



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

SPECIFICATION

FOR

11 kV 12.5 kA OUTDOOR SWITCHGEAR

FOR

VARIOUS 33/11 kV SUBSTATIONS

IN

MAHARASHTRA

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SPECIFICATION FOR 11 kV, 12.5 kA, OUTDOOR SWITCHGEAR
WITH ASSOCIATED C&R PANELS, CURRENT TRANSFORMERS,
POTENTIAL TRANSFORMERS, ISOLATORS etc.

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

1.0 SCOPE:

- 1.1. This specification covers design, manufacture, assembly, testing before supply, inspection, packing and delivery and other basic technical requirements in respect of 11 kV, 12.5 kA OUTDOOR SWITCHGEAR WITH ASSOCIATED C&R PANELS, CURRENT TRANSFORMERS, POTENTIAL TRANSFORMERS, ISOLATORS (with highest system voltage of 12kV) & CABLES, to be installed at various 33/11 kV sub-stations in Maharashtra. The equipment to be supplied against this specification are required for vital installations where continuity of service is very important. The design, materials and manufacture of the equipment shall, therefore, be of the highest order to ensure continuous and trouble-free service over the years.
- 1.2. Only breaker manufacturer can quote against this specification.
- 1.3. 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.
- 1.4. Configuration:
The 11 kV 12.5 kA outdoor switchgear shall comprise of one incommer bay and three outgoing feeder bays with equipment as indicated in the enclosed drawings.
- 1.5. Tender scope also includes conductor and terminal connectors/Hardware required to inter connect the equipment covered in this specification to above configuration and to the over head main bus.
- 1.6. THE RESPECTIVE DRAWINGS ALONGWITH NOTES AND SPECIFICATION ATTACHED HERETO FORM AN INTEGRAL PART OF THIS SPECIFICATION FOR ALL PURPOSES.
- 1.7. 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. The dimensional drawings attached with this specification and the notes thereto are generally of illustrative nature. In actual practice, notwithstanding 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.
- 1.8. 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.

1.9. 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.

1.10. Recommended spares:

The tenderer shall furnish in his offer a list of recommended spares with unit rates for each set of equipment that may be necessary for satisfactory operation and maintenance of circuit breaker and Isolators for a period of 5 years. The purchaser reserves right of selection of items and quantities of these spares to be ordered. The cost of such spares shall not be considered for tender evaluation.

1.11. Erection and maintenance tools

The tenderer shall submit a list and unit rates of all the special tools, equipment and instruments required for erection, testing, commissioning and maintenance of the equipment. The purchaser shall decide the quantity of tools to be ordered. Prices of these tools shall not be considered for tender evaluation. However, the list of necessary tools/equipment which will be supplied free of cost with each CB may be furnished separately.

2.0 SERVICE CONDITIONS:

2.1. System particulars:

(i)	Nominal system voltage	...	11 kV
(ii)	Corresponding highest system voltage	...	12 kV
(iii)	Frequency	...	50 Hz+3%
(iv)	Number of phases	...	3
(v)	Neutral earthing	...	Solidly grounded
(vi)	Fault level (minimum)	...	12.5 kA for 3 sec.

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

(i)	Max. ambient air temperature	:	50 Deg. C
(ii)	Max. relative humidity	:	100 %
(iii)	Max. annual rainfall	:	1450 mm
(iv)	Max. wind pressure	:	150 kg/sq.m.
(v)	Max. altitude above mean sea level	:	1000 mtrs.
(vi)	Isoceraunic level	:	50
(vii)	Seismic level(Horizontal acceleration)	:	0.3 g.
(viii)	Climatic Condition		Moderately hot and humid tropical climate conducive to rust and fungus growth.

(ix)	Reference Ambient Temperature for temperature rise	:	50 deg C
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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.

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

2.3.1. Rating:

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

3.0 CODES AND STANDARDS:

3.1. 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 off his responsibilities.

3.2. The 11 kV, 12.5 kA switchgear shall conform to IS: 13118 as amended upto date or other International Standards for equal or better performance.

3.3. Unless otherwise specified, the equipment offered shall conform 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.	IEC 694	Common clauses for switchgear
c.	IS 3156/1992	Voltage transformers
d.	IS 2705/1992	Current transformers.
e.	IS 5621:1980	Hollow Insulators for use in electrical equipment
f.	IS:335/1993	New Insulating oil.
g.	IS 9921/1981, 82,85	Alternating Current Disconnecter (Isolators.)
h.	IS:2544/1973	Porcelain Post Insulators
i.	IS 12063/1987	Degree of protection provided for enclosures for electrical equipment.
j.	IS 5/2005	Colours for ready mixed paints and enamels.
k.	IS 5578/1984	Marking of insulated conductor.
l.	IS 1248/2003	Indicating instruments.
m.	IS 14697/1999	HT static TOD Energy meter
n.	IS 6875 amended upto date	Control switches.
o.	IS 3231/1986 & 87	Electrical Relays for Power System Protection.
p.	IEC 60255 amended upto date	Numerical biased protection relays.
q.	IS 4794/68 & 86	Push button.
r.	IS:9385/1979	High Voltage Fuses

- 3.4. In the event of offered equipment conforming to Standards other than the above, the salient points of comparison between the Standard(s) adopted and the relevant IS/IEC shall be indicated in the technical offer to bring out clearly how the chosen standard is equal to or better than the ones stipulated in this specification. Copies of the Standard (s) adopted shall be furnished.

