of earthing trolleys shall be quoted, Per set two earthing trolleys are required.

5.3.10. Electrical anti pumping device shall be provided for breaker.

5.3.11. Principal parameter for the circuit breaker will be:

i.	Rated voltage	: 12 kV
ii.	Rated insulation level	: 12/28/75 kV
iii.	T.R.V peak value	: 20.6 kV
iv.	Rated symmetrical current breaking	: 25 kA
v.	Rated making current(Peak)	: 62.5 kA
vi.	Short time current rating	:25 kA for 3 second

5.3.12. Circuit Breakers Control Switch:

5.3.12.1. Circuit Breakers Control Switches should have finger touch proof terminals. For the convenience of maintenance, screw driver guide should be from top/bottom of the switch and not from the side. Terminal wire should be inserted from the side of the switch terminal.

5.3.12.2. Terminal screws must be captive to avoid misplace during maintenance.

5.3.12.3. Switch shall be with 48 mm x 48 mm escutcheon plate marked with Trip & Close.

5.3.12.4. Circuit Breakers control switch shall be Non- discrepancy type

5.3.12.5. Trip-neutral-close, with pistol grip handle must be pushed in to spring return to either trip or close position from Neutral position for safety and not just turn to trip.

5.3.12.6. One contact to close in each position of Trip and Close. Contact not required in Neutral position. Contact rating shall be 12 A at 30 V DC

5.3.13. Protective Relays:

5.3.13.1. Numerical biased protection relays (Principle Requirements are given in annexure- II B) shall be suitable for auxiliary supply (30 V D.C.) and shall have a reset push button and a test push button to test the relay function with provision to trip bypass push button.

5.3.13.2. The Non directional 3 O/C & 1 E/F numerical relay with High set Relay should be provided.

5.3.13.3. For each Incomer and feeder, non-directional, 3 Over current and 1 Earth fault numerical relays shall be provided as per the technical specification

5.3.13.4. For each incomer and feeder, high speed tripping relay shall be provided. Over current & Earth fault relay shall be connected to trip coil through high speed trip relay.

5.3.13.5. All relays should be suitable for flush mounting on C & R panel and all connections should be on backside. The relay should be draw –out type preferably with automatic shorting of CT circuit at a time of removal of relay from the casing.

5.3.13.6. LED Display : Relay should have 12 mm LED backlit display.

5.3.13.7. Trip circuit supervision scheme shall be such that testing of trip circuit healthiness is possible irrespective of whether the C. B. is in the closed or open position. The Trip

Circuit Healthy LED should glow continuously in CB 'ON' Position and on demand in C.B. 'OFF" position. The rating of dropping resistance in series with Trip Circuit Healthy LED shall be such that the Trip Coil should not get damaged because of continuous current flowing through it.

5.3.13.8. Test terminal blocks used in metering circuit shall be suitable for 3 phase 4 wire type connections.

5.4. CURRENT TRANSFORMERS

5.4.1. The C.Ts. being prone to failure due to various reasons, the quality and reliability of the CTs are of vital importance. C.T. shall be rated for 25 kA for 3 sec. short time current. Insulation used shall be of very high quality, details of which shall be furnished in the technical offer.

5.4.2. The instrument security factor for metering core shall be low enough but not greater than 5 at lower ratio. This shall be demonstrated on metering core in accordance with the procedure specified in relevant IS/IEC

5.4.3. Primaries shall be wound or bar type, rigid, high conductivity grade copper conductor. Unavoidable joints on the primary conductor shall be welded type, preferably lap type. The current density at any point shall not exceed 1.6 A/sq. mm.

5.4.4. Suitable insulated copper wire of electrolytic grade shall be used for CT secondary winding. Multi ratio in CT shall be achieved by reconnection of secondary winding tapping.

5.4.5. Secondary terminal studs shall be provided with at least three nuts, two plain and two spring washers for fixing leads. The stud, nut and washer shall be of brass, duly nickel plated. The minimum outside diameter of the studs shall be 6 mm. The length of at least 15 mm shall be available on the studs for inserting the leads. The space clearance between nuts on adjacent studs when fitted shall be atleast 10 mm.

5.4.6. The CTs shall be resin/epoxy cast. Contact tips on primary terminals shall be silver plated. Correct polarity shall be invariably marked on each primary and secondary terminals.

5.4.7. Details of CTs

i. IS: 16227 Part I & II

ii. Insulation level : 12/28/75 kV

iii. Class of Insulation: E

iv. Short time current : 25 kA for 3 sec.

v. CT Details	Incomer	Bus coupler	Feeder
a. Ratio	800-400/5-5A	800-400/5-5 A	400-200/5-5A
vi. Class of accuracy			
a. Core I	0.2	0.2	0.2
b. Core II	5P10	5P10	5P10
vii. Purpose of each core			
a. Core I	Metering	Metering	Metering
b. Core II	Protection	Protection	Protection

viii. BURDEN

a. Core I	20VA	20VA	20VA
b. Core II	20VA	20VA	20VA

5.5. POTENTIAL TRANSFORMER

5.5.1. Potential transformers shall be single phase units connected to the line side in the respective incomer. H.V side shall be connected in star formation and L.V. side in star/open delta formation. Three numbers of HRC fuses of suitable rating shall be provided for HV side.

5.5.2. PT may be provided in a separate compartment. The primary and secondary contacts (moving & fixed type) shall have firm grip while in service. Service position locking mechanism shall be provided and indicated by bidder in relevant drawing. Rigidity of primary stud point with earth bus in service position shall be confirmed.

5.5.3. P.T. shall be epoxy/resign cast. Contact tips of primary/secondary contacts shall be silver plated. Correct polarity shall be distinctly marked on primary and secondary terminal

5.5.4. Secondary terminal studs shall be provided with at least three nuts, two plain and two spring washers for fixing leads. The stud, nut and washer shall be of brass, duly nickel plated. The minimum outside diameter of the studs shall be 6 mm. The length of at least 15 mm shall be available on the studs for inserting the leads. The space clearance between nuts on adjacent studs when fitted shall be at least 10 mm.

5.5.5. Details of PTs

i. IS: 16227 Part I & III

ii. Insulation level : 12/28/75 kV

iii. Class of Insulation : Class E

iv. Rated voltage factor : 1.2 continuous & 1.5 for 30 Sec.

v. Ratio : $\frac{11KV/110V}{V3 / V3}$

vi. Burden : Core I - 50 VA

vii. Class of accuracy: Core I - Class 0.2

viii. Purpose : Core I - Metering

ix. Connection : Star/Star

x. Each secondary core will be protected by suitable MCB.

5.6. CUBICLE

5.6.1. The switchgear cubicle (panel) shall be made of sheet steel of thickness not less than 2 mm and shall be free standing floor mounting indoor type. There shall be sufficient reinforcement to have level surfaces resistance to vibration and rigidity during transportation & installation. The compactness of the C.B shall be made use of by the designer to make the switchgear panels as compact as possible. Cubicle shall be dust, moisture & vermin proof, and shall provide degree of protection not less than IP4X in accordance with IS 12063/1987. The cubicle shall be designed such that in both the test and isolated position of the C.B truck, the front cover of the cubicle shall remain closed.

5.6.2. Design & construction of the switchgear panel shall be of the highest order. All sheet steel work shall be treated as per the seven tank process before applying primary coating. For the final coat (stowed) epoxy paint color shade of dove grey to shade No.694 as per IS:5 shall be used. Alternatively powder coating may also be accepted. The panels after final painting shall present an aesthetically pleasing appearance, free of any dent or uneven surface.

5.6.3. Two separate earthing terminals shall be provided in each panel and shall be connected to the earth bus within the panel. The earth bus shall be of copper and shall have adequate cross sectional area.

5.6.4. Each of the Switchgear panel shall be of unitised construction with all necessary accessories like end covers etc. However the design shall allow for extension on both sides without limit. Busbar design shall be such that panel to panel interconnection can be carried out without difficulty as and when required.

