MAHAVITARAN
Maharashtra State Electricity Distribution Co. Ltd.

SPEC. NO. STORES/ MSC-II/ 11kV Indoor Switchgear/2011

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 and relay 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.

4.2. 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:-

a.	IS 13118/1991	High Voltage Alternative current circuit breaker
b.	IS:12729/2004	High-Voltage Switchgear and Control gear Standards
c.	IEC 694	Common clauses for switchgear
d.	3427/1997	A.C. Metal Enclosed Switchgear and Control gear
e.	IS 3156/1992	Voltage transformers
f.	IS 2705/1992	Current transformers.

g.	IS 5621:1980	Hollow Insulators for use in electrical equipment
h.	IS:2544/1973	Porcelain Post Insulators
i.	8828/1996	MCB
j.	IS 12063/1987	Degree of protection provided for enclosures for electrical equipment.
k.	IS 5/2005	Colour for ready mixed paints and enamels.
l.	IS 55781984	Marking of insulated conductor.
m.	11353/1985	Guide for Uniform System of Marking and Identification of Conductors and Apparatus Terminals
n.	IS 1248/2003	Indicating instruments.
o.	IS 14697/1999 amended uptodate	HT Static tri vector TOD Energy meters
p.	IS 6875 amended uptodate	Control switches.
q.	IS 3231/1986 & 87 amended upto date	Electrical Relays for Power System Protection.
r.	IEC 60255 amended uptodate,	Numerical biased protection relays.
s.	IS 8686/1977	Static protective relays.
t.	IS 4794/68 & 86	Push button.
u.	IS:9385/1979	High Voltage Fuses
v.	IS 9431/1979	Indoor post insulator of organic material

4.3. 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 compartmentalised 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 1.6Amps/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 a 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	127 mm	127 mm
2.	Phase to earth	77 mm	77 mm

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.(Distribution) 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 i.e. O-0.3 sec.-CO-30 sec.-CO.

5.3.3. 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.

5.3.4. 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.

5.3.5. 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.

5.3.6. 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.

5.3.7. 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.

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

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

5.3.10. 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.

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

5.3.12. 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

5.3.13. Circuit Breakers Control Switch:

5.3.13.1. 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.

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

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

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

5.3.13.5. 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.

5.3.13.6. 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

5.3.14. Protective Relays:

5.3.14.1. 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.

5.3.14.2. The Non directional 2 O/C & 1 E/F relay with High set Relay should be provided.

5.3.14.3. For each Incomer and feeder, non-directional, 2 Over current and 1 earth fault relays shall be provided. All these relays shall be of 3 seconds IDMT characteristics, the O/C elements having current setting variable from 50% to 200 % in steps of 10%, and the E/F elements having current setting variable from 5% to 80% in steps of 5%.

5.3.14.4. 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.

5.3.14.5. 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.

5.3.14.6. LCD Display : Relay should have 12 mm LCD backlit display.

5.3.14.7. 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.

5.3.14.8. 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: 2705 or IEC 185

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	0.5	0.5	0.5
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: 3156 or IEC 186

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 0.5

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 moulded piece. 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 2 O/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	HT Static Trivector TOD energy Meter with RS 232 port	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

5.7.2. Scheme features

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

5.7.2.2. 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.

5.7.2.3. 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. (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.

5.8.2.2. <u>Annunciators</u>:

i. 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 Incommers and Bus Coupler

   b. Two numbers for outgoing feeders.

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

iii. 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.

iv. 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.

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

vi. 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.

vii. 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.

viii. 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.

ix. 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.

5.8.3. 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.

5.8.4. 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).

5.8.5. 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 for following tests in line with the relevant 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

B. Circuit Breaker

a. Mechanical Endurance Test

C. Current Transformer

a. Short Time Current Test

b. Impulse Voltage Withstand Test

c. Temperature Rise Test

D. Potential Transformer

a. Impulse Voltage Withstand Test

b. Temperature Rise Test

E. Switchgear Panel

a. IP 4X 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 standard by the successful bidder at NABL 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, Stores, 1st 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 finalisation 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, Stores , 1st 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 indoor 11 panel Switchgear.

ii. Typical single line diagram for 11 panel Switchgear.

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 particulars of Switchgears.

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

i. Foundation getails 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 schedules which is part and parcel of the tender specification and offer. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection.

Schedule 'A' ... Schedule of Deviation
Schedule 'B' ... Tenderer's Experience
Schedule 'C' ... Schedule of deviation from specified standards.
Schedule 'D' ... Deviation from specified test requirements

All deviations from the specification shall be brought out in the schedules of deviation (Schedules 'A' 'C' & 'D"). Unless otherwise brought out specifically by the tenderer in the schedule of deviations (Schedule 'A', 'C' & 'D'), the items offered shall be deemed to conform to all clauses of the specification. The discrepancies if any between the specification and the categories or literature submitted as part of the offer by the bidder shall not be considered as valid deviations and no representations in this regard will be entertained unless these are specifically brought out in the schedule of deviations as stated above.

Any additional information other than those called for as per the above schedules may be furnished separately by the tenderer, if felt necessary by him.

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. (Stores) 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. Following Type Test Reports.

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

B. Circuit Breaker

a. Mechanical Endurance Test

C. Current Transformer

a. Short Time Current Test

b. Impulse Voltage Withstand Test

c. Temperature Rise Test

D. Potential Transformer

a. Impulse Voltage Withstand Test

b. Temperature Rise Test

E. Control & Relay Panel

a. IP Test

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:

1. 1. Numerical non directional,2 O/C + 1 E/F relay with high set relay .

Elements	2 O/C + 1 E/F + High set for both O/C & E/F separately
CT Secondary input current to relay	1A / 5 Amp selectable.
Operating Characteristics selectable	1. IDMT - 3 Sec. 2. IDMT- 1.3 sec. 3. Very Inverse 4. Extremely Inverse 5. Definite time
Auxiliary supply	30 V DC
Setting for O/C	50% to 200% in steps of 10%
Setting for E/F	10% to 40% in steps of 5 %
HF setting for overcurrent	100 % to 3000 % in steps of 100%
HF setting for earth fault	100 % to 1200 % in steps of 100%
Time multiplier setting for O/C & E/F	0.05 to 1.5 in steps of 0.01
Memory storage for fault information	Storing of latest five faults with date & time stamping, fault amplitude , type of fault with FIFO feature
Mounting	Flush & all connections should be on back side. The relay should be draw out type preferably with automatic shorting of CT circuit at a time of removal of relay from casing.
LED indications	1. power ON – green colour 2. pick up – yellow colour 3. Trip- red colour 4. HF – Red colour

Push buttons	Reset push button for resetting the relay manually. Test push button for trip test of relay with provision of trip bypass push button
Output contacts	2 trip & 2 alarm contacts
Communication port	The relay should have RS 232 communication port compatibility to SCADA with provision for four digital input & four digital output contacts
Contact rating	1. make & carry AC : 1250VA, 5A, 660V DC : 1250W, 5A,660V. 2. Contact breaking : AC: 1250VA,5A,660V DC: 100W resistive , 50 W inductive
Self diagnosis feature	Relay should have self diagnosis for its healthiness of functioning & should show indication in case of its failure
Password protection	The relay should have provision f password protection for the applied settings
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.
Operational indicator	Flags
IS reference	IEC 60255 , IS 3231 amended uptodate