4.0 PRINCIPAL TECHNICAL PARAMETERS

Principal technical parameters of various equipment shall meet the requirements listed in Annexure II (A to E)

5.0 GENERAL TECHNICAL REQUIREMENTS:

5.1. Outdoor switchgears:

- 5.1.1. The requirement is for 11 kV, 12.5 kA for 3 sec switchgear alongwith associated equipment for outdoor installation. Equipment shall be offered bay-wise i.e. for incomer bay and feeder (out-going) bay and shall consist of circuit breakers, indoor indication panels, Outdoor Control, Relay & Metering Panels, Isolators, CTs and Bus PTs, conductor, all type of necessary connector alongwith suitable mounting structure. All these equipment shall have suitable terminal/equipment connectors as detailed under clause No.5.5

- 5.1.2. Bill of material for outdoor switchgear (Bay-wise)

- 5.1.2.1. Each incomer bay shall consist of the following equipment:-

- (i) Vacuum circuit breaker of rating 11 kV, 12.5 kA and suitable for 800 Amps. continuous current carrying, complete with operating mechanism, and necessary controls and wiring.
- (ii) Three outdoor 11kV C.T.s of Ratio 600-300/5-5A.
- (iii) Two off-load isolators rated for 800 Amps continuous current carrying, without earth blades.
- (iv) Steel structures for mounting items i, ii, iii and iv
- (v) Outdoor type Control, Relay and metering panels as per clause no.5.3
- (vi) Indoor type indication panel as per clause no.5.4
- (vii) Cables and accessories required to connect outdoor and indoor panel.

- 5.1.2.2. Equipment for each feeder (out-going) bay shall be as follows:-

- (i) One Vacuum circuit breaker of rating 11kV, 12.5 kA suitable for 400 Amps. continuous current carrying, complete with operating mechanism and controls and wiring.
- (ii) Three 11kV outdoor C.T.s of ratio 400-200-100/5-5A
- (iii) Two 11kV off-load isolators rated for 400 Amps continuous current. Bus side isolators shall be without earth blades and outgoing feeder side isolators shall be with earth blades.
- (iv) Support structures for mounting items i, ii & iii above.
- (v) Outdoor type Control, Relay and metering panels as per clause no.5.3
- (vi) Indoor type indication panel as per clause no.5.4
- (vii) Cables and accessories required to connect outdoor and indoor panel.

- 5.1.2.3. Bus PT as follows:

- (i) Three outdoor single phase PTs of ratio

$$\frac{11\text{kV} / 110\text{V} / 110\text{V}}{\sqrt{3} / \sqrt{3} / \sqrt{3}}$$
- (ii) One off-load isolators rated for 800 Amps continuous current carrying, without earth blades.

5.1.3. Clearances and spacing as indicated below shall be provided.

a)	Phase to phase (Electrical) clearance for Breaker poles	280 mm (minimum)
b)	Phase to phase (Electrical) clearance for C.T.s & P.T.s	370 mm (minimum)
c)	Phase to earth clearance (H.T.Terminal to nearest grounded metal part)	370 mm
d)	Height of 11 kV terminals from ground level	3100 mm (minimum)
e)	Spacing between isolator poles (Centre to Centre)	1000 mm (fixed)
f)	Height of lowest part of support insulator from ground level	2800 mm (minimum)

Tenderers shall confirm in their technical offer that all clearances and spacing as stated above will invariably be provided. Offers without such confirmation are liable to be rejected.

5.2. Circuit Breakers

5.2.1. Circuit breakers shall be Vacuum type. Porcelain clad breakers confirming to **M1/M2** class will be accepted.

5.2.2. The circuit breakers offered shall be 3-pole gang operated Vacuum circuit breakers having rating 12.5KA for 3 seconds Incomer breaker shall have 800 Amps continuous current rating whereas the feeder (outgoing) breaker shall be of 400Amps. For similar rated circuit breakers, it shall be possible to interchange the CBs if required in future.

5.2.3. C.B. shall be suitable for rapid reclosing cycle O-0.3 sec - CO - 3 min-CO. First pole to clear factor shall be 1.5

5.2.4. Breaker Contacts

5.2.4.1. Main contacts shall have ample area and contact pressure for carrying continuous rated and short time current without excessive temperature rise, which may cause pitting or welding.

5.2.4.2. The inside operating rod or insulated fiber glass connecting rods wherever used shall be sturdy and shall not break during the entire life period of the breaker. The insulated rod shall have anti tracking quality towards electrical stresses.

5.2.5. Operating mechanism

5.2.5.1. Operating mechanism and control circuitry shall be housed in suitable metallic enclosure. It shall be painted white on the interior and Dark Admiralty Grey to shade no 632 of IS-5 on exterior surface. The enclosures shall be dust, moisture and vermin proof, to provide a Degree of protection to IP 55 in accordance with IS:13947. Control cubicle for local operation of the breaker shall be mounted at a convenient height to enable easy operation from ground level. It shall have backwards slanting hood of 2 mm thick (14 SWG) sheet for protection against rain water. It shall accommodate the following items:-

Sr.No.	Item	Quantity	
		Incomer	Feeder
1	Mechanical ON & OFF knobs.	1 No.	1 No.
2	Electrical ON/OFF push buttons	1 No. each	1 no. each
3	Mechanical ON/OFF indicator.	1 No. each	1 No. each
4	Electrical ON/OFF indicator	1 NO. each	1 No. each
5	Mechanical spring charged indicator.	1 No.	1 No.
6	Electrical spring charge indicator	1 No.	1 No.
7	Auxiliary A.C./D.C. supply indication	1 No. each	1 No. each
8	Conveniently located manual emergency trip	1 No.	1 No.
9	Auxiliary switches as specified else where in this specification	1 set	1 set
10	Control cable termination connector blocks with stud type brass terminals of min 4 mm dia	1 set	1 set
11	One power plug along with control switch (240V,10A).	1 set	1 set
12	Space heater along with ON/OFF switch and thermostat	1 set	1 set
13	Cubical illumination lamp with switch.	1 set	1 set
14	Mechanical Operation counter to register the number of breaker operations.	1 No.	1 No.
15	Local/Remote switch	1 No.	1 No.