5.6.5. Explosion vents of suitable design shall be provided on the roof sheet of the busbar/cable/CT's chambers so as to enable discharge of explosive gases from inside during a flashover. However the provision of explosion vent shall not affect the degree of protection/vermin proofing of the panel.

5.6.6. Power cable Compartment

5.6.6.1. Power cable compartment shall be provided at the rear of the switchgear panels and shall be suitable for cable entry from the bottom cable trenches. Rear bottom plates of the cable compartment shall be fitted with removable gland plates of adequate size for fixing the cable glands.

5.6.6.2. Cable compartments for the incomer shall be suitable for terminating 3nos. of 3x400 sq.mm XLPE cables and that for feeder shall be suitable to accommodate 2 nos. of 3x400 sq.mm. XLPE cables. Copper terminator strip of suitable size shall be provided for termination of cables and shall have adequate height inside to accommodate the heat shrinkable type indoor cable termination. Cable compartment shall be robust enough & self supporting. The design shall be such that the weight of the power cable within the compartment shall not cause direct pressure on the C.T.studs. Suitable clamping arrangement shall be provided at the bottom of the cable compartment. Each power cable shall be terminated independently.

5.6.7. CONTROL WIRING

5.6.7.1. All wiring shall be carried out with 1100 volts grade single core, multistrand flexible tinned copper wires with PVC insulation. The conductor size shall 2.5 sq mm (minimum) for circuits. Wiring trough may be used for routing the cables. Wire numberings and colour code for wiring shall be as per IS:5578/1984. The wiring diagram for various schematics shall be made on thick and durable white paper in permanent black ink and same should be encased in plastic cover, thermally sealed. It should be kept visibly in a pocket of size 350 x 400 mm of MS sheet of 1 mm thickness, on the interior surface of the door of C & R Panel.

5.6.7.2. All front mounted as well as internally mounted items including MCBs shall be provided with individual identification labels. Labels shall be mounted directly below the respective equipment and shall clearly indicate the equipment designation.

5.6.7.3. Further it shall be ensured that any control wiring if at all routed through the H.T chamber is properly insulated and provided with metallic barriers to prevent damages due to heat.

5.6.8. Wiring and control wiring terminals:-

5.6.8.1. Terminal blocks shall be of clip-on design made out of non-trackable insulating material of 1100 V grade. All terminals shall be stud type, with all current carrying and live parts made of tinned plated brass. The studs shall be of min 4 mm dia brass. The washers, nuts, etc. used for terminal connectors shall also be of tinned plated brass.

5.6.8.2. The terminal connector/blocks shall be disconnecting type terminal connectors with automatic shorting of C.T. secondary terminals shall be provided in CT secondary circuit. All other terminal connectors shall be Non- disconnecting type. Terminal should be shock protected in single mouldedpiece. Terminal block should have screw locking design to prevent loosening of conductor.

5.6.8.3. At least 20% spare terminals shall be provided. All terminals shall be provided with ferrules indelibly marked or numbered and identification shall correspond to the designations on the relevant wiring diagrams. The terminals shall be rated for adequate capacity which shall not be less than 10 Amps for control circuit. For power circuit it shall not be less than 15 Amps.

5.6.8.4. All front mounted as well as internally mounted items shall be provided with individual identification labels. Labels shall be mounted directly below the respective equipment and shall clearly indicate the equipment designation. Labeling shall be on aluminium anodised plates of 1 mm thickness, letters are to be properly engraved.

5.6.8.5. All fuses used shall be of HRC type. The fuse base and carrier shall be plug-in type moulded case kitkat of backelite/DMC. All current carrying and live parts shall be of tinned/nickel plated copper. No fuse shall be provided on DC negatives and AC neutrals. Tinned copper links shall, however, be provided on DC negatives and AC neutrals.

5.6.9. All MCBs as per IS:8828/1993 (amended upto date) of adequate rating shall be used

5.7. CONTROL AND RELAY PORTION OF 11 kV INDOOR SWITCHGEARS:

5.7.1. Bill of materials:

5.7.1.1. The relays, meters and equipment as described below should be provided on the switchgear for each for incomer, bus-section, and feeder as follows:-

Sr. No.	Description	Quantity		
		Incomer	Bus-Sect.	Feeder
1	Circuit label	1 No.	1 No	1 No
2	Vacuum Circuit Breaker 12 kV, 800 Amps,25 kA	1 No.	1 No.	--
3	Vacuum Circuit Breaker 12 kV, 400 Amps,25 kA	--		1 No.
4.	Motor for spring charge	1 No.	1 No	1 No
5.	Starter with fuse and link for Motor.	1 No.	1 No	1 No
6.	Ammeter, 48x96 sq. mm	1 No.	1 No	1 No
7.	Ammeter selector switch	1 No.	1 No.	1 No
8.	Voltmeter, 48x96 sq. mm	1 No.	-	-

9.	Voltmeter selector switch.	1 No.	-	-
10	Digital Frequency Meter	1 No.	1 No.	1 No
11	Control switch for circuit breaker.	1 No.	1 No.	1 No
12	Local/Remote selector switch.	1 No.	1 No.	1 No
13	Auto/Manual selector Switch.	1 No.	1 No.	1 No
14	Indicating LED (Amber colour) for 'Trip Circuit Healthy'	1 No.	1 No.	1 No
15	Push button for 'Trip circuit Healthy Test'	1 No.	1 No.	1 No
16	Indicating LED (White colour) for 'spring charged'	1 No.	1 No.	1 No
17	Indicating LED (Red colour) for C.B. ‘ON”	1 No.	1 No.	1 No
18	Indicating LED (Green colour) for C.B. ‘OFF”	1 No.	1 No.	1 No
19	Indicating LED for Auto Trip	1 No.	1 No.	1 No
20	Mimic diagram section	1 set	1 set	1 set
21	Numerical non-directional combined 3O/C+1E/F relays (IDMT 3-sec relays.)	1 set	1 set	1 set
22	Numerical High Speed Master Trip Relay	1 set	1 set	1 set
23	TOD with DLMS Energy Meter with RS 232 port as per MSEDCL latest tech spec.	1 No	-	1 No
24	Single phase Current Transformer 800-400/5-5 Amp	3 Nos.	3 Nos.	--
25	Single phase Current Transformer 400-200/5-5 Amp	--	--	3 Nos.
26	Single phase Potential Transformer	3 Nos.	--	--
27	Alarm scheme consisting of alarm relay(s), indicating LED and Accept/Reset push button(s)	-	1 set	-
28	Alarm bell	-	1 No	-
29	Voltage selection Scheme consisting of auxiliary relays and PT-1/PT-2 fail indicating LEDs.-	-	1 set	-
30	Space heater alongwith MCB	1 set	1 set	1 set
31	Thermostat	1 No.	1 No.	1 No
32	Toggle switch for Heater	1 No.	1 No.	1 No
33	Cubicle illumination lamp alongwith door operated control switch.	1 set	1 set	1 set
34	Power plug alongwith control switch.	1 set	1 set	1 set
35	Wiring alongwith MCBs, terminal blocks and terminal connectors	1 set	1 set	1 set

Scheme features :

5.7.1.2. Trip circuit supervision scheme as per clause no. 5.3.14.7 shall be provided for each circuit breaker.

5.7.1.3. When two or more incomers are required at one station, suitable voltage selection scheme to select the correct PT supply will be essential . Voltage selection scheme offered shall be suitable to select (automatically) the PT supply as follows

i. Both incomers 'ON' and both PTs healthy- PT supply from respective incomer shall feed all circuits in that section.

ii. Both incomers 'ON' and one PT fails : PT supply shall change over, provided the bus-section breaker is closed.

iii. One incommer out, P.T. supply shall change over, provided the bus-section breaker is closed.