2. 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

3. 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

4. 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

5. 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

6. 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

7. HT Static Tri-vector TOD Meter:

3 Phase 4 wire HT Static Tri-vector TOD Meter having kWH element of class 0.5 accuracy with following parameters.

Class of accuracy	0.5
IS	14697/1999 amended uptodate
C.T. Ratio	i) 400-200 /5A for feeder panels ii)800-400/5A for Incomer Panels
V.T. Ratio	11000/110V
Type	Static
Mounting	Flush
Measuring parameters	kWh, kVArh, kVAh, instantaneous P.F., kW, kVA, supply frequency, phase voltages and phase currents.
Make	Secure/L&T/L&G/Elster or equivalent
Display	Customised backlit liquid crystal display

8. Space Heater

Capacity	80 Watts
Voltage	240 V AC
Type	Strip type

9. Thermostat

Voltage	240 V AC
Range	30-90 Deg.C

10. Contactor for antipumping duty

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

11. L/R. Switch

4 way, 2 positions stay put handle

Contacts	2 contacts to close in each position

12. Auxiliary contactor

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

13. Auto manual selector switch

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

Auxiliary voltage	30 V DC

14. Micro switch

Voltage	240 V AC
Contacts	1 N/C

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

Type	EX 110 of Elmex or equivalent
Current	5 Amps.

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

Bulb voltage	30 V DC

17. 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. 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

ANNEXURE-I

LIST OF UNIT PRICED ITEMS

(Note : Make and type designation of each item shall be furnished)

	Make & Type	Unit Price Ex. Works with packing	Unit Price with forwarding freight & Ins.	Unit Price F.O.R. destn.
1.	Indoor switchgear (incomer panel)			
2.	Indoor switchgear (bus section panel)			
3.	Indoor switchgear (feeder panel)			
4.	C.T, (3 nos.)for incomer 800-400/5-5 A			
5.	CTs for bus section 800-400/5-5 A			
6.	CTs for feeders 400-200/5-5A			
7.	Single phase P.T.s			
8.	Digital 48x96 sq. mm. case.			
	a) Ammeter			
	b) Voltmeter			
9.	Selector switch for			
	a) Ammeter			
	b) Voltmeter			
10.	Digital frequency meter			
11.	Non-Discrepancy control switch for C.B.			
12.	O.D.S. type T-N-C Control switch for CB			
13.	Local/remote selector switch			
14.	Indicating LED			
15.	Push button			
16.	Numerical Non directional 2 O/C+1E/F IDMTL 3 sec relay			
17.	Numerical High speed trip relay (2 N/O+2 N/C)			
18.	Alarm cancellation scheme as per item No.26 under clause 5.7.1.1			
19.	Alarm relay			
20.	Voltage selection scheme as per item No. 28 under clause 5.7.1.1			
21.	HT Static trivector TOD Energy meter (3 Ph, 4 wire)			

22. TTB for TOD meter
23. Flasher relay for discrepancy switch
24 Any other equipment (if felt necessary by the tenderer)
25. Alarm Bell.
26. Earthing Trolley for Feeder earthing
27. Cable earthing Trolley
28. Bus earthing truck

SCHEDULE - A

SCHEDULE OF DEVIATIONS FROM SPECIFICATION

SR.NO.	CLAUSE NO.	DETAILS OF DEVIATION

NAME OF FIRM _____

NAME & SIGNATURE OF TENDERER_____

DESIGNATION _____

DATE _____

SCHEDULE - B

SCHEDULE OF TENDERER'S EXPERIENCE

Tenderer shall furnish here a list of similar orders executed/under execution by him to whom a reference may be made by Purchaser in case he considers such a reference necessary.

Sr. No.	Name of Client & Description order	Value of order alongwith size & qty	Period of supply and commissioning	Name & Address to whom reference may be made
1	2	3	4	5

NAME OF FIRM _____

NAME & SIGNATURE OF THE TENDERER_____

DESIGNATION _____

DATE _____

SCHEDULE-'C'

SCHEDULE OF DEVIATIONS FROM SPECIFIED STANDARDS

Sr. No.	**Particulars**	**Stipulation of specified standard**		**Stipulation of standard adopted by tenderer**		**Remarks**
		Standard ref.	Stipulations	Standard ref.	Stipulations	

NAME OF FIRM_____

NAME & SIGNATURE OF THE TENDERER_____

DESIGNATION _____

DATE _____

SCHEDULE - D

DEVIATIONS FROM SPECIFIED TEST REQUIREMENTS SPECIFIED IN RELEVANT AND PRESENT SPECIFICATIONS.

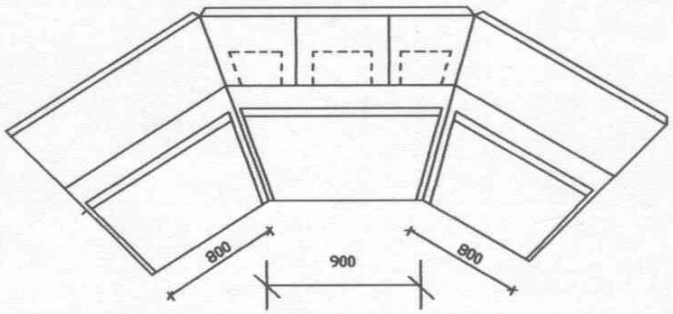
Sr. No.	Name of Test	Standard No. & Clause No.	Requirement of standards	Proposed deviation	Reasons for deviation.
1.	TYPE TEST				
2	ADDITIONAL TEST				
3	ACCEPTANCE TEST				
4	ROUTINE TEST				

NAME OF FIRM_____

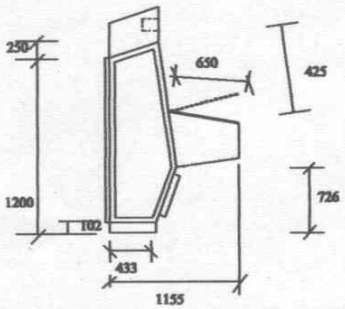
NAME & SIGNATURE OF TENDERER_____

DESIGNATION_____

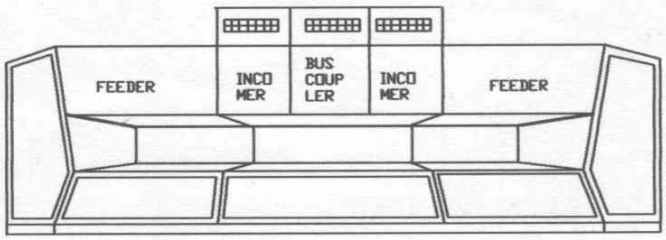
DATE: _____



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	A. E. (Mod 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	

MAHARASHTRA STATE ELECTRICITY DISTRIBUTION COMPANY LTD.

TECHNICAL SPECIFICATION FOR HT STATIC TRI-VECTOR TOD METER

SPECIFICATION NO: DIST /MM-IV/14 Dt.11.06.2008.