5.2.5.2. Auxiliary Switches:

- 5.2.5.2.1 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.
- 5.2.5.2.2 All spare auxiliary contacts of the circuit breakers shall be wired up and brought to the terminal block. Minimum 4 N/O + 4 N/C contacts shall be available on each breaker for this purpose. Auxiliary contact multiplier, if any used, shall be connected to the DC supply only.
- 5.2.5.2.3 Insulation level of auxiliary contacts shall be 1100 volts, 2.5 kV for 1 min.
- 5.2.5.3. In case the control cubicle mounting height is more, there shall be provision of suitable folding type ladder attached to the breaker support structure, by means of which it will be possible to reach the control cubicle/operating mechanism box conveniently. Further, electrical ON/OFF push buttons/switch shall be accessible from the ground.
- 5.2.5.4. 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.
- 5.2.5.5. Tripping of the circuit breakers shall be through "Shunt trip" coils rated for 30V DC operation. It shall be possible to trip the breaker manually in case of necessity.
- 5.2.5.6. In each circuit breaker, one potential free contact of the limit switch of spring charging motor shall be provided for remote indication of spring charged. This contact shall be wired up and brought to the terminal block.
- 5.2.5.7. Electrical antipumping device shall be provided for breaker.

5.3. Outdoor Control, Relay & Metering panels:

5.3.1. Constructional details:

- 5.3.1.1. Each Circuit Breaker should be provided with a separate outdoor type Control, Relay & Metering panel. It shall be painted white on the interior and Dark Admiralty Grey to shade No.632 of IS-5 on the exterior surface.
- 5.3.1.2. Panel shall be made of rigid welded structural frames enclosed completely with smooth finished sheet steel of thickness not less than 2 mm. There shall be sufficient reinforcement to provide level surfaces, resistance to vibration and rigidity during transport and installation. Panel shall be completely metal enclosed and shall provide a minimum degree of protection to IP 55 in accordance with IS 12063/1987. Type test report in this respects shall be furnished with offer.
- 5.3.1.3. To protect instruments of Control, Relay & Metering panel from atmospheric exposure these shall be mounted on separate sheet provided inside the panel so as that shall not be exposed directly to atmospheric condition.
- 5.3.1.4. The doors shall be provided with 3-point locks operated by suitable handle. A backwards slanting hood of 2 mm thick sheet should be provided for protection against rain water. Bottom plates of the panels shall be fitted with removable brass cable glands to allow cable entries from the bottom. Terminal Connectors and Test terminal blocks for cables shall be fixed at an elevated height of at least 200 mm above the Bottom plate.
- 5.3.1.5. Adequate quantity of cable glands of suitable size shall be provided.
- 5.3.1.6. Design, materials selection and workmanship shall be such as to result in a neat appearance both inside and outside, with no welds, rivets or bolt heads apparent from outside. Steel sheets shall be suitably treated to achieve neat appearance and long life.
- 5.3.1.7. Each panel shall be provided with cubicle illumination lamp in shrouded holder, controlled by door operated switch. Space heater of 80 W rating alongwith control switch shall be provided inside each panel. Cubicle lamp and space heater shall be suitable to work on 240 V AC supply. In each panel, one 3-pin 10 Amp industrial type power plug alongwith control switch shall be provided for extending 240 V AC supply.
- 5.3.1.8.** Each panel shall be provided with one earth bus of size 25x3mm.(minimum). The earth bus shall be of tinned/nickel plated copper. All metallic cases of relays, meters, instruments etc. shall be connected to this bus independently for their effective earthing.

5.3.2. Circuit Breakers control switch:

- 5.3.2.1. 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.
- 5.3.2.2. Terminal screws must be captive to avoid misplace during maintenance.
- 5.3.2.3. Switch shall be with 48 mm x 48 mm escutcheon plate marked with Trip & Close.
- 5.3.2.4. Circuit Breakers control switch shall be Non- discrepancy type
- 5.3.2.5. 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.
- 5.3.2.6. 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.

5.3.3. Protective Relays:

- 5.3.3.1. 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.
- 5.3.3.2. The Non directional 2 O/C & 1 E/F relay with High set Relay should be provided.
- 5.3.3.3. 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%.
- 5.3.3.4. 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.
- 5.3.3.5. 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.
- 5.3.3.6. 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 lamp 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 lamp shall be such that the Trip Coil should not get damaged because of continuous current flowing through it.
- 5.3.3.7. LCD Display : Relay should have 12 mm LCD backlit display.

5.3.4. Equipment to be mounted on Control, Relay & Metering Panels

- 5.3.4.1. Following equipment for incomer and feeder Control, Relay & Metering panels shall be provided.

Sr. No.	Description	Quantity	
		Incomer	Feeder
1.	Circuit label	1 No.	1 No.
2.	Ammeter, 48 x 96 mm	1 No.	1 No.
3.	Voltmeter, 48 x 96 mm	1 No.	Nil
4.	Ammeter selector switch	1 No.	1 No.
5.	Voltmeter selector switch	1 No.	Nil
6	Non - discrepancy type T-N-C switch	1 No.	1 No.
7	Electrical close circuit along with anti pumping feature and trip circuit.	1 set	1 set
8 (a)	Trip circuit supervision scheme for pre-trip as well as post-trip supervision	1 set	1 set
(b)	Amber indicating lamp for 'trip Circuit Healthy'	1 No.	1 No.
(c)	Push button for 'Trip circuit Healthy Test.	1 No.	1 No.
9	White indicating lamp for 'spring charged'	1 No.	1 No.
10	Non directional, three elements combined 2 O/C+ 1 E/F relay (IDMT 3 sec. characteristics)	1 set	1 set
11	High speed tripping relay	1 No.	1 No.
12	3 phase, 4 wire Static Trivector TOD Energy meter with RS 232 port	1 No.	1 No.
13	TTB for TOD Meter	1 No.	1 No.
14	Space heater alongwith ON/OFF switch and thermostat.	1 set	1 set
15	Cubicle illumination lamp alongwith door operated control switch.	1 set	1 set

16	Power plug 240V, 10A industrial type alongwith control switch.	1 set	1 set
17	Wiring alongwith HRC fuses, terminal blocks and terminal connectors.	1 set	1 set

5.4. Indoor Indication panel:

5.4.1. Constructional details:

5.4.1.1. Common indoor type Indication panel shall be provided for incomer and three feeder panel.

5.4.1.2. The indication panel against this specification shall be simplex type with all indications for Incomer and feeders mounted on the front.