5.7.1.4. PT supply to all the panels including the incomer shall be routed through the voltage selection scheme. When one of the PTs fails, the same shall be indicated automatically by the respective PT fail indicating LED. All necessary relays/contacts for above schemes shall be accommodated in empty chamber of adopter panel inside front door.

5.8. SUPERVESORY CONTROL DESK:

5.8.1. The operator's supervisory control desk generally conforming to the configuration and dimension shown in the diagram enclosed alongwith two revolving chairs (Godrej make) and one side rack of steel drawers (Godrej make) for storage of record etc. should be provided.

5.8.2. The desk should include following facilities.

i. Mimic diagram depicting the bus and positions of breakers for all the panels on the Switchgear Board.

ii. Discrepancy switches for remote closing and tripping of all the breakers on the Board.

iii. Flasher relay for discrepancy switch suitable for 30 V DC.

iv. Repeat annunciation system both visual and audio i.e. alarm bell with accept, reset & LED test push buttons.

v. Indication for 'spring charged' status.

vi. HT Static tri-vector TOD Energy meter (single unit) for measurement of voltage, current, PF, kW, KVA, KVAr, kWh, KVAh, Maximum demand in KVA for 15/30 minutes interval- one for each circuit breaker as per MSEDCL latest technical specification . (Metering equipment is not required for bus coupler)

vii. Test Terminal Block for each metering equipment.

viii. All the control cables, connectors, accessories, etc. for connecting the control desk to the switchgear Board for ready connection and commissioning. (distance between the switchgear board and control desk should be 50 meters approx.)

ix. Space heater with thermostat and toggle switch.

Annunciators:

x. 3 Nos of 8 Window annunciators suitable for the visual and audible alarm annunciation shall be provided on the supervisory control desk for following. These shall be micro processor based units using bright LEDs.

   a. One number for Incomers and Bus Coupler

   b. Two numbers for outgoing feeders.

xi. Annunciator facia units shall have translucent plastic windows for each alarm point.

xii. Annunciator facia plate shall be engraved in black lettering with respective alarm inscription as specified. Alarm inscriptions shall be engraved on each window in not more than three lines and size of the lettering shall be about 5 mm. The inscriptions shall be visible only when the respective facia LED is glow.

xiii. Annunciator facia units shall be suitable for flush mounting on panels. Replacement of individual facia inscription plate and LED shall be possible from front of the panel.

xiv. Each annunciator shall be provided with 'Accept', 'Reset' and 'Test' push buttons, coloured red, yellow and blue respectively.

xv. Special precaution shall be taken by the supplier to ensure that spurious alarm conditions do not appear due to influence of external magnetic fields on the annunciator wiring and switching disturbances from the neighbouring circuits within the panels.

xvi. In case 'RESET' push button is pressed before abnormality is cleared, the LEDs shall continue to glow steady and shall go out only when normal condition is restored.

xvii. Any new annunciation appearing after the operation of 'Accept' for previous annunciation, shall provide a fresh audible alarm with accompanied visual, even if the process of "acknowledging" or "resetting" of previous alarm is going on or is yet to be carried out.

xviii. Provision for testing healthiness of visual and audible alarm circuits of annunciator shall be available.

Mounting	Flush
No. of facia windows	8
No. of windows per row	4
Supply voltage	30 V DC
No. of LEDs per window	2
Lettering on facia plate	Properly engraved

8 Window Annunciation Scheme to indicate following functions for Incomer 1, Incomer 2 and Bus coupler		
1	Main protection (O/C) Trip for incomer 1	1 no.
2	Main protection (E/F) Trip for incomer 1	1 no.
3	Main protection (O/C) Trip for incomer 2	1 no.
4	Main protection (E/F) Trip for incomer 2	1 no.
5	Main protection (O/C) Trip for Buscoupler	1 no.
6	Main protection (E/F) Trip for Buscoupler	1 no.
7	Spare	1 no.
8	Spare	1 no.

8 Window Annunciation Scheme to indicate following functions for Outgoing Feeder 1,2,3 & 4		
1	Main protection (O/C) Trip for feeder 1.	1 no.
2	Main protection (E/F) Trip for feeder 1.	1 no.
3	Main protection (O/C) Trip for feeder 2.	1 no.
4	Main protection (E/F) Trip for feeder 2.	1 no.
5	Main protection (O/C) Trip for feeder 3.	1 no.
6	Main protection (E/F) Trip for feeder 3.	1 no.
7	Main protection (O/C) Trip for feeder 4.	1 no.
8	Main protection (E/F) Trip for feeder 4.	1 no.

8 Window Annunciation Scheme to indicate following functions for Outgoing Feeder 5,6,7 & 8		
1	Main protection (O/C) Trip for feeder 5.	1 no.
2	Main protection (E/F) Trip for feeder 5.	1 no.
3	Main protection (O/C) Trip for feeder 6.	1 no.
4	Main protection (E/F) Trip for feeder 6.	1 no.
5	Main protection (O/C) Trip for feeder 7.	1 no.
6	Main protection (E/F) Trip for feeder 7.	1 no.
7	Main protection (O/C) Trip for feeder 8	1 no.
8	Main protection (E/F) Trip for feeder 8.	1 no.

The operators desk be made of sheet steel of thickness not less than 2 mm. and shall be free standing floor mounting indoor type. The desk should be dust moisture and vermin proof. It should be elegant in appearance and should be treated and painted as detailed in clause No.5.1.8.2.

5.8.3. The desk should be modular in construction. Each module should be about 800 mm. wide and should accommodate controls, indications and metering equipment for four feeder breakers and one module for the incomer & one B.C. The desk for the 11 panels switchgear Board (viz. 2 I/C + 1 B.C. + 8 O/G) shall have three such modules (Total length about 2.4 m). and the desk for the 7 panels switchgear Board (viz. 2 I/C + 1 B.C. + 4 O/G) shall have two such modules (Total length about 1.6 m).

5.8.4. The two modules for 7 panel board and three modules for 11 panel Board should be assembled in such a way that the complete desk has a semi-circular/ arc-link configuration for easy and convenient operations.

6.0 TESTS

6.1. Type Tests

6.1.1. The equipment offered in the tender should have been successfully type tested at NABL laboratories or any international accredited laboratories for following tests in line with the relevant IEC/IS standard and technical specification, within the last 5 (five) years from the date of offer. The bidder shall be required to submit complete set of the following type test reports alongwith the offer.

A. Switchgear Panel (**with circuit breaker installed**)

a. Lightning Impulse Voltage withstand Test

b. Out of phase making & breaking test

c. H.V. dry 1 min power frequency withstand test

d. Short time and peak withstand current test

e. Short circuit test with basic duties

f. Single phase breaking capacity test.

g. Cable charging breaking current test

h. Temperature Rise test

i. Internal Arc test as per IEC 62271-200

B. Circuit Breaker

a. Mechanical Endurance Test (**M2** Class)

C. Current Transformer

a. Short Time Current Test

b. Impulse Voltage Withstand Test

c. Power frequency withstand(Dry and Wet) test

d. Temperature Rise Test

e. Partial Discharge Test

f. Determination of errors and dimension test

D. Potential Transformer

a. Impulse Voltage Withstand Test

b. Temperature Rise Test

c. Power frequency (Dry & Wet) withstand test

d. Partial Discharge Test

e. Accuracy Class

E. Switchgear Panel

a. IP 5X Test

6.1.2. In case these type tests are conducted beyond five years, the said type tests shall be carried out as per the relevant IS/IEC standard by the successful bidder at NABL or international accredited laboratories in presence of purchaser's representative free of cost before commencement of supply. The undertaking to this effect should be furnished along with the offer without which the offer shall be liable for rejection.

6.1.3. If above tests are carried out on higher capacity of offered equipment, then the offer is considered for placement of order. However, successful bidders have to carry out the said type tests on offered type equipment before commencement of supply at their own expense.

6.1.4. Successful bidders have to submit a set of above type test reports after approval of the drawings to the Chief Engineer, (Testing) , 5th floor, Prakashgad, MSEDCL, Bandra (E). Original type test reports have to be made available for verification.