INDEX

MAHARASHTRA STATE ELECTRICITY DISTRIBUTION COMPANY LTD.

TECHNICAL SPECIFICATION FOR HT STATIC TRI-VECTOR TOD METER

SPECIFICATION NO: DIST /MM-IV/14 Dt.11.06.2008.

1.0 SCOPE:

This specification covers design, manufacture, testing, supply and delivery of ISI mark HT STATIC Tri-Vector Meters, required for H.T. Consumers` Installations. Meters shall be suitable for measurement of energy and power demand as per power tariff requirement of A.C. balanced / unbalanced loads. The original manufacturer of HT STATIC Tri-Vector Meters, shall only quote against this tender. In case of Foreign Manufacturer, the authorised Agents /Traders/Distributors may also bid, provided they have all the testing facilities in India and meters bear ISI mark.

2.0 QUALIFYING REQUIREMENTS:-

2.1 I] Offers of only original manufacturers of L.T.A.C. Static Energy Meters shall be accepted against the Tender.

II] The following qualifying requirement shall be fulfilled by the bidders/ manufacturers

a) The bidder/manufacturer should have turnover of Rs.80 crores during any one of the last three financial years.

b) The bidder/manufacturer should have supplied 12.5 lakhs static meters during the last three financial years.

c) The bidder/manufacturer should have minimum experience of three years of supply or manufacturing for static meters upto the end of the last financial year.

III] The offers of Indian subsidiary company, whose parent company is located abroad fulfilling the qualifying requirements shall be considered provided the Indian participant subsidiary company fulfils the minimum experience of three years of supply or manufacturing for static energy meters upto the end of the last financial year. However, the conditions of turnover of Rs.80 crores during any one of the last three financial years and supply of minimum quantity of 12.5 lakhs static energy meters during last three financial years can be fulfilled by the parent company located in abroad on behalf of their Indian subsidiary company. The parent company shall furnish undertaking for accepting responsibility for supplying quality meters as per specifications and execution of the contract on behalf of its India based subsidiary unit who has participated in the tender in Annexure U-I.

IV] In case of offers of Foreign bidders/manufacturers, they shall fulfill Qualifying Requirement as per Sr. No. 2.1 [I] and 2.1 [II] above.

3.0 SERVICE CONDITIONS:

The meters to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions

3.1 Environmental Condition

a)	Maximum ambient temperature	55 ^{0}C
b)	Maximum ambient temperature in shade	45 ^{0}C
c)	Minimum temperature of air in shade	35 ^{0}C
d)	Maximum daily average temperature	40 ^{0}C
e)	Maximum yearly weighted average temperature	32 ^{0}C
f)	Relative Humidity (%)	10 to 95
g)	Maximum Annual rainfall (mm)	1450
h)	Maximum wind pressure (Kg/m.sq)	150
i)	Maximum altitude above mean sea level (meters)	1000
j)	Isoceraunic level (days/year)	50
k)	Seismic level (Horizontal acceleration)	0.3g
l)	Climate:- Moderately hot and humid tropical climate conducive to rust and fungus growth.	

4.0 APPLICABLE STANDARDS:

- The Meter should conform to requirements of **IS:14697/1999**(amended up to date) and other relevant IS specifications including CBIP Tech-Report-88 amended up to date. The specifications given in this document supersedes the relevant clauses of IS: 14697/1999(amended up to date) wherever applicable.
- The meter shall bear ISI Mark.
- The class of accuracy shall be 0.5S.

4.1 Current & Voltage rating

> Type of Service: H.T. Tri-Vector meter combined with KVA Demand shall be suitable for use on 3 phase 4 wire system .The connection diagrams for this system shall be provided on terminal cover.

> P.T. Secondary Voltage... 63.5 Volts Ph-N

- Rated voltage shall be 3 * 63.5 Volts. The voltage range shall be +15% to – 30% of rated voltage.

  Meter shall be programmed for P.T. ratio 11 kV/√3/110 V/√3.
- The secondary current of C.T. shall be either 5 Amps or 1 Amp.

  Meter shall be programmed for C.T. ratio of 5/5 or 1/1 Amp respectively.
- Rated basic current for meter shall be either 5 Amps or 1 Amp as per the need, however the exact rating i.e.1 or 5 A will be informed at the time of issue of the purchase order.
- The maximum continuous current of the meter is 2 times (200 %) of Ib. The starting current for the meter should be 0.1% of Ib.

4.2 Temperature

The standard reference temperature for performance shall be 27^0C. The mean temperature co-efficient should not exceed 0.03%.

4.3 Frequency

The rated frequency shall be 50 Hz ± 5%.

4.4 Power Factor

Power Factor range - Zero Lag-Unity-Zero Lead. For leading Power factor the value of KVAh should be equal to KWh, for the purpose of calculation of average power factor (on the basis of KWh / KVAh). i.e. The value of KVAh shall be based on lagging value of KVARh & KWh.

4.5 Power consumption - less than 1Watt and 4 VA /phase in voltage circuit and 2 VA/phase in current circuit.

5.0 CONSTRUCTION

5.1 The meter shall be projection type, dust and moisture proof. The cover shall be made of Polycarbonate material so as to give it tough and non-breakable qualities. The meter body shall be type tested for IP51 degree of protection.

5.2 Moulded standard single terminal block shall be provided for current and voltage connections to meet the requirement of terminal connection arrangement. The termination arrangement shall be provided with a transparent extended terminal cover, sealable independently, to prevent unauthorized tampering .

5.3 All insulating materials used in the construction of the meter shall be substantially non-hygroscopic, non aging and of tested quality.

5.4 All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results.

5.5 Sealing provision shall be made against opening of the terminal cover and front cover. It is necessary to provide unidirectional screws with two holes for sealing purpose. The meter shall be pilfer-proof & tamper-proof.

5.6 The meter shall have Poly –carbonate translucent base and transparent cover of Poly-carbonate material, which shall be ultra-sonically (continuous welding) welded so that once the meter is manufactured and tested at factory, it should not be possible to open the cover at site except the terminal cover. The thickness of material for meter cover and base shall be 2 mm (minimum).

5.7 The terminal block, the terminal cover and the meter case shall ensure reasonable safety against the spread of fire. They should not be ignited by thermal overload of live parts in contact with them.

5.8 The real time quartz clock shall only be used in the meter for maintaining time (IST) and calendar. The time accuracy shall be as per provision of CBIP-88 Tech. report. Facility for adjustment of real time should be provided through CMRI with proper security.

5.9 The meter shall be completely factory sealed except the terminal block cover. The provision shall be made on the Meter for at least two seals to be put by utility user. The Terminal cover should be transparent with one side hinge with sealing arrangement.

5.10 The Push button shall be provided for high resolution reading of display, as brought out elsewhere in this specification.

5.11 The meter shall have a suitable test output device for testing meter. Preferably the blinking LED or other similar device like blinking LCD shall be provided. The test output device should have constant pulse rate i.e. Pulse/KWh and pulse/KVARh and its value (meter constant) should be indelibly printed on the name plate.