5.4.1.3. The indication panel shall be suitable for indoor installation. Panel shall be completely metal enclosed, and shall provide degree of protection not less than IP 30 in accordance with IS 12063/1987. Type test report in this respects shall be furnished before commencement of supply.

5.4.1.4. Panel shall be made of folded construction rigid structural frames enclosed completely with smooth finished rolled Mild steel of thickness not less than 3 mm for front portion of panel and 2 mm for other portions of panel. Sufficient re-inforcement shall be provided for level surfaces, so as to have resistance to vibration and rigidity during transport, installation and operation. Box should be mounted on Galvanised M. S. angle stand.

5.4.1.5. Each simplex panel shall have suitable hinged doors at the back. The doors shall be provided with 3-point locks operated by suitable handle. Bottom plates of the panel shall be fitted with removable gland plates to allow cable entries from the bottom. Terminal Connectors and Test terminal blocks for cables shall be fixed at an elevated height of at least 200 mm above the Bottom plate.

5.4.1.6. Design, materials selection and workmanship shall be such as to result a neat appearance both inside and outside with no welds, rivets or bolt heads apparent from outside. Steel sheets shall be suitably treated to achieve neat appearance and also long life. Final painting of panel shall be done with Light Grey colour to shade no.631 as per IS-5, for both interior and exterior. Epoxy powder coating method shall be used for painting, and shall have matt finish.

5.4.1.7. Annunciators :

5.4.1.7.1 9 Window annunciators suitable for the visual and audible alarm annunciation shall be provided on the indication panel. These shall be micro processor based units using bright LEDs.

5.4.1.7.2 Annunciator fascia units shall have translucent plastic windows for each alarm point.

5.4.1.7.3 Annunciator fascia 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 fascia LED is glow.

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

5.4.1.7.5 Unless otherwise specified, one alarm buzzer meant for non-trip alarms and one bell meant for trip alarms shall be provided in indication panel (mounted inside).

- 5.4.1.7.6 Each annunciator shall be provided with 'Accept', 'Reset' and 'Test' push buttons, coloured red, yellow and blue respectively.
- 5.4.1.7.7 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.
- 5.4.1.7.8 In case 'RESET' push button is pressed before abnormality is cleared, the lamps shall continue to glow steady and shall go out only when normal condition is restored.
- 5.4.1.7.9 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.
- 5.4.1.7.10 Provision for testing healthiness of visual and audible alarm circuits of annunciator shall be available.

9 Window Annunciation Scheme to indicate following functions.		
i)	Main protection (O/C) Trip for incomer.	1 no.
ii)	Main protection (E/F) Trip for incomer.	1 no.
iii)	Main protection (O/C) Trip for feeder 1.	1 no.
iv)	Main protection (E/F) Trip for feeder 1.	1 no.
v)	Main protection (O/C) Trip for feeder 2.	1 no.
vi)	Main protection (E/F) Trip for feeder 2.	1 no.
vii)	Main protection (O/C) Trip for feeder 3.	1 no.
viii)	Main protection (E/F) Trip for feeder 3.	1 no.
ix)	Spare	1 no.

Mounting	Flush
No. of fascia windows	9
No. of windows per row	3
Supply voltage	30 V DC
No. of LEDs per window	2
Lettering on fascia plate	Properly engraved

- 5.4.1.8. Adequate quantity of cables, its accessories and cable glands of suitable size shall be provided.
- 5.4.1.9. Design, materials selection and workmanship shall be such as to result in a neat appearance both inside and outside, with no welds, rivets or bolt heads apparent from outside. Steel sheets shall be suitably treated to achieve neat appearance and long life.
- 5.4.1.10. Each panel shall be provided with cubicle illumination lamp in shrouded holder, controlled by door operated switch. Space heater of 80 W rating alongwith control switch shall be provided inside each panel. Cubicle lamp and space heater shall be suitable to work on 240 V AC supply. In each panel, one 3-pin 10 Amp industrial type power plug alongwith control switch shall be provided for extending 240 V AC supply.

5.4.1.11. Each panel shall be provided with one earth bus of size 25x3mm.(minimum). The earth bus shall be of tinned plated copper. All metallic cases of relays, meters, instruments etc. shall be connected to this bus independently for their effective earthing.

5.4.2. Equipment to be mounted on Indication Panel

5.4.2.1. Following equipment for incomer and feeder Indication panel shall be provided.

Sr. No.	Description	Quantity	
		Incomer	Feeder
1	Circuit lable	1 No.	1 No.
2	White indicating lamp for `spring charged'	1 No.	1 No.
3	Space heater alongwith ON/OFF switch and thermostat.	1 set	1 set
4	Cubicle illumination lamp alongwith door operated control switch.	1 set	1 set
5	Power plug 240V, 10A industrial type alongwith control switch.	1 set	1 set
6	Wiring alongwith HRC fuses, terminal blocks and terminal connectors.	1 set	1 set
7	The red lamp of suitable rating to indicate breaker "ON"	1 No.	1 No.
8	Green lamp to indicate breaker "OFF"	1 No.	1 NO.

5.5. Wiring and control wiring terminals:-

5.5.1. 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.