6.2. Acceptance and Routine Tests:

6.2.1. All acceptance and routine tests as stipulated in relevant IS/IEC shall be carried out by the supplier in the presence of purchaser's representative without any extra cost to the purchaser.

6.2.2. After finalization of the program of type/acceptance/routine testing, the supplier shall give three weeks advance intimation to the purchaser, to enable him to depute his representatives for witnessing the tests.

7.0 INSPECTION:

7.1. The inspection may be carried out by the purchaser at any stage of manufacture. The successful Tenderer shall grant free access to the purchaser's representative/s at a reasonable notice when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser, shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

7.2. The supplier shall keep the purchaser informed in advance, about the manufacturing program so that arrangement can be made for stage inspection.

7.3. The purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The supplier shall keep the purchaser informed, in advance, about such testing program.

8.0 QUALITY ASSURANCE PLAN:

8.1. The tenderer shall invariably furnish following information alongwith his offer, failing which his offer shall be liable for rejection. Information shall be separately given for

individual type and current rating of circuit breaker/CTs/PTs/Panel mounting & accessories.

i. Statement giving information about names of sub-suppliers, list of testing standards, list of tests normally carried out for bought out item.

ii. Copies of test certificates in respect of following bought out items.

   a. Vacuum Interrupter.

   b. Insulators

   c. Bus Bar Material

   d. Instrument transformers.

   e. Terminal connectors

iii. List of areas in manufacturing process, where stage inspection are normally carried out by the tenderer for quality control and details of such tests and inspections.

iv. List of testing equipment available with the tenderer for final testing of breakers vis-a-vis the type, special, acceptance and routine tests specified herein. The limitations in testing facilities shall be very clearly brought out in Schedule-E i.e. schedule of deviation from specified test requirements.

8.2. The successful tender shall submit the routine test certificates of bought out accessories at the time of routine testing of the fully assembled breaker for the goods manufactured within purchaser's country. The supplier shall also submit the central excise passes for the raw material at the time of routine testing of the fully assembled breaker.

9.0 PERFORMANCE GUARANTEE:

9.1. All equipment supplied against this specification shall be guaranteed for a period of 66 months from the date of receipt at the consignees stores centers or 60 months from the date of commissioning, whichever is earlier. However, any engineering error, omission, wrong provision, etc. which do not have any effect on the time period shall be attended to as and when observed/pointed out without any price implication.

10.0 DOCUMENTATION

10.1. After receipt of letter of Award, the successful tenderers shall submit 3 sets of complete drawings alongwith detailed bill of materials for approval. to the Chief Engineer, (Testing), 5th floor, Prakashgad, MSEDCL, Bandra (E). Space for stamp and signature of approving authority shall be kept at right hand bottom corner above name block. If any modifications are required on these, the same will be conveyed to the supplier who shall modify the drawings accordingly and furnish final drawings for approval. **In no case delivery extension will be granted for any delay in drawing approval.**

10.2. The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation will be permitted without the written approval of the Distribution Department. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the suppliers risk.

10.3. After approval of the drawings and bills of materials, the suppliers shall submit detailed packing lists for approval. After approval, copies of these packing lists shall be forwarded to the respective consignees. Copies of packing lists shall also be submitted to the Chief Accounts Officer (SB), MSEDCL, alongwith the bills for payment.

10.4. Six set of final drawings, bill of materials ,wiring schedules, technical literature and commissioning manuals shall invariably be forwarded to the consignee alongwith the each panel consignment, and shall be listed out in the packing list when submitted for approval. All drawings shall preferably be of A3 size. No drawing of width more than 35 cm will be acceptable.

10.5. In case the supplier fails to furnish contractual drawings and manuals even at the time of supply of equipment, the date of furnishing of drawings/manuals will be considered as the date of supply of equipment for the purpose of computing penalties for late delivery.

10.6. List of drawings to be submitted alongwith the offer are as under:

i. GA of 11KV VCB (Indoor Type)Switchgear Panel Board.

ii. Typical single line diagram for11KV VCB (Indoor Type) Switchgear Panel Board .

iii. Sectional view of incomer, bus coupler & feeder panels.

iv. GA of Circuit Breaker truck.

v. GA of Current Transformer

vi. GA of Potential Transformer.

vii. G. A. Drawing for Control Desk.

viii. Bill of material for complete switchgear.

ix. Technical Details of Switchgears.

10.7. Successful tenderer shall furnish all above drawings and following additional drawings for approval before commencement of supply.

i. Foundation details for 11 Panel Switchgear.

ii. Equipment door layout for incomer, bus coupler & feeder panels.

iii. Schematic Diagram for incomer bus coupler & feeder section of Switchgear

iv. Protection Circuit for incomer bus coupler & feeder section of Switchgear

v. DC control circuit for incomer, bus coupler & feeder section.

vi. Metering circuit for incomers, bus coupler & feeder section.

vii. Annunciator and Alarm scheme.

viii. P.T. supply change over scheme.

ix. Terminal block details for incomer, bus coupler & feeder section.

x. Cross section view for CTs.

xi. Name Plate & Connection diagram for CTs.

xii. Cross section view for PTs.

xiii. Name Plate & Connection diagram for PTs.

xiv. Schematic Diagram for Control Desk.

xv. G. A. Drawing for Chair.

xvi. G. A. Drawing for Sliding Door Unit.

11.0 PACKING AND FORWARDING

11.1. The equipment shall be packed in crates suitable for vertical/horizontal transport as the case may be and the packing shall be suitable to withstand handling during the transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable materials shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost.

11.2. Each consignment shall be accompanied by a detailed packing list containing the following information :

a. Name of the consignee

b. Details of consignment.

c. Destination

d. Total weight of consignment

e. Sign showing upper/lower side of the crate.

f. Handling and unpacking instructions.

g. Bill of material indicating contents of each package.

11.3. All the equipment covered in this specification shall be delivered to the various stores centres of the MSEDCL as will be intimated to the successful tenderers. The equipment shall be delivered to these stores centers only by road transport, and shall be suitably packed to avoid damages during transit in the case of indigenous supplies.

11.4. The tenderers shall quote delivery periods for various equipment, and shall stick-on to the committed delivery. The delivery period will be counted from the date of issue of detailed purchase order. It may clearly be noted that the delivery periods will under no circumstances be linked up with other formalities like drawing approval, etc. It is therefore the responsibility of the successful tenders to submit the drawings, bill of materials, packing lists, etc. in time and get these approved by the Distribution Department of the MSEDCL.

12.0 SUPERVISORY ERECTION & COMMISSIONING

Erection and commissioning of the equipment covered in this specification will normally be carried out by the Boards personnel. However, the tenderers may quote their terms and conditions for deputing their Engineers/Technicians to the various sites for carrying out the erection and commissioning work.

13.0 SCHEDULES

The tenderer shall fill in the following schedule which is part and parcel of the tender specification and offer. If the schedule is not submitted duly filled in with the offer, the offer shall be liable for rejection.

Schedule 'A' ... Guaranteed Technical Particulars

14.0 INFORMATION TO BE FILLED IN & FURNISHED INVARIABLY BY THE TENDERERS.

14.1. The offers shall be complete in all respects, failing which the same are liable for rejection. In the bill of materials for each items, the tenderer shall state the type designation and make of each item/equipment. Unit prices of all items and sub-components shall be quoted. The list of items for which unit prices are quoted (without the price part) shall be submitted alongwith the technical offer. Guaranteed technical particulars for various equipment shall be elaborate and complete in all respects. It may be noted that the technical evaluation of the tender is made mainly based on the guaranteed technical particulars furnished alongwith the technical offer. Technical offer shall be submitted in triplicate, and each set shall include all the necessary particulars including the technical literature on various equipment.