5.12 The meter accuracy shall not be affected by AC/DC magnetic field upto 0.2

Tesla on all the sides of meter i.e. front, sides, top and bottom of the meter as per CBIP-88 Technical Report with latest amendments. Moreover meter accuracy shall not be affected if permanent magnet of 0.5 Tesla is applied for 15 minutes . Under influence of any magnetic field (AC/DC/Permanent)above 0.2 Tesla, meter shall record energy considering Imax and reference voltage at unity power factor.

5.13 CTs are to be provided with magnetic shielding and they should be tested Separately prior to Assembly.

5.14 The meter shall also be capable to withstand and shall not get damaged if phase-to-phase voltage is applied between phases & neutral for five minutes.

5.16 In meter, power supply unit should be micro control type instead of providing transformer and then conversion to avoid magnetic influence.

5.17 Non specified display parameter in the meter should be blocked and it should not be accessible for reprogramming at site.

5.18 Complete metering system should not be affected by the external electromagnetic interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic fields and DC current in AC supply etc. The Meter shall meet the requirement of CBIP Tech-report 88 (amended up to date).

5.19 The meter shall withstand any type of High Voltage and High Frequency surges which are similar to the surges produced by induction coil type instruments without affecting the accuracy of the meter .

5.20 The meter should have facility for data retrieval through optical port using CMRI or Laptop PC and Wired RS232 (RJ-11 type is also acceptable) communication port for remote meter reading facility. RS 232 port on terminal block is also acceptable. Sealing arrangement for both Optical & RS 232 port shall be provided.

5.21 Self Diagnostic Features.

5.21.1 The meter shall keep log in its memory for unsatisfactory functioning or nonfunctioning of Real Time Clock battery, also it shall be recorded and indicated in reading file at base computer software.

5.21.2 All display segments: "LCD Test" display shall be provided for this purpose.

5.22 The meter shall have facility to read the default parameters during power supply failure. An internal maintenance free battery (Ni-mh or Li-ion or NI CD)of long life of 15 years shall be provided for the same. A suitable push button arrangement for activation of battery shall be provided. This battery may be of external type with inductive coupling arrangement. External battery is to be provided with inbuilt charger, in the ratio of one battery pack per 50 Nos meters.

5.23 Wire/Cable less design : The meter PCB should be wire less to avoid improper and loose connections/ contacts.

5.24 PCB used in meter shall be made by Surface Mounting Technology.

5.25 The RTC battery & the battery for display in case of power failure should be separate.

6.0 TOD TIMINGS

There shall be provision for at least 6 (Six) TOD time zones for energy and demand. The number and timings of these TOD time Zones shall be programmable.

At present the time zones shall be programmed as below:

TIME ZONE "A" 00.00 to 06.00 hrs and 22.00 to 24.00 hrs.

TIME ZONE "B" 06.00 to 09.0 0 hrs and 12.00 to 18.00 hrs.

TIME ZONE "C" 09.00 to 12.00 hrs.

TIME ZONE “D” 18.00 to 22.00 hrs.

7.0 ANTI TAMPER FEATURES

The meter shall detect and correctly register energy (Active + Reactive)only in forward direction under following tamper conditions:

7.1 The meter accuracy shall not be affected by change of phase sequence. It should maintain the desired accuracy in case of reversal of phase sequence.

7.2 The meter should continue to work even without neutral.

7.3 The meter should work in absence of any two phases i.e. it should work on any one phase wire and neutral, to record relevant energy.

7.4 If the magnetic field is more than 0.2 Tesla then the same should be recorded as magnetic tamper event with date & time stamping and the meter should record Energy considering the maximum value current (Imax) at ref. voltage and unity PF in all the three phases.

8.0 TAMPER EVENTS

The meter should have features to detect the occurrence and restoration of the following abnormal events.

8.1 Missing potential and potential imbalance.

The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of potential failure and low potential, which could happen due to

disconnection of potential leads (one or two). Meter shall also detect and log cases of voltage unbalance (10% or more for 5 Minutes.) Higher of the 3 phase voltages shall be considered as reference for this purpose.

8.2 Current unbalance:

The meter shall be capable of detecting and recording occurrence and restoration with date and time of current unbalance (30% or more for 15 minutes) Higher of the 3 phase currents shall be considered as reference for this purpose.

8.3 Current Reversal:

The meter shall be capable of detecting and recording occurrence and restoration with date and time of reversal of current with phase identification for persistence time of 5 minutes. It should also possess a current reversal counter.

8.4 Power ON / OFF

The meter shall be capable to record power ON/OFF events in the meter memory. All potential failure should record as power off event.

The meter shall keep records for the minimum 280 events. (Occurrence + Restoration). For above abnormal conditions the recording of events shall be on FIFO basis. It shall be possible to retrieve the abnormal event data along with all related snap shots data through the meter optical port with the help of CMRI & downloaded the same to the base computer. All the information shall be made available in simple & easy to understand format.

8.5 Current circuit short

The meter shall be capable of detecting and recording occurrences and restoration of shorting of any one or two phases of current.

9.0 DISPLAY OF MEASURED VALUES

9.1 Permanently backlit LCD panel shall show the relevant information about the parameters to be displayed. The corresponding non-volatile memory shall have a minimum retention time of 10 years. In the case of multiple values presented by a single display it shall be possible to display the content of all relevant memories. When displaying the memory, the identification of each parameter applied shall be possible. The principal unit for the measured

values shall be the kilowatthour (kWh) for active energy, kVARh for reactive energy and kVAh for apparent energy.

9.2 The display shall be minimum full 6 digit type display. The size of digit should be minimum 8X5 mm. The decimal units shall not be displayed. The adequate back up arrangement for storing of energy registered at the time of power interruption shall be provided.

9.3 The meters shall be pre-programmed for following details. Display other than specified below shall be blocked.

P.T.Ratio---- 11000/√3/110/√3 V,

C.T.Ratio----- 5/5 A.(1/1 A as the case may be).

M.D. resetting should be manual

MD Integration Period is 30 Minutes.

Average power factor with 2 decimal digits shall be displayed.

Billing parameters to be displayed presently shall be as shown below, but provision shall be as per specification.

Load survey data for every 30 minutes and for previous 60 days for specified parameters. Load survey data shall be first in first out basis (FIFO)

Tamper data will be stored in memory and retrieved by MRI or Laptop.

The necessary software shall be provided.

It should be possible to upload the MRI data to any PC having MRI software. A consumer based data uploading facility is required so that MRI will upload data only in that PC which has the concerned consumers` data . the consumer code+ meter No. Should be the key for creating consumers` files or overwriting consumers` files in PC. The software system files and data files should be stored in different directories.

The "record number field should be 10 digits Alphanumeric.(2digit for Zones,2 for Circle & 6 for consumer No.) Before accepting the data for "Record Number" the system should wait for pressing of "Enter" key.