5.5.2. 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.

5.5.3. 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.

5.5.4. 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.

5.5.4.1. 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.

5.5.5. All fuses used shall be of HRC type. The fuse base and carrier shall be plug-in type moulded case kitkat of Bachelite/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. Isolators:

5.6.1. For each bay, two nos. of isolators shall be offered. For incomer bays, the isolators shall be of 800 Amps. continuous current rating and for feeder(outgoing), the isolators shall be of 400 Amps. continuous current rating. Bus side isolator in the feeder bay will be without earth blades and outgoing feeder side isolators will be with earth blades.

5.6.2. All isolators shall be of center post rotation, double brake, horizontal isolation type and shall have a short time rating of 12.5KA for 3 seconds. The contacts and blades of the isolators shall be of electrolytic grade copper. The fasteners (nut-bolts) used for current carrying parts shall be of non magnetic stainless steel. Spacing between phases for all isolators shall be of 1000mm. Further the current density for copper current carrying parts shall not be more than 1.6 Amp./mm.sq in solid conductor and 2 Amp/sq.mm. in hollow tubes. The current density for Alluminium current carrying parts shall not be more than 1 Amp./mm.sq

5.6.3. Tenderers shall quote separately for isolators with integral earthing facility. Such isolators shall have built-in mechanical inter lock between the main and earth blades so that the closing of the main blade is not possible without opening the earth blade and closing of the earth blade will not be possible without opening the main blade.

5.6.4. All the fixed contacts shall be provided with a sheet metal rain hood. This rain hood shall be fabricated out of at least 2 mm thick Galvanised iron sheet metal and shall be designed such that it will in no case shall obstruct or restrict the movement of moving contracts (blades) and arcing horns, if provided.

5.6.5. Operating mechanism:

Manual operating mechanism gang operated through Hand operated lever shall be provided for main switch and earth switch separately.

5.6.6. The operating mechanism shall provide quick, simple and effective operation. The design shall be such that one man shall be able to operate the isolator without undue effort. The operating mechanism shall be suitable to hold the main switch or earth switch in closed or opened position to prevent operation by gravity, wind, short circuit, seismic acceleration, vibration, shock, accidental touching etc.

5.6.7. Padlocking device:

The isolator and earthing switch shall be provided with padlocking device to permit locking of the isolator and earthing switch in both fully open and fully closed positions.

5.6.8. Earthing:

5.6.8.1. Flexible branded copper connections shall be provided between rotating earth blades and the frame which shall have a cross section of at least 50 sq mm and shall be tinned or suitably treated against oxidation.

5.6.8.2. The frame of each disconnect and earthing switch shall be provided with two reliable earthing terminals for connection to the purchaser's earthing conductor/flat so also clamping screw suitable for carrying specified short time current. Flexible ground connectors shall be provided for connecting operating handle to the earthing flat. The diameter of clamping screw shall be atleast 12 mm. The connecting point shall be marked with earth symbol.

5.6.9. Moving blades:

5.6.9.1. Contact surface of moving blades and associated connectors/contacts and terminal pads shall be heavily silver plated to atleast 15 microns thick. The surface shall be wiped during closing and opening operations to remove any film, oxide coating etc. Wiping action shall not cause scouring or abrasion of surfaces.

5.6.9.2. Material of Earthing blades & contacts shall be the same as those of the main moving blades and contacts respectively. Cross-sectional area of the Earthing blades and contacts shall not be less than 50% of corresponding area of main moving blades and contacts.

5.6.10. Bearings:

All the friction locations and rotating parts shall be provided with two nos. of bearings of atleast 25 mm ID. 50 mm clear spacing between the bearing shall be provided. The housing for bearings shall be made of gravity dia cast metal with smooth surface and suitably machined for seating the bearings. The bearings bushes, joints, springs etc. shall be so designed that no lubrication shall be required during the service.

5.6.11. Tandem pipe:

Tandem pipe shall be of at least 25 mm NB, atleast 2200 mm long and class B Mild steel galvanised. One single tandem pipe shall be used for phase coupling of double break isolators. Base plate of rotating insulators for connection of tandem pipe shall be made out of one piece of at least 6 mm thick M.S.plate. Bolt and shackle device shall be used to connect tandem pipe to the base plate. Wherever unavoidable sliding clamps may be used. These clamps shall be made out of at least 6 mm thick M.S.flat with four nos. of nuts and bolts. A grubscrew shall be provided for securing connection on tandem pipes.

5.6.12. Down pipe:

50 mm ID class B Mild steel galvanised single piece pipe shall be provided for operating disconnects. The pipe shall be terminated into a suitable swivel type joint between the tandem pipe driving mechanism and the operating mechanism if required to take care of marginal angular misalignment at site.

5.6.13. Insulators

5.6.13.1. All outdoor type Porcelain insulators shall have a creepage distance of 25mm/kV(i.e. 300mm). The insulators shall be of outdoor post type conforming to IS 2544. All insulators shall have a rated voltage not less than 12 kV and rated current of 2000 Amps.

5.6.13.2. Post type insulators with 57 mm PCD shall only be provided. Pin type or Polycone insulator shall not be acceptable.

5.6.13.3. The insulators shall be provided with a completely galvanised steel base designed for mounting on the support. The base and mounting arrangement shall be such that the insulator shall be rigid and self standing. Cap provided on top of the insulator shall be of high grade cast iron/malleable steel casting or aluminium alloy. It shall be machine faced and hot dip galvanised in case of first two options. The cap shall have four nos. of tapped holes with PCD same of that of insulator base. The holes shall be suitable for bolts with threads having anticorrosive protection. The effective depth of threads shall be adequate.