15.0 Qualifying Requirement : As per tender.

16.0 Final Inspection :

16.1. C.E. (Testing) will depute representatives from testing and inspection wing at the time of final inspection.

17.0 Following documents shall be submitted along with offer.

17.1. Test certificates of Bus Bar for STC rating or undertaking in this respect.

17.2. Quality Assurance Plan.

17.3. Names of sub-suppliers.

17.4. List of testing equipment available with the tenderer for final testing of breakers.

17.5. Type Test Reports listed in clause no. 6.1.of tech spec .

17.6. Copies of test certificates in respect of following bought out items.

a. Vacuum Interrupter.
b. Insulators
c. Bus Bar Material
d. Instrument transformers.
e. Terminal connectors

18.0 GENERAL REQUIREMENTS FOR PROTECTIVE,MEASURING & CONTROL EQUIPMENTS

Principal requirements of protective relays, metering equipment, auxiliary relays breaker control switches etc. are as follows:

18.1.a High Speed Master Trip Relay hand reset type conforming IS: 3231

Aux. voltage	30 V, DC
Coil rating	30 V.DC, Voltage band for satisfactory operation – 50 to 120 % of rated voltage.
Operating time	10 milli sec nominal at rated voltage
Burdon of relay coil	low burdon 40 watt at rated voltage
Contact configuration	3 NO + 2 NC combination with additional hand reset coil cut of contact (seal in intact)

Contact ratings	
Make and carry	A.C. – 1250 VA with max 5 amp & 660 volts, D. C. – 1250 w dc with max 5 amp & 660 Volts
Make and carry for 3 sec	A.C. – 7500 VA with max 30 amp & 660 volts, D.C. – 7500 W dc with max 30 amp & 660 volts
Break	A.C. – 1250 VA with max 5 amp & 660 volts, D.C. – 100 W resistive 50 watt inductive with max 5 amp & 660 volts
Insulation	2 KV RMS , 50 Hs for 1 min. 2.5 KV/ 1 sec between all terminals & case as per IS 3231 1 KV RMS , 50 Hz for 1 min. across open contact
Operating Temp	-10 degree C to 55 dg C
Operation indication	Mechanical red colour flag

18.1b. TOD ENERGY METER : As per MSEDCL latest technical specification.

18.2a. Ammeter:

Each circuit one ammeter and associated selector switch shall be provided.

Mounting	Flush
Size	48 x 96 sq. mm. case
Response Time	1 second
Operating Temperature	Up to 55°C
Dielectric Strength	2 kV RMS for 1 minute
Frequency	50 Hz
Operating Current	5 A from CT Secondary.
Type	Panel Mounting with $3^1/_2$ Digital Display

18.2b. Ammeter selector switch:

Ammeter Selector switch shall be a four-position (3 way with off) rotory type with R, Y, B and 'OFF' positions marked clearly on 48x48 mm brushed aluminium plate with black handle. Switch should be single hole mounting and not screw mounting. Switches should have finger touch proof terminals. Terminal wire should be inserted from the side of the switch terminal. Terminal screw must be captive to avoid misplace during maintenance.

Rated Insulation Voltage	1100 V
Rated Impulse withstand voltage	6 kV
Rated Operational Current	12 A

18.3a. Volt Meter.

Mounting	Flush
Size	48 x 96 sq. mm. case
Response Time	1 second
Operating Temperature	Up to 55°C
Dielectric Strength	2 kV RMS for 1 minute
Auxiliary Supply	110 V
Frequency	50 Hz
Operating Voltage	110 V from PT Secondary.
Type	Panel Mounting with $3^1/_2$ Digital Display

18.3b. Volt Meter selector switch:

Voltmeter Selector Switch shall be seven position type (6 way & off) with 3 phase to phase and 3 phase to neutral position marked clearly on 48x48 brushed aluminium plate with black handle. Switch should be single hole mounting and not screw mounting. Switches should have finger touch proof terminals. Terminal wire should be inserted from the side of the switch terminal. Terminal screw must be captive to avoid misplace during maintenance.

Rated Insulation Voltage	1100 V
Rated Impulse withstand voltage	6 kV
Rated Operational Current	12 A

18.4. Space Heater

Capacity	80 Watts
Voltage	240 V AC
Type	Strip type

18.5. Thermostat

Voltage	240 V AC
Range	30-90 Deg.C

18.6. Contactor for antipumping duty

Contacts	2 N/O + N/C
Coil voltage	30V DC.

18.7. L/R. Switch

4 way, 2 positions stay put handle

Contacts	2 contacts to close in each position

18.8. Auxiliary contactor

Contacts	ARR 2 N/O+2 N/C
Auxiliary voltage	30 V DC

18.9. Auto manual selector switch

Stay put type, pistol grip handle, 2 contacts to close in each position

Auxiliary voltage	30 V DC

18.10. Micro switch

Voltage	240 V AC
Contacts	1 N/C

18.11.. D.C. snaper switch with blow out magnet

Type	EX 110 of Elmex or equivalent
Current	5 Amps.

18.12. Discrepancy type control switch suitable for remote control of circuit breaker

Bulb voltage	30 V DC

18.13. Digital Frequency Meter.

Mounting	Flush in 96 sq.mm. case
Size	96 mm x 96 mm x 70 mm
Range	45 Hz to 55 Hz
Dielectric Strength	2 kV RMS for 1 minute
Power Consumption	Less than 6 VA
Type	Electronic 4 Digit Digital frequency meter.
Display	Seven segment red colour LED Display with 0.5” height
IS Reference	IS:1248

18.14 Terminal Connector

Material	Nickel plated Brass
Size of Stud	Minimum 4 mm dia
Current capacity	
a. Normal	10 amps
b. breaking	4 amps
Insulation	1100 V/3 kV of 1 min

18.15 3 O/C + 1 E/F Numerical Protection relay with IEC -103 Communication Protocol

1	Elements	3 O/C + 1 E/F + High set for both O/C & E/F separately
2	CT Secondary input current to relay	Selection for 1 A / 5 A through software & shall be possible at site
3	Operating Characteristics selectable	1. IDMT – 3Sec. 2. IDMT- 1.3sec. 3. Very Inverse 4. Extremely Inverse 5. Definite time 6. User defined inverse 7. Long time inverse
4	Auxiliary supply	18 V to 250 V DC/ AC
5	Instantaneous O/C Plug setting	5 % to 200% in steps of 1%
6	Instantaneous E/F Plug setting	5 % to 200 % in steps of 1 %
7	High Set O/C setting	5 % to 2500 % in steps of 1 %
8	High Set E/F setting	5% to 2500 % in steps of 1 %
9	Time multiplier setting for O/C & E/F	0.01 sec to 10.0 in steps of 0.01.
10	Memory storage for fault information	Storing of latest 100 events with date & time stamping fault amplitude, type of fault, faulty phase with FIFO feature (available on display & shall be retrievable through software)
11	Thermal overload function	To protect cables & transformers from the effects of long term degradation on overloading, the relay shall have the thermal overload setting as per IEC.
12	Auto reclose function	Four shot, three phase auto reclose facility with independent time setting shall be available
13	Pre-Logic	User programmable facility to achieve customized functions, create logics with external information through DI/DO etc.
	Mounting	1.All relay connections should be from back side.