Two separate fields should be provided for consumer name and address – one name field of one line , and other Address field for two lines

9.4 The meter shall be capable of recording and displaying automatically

the following

9.4.1 **Normal mode** (with Scrolling time 9 sec)

1) LCD Test
2) Date and time
3) Cumulative kWH
4) Cumulative RkVAh lag
5) Cumulative kVAh
6) Present kVAMD
7)TOD kWh
8)TOD RkVAh lag
9)TOD kVAh
10)Average PF for the month, minimum 2 decimal digits
11) Number of MD reset.
12) Number of Tamper Count.

9.4.2 **Alternate Mode**

After using pushbutton the following parameters should be displayed..

1) TOD kWH
2) TOD RkVAh
3) TOD kVAH
4) Current kVAMD TOD
5) Cumulative kVAMD
6) Cumulative kWh
7) Cumulative RkVAh
8) Cumulative kVAh
9) Instantaneous Power Factor
10) Voltage R phase
11) Voltage Y phase
12) Voltage B phase
13) Current R phase
14) Current Y phase
15) Current B phase
16) kVAMD occurance date & time TOD
17) MD reset count
18) High resolution kWh (for calibration)
!9) High resolution RkVAh (for calibration)
20) Rising Demand with elapsed time

21) kVA value M1 TOD

Other kVAMD values shall be available in reset backup data for 6 months..

NOTE : The meter display should return to Default Display mode (mentioned above) if the ' Push button ' is not operated for more than 15 seconds..

9.5 The meter should measure & record total energy (Active + Reactive) consisting of energy due to harmonics.

9.6 Maximum Demand Integration Period :- Integration period for KVAMD should be of 30 minutes real time based. However it shall be programmable to 15 minutes if required.

9.7 MD RESET

The meter should have following MD resetting options.

a) Automatic reset at the end of certain predefined period (say, end of the month) - This option shall be blocked by default and made programmable through hand held terminal /CMRI for the actual date required.

b) Resetting through a hand held terminal (CMRI) capable of communicating with the meter.

c) Manual resetting arrangement with sealing facility**.**

10. **DEMONSTRATION**

The purchaser reserves the right to ask to give the demonstration of the equipment offered at the purchaser's place.

11 **BILLING HISTORY & LOAD SURVEY**

The meter shall have sufficient non-volatile memory for recording history of billing parameters (Cumulative KWh at the time of reset and KVAMD) for last 6 months and load survey.

11.1 Load survey parameters :-

[i] KWh [ii] RKVAh [iii) KVAh [iv) KVAMD [v) Current per phase

[vi) Voltage per phase

The logging interval for load survey shall be 30 minutes. Load survey data shall be logged for last 60 days on non time based basis. i.e. if there is no power for more than 24 hours, the day should not be recorded Whenever meter is taken out and brought to laboratory the L/S data shall be retained for the period of actual use of meter. This load survey data can be retrieved as and when desired and load profiles shall be viewed

graphically / analytically with the help of meter application software. The meter application software shall be capable of exporting / transmitting these data for analysis to other user software in spreadsheet format .

12.0 **COMPUTER SOFTWARE.**

12.1 The following Software shall be supplied by the Meter manufacturer without extra cost.

1] Resident Software (MS-DOS 5.0 or higher version) in the Meter Reading Instrument (CMRI) for data retrieval and programming the meter.

2] Base Computer Software for accepting data from CMRI and downloading instructions from base computer to CMRI.

3] Necessary software for loading application program via serial port.

4] Other special application software of the manufacturer for the Meter.

12.2 The Meter shall be capable to communicate directly with laptop computer.

Base Computer Software shall be suitable for all types of dot matrix & inkjet printers.

12.3 For efficient and speedy recovery of data downloaded through CMRI on base computer, licensed copies of base computer software shall have to be supplied. This software will be used at numbers of places up to Division level. As many copies of base computer software as required up to Division level shall be provided free of cost by Supplier.

12.4 The base computer software shall be Window based & user friendly. The data transfer shall be highly reliable and fraud proof (No editing shall be possible on base computer by any means. The software shall have capability to convert all the data into ASCII format.

12.5 ***The protocol used in the meter shall have to be provided at the time of supply for the purpose of Automatic Meter Reading System. Confirmation shall be given to that extent in GTP.***

The Suppliers shall also have to submit the protocol for meters supplied in the past and ensure that protocol corresponds to the type of meter supplied

The protocol shall be shared by MSEDCL.

13.0. **CONNECTION DIAGRAM AND TERMINAL MARKINGS.**

The connection diagram of the meter shall be clearly shown on inside portion of the terminal cover and shall be of permanent nature. Meter terminals shall also be marked and this marking

should appear in the above diagram. The diagram and terminal marking on sticker will not be allowed.

14.0 **NAME PLATE AND MARKING**

Meter shall have a nameplate clearly visible, effectively secured against removal and indelibly and distinctly marked with all essential particulars as per relevant standards. Meter Serial Number shall be Bar Coded along with numeric number. The size of bar coded number should not be less than 35x5 mm. The manufacturer's meter constant shall be marked on the name plate. Meter serial number & bar code on sticker will not be allowed.

In addition to the requirement as per IS following shall be marked on the name plate.

1) Purchase order No.

2) Month and Year of manufacture

3) Name of purchaser i.e. MSEDCL

4) Guarantee of Five Years

5] ISI mark.

15.0 **TESTS:-**

15.1 Type Tests:-The Meter shall be fully type tested as per the relevant standards **within 5 years from the date of opening of Tender.** The type test reports of the offered meters shall be submitted along with the offer. All the Type Test shall be carried out from laboratories which are accredited by the National Testing and Calibration Laboratories (NABL) of Govt. of India such as CPRI Bangalore/ Bhopal, ERDA Baroda, to prove that the Meters meets the requirements of the specification. The Tenderers should also furnish certificate from laboratories where type tested that requisite test facility available in house for that particular test. Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable. The purchaser reserves the right to demand repetition of some or all the type tests in presence of purchaser's representative at purchaser's cost. For this purpose, the tenderer shall quote unit rates for carrying out each type test. However, such unit rates will not be considered for evaluation of the offer. **In case the meters is type tested earlier to 5 years from the date of opening of tender, the bidder have to carry our the fresh type tests at their cost before commencement of supply.**

15.2 Acceptance Tests:-ALL acceptance tests as per IS 14697/1999 shall be carried out on the meter.

15.3 Routine Test:- All routine tests as per IS:14697/1999 shall be carried out on all the meters.

15.4 Transportation Test:

At least 50% of the samples of the meters be tested for error at Imax, Ib and 5% Ib at unity power factor and 50% Imax and 10% Ib at 0.5 lagging Power Factor besides checking them for starting current. This test shall be conducted on ready to install meter i.e. meter cover ultrasonically welded & sealed. After recording these errors, the meters be put in their normal packing and transported for at least 50 km in any transport vehicle such as pick up van, Jeep, etc. on uneven rural roads and then re-tested at all these loads after the transportation. The variation in errors recorded before and after transportation should not exceed 1% at higher loads and 1.5% at loads below Ib.