5.6.13.4. The insulator shall be made of homogeneous and vitreous porcelain of high mechanical and dielectric strength. It shall have sufficient mechanical strength to sustain electrical and mechanical loading on account of wind load, short circuit stresses etc. Glazing of the porcelain shall be of uniform brown or dark brown colour with a smooth surface arranged to shed away rain water. The porcelain shall be free from lamination and other flaws or imperfections that might affect the mechanical or dielectrical quality. It shall be thoroughly vitrified, tough and impervious to moisture.

- 5.6.13.5. The porcelain and metal parts shall be assembled in such a manner and with such material that any thermal differential expansion between the metal and porcelain through the range of temperature specified in this specification shall not loosen the parts or create undue internal stresses which may affect the mechanical or electrical strength or rigidity. The assembly shall not have excessive concentration of electrical stresses in any section or across leakage surfaces. The cement used shall not give rise to chemical reaction with metal fittings. The insulator shall be suitable for water washing by rain or artificial means in service condition.
- 5.6.13.6. The insulator unit shall be assembled in a suitable jig to ensure correct positioning of the top and bottom metal fittings relative to one another. The faces of the metal fittings shall be parallel and at right angle to the axis of the insulator and corresponding holes in the top and bottom metal fittings shall be in a vertical plane containing the axis of the insulator.
- 5.6.13.7. It shall be the sole responsibility of the supplier to carry out thorough inspection and quality checks on the insulators at the insulator supplier's works, before offering the insulators for purchaser's inspection.

5.7. Instrument Transformers:

- 5.7.1. All 11kV Instrument transformers shall be **oil cooled or dry type outdoor**, single phase units. Oil cooled Instrument Transformers shall be of dead tank design with the insulator housing of porcelain material. The mounting arrangement of Instrument Transformers shall have four holes equispaced at 350 ± 5 mm. distance suitable for 16mm. stud/foundation bolt.
- 5.7.2. In case of dry type Instrument Transformers tenderer shall give full technical and constructional details, without which offered Instrument Transformer shall not be technically acceptable.
- 5.7.3. CTs shall have short time rating of 12.5KA for 3 seconds. The primary and secondary windings of CTs shall be of copper.
- 5.7.4. In case all three CTs are mounted on the same structure, clearances as specified elsewhere in the specification shall be maintained.
- 5.7.5. The principal technical parameters for CTs shall be as per Annexure II D
- 5.7.6. Three 11 kV single phase PTs shall be offered with Isolator on 11 kV Bus. These PTs shall be suitable for connection in star formation on primary side with solidly earthed neutral. The neutral end of the primary winding shall be brought out for earthing. Each P.T. unit shall have H.V. neutral earthing link of suitable size and of tinned plated copper.
- 5.7.7. The PTs shall have primary and secondary windings made of copper. PT shall have two windings in the secondary.
- 5.7.8. The principal technical parameters for PTs shall be as per Annexure II E
- 5.7.9. ITs shall be only of reputed make. Performance certificates and type test certificates for CTs/PTs shall be furnished alongwith the technical offer.
- 5.7.10. The metal tank shall be fabricated from M. S. Sheet of minimum 3.15 mm thick **on side and min. 5 mm on top & Bottom of CTs.** The metal tanks shall be coated with at least two coats of zinc rich epoxy paint. In case of oil cooled Its inside all sides of tank shall be painted with oil resistant white enamel paint. All the ferrous hardware, exposed to atmosphere, shall be hot dip galvanized. All other fixing nuts, bolts, washers in the electric current path shall be made out of stainless steel.

5.7.11. Nuts and bolts or screws used for fixation of the interfacing porcelain bushings for taking out terminals shall be provided on flanges cemented to the bushings and not on the porcelain.

5.7.12. If gasketed joints are used, nitrile/ butyl rubber gaskets shall be used. The gasket shall be fitted in properly machined groove with adequate space for accommodating the gasket under compression.

5.7.13. Oil cooled Instrument Transformers:

5.7.13.1. The Instrument transformer shall be provided with prismatic type oil level indicator at suitable location so that the oil level is clearly visible with naked eye to an observer standing at ground level.

5.7.13.2. The unit shall be filled with oil under vacuum after processing to eliminate air and moisture from the winding and shall be hermetically sealed.

5.7.13.3. Oil filling and/or oil sampling cocks if provided to facilitate factory processing shall be properly sealed before dispatch of the instrument transformers. It is preferable to provide leakage proof threaded plugs / caps instead of cocks for oil filling & sampling outlets.

5.7.13.4. The porcelain housing for instrument transformer shall be of single piece construction without any joint or construction. The housing shall be made of homogeneous vitreous porcelain of high mechanical and dielectric strength. Glazing of porcelain shall be of uniform brown or dark brown colour. With a smooth surface to shade away rainwater or condensed water particles. The profile of porcelain shall be aerodynamic type conform to IEC 815 / IS 2099.

5.7.13.5. Out door type bushing shall have a creepage distance of 25 mm/kV. The bushing housing shall have a rated voltage not less than 12 kV at rated current of 2000 amps. Vertical clearance of porcelain housing shall be at least 370 mm.

5.7.14. Dry type Instrument transformers.

5.7.14.1. The Instrument Transformers shall be so constructed as to ensure that the dry insulation media (resin, epoxy or any other polymer used) does not absorb moisture or develop cracks or breaks in to pieces during its life span when installed outdoor. The media shall also have anti-tracking properties against electrical stresses.

5.7.14.2. The HV/LV windings shall be made of HCE grade copper and cast under high vacuum using pure liquid epoxy **resin or nylon** system to achieve void less embedment of windings. Use of mica and fiberglass insulation shall be avoided.

5.7.14.3. The material used for encapsulation shall be finely and scientifically graded well bounded polymer resin resin with good electrical, mechanical weathering properties.