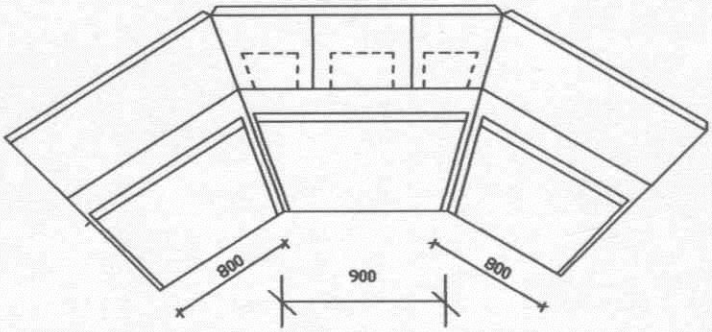
14		2. Relay should be DRAWOUT type model with automatic shorting of CT circuit at a time of removal relay from casting
15	LED indications	6 programmable LEDs & 1 LED for healthy indication. Color of LED 01– Green 02- Yellow 03 to 07 -Red
16	Push buttons	Reset push button for resetting the relay manually. Functional keys should be available for separate trip command.
17	Output contacts	The relay shall 6 NO + 2 changeovers potential free and heavy-duty Programmable contacts.
18	Contact rating	Continuous carry -5A, Make & Carry for 0.5 Sec-30A Make & Carry for 3 sec-15 A
19	Self-diagnosis feature	Relay should have self-diagnosis for its healthiness of functioning & should show indication in case of its failure
20	Password protection	The relay should have provision password protection for the applied settings
21	Selectivity of primary CT current	The relay should have facility to select the primary CT current from 50A to 1600A in steps of 50A. The relay should display the CT primary current.
22	Operational indicator	LED
23	IS reference	IEC 60255, IEC 103, IS 3231 amended up to date
24	LCD Display	Relay shall have minimum 2 line LCD backlit display
25	Features	Minimum 2 setting groups (3 phase and 1 phase)
26	Disturbances recorder	The DR shall capture waveforms of analogue channels, and all the DI channels & the DO channels. It shall be possible to configure and capture in DR, all the internal functions like over current start etc. for better analysis of the fault information. It shall have a minimum storage of 10 records of 2sec each(total memory 20sec).It shall have facility to record information prior to fault incidence with approx-trigger time setting of 25% (programmable).

27	Communication port	Relay should have RS 485 communication port compatible for integration with SCADA RTU
28	Diagnostic Port	Relay Should have diagnostic port for configuration /downloading
29	Communication protocol	IEC -60870-5-103

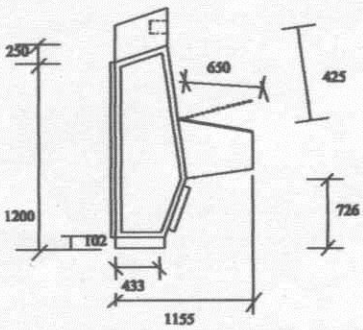
NOTE :

1. CT/PT connectors on relay shall be screw type.
2. Relay shall communicate following data to RTU-
   a. 3 phase on line current voltages
   b. Trip events after faults with time stamp
   c. Pick up events after fault with time stamp
   d. Recorded fault currents (3Phase + Neutral)
3. Relay shall accept time synchronization from SCADA RTU periodically.
4. Relay shall be supplied with license software & all connecting accessories for configuration/data downloading etc. Necessary software for relay setting, retrieving DR, event log, trip log shall be supplied by bidder free of cost. Necessary multiuser/corporate license software is to be supplied to MSEDCL for installation on all Testing division PC's.

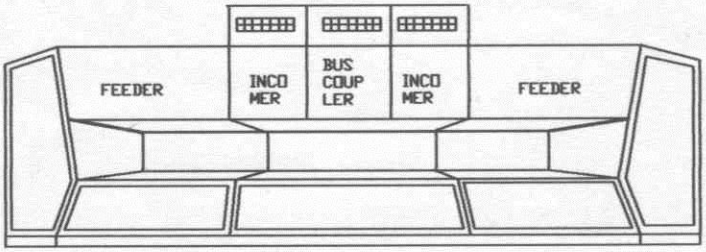
SUPERVISORY CONTROL DESK DRAWING



TOP VIEW



SIDE VIEW OF UNIT MOUDLE



FRONT VIEW

INDICATIVE DRAWING

ALL DIMENSIONS ARE IN mm

DRAWN BY	Dy. E. E. (MM II)	CONTROL DESK	
CHECKED BY	E. E. (MM II)	DATE	MSEDCL
RECOMMENDED BY	S. E. (MM)	SCALE NTS	DISTRIBUTION SECTION MM CELL
APPROVED BY	C. E. (DIST)	DRG. NO. DIST/MM/11 kV IDSWG/CONTROL DESK	

Schedule A
GUARANTEED TECHNICAL PARTICULARS FOR
11 KV INDOOR VCB PANEL with control desk

Sr.No.	**GTP Parameters**	
1	Make of Indoor Circuit Breaker	Text
2	Indoor Circuit Breaker shall be Vacuum Circuit Breaker (Yes/no)	Boolean
3	Indoor Circuit Breaker shall be horizontal draw out, Horizontal isolation type. (Yes/No)	Boolean
4	Designation of Indoor Circuit Breaker	Text
5	Make of Vacuum Interrupter	Text
6	Rated voltage of Indoor Circuit Breaker shall be 11 kV	Text
7	Indoor Circuit Breaker shall be suitable for 50 Hz frequency.	Text
8	Maximum continuous voltage of Indoor Circuit Breaker shall be 12 kV	Text
9	Rated Continuous current of Indoor Circuit Breaker used in Incomer shall be minimum 800 Amps (in Amps)	Numerical
10	Rated Continuous current of Indoor Circuit Breaker used in Buscoupler shall be minimum 800 Amps (in Amps)	Numerical
11	Rated Continuous current of Indoor Circuit Breaker used in feeder shall be minimum 400 Amps (in Amps)	Numerical
12	Rated Symetrical Short Circuit Breaking Current of Indoor Circuit Breaker for 3 seconds shall be minimum 25 kA (in KA)	Numerical
13	Rated Operating Sequence of Indoor Circuit Breaker	Text
14	First pole to clear factor of Indoor Circuit Breaker shall be 1.5	Text
15	Rate of Rise of trasient recovery voltage of Indoor Circuit Breaker shall be 0.34 kV/micro second.	Text
16	Peak Voltage of trasient recovery voltage of Indoor Circuit Breaker shall be 20.6 kV	Text
17	Rated Symetrical Short Circuit Making Current of Indoor Circuit Breaker shall be minimum 62.5 kA	Text
18	Power frequency withstand voltage for 1 min of Indoor Circuit Breaker shall be minimum 28 kV.	Text
19	Impulse withstand voltage of Indoor Circuit Breaker shall be minimum 75 kV	Text
20	Indoor Circuit Breaker shall have Motor wound spring charging type closing mechanism.	Text
21	Voltage rating of spring released coil used in Indoor Circuit Breaker shall be 30 V DC (Yes/No)	Text
22	Burden of spring released coil used in Indoor Circuit Breaker in Watts.	Text
23	Voltage rating of spring charging motor used in Indoor Circuit Breaker shall be 240 V AC	Text
24	Watts of spring charging motor used in Indoor Circuit Breaker in VA.	Numerical
25	Indoor Circuit Breaker shall have shunt tripping mechanism (Yes/No)	Boolean
26	Voltage rating of tripping coil used in Indoor Circuit Breaker shall be 30 V DC (Yes/No)	Boolean
27	Burden of tripping coil used in Indoor Circuit Breaker in Watt.	Text
28	Whether mechanical ON/OFF indication provided for Indoor Circuit Breaker. (Yes/No)	Boolean