15.5 Other Acceptance Tests :

i. Meters shall be tested for tamper conditions as stated in this specification.

ii. Glow wire testing for poly-carbonate body.

iii. Power consumption tests shall be carried out.

iv. The meter shall comply all the test for external AC/DC magnetic field as per CBIP Tech Report 88 with latest amendments. Moreover, the magnetic influence test for permanent magnet of 0.5 Tesla for minimum period of 15 minutes shall be carried out. After removal of magnet. meter shall be subjected to accuracy test as per IS 14697/1999 (amended up to date). No deviation in error is allowed in the accuracy as per specification.

v. The meter shall withstand impulse voltage at 10 kV.

The test 15.5, (i) to (iii) shall be carried out at factory for each inspected lot at the time of pre dispatch inspection.

The tests 15.5 (iv) & (v) shall be carried out on one sample from first lot as per procedure laid down in IS14697/1999(amended up to date) and CBIP Tech-Report 88.(with latest amendments) in NABL LAB. The test report shall be got approved from CE(Dist.) before commencement of supply.

15.6 For influence quantities like voltage variation, frequency variation, voltage unbalance etc. the limits of variation in percentage error will be as per IS:14697/1999.(amended up to date)

15.7 Guaranteed Technical Particulars:- The tenderer should also furnish the particulars giving specific required details of Meters in schedule `A' attached. The offers without the details in Schedule `A' stand rejected.

16.0**PRE-DESPATCH INSPECTION**

All Acceptance tests and inspection shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the manufacturer and purchaser at the time of purchases. The manufacturer shall offer to the inspector representing the purchaser all the reasonable facilities, free of charge, for inspection and testing, to satisfy him that the material

is being supplied in accordance with this specification. The Company's representative/Engineer attending the above testing will carry out testing as per IS:14697/1999 & this specification and issue test certificate approval to the manufacturer and give clearance for dispatch. The first lot of meter may be jointly inspected by the representative of the Chief Engineer (Stores) and the Executive Engineer (INSPECTION WING).

17.0 **JOINT INSPECTION AFTER RECEIPT AT STORES(Random Sample Testing)** From each lot (lot means the total number of meters received in a Store out of inspected and approved lot by E.E.(IW) or purchaser's representative under one approval letter) of meters received at Stores, 5 sample meters shall be drawn and these meters will be tested by Our Testing Engineer in presence of Supplier's representative jointly for (i) no load condition,(ii) limits of error test (iii) starting & (iv) repeatability of error test and (v) tamper conditions as per this specification. The 5 days advance intimation will be given to the supplier and if the suppliers fails to attend the joint inspection on the date informed ,the Testing will be carried out by our Testing Engineer in absence of suppliers representative .If the meters failed in above random sample testing, the lot will be rejected.

18.0**GUARANTEE**

The Meter shall be guaranteed for the period of five years from the date of commissioning or five and half year from the date of despatch whichever is earlier. The meters found defective within the above guarantee period shall be replaced/repaired by the supplier free of cost within one month of receipt of intimation. If the defective meters are not replaced/repaired within the specified period above, the Company shall recover an equivalent amount plus 15 % supervision charges from any of the bills of the supplier.

19.0 **PACKING**

19.1 The meters shall be suitably packed in order to avoid damage or disturbance during transit or handling. Each meter may be suitably packed in the first instance to prevent ingress of moisture and dust and then placed in a cushioned carton of a suitable material to prevent damage due to shocks during transit. The lid of the carton may be suitably sealed. A suitable number of sealed cartons may be packed in a case of adequate strength with extra cushioning, if considered necessary. The cases may then be properly sealed against accidental opening in transit. The packing cases may be marked to indicate the fragile nature of the contents.

19.2The following information shall be furnished with the consignment:

- Name of the consignee.
- Details of consignment
- Destination
- Total weight of consignment
- Sign showing upper/lower side of the crate
- Sign showing fragility of the material.
- Handling and unpacking instructions.
- Bill of Materials indicating contents of each package and spare materials.

20.0 **TENDER SAMPLE**

Tenderers are required to submit 07 nos. of meter samples of each offered type / item as per technical specification of tender document , from any one of the factories on or before the time and date stipulated for submission of offer , for evaluations. The samples shall be clearly marked with each type / item for which sample submitted and name of bidder. Out of these,Two samples should be without ultrasonic welding to confirm constructional features.

21.0**QUALITY CONTROL**

The purchaser shall send a team of experienced engineers for assessing the capability of the firm for manufacturing of meters as per this specification. The team should be given all assistance and co-operation for inspection and testing at the bidder's works. The tenderer has to give all facilities for carrying out the testing of samples

22.0 **MINIMUM TESTING FACILITIES**

Manufacturer should posses fully **Automatic computerized Meter Test Bench System having inbuilt source and load adjustment** for carrying out routine and acceptance Tests as per IEC:687 or CBIP-88. In addition this facility should produce Test Reports for each and every Meter. The tenderer should have the necessary minimum testing facilities for carrying out the following tests.

i) A.C. Voltage test
ii) Insulation Resistance Test
iii) Test on limits of errors
iv) Test on meter constant

v) Test of starting condition

vi) Test of no-load condition

vii) Repeatability of error test

viii) Test of power Consumption

ix) Vibration test

x) Shock test

xi) Tamper conditions - -as per MSEDCL, specification.

xii) The manufacturer should have duly calibrated RSS meter of class 0.1 accuracy.

23.0 MANUFACTURING ACTIVITIES:-

(i) Meter should be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and reflow solder process. Further, the Bidder should own or have assured access(through hire, lease or sub-contract) of above facilities.

(ii) Quality should be ensured at the following stages:

(a) At PCB manufacturing stage each company shall be subjected to computerized bare company testing.

(b) At insertion stage all components should under go computerized testing for conforming to design parameters and orientation.

(c) Complete assembled and soldered PCB should under go functional testing using Automatic Test Equipments (ATEs)

(d) Prior to final testing and calibration, all meters shall be subjected to aging test (i.e. Meters will be kept in ovens for 72 hours at 55 ^{0}C temperature and atmospheric humidity under real life condition at it's full load current .After 72 hours meters should work satisfactory) to eliminate infant mortality.

(e) The calibration of meters shall be done in-house.

(f) The bidders should submit the list of all imported & indigenous components separately used in meter along with the offer.

(g) Bought out items:- A detailed list of bought out items which are used in the manufacture of the meter should be furnished indicating the name of firms from whom these items are procured. The bidder shall also give the details of quality assurance procedures followed by him in respect of the bought out items.

24.0 QUALITY ASSURANCE PLAN

24.1 The tenderer shall invariably furnish QAP as specified in **Annexure-I** along with his offer the QAP adopted by him in the process of manufacturing.

24.2 Precautions taken for ensuring usages of quality raw material and subcomponent shall be stated in QAP

25.0 The COMPONENT SPECIFICATION as per Annexure -III enclosed..

26.0 SCHEDULES:-

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

Schedule `A' ... Guaranteed and technical particulars (As indicated in GTP parameters on E-Tendering)

Schedule `C' ... Tenderer's Experience

The discrepancies if any between the specification and the catalogs and/or literatures submitted as part of the offer by the bidders, the same shall not be considered and representations in this regard will not be entertained.