5.7.14.4. The insulation coordination between phase to earth shall be in accordance with IS 2165 (Part I).

5.7.14.5. Enamel, if used for conductor insulation, shall be either polyvinyl acetate type or amide type and shall meet the requirements of IS 4800. Polyester enamel shall not be used. Double cotton cover, if used, shall be suitably covered to ensure that it does not come in contact with oil.

5.7.15. The dimensions of the terminal box and its openings shall be adequate to enable easy access and working space with use of normal tools.

5.7.16. Correct polarity shall be invariably marked on each primary and secondary terminal. Facility shall be provided for short circuiting and grounding of the C.T.secondary terminals inside the terminal box.

- 5.7.17. The instrument security factor of metering core shall be low enough but not greater than 5. This shall be demonstrated on all the ratios of the metering core, in accordance with procedure specified in IEC 185 or IS 2705.
- 5.7.18. **Primary Winding**
Primary winding shall be hair pin type or wound type made out of high conductivity copper. Conductors used for the primary winding shall be rigid. Unavoidable joints in the primary winding shall be welded type preferably lap type. The details of such welded joints shall be indicated in the drawings submitted with the offer. For primary winding current densities shall not exceed the limit of **1.6 Amp/sq mm for normal current**.
- 5.7.19. **Secondary Windings**
Suitably insulated copper wire of electrolytic grade shall be used for secondary windings. Type of insulation used shall be described in the offer. For multi ratio C.T. design, the multi ratio shall be achieved by secondary winding tappings only.
- 5.7.20. **Primary Terminals**
The primary terminals shall be of stud type of size of 30mm dia x 80mm length for all CTs. The primary terminals shall be of heavily tinned electrolytic copper of 99.9% conductivity. The minimum thickness of tinning shall be 15 microns.
- 5.7.21. Secondary Terminals**
- 5.7.21.1. Secondary terminal studs shall be provided with at least three nuts and two plain and two spring washers for fixing the leads. The studs, nuts and washers shall be of brass, duly nickel plated. The minimum out side diameter of the studs shall be 6 mm. The length of at least 15mm shall be available on the studs for inserting the leads. The space clearance between adjacent nuts when fitted shall be at least 10 mm from the outside circum dia of the nuts.
- 5.7.22. The instrument transformer shall be provided with non-corrosive, legible name and rating plates, with the information specified in relevant standards, duly engraved/punched on it.
- 5.8. Support structure, equipment frame etc.**
- 5.8.1. Equipment frame, support structure, angles, channels etc. meant for the outdoor switch gear and other equipment viz. CTs, PTs, Isolators etc. shall all be hot dip galvanized. All the ferrous metal parts shall be hot dip galvanized smoothly as per IS 3638(as amended upto date), IS or any other equivalent authoritative standard. The material shall be galvanised only after shop operations upon it have been completed. The metal parts before galvanization should be thoroughly cleaned of any paint, grease, rust, scales or alkalis or any foreign deposits which are likely to come in the way of galvanization process. The metal parts coating shall withstand minimum four one minute dips in copper sulphate solution as per IEC-168. Fasteners (nut-bolts) shall be of non-magnetic stainless steel. No spring washer shall be used, instead one check nut of suitable size shall be provided with each bolt.
- 5.8.2. Support structure shall be supplied for each of the outdoor equipment and shall be suitable to maintain the clearances and spacing stipulated for various equipment. Current transformers and potential transformers may be mounted on the same structure as that of the circuit breaker, provided the requisite electrical and mechanical clearances are properly maintained. Typical bay arrangements indicating sectional clearances are shown in the enclosed drawings.
- 5.8.3. The main structure shall be fabricated out of hot dip galvanized angle of minimum 75x75x6 mm or equivalent strength.

5.8.4. Successful tenderers shall clearly indicate on the relevant G.A.drawings the total dead weight coming on each support structure. Impact load, if any, shall also be stated on relevant drawing. These details are required for designing suitable foundations for the support structure for CBs, Isolators, etc.

5.9. Equipment terminal connectors(HV)

5.9.1. Tenderers shall include in their scope suitable connectors for each outdoor equipment. In the case of equipment with copper terminals, the terminal connectors shall be made of electrolytic grade copper, and shall be suitable for crimping type connection. Material required for inter connection between various bay equipment in between the two isolators of each bay shall be included in the tenderer's scope of supply. Details of the inter connector and the material used for the terminals/jumpers shall be furnished in the offer. In order to fix the jumper length, size etc. standard layout drawing is enclosed. Successful tenderer shall have to adopt Board's standard foundation plan.

5.9.2. Take-off terminals of both the isolators of each bay and for Cu-Al bimetallic connections shall be of electrolytic grade aluminium and suitable for crimping ACSR jumper along with suitable bimetallic plate of minimum 2 mm thickness. These connectors shall be suitable for 200 mm.sq. ACSR conductor for incomer and 50mm.sq/80mm.sq. ACSR conductor for outgoing feeder. All nut-bolts used in the connectors shall be of non-magnetic stainless steel. In place of spring washers, check nut of suitable size shall be provided.

5.10. Earthing

Metal tanks of the instrument transformers and all other equipment, C & R panels, mechanism boxes, structures etc. shall be provided with two separate earthing terminals of size 16 mm dia. X 30 mm length H.D.G., with one plane washer and one nut, for connection to station earth-mat.

5.11. Lifting arrangement

Instrument transformers and switchgear equipment shall be provided with suitable lifting arrangement to lift the entire unit. Lifting arrangement (lifting eye) shall be positioned in such a way so as to avoid any damage to the porcelain housing, primary terminals or the tanks during the process of lifting for installation/transport. The general arrangement drawing shall show clearly the lifting arrangements provided such as lifting eye, guide etc.