29	Whether mechanical spring charged indication provided for Indoor Circuit Breaker. (Yes/No)	Boolean
30	Whether manual Trip/Close provided for Indoor Circuit Breaker. (Yes/No)	Boolean
31	Whether mechanical spring charging provided for Indoor Circuit Breaker. (Yes/No)	Boolean
32	Whether electrical antipumping device provided for Indoor Circuit Breaker. (Yes/No)	Boolean
33	Whether any contact multiplier used for Indoor Circuit Breaker. (Yes/No)	Boolean
34	If contact multiplier used for Indoor Circuit Breaker then voltage rating of contact multiplier used.	Text
35	If contact multiplier used for Indoor Circuit Breaker then burden of contact multiplier used.	Text
36	Indoor Circuit Breaker : No of auxiliary contacts available for purchasers use shall be atleast 4 NO + 4 NC	Text
37	Indoor Circuit Breaker : Whether potential free contact available for remote indication of "Spring charged" (Yes/No)	Text
38	Clearance between phases in breaker chamber for Indoor Circuit Breaker shall be atleast 130 mm. (in mm)	Numerical
39	Clearance between phases in busbar chamber for Indoor Circuit Breaker shall be atleast 180 mm (in mm)	Numerical
40	Clearance between phase and earth in breaker chamber for Indoor Circuit Breaker shall be atleast 80 mm. (in mm)	Numerical
41	Clearance between phase and earth in busbar chamber for Indoor Circuit Breaker shall be atleast 115 mm. (in mm)	Numerical
42	Make of Current Transformer	Text
43	Type of Current Transformer	Text
44	Designation of Current Transformer.	Text
45	Rated Insulation level of Current Transformer shall be min. 12/28/75 kV.	Text
46	Current Transformer Ratio used in incomer panel shall be 800-400/5-5 A.	Text
47	Current Transformer ratio used in bus coupler panel shall be 800-400/5- 5A.	Text
48	Current Transformer used in feeder panel shall be 400-200/5-5 A.	Text
49	VA Burden of core 1 of Current Transformer used in incomer panel shall be 20 VA. (in VA)	Numerical
50	VA Burden of core 2 of Current Transformer used in incomer panel shall be 20 VA. (in VA)	Numerical
51	VA Burden of core 1 of Current Transformer used in bus coupler panel shall be 20 VA. (in VA)	Numerical
52	VA Burden of core 2 of Current Transformer used in bus coupler panel shall be 20 VA. (in VA)	Numerical
53	VA Burden of core 1 of Current Transformer used in feeder panel shall be 20 VA. (in VA)	Numerical
54	VA Burden of core 2 of Current Transformer used in feeder panel shall be 20 VA. (in VA)	Numerical
55	Accuracy class for core 1 of Current Transformer used in incomer panel shall be Cl 0.5	Text
56	Accuracy class for core 2 of Current Transformer used in incomer panel shall be Cl 5P10	Text
57	Accuracy class for core 1 of Current Transformer used in bus coupler panel shall be Cl 0.5	Text

30	Whether manual Trip/Close provided for Indoor Circuit Breaker. (Yes/No)	Boolean
31	Whether mechanical spring charging provided for Indoor Circuit Breaker. (Yes/No)	Boolean
32	Whether electrical antipumping device provided for Indoor Circuit Breaker. (Yes/No)	Boolean
33	Whether any contact multiplier used for Indoor Circuit Breaker. (Yes/No)	Boolean
34	If contact multiplier used for Indoor Circuit Breaker then voltage rating of contact multiplier used.	Text
35	If contact multiplier used for Indoor Circuit Breaker then burden of contact multiplier used.	Text
36	Indoor Circuit Breaker : No of auxiliary contacts available for purchasers use shall be atleast 4 NO + 4 NC	Text
37	Indoor Circuit Breaker : Whether potential free contact available for remote indication of "Spring charged" (Yes/No)	Text
38	Clearance between phases in breaker chamber for Indoor Circuit Breaker shall be atleast 130 mm. (in mm)	Numerical
39	Clearance between phases in busbar chamber for Indoor Circuit Breaker shall be atleast 180 mm (in mm)	Numerical
40	Clearance between phase and earth in breaker chamber for Indoor Circuit Breaker shall be atleast 80 mm. (in mm)	Numerical
41	Clearance between phase and earth in busbar chamber for Indoor Circuit Breaker shall be atleast 115 mm. (in mm)	Numerical
42	Make of Current Transformer	Text
43	Type of Current Transformer	Text
44	Designation of Current Transformer.	Text
45	Rated Insulation level of Current Transformer shall be min. 12/28/75 kV.	Text
46	Current Transformer Ratio used in incomer panel shall be 800-400/5-5 A.	Text
47	Current Transformer ratio used in bus coupler panel shall be 800-400/5- 5A.	Text
48	Current Transformer used in feeder panel shall be 400-200/5-5 A.	Text
49	VA Burden of core 1 of Current Transformer used in incomer panel shall be 20 VA. (in VA)	Numerical
50	VA Burden of core 2 of Current Transformer used in incomer panel shall be 20 VA. (in VA)	Numerical
51	VA Burden of core 1 of Current Transformer used in bus coupler panel shall be 20 VA. (in VA)	Numerical
52	VA Burden of core 2 of Current Transformer used in bus coupler panel shall be 20 VA. (in VA)	Numerical
53	VA Burden of core 1 of Current Transformer used in feeder panel shall be 20 VA. (in VA)	Numerical
54	VA Burden of core 2 of Current Transformer used in feeder panel shall be 20 VA. (in VA)	Numerical
55	Accuracy class for core 1 of Current Transformer used in incomer panel shall be Cl 0.5	Text
56	Accuracy class for core 2 of Current Transformer used in incomer panel shall be Cl 5P10	Text
57	Accuracy class for core 1 of Current Transformer used in bus coupler panel shall be Cl 0.5	Text

58	Accuracy class for core 2 of Current Transformer used in bus coupler panel shall be Cl 5P10	Text
59	Accuracy class for core 1 of Current Transformer used in feeder panel shall be Cl 0.5	Text
60	Accuracy class for core 2 of Current Transformer used in feeder panel shall be Cl 5P10	Text
61	Limitation of exciting current of Current Transformer	Text
62	Material use for primary/secondary winding of Current Transformer shall be Copper	Text
63	Cross section of primary winding of Current Transformer used in incomer panel shall be minimum 500 sq. mm.	Text
64	Cross section of primary winding of Current Transformer used in bus coupler panel shall be minimum 500 sq. Mm.	Text
65	Cross section of primary winding of Current Transformer used in feeder panel shall be minimum 250 sq. mm.	Text
66	Short Time Current rating fir 3 seconds of Current Transformer shall be minimum 25 kA.	Text
67	I. S. F. at lower ratio of Current Transformer shall not be more than 5.	Text
68	Type of Insulation Housing of Current Transformer shall be epoxy/resign cast.	Text
69	Make of Potential Transformer	Text
70	Type of Potential Transformer	Text
71	Designation of Potential Transformer	Text
72	Rated insulation level of Potential Transformer shall be minimum 12/28/75 kV	Text
73	Is offered Potential Transformer single phase units? (Yes/No)	Boolean
74	Voltage Ratio of Potential Transformer shall be (11kV/rt3)/(110V/rt3)/(110V/rt3) (Yes/No)	Boolean
75	Potential Transformer shall have two secondary cores. (Yes/No)	Boolean
76	VA Burden of Core I of Potential Transformer shall be 50 VA (in VA)	Text
77	VA Burden of Core 2 of Potential Transformer shall be 30 VA (in VA)	Text
78	Accuracy class of Core 1 of Potential Transformer shall be Cl 0.5	Text
79	Winding connection of Potential Transformer shall be Star/Star Open delta.	Text
80	Rated Voltage factor and time of Potential Transformer shall be 1.2 Continuous & 1.5 for 30 seconds.	Text
81	Type of insulation housing of Potential Transformer shall be resin/epoxy cast.	Text
82	Whether HT fuses provided for Potential Transformer. (Yes/No)	
83	Material used for primary/secondary winding of Potential Transformer shall be Copper. (Yes/No)	
84	Type of Indoor Switchgear	Text
85	Designation of Indoor Switchgear	Text
86	Degree of protection provided to Indoor Switchgear shall not be less than IP5X	Text
87	Thickness of sheet steel of Indoor Switchgear shall not be less than 2 mm.	Text
88	Number and name of compartments of Indoor Switchgear.	Text
89	One minutes Power Frequency withstand voltage of Indoor Switchgear shall be min. 28 kV.	Text