SCHEDULE - "C"

TENDERER'S EXPERIENCE

SR.NO	Order number	Number of Meters supplied-

NAME OF FIRM _____

NAME & SIGNATURE OF TENDERER_____

DESIGNATION _____

DATE _____

ANNEXURE I

Quality Assurance Plan

A) The bidder shall invariably furnish the following information alongwith his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.

i) Statement giving list of important raw materials, names of sub- suppliers for the raw materials, list of standards according to which the raw materials are tested. List of test normally carried out on raw materials in presence of Bidder's representative, copies of test certificates :

ii) Information and copies of test certificates as in (i) above in respect of bought out accessories.

iii) List of manufacturing facilities available.

iv) Level of automation achieved and list of areas where manual processing exists.

v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

vi) List of testing equipment available with the bidder for final testing of equipment specified and test plan limitation. If any, vis-a-vis the type, special acceptance and routine tests specified in the relevant standards. These limitation shall be very clearly bought out in schedule of deviation from specified test requirements.

B) The successful bidder shall within 30 days of placement of order, submit following information to the purchaser.

i) List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished alongwith offers.

ii) Type test certificates of the raw materials and bought out accessories if required by the purchaser.

iii) Quality assurance plan (QAP) with hold points for purchaser's inspection.

The quality assurance plant and purchasers hold points shall be discussed between the purchaser and bidder before the QAP is finalized.

C) The contractor shall operate systems which implement the following :

i) Hold point : A stage in the material procurement or workmanship process beyond which work shall not proceed without the documental approval of designated individuals organizations. The purchaser's written approval is required to authorise work to progress beyond the hold points indicated in quality assurance plans.

ii) Notification point : A stage in the material procurement or workmanship process for which advance notice of the activity is required to facilitate witness. If the purchaseer does not attend after receiving documented notification in accordance with the agreed procedures and with the correct period of notice then work may proceed.

D) The successful bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing if required by

the purchaser and ensure that Quality Assurance program of the contractor shall consist of the quality systems and quality plans with the following details.

i) The structure of the organization.

The duties and responsibilities assigned to staff ensuring quality of work.

The system for purchasing taking delivery and verification of material.

The system for ensuring quality workmanship.

The system for retention of records.

The arrangements for contractor's internal auditing.

A list of administration and work procedures required to achieve and verify contract's quality requirements these procedures shall be made readily available to the project manager for inspection on request.

ii) Quality Plans :

An outline of the proposed work and programme sequence. The structure of the contractor's organization for the contract.

The duties and responsibilities assigned to staff ensuring quality of work.

Hold and notification points.

Submission of engineering documents required by the specification.

The inspection of materials and components on receipt. Reference to the contractor's work procedures appropriate to each activity.

Inspection during fabrication/ construction.

Final inspection and test.

ANNEXURE II

DISPLAY SEQUENCE FOR THE PARAMETERS.

A) **Default Display (With scrolling time 9 sec.)**

1) LCD Test
2) Date and time
3) Cumulative kWH
4) Cumulative RkVAh lag
5) Cumulative kVAh
6) Present kVAMD
7) TOD kWh
8) TOD RkVAh lag
9) TOD kVAh
9) Average PF for the month, minimum 2 decimal digits
10) Number of MD reset.
11) Number of tamper counts.

B) **On- demand Display :**

After using pushbutton the following parameters should be displayed..

1.TOD kWH
2 TOD RkVAh
3 TOD kVAH
4. Current kVAMD TOD
5.Cumulative kVAMD
6.Cumulative kWh
7.Cumulative RkVAh
8.Cumulative kVAh
9.Instantaneous Power Factor
10.Voltage R phase
11.Voltage Y phase
12.Voltage B phase
13.Current R phase
14.Current Y phase
15.Current B phase
16.kVAMD occurance date & time TOD
17.MD reset count
18.High resolution kWh (for calibration)

19.High resolution RkVAh (for calibration)

20.Rising Demand with elapsed time

21.kVA value M1 TOD

22.kVA value M2 TOD

NOTE :The meter display should return to Default Display mode (mentioned above) if the ' Push button ' is not operated for more than 15 seconds.

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ANNEXURE III

Sr.No.	Component function	Requirement	Makes and Origin
1	Current Transformers	The Meters should be with the current transformers as measuring elements . The current transformer should withstand for the clauses under 5&9 of IS-14697/1999	The current transformer should withstand for the clauses under5&9 of IS-14697/1999
2	Measurement or computing chips	The measurement or computing chips used in the Meter should be with the Surface rmount type along with the ASICs.	USA: Anolog Devices, Cyrus Logic, Atmel, Philips South Africa :SAMES Japan : NEC
3	Memory chips	The memory chips should not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges.	USA: Atmel, National Semiconductors, Texas Instruments, Philips, ST, Japan : Hitachi or
4	Display modules	a) The display modules should be well protected from the external Uv radiations. b) The display visibility should be sufficient to read the Meter mounted at height of 0.5 meter as well as at the height of 2 meters (refer 3.2 d for Viewing angle). c) The construction of the modules should be such that the displayed quantity should not disturbed with the life of display (PIN Type). d) It should be trans-reflective HtN or STN type industrial grade with extended temperature range.	Hongkong : Genda Singapore: Bonafied Technologies. Korea: Advantek China : Success Japan : Hitachi, Sony.
5	Communication Modules	Communication modules should be compatible for the two ports (one optical port for	USA: National Semiconductors

		communication with meter reading instruments & the other hardwired RS 232 port to communicate with various modems for AMR)	HP, Optonica Holland / Korea : Phillips Japan : Hitachi Taiwan: Ligitek
6	Optical port	Optical port should be used to transfer the meter data to meter reading instrument. The mechanical construction of the port should be such to facilitate the data transfer easily.	USA: National Semiconductors HP, Holland / Koread : Phillips Japan : Hitachi Taiwan: Ligitek
7	Power supply	The power supply should be with the Capabilities as per the relevant standards. The power supply unit of the meter should not be affected in case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections	SMPS Type
8	Electronic components	The active & passive components should be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	USA : National Semiconductors, Atmel,, Philips, Taxas Instruments Japan : Hitachi, Oki, AVZ or Ricon Korea; Samsung
9	Mechanical parts	a)The internal electrical components should be of electrolytic copper & should be protected from corrosion, rust etc. b) The other mechanical components should be protected from rust, corrosion etc. by suitable plating/painting methods.	
10	Battery	Chargeable maintenance free guaranteed life of 10 years.	Varta, Tedirun, Sanyo or National.
11	RTC & Micro	The accuracy of RTC shall be as	USA : Philips,

	controller.	per relevant IEC / IS standards.	Dallas Atmel, Motorola, Microchip Japan : NEC or Oki.
12	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm.	

ANNEXURE U-I
"INDEMNITY BOND"

UNDERTAKING TO BE SUBMITTED BY THE PARENT COMPANY SITUATED ABROAD IN CASE OF THE PARTICIPANT BIDDER WHO IS AN INDIAN BASED SUBSIDIARY ON GENERAL STAMP OF RUPEES 200/-

The Executive Director (Stores),
Maharashtra State Electricity Distribution Co. Ltd.,
Prakashgad, Bandra (E),
Mumbai – 400 056.

Dear Sir:

Sub:- Undertaking against Tender _____
for procurement of _____

We, M/s ._____having registered office at _____ are the Parent Company of M/s. _____ who have participated against your tender No. _____ for procurement of _____.

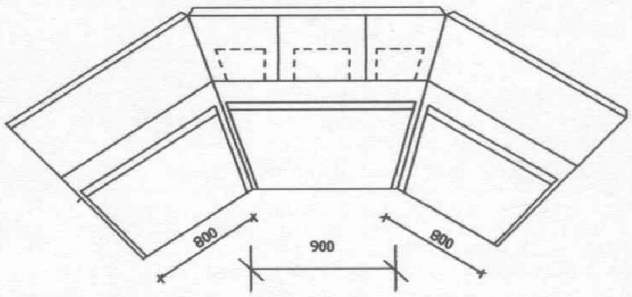
We have carefully read and have thoroughly understood and agree to the terms and conditions of the subject tender.

We hereby undertake that in case of placement of order against the subject tender on our subsidiary company, M/s._____, in the event of we accept all the responsibilities and liabilities for supply of quality meters as per specification of the tender and execution of the contract. We further hereby undertake that we shall be responsible for any liability arising out of the contract placed on M/s._____. and to pay MSEDCL on demand the sum of rupees as per agreement in the event of any breach of condition of the purchase order, loss and damage of the material till expiry of guarantee period as stipulated in the order.

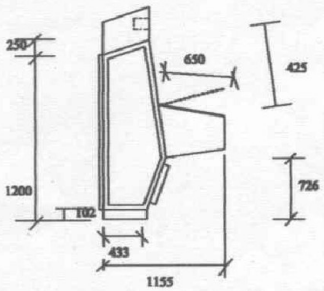
Our liability here under shall not be impaired or discharged by extension of time or variation or alteration made with or without our knowledge or consent by or between the parties to the said contract. This undertaking shall be valid and binding on us upto and including the execution and guarantee period of the order and shall not be terminable by notice or change in the constitution of any of the companies. In case of any dispute arising out of or in connection with this tender or contract, if concluded, the same shall be subject to the exclusive jurisdiction of the **"Court in Mumbai (India)."**

Yours faithfully,
(Authorised Signatory)

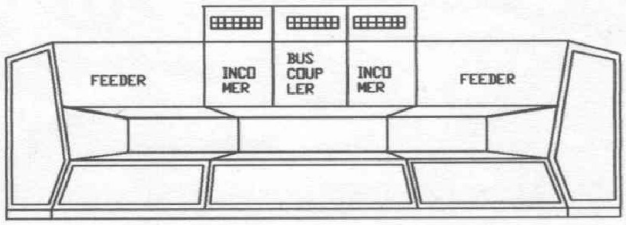
FOR _____



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	

	11kV 25KA (500 MVA) Indoor Switchgear (configuration 2I+1B+8F)	
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 Intrrupter	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 shall be O - 0.3 sec - CO - 30 Sec - CO (Yes/No)	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

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.	
69	Make of Potential Transformer	
70	Type of Potential Transformer	
71	Designation of Potential Transformer	
72	Rated insulation level of Potential Transformer shall be minimum 12/28/75 kV	
73	Is offered Potential Transformer single phase units? (Yes/No)	
74	Voltage Ratio of Potential Transformer shall be (11kV/rt3)/(110V/rt3)/(110V/rt3) (Yes/No)	
75	Potential Transformer shall have two secondary cores. (Yes/No)	
76	VA Burden of Core I of Potential Transformer shall be 50 VA (in VA)	
77	VA Burden of Core 2 of Potential Transformer shall be 30 VA (in VA)	
78	Accuracy class of Core 1 of Potential Transformer shall be Cl 0.5	
79	Winding connection of Potential Transformer shall be Star/Star Open delta.	
80	Rated Voltage factor and time of Potential Transformer shall be 1.2 Continuous & 1.5 for 30 seconds.	
81	Type of insulation housing of Potential Transformer shall be resin/epoxy cast.	
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	
85	Designation of Indoor Switchgear	
86	Degree of protection provided to Indoor Switchgear shall not be less than IP4X	
87	Thickness of sheet steel of Indoor Switchgear shall not be less than 2 mm.	
88	Number and name of compartments of Indoor Switchgear.	
89	One minutes Power Frequency withstand voltage of Indoor Switchgear shall be min. 28 kV.	

90	Impulse withstand voltage of Indoor Switchgear shall be min. 75 kVp.	
91	Short Circuit withstand current at rated voltage for 3 second of Indoor Switchgear shall be min. 25 kA for Breaker	
92	Short Circuit withstand current at rated voltage for 3 second of Indoor Switchgear shall be min. 25 kA for Bus Bar.	
93	Whether power cable entry provided from rear bottom of Indoor Switchgear.	
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.	
97	Number of heaters provided per panel shall not be less that 2.	
98	Whether automatic safety shutter provided to Indoor Switchgear. (Yes/No)	
99	Material of earth bus provided for Indoor Switchgearshall be copper. (Yes/No)	
100	Size of earth bus provided for Indoor Switchgear.	
101	Material of terminal connector provided in Indoor Switchgear.	
102	Type of terminal connector provided in Indoor Switchgear.	
103	Whether Indoor Switchgear panels shall be of unitised construction. (Yes/No)	
104	Whether extension on both sides of panels without limitation is possible. (Yes/No)	
105	Material of bus bar provided for Indoor Switchgearshall be copper. (Yes/No)	
106	Size of bus bar provided for Indoor Switchgear.	
107	Current rating of bus bar provided for Indoor Switchgear shall be min. 2000 A	
108	Current density adopted for bus bar provided in Indoor Switchgear shall be more than 1.6 A/sq.mm	
109	Number of fasteners used for bus bar joints provided for Indoor Switchgear.	
110	Size of fasteners used for bus bar provided for Indoor Switchgear.	
111	Material used for fastners used for bus bar joint shall be non magnetic stainless steel. (Yes/No)	
112	Material use for Bus Support Insulator used in indoor switchgear.	
113	Voltage class of Bus Support Insulator used in indoor switchgear shall be min 12 kV.	
114	Creepage Distance of Bus Support Insulator used in indoor switchgear shall be 300 mm.	
115	Cantilever strength of Bus Support Insulator used in indoor switchgear shall be 1200 kgf.	
116	Phase to phase clearance of Bus Support Insulator used in indoor switchgear shall be 180 mm.	
117	Phase to earth clearance of Bus Support Insulator used in indoor switchgear shall be 130 mm.	
118	Make of non direction 2 O/C + 1 E/F relay.	
119	Type of non direction 2 O/C + 1 E/F relay.	
120	Designation of non direction 2 O/C + 1 E/F relay.	
121	Setting of O/C elements of non direction 2 O/C + 1 E/F relay shall be 50% to 200 % of Base Current.	
122	Setting of E/F elements of non direction 2 O/C + 1 E/F relay shall be 10% to 40 % of Base Current.	
123	Charecteristics of non direction 2 O/C + 1 E/F relay shall be 0-3 sec.	

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

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