90	Impulse withstand voltage of Indoor Switchgear shall be min. 75 kVp.	Text
91	Short Circuit withstand current at rated voltage for 3 second of Indoor Switchgear shall be min. 25 kA for Breaker	Text
92	Short Circuit withstand current at rated voltage for 3 second of Indoor Switchgear shall be min. 25 kA for Bus Bar.	Text
93	Whether power cable entry provided from rear bottom of Indoor Switchgear.	Text
94	Whether control cables are routed through H. T. Cubicle. (Yes/No)	
95	Paint shade of Indoor Switchgear shall be 694 as per IS:5. (Yes/No)	
96	Type of paint used for Indoor Switchgear.	Text
97	Number of heaters provided per panel shall not be less that 2.	Text
98	Whether automatic safety shutter provided to Indoor Switchgear. (Yes/No)	
99	Material of earth bus provided for Indoor Switchgearshall be copper. (Yes/No)	Text
100	Size of earth bus provided for Indoor Switchgear.	Text
101	Material of terminal connector provided in Indoor Switchgear.	Text
102	Type of terminal connector provided in Indoor Switchgear.	Text
103	Whether Indoor Switchgear panels shall be of unitised construction. (Yes/No)	Text
104	Whether extension on both sides of panels without limitation is possible. (Yes/No)	Text
105	Material of bus bar provided for Indoor Switchgearshall be copper. (Yes/No)	
106	Size of bus bar provided for Indoor Switchgear.	Text
107	Current rating of bus bar provided for Indoor Switchgear shall be min. 2000 A	Text
108	Current density adopted for bus bar provided in Indoor Switchgear shall be more than 1.6 A/sq.mm	Text
109	Number of fasteners used for bus bar joints provided for Indoor Switchgear.	Text
110	Size of fasteners used for bus bar provided for Indoor Switchgear.	Text
111	Material used for fastners used for bus bar joint shall be non magnetic stainless steel. (Yes/No)	Text
112	Material use for Bus Support Insulator used in indoor switchgear.	Text
113	Voltage class of Bus Support Insulator used in indoor switchgear shall be min 12 kV.	Text
114	Creepage Distance of Bus Support Insulator used in indoor switchgear shall be 300 mm.	Text
115	Cantilever strength of Bus Support Insulator used in indoor switchgear shall be 1200 kgf.	Text
116	Phase to phase clearance of Bus Support Insulator used in indoor switchgear shall be 180 mm.	Text
117	Phase to earth clearance of Bus Support Insulator used in indoor switchgear shall be 130 mm.	Text
118	Make of non-direction 3 O/C + 1 E/F relay.	Text
119	Type of non-direction 3O/C + 1 E/F relay.	Text
120	Designation of non direction 23O/C + 1 E/F relay.	Text
121	Setting of O/C elements of non direction 3 O/C + 1 E/F relay shall be 50% to 200 % of Base Current.	Text
122	Setting of E/F elements of non direction 3 O/C + 1 E/F relay shall be 10% to 40 % of Base Current.	Text

123	Characteristics of non direction 3 O/C + 1 E/F relay shall be 0-3 sec.	Text
124	Number of N/O & N/C contacts provided for non direction 3 O/C + 1 E/F relay.	Text
125	Non direction 23O/C + 1 E/F relay shall be suitable for 30 V DC Auxiliary Voltage.	Text
126	Operational indicator of non direction 3O/C + 1 E/F relay shall be flags.	Text
127	Make of High speed Master Trip relay.	Text
128	General Design of High speed Master Trip relay.	Text
129	Designation of High speed Master Trip relay.	Text
130	Number of poles of High speed Master Trip relay shall be 3.	Text
131	High speed Master Trip relay shall be suitable for 5 amp C. T. Secondary current.	Text
132	Time setting of High speed Master Trip relay.	Text
133	High speed Master Trip relay shall be suitable for 50 Hz frequency.	Text
134	Auxiliary contacts available for High speed Master Trip relay shall be atleast 2 NO + 2 NC of Hand Reset	Text
135	High speed Master Trip relay shall be suitable 30 V DC Auxiliary Supply.	Text
136	Operational indicator of High speed Master Trip relay shall be Hand reset type Mechanical flag in window	Text
137	Make of Ammeter	Text
138	Size of Ammeter	Text
139	Response time of Ammeter shall be 1 second.	Text
140	Ammeter shall be operable up to 55°C	Text
141	Dielectric strength of Ammeter shall be 2 kVrms for 1 min.	Text
142	Make of Ammeter selector switch	Text
143	Designation of Ammeter selector switch.	Text
144	Make of Voltmeter	Text
145	Type of Voltmeter.	Text
146	Size of Voltmeter.	Text
147	Response time of Voltmeter shall be 1 second.	Text
148	Voltmeter shall be operable up to 55°C	Text
149	Dielectric strength of Voltmeter shall be 2 kVrms for 1 min.	Text
150	Make of Voltmeter selector switch	Text
151	Designation of Voltmeter selector switch.	Text
152	Make of HT Trivector TOD energy meter.	Text
153	Type & Designation of HT Trivector TOD energy meter .	Text
154	Class of accuracy of HT Trivector TOD energy meter shall be 0.5	Text
155	Measuring parameters of HT Trivector TOD energy meter.	Text
156	HT Trivector TOD energy meter shall have customised backlite liquid crystal display.	Text
157	Make of Digital Frequency Meter.	Text
158	Size of Digital Frequency Meter.	Text
159	Range of Digital Frequency Meter shall be 45 Hz to 55 Hz.	Text
160	Type of Digital Frequency Meter.	Text
161	Display of Digital Frequency Meter shall be seven segment red colour LED Display with 0.5" height	Text
162	Material of Terminal Connector shall be Nickel Plated Brass.	Text
163	Size of stud of Terminal Connector shall be Minimum 4 mm dia.	Text
164	Normal current capacity of terminal connector shall be 10 amps.	Text

165	Breaking current capacity of terminal connector shall be 4 amps.	Text
166	Is list of testing equipment submitted.	Boolean
167	Is the list of plant and machinery submitted.	Boolean
168	Is test certificates of Bus Bar for STC rating or undertaking in this respect submitted.	Boolean
169	Is Quality Assurance Plan submitted.	Boolean
170	Are names of sub suppliers submitted.	Boolean
171	Is Type Test Reports for Lightning Impulse Voltage Withstand test for switchgear panel(with circuit breaker installed) submitted.	Boolean
172	Is Type Test Reports for Dry H.V. 1 min power frequency withstand test for switchgear panel (with circuit breaker installed) submitted.	Boolean
173	Is Type Test Reports for Short time and peak withstand current t test for switchgear panel(with circuit breaker installed) submitted.	Boolean
174	Is Type Test Reports for Short Circuit Test with basic duties for switchgear panel (with circuit breaker installed) submitted.	Boolean
175	Is Type Test Reports for Single phase breaking capacity test for switchgear panel (with circuit breaker installed) submitted.	Boolean
176	Is Type Test Reports for Temperature Rise Test for switchgear panel (with circuit breaker installed) submitted	Boolean
177	Is Type Test Reports for Mechanical Endurance test for the offer circuit breaker installed) submitted.	Boolean
178	Is Type Test Reports for Short Time Current test for Current Transformer submitted.	Boolean
179	Is Type Test Reports for Impulse Voltage Withstand Test for Current Transformer submitted.	Boolean
180	Is Type Test Reports for Temperature Rise Test for Current Transformer submitted.	Boolean
181	Is Type Test Reports for Impulse Voltage Withstand Test for Potential Transformer submitted.	Boolean
182	Is Type Test Reports for Temperature Rise Test for Potential Transformer submitted.	Boolean
183	Is test certificate in respect of Vacuum Interrupter submitted.	Boolean
184	Is test certificate in respect of Insulators submitted.	Boolean
185	Is test certificate in respect of Bus Bar Material submitted.	Boolean
186	Is test certificate in respect of current transformer submitted.	Boolean
187	Is test certificate in respect of Potential Transformer submitted.	Boolean
188	Is test certificate in respect of terminal Connectors submitted.	Boolean