5.12. Painting

5.12.1. All sheet metal parts (panel, mechanism box, metal housing, Instrument transformer etc.) for outdoor installation shall be designed and fabricated with special care to avoid rust/fungus formation and corrosion. All metal parts shall preferably be hot dip galvanized. If this is not possible due to practical difficulties, cold galvanising or epoxy coating shall be provided for all sheet metal parts, used for outdoor installation. Sheet steel shall be treated as per the 7 tank process. In case tank process for treating the sheet metal is not possible, alternate process adopted shall be clearly explained in the technical offer which shall be got approved by the Board. **Dark Admiralty Grey** shade as per colour shade no:632 of IS-5 shall be used for epoxy coating.

5.12.2. The sheet metal works, after final painting shall present an esthetically pleasing appearance, free of any dent or uneven surface.

5.13. Labels

5.13.1. All front mounted as well as externally mounted items including fuses 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. The letters are to be properly engraved.

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

5.13.3. All the equipment and their parts shall be provided with suitable labels for identification and ease of operation and maintenance.

6.0 TESTS:

6.1. Type tests:

6.1.1. The equipment (Vacuum Circuit Breaker, CT,PT, Isolator, C&R panel, Relay etc) offered in the tender should have been successfully type tested at NABL laboratories for the tests indicated in the enclosed Annexure III 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 type test reports alongwith the offer.

6.1.2. In case these type tests are conducted earlier than five years, all the type tests as per the relevant standard shall be carried out 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 bidder have to submit a set of above type test reports after approval of drawings to the Chief Engineer, (STORES), I st floor, Prakeshgad, MSEDCL, Bandra. Original type test reports have to be make available for verification.

6.2. Acceptance & Routine Tests:

6.2.1. All acceptance and routine tests as stipulated in the respective applicable standards amended up-to-date for all the equipment shall be carried out by the supplier in the presence of purchaser's representative without any extra cost to the purchaser before despatch.

6.2.2. The tenderer shall have full facilities to carry out all the acceptance and routine test as per the applicable standards.

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

7.0 INSPECTION:

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

7.2. The supplier shall keep the purchaser informed, in advance, about the manufacturing programme so that arrangement can be made from 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 programme.

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 voltage rating of equipment:
- 8.2. Statement giving information about names of sub-suppliers, list of testing standards, list of tests normally carried out in presence of tenderer's representative and copies of test certificates in respect of following items of raw materials.
- (a) Copper
 - (b) Interrupter
 - (c) Porcelain Hollow support insulator
- 8.3. Information and copies of test certificate as in (i) above in respect of bought out accessories.
- 8.4. 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.
- 8.5. Special features provided in the equipment to make it maintenance free.
- 8.6. 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.
- 8.7. The successful tenderer shall, within 30 days of placement of Letter of Award, submit following information to the Chief Engineer (**STORES**) of the purchaser.
- 8.8. List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished alongwith the offer.
- 8.9. Type test certificates of the raw material and bought out accessories.
- 8.10. Quality assurance plan (QAP) with Customers hold points (CHP) for purchaser's inspection. The quality assurance plan and purchaser's hold points shall be discussed between the purchaser and supplier, before it is finalised.
- 8.11. The successful tenderer 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 necessary documentary proof of source for the raw material used in manufacture of the offered goods, at the time of routine testing of the fully assembled breaker.

9.0 PERFORMANCE GUARANTEE:

All equipment supplied against this specification shall be guaranteed for a period of 66 months from the date of receipt at the consignee's Stores Centre 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 issue of letter of acceptance, the successful tenderers shall submit 3 identical sets of complete drawings alongwith detailed bill of materials for approval, to **the Chief Engineer (STORES), 1st floor, Prakashgad, MSEDCL, Bandra (E), Mumbai-400 051.** 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 approved.

- 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 supplier's 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, Prakashgad, Bandra (East) alongwith the bills for payment.
- 10.4. Before dispatch of equipment to various consignees, the suppliers shall furnish sets of final drawings, including bills of materials and wiring schedules and also sets of technical literature and commissioning manuals. These shall be in Five sets and shall be furnished to the office of CE (STORES) , Bandra(E) positively before the dispatch of equipment. All drawings shall preferably be of A3 size. No drawing of width more than 35 cm will be acceptable. One set each of the final drawings, bill of materials ,wiring schedules and commissioning manuals shall invariably be forwarded to the consignee alongwith the each switchgear consignment and shall be listed out in the packing list, when submitted for approval.
- 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) General arrangement drawing for incomer bay & outgoing bay.
 - (ii) General arrangement drawing for circuit breaker.
 - (iii) General arrangement drawing for Isolator (a) with and (b) without earth blade.
 - (iv) General arrangement drawing of current transformer.
 - (v) General arrangement drawing of potential transformer.
 - (vi) General arrangement drawing for control and relay panels
 - (vii) Bill of material for complete switchgear and associated equipment, CTs, PTs, Isolators, Terminal connectors etc. (Annexure II & III)
- 10.7. Successful tenderer shall furnish all above drawings and following additional drawings for approval.
 - (i) Support structure for circuit breaker, Isolator, CT & PT.
 - (ii) Common Foundation Plan and design details/data of foundations for incomer bus & outgoing section.
 - (iii) Detailed drawing for T-Connector, terminal connector and other connector.
 - (iv) Schematic diagram of power control & protection circuit for incoming and outgoing feeder bay.
 - (v) Schematic diagram and sequence diagram of circuit breaker.
 - (vi) Detailed drawings for every equipment showing Assembly, important cross sections, drawings of relevant parts, joints, gaskets, name plates and other informative drawings etc.

- 10.8. The drawings, technical literature and manuals submitted by the tenderer alongwith his offer shall be treated as purely and generally informative in nature and unless the details incorporated in them are clearly and specifically brought out in the various Schedules for Guaranteed Technical Particulars and Schedules of Deviations, the same shall not be binding upon the purchaser (a) for evaluation of the offer and (b) for the order, if placed.

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 centres 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 to the committed delivery. The delivery period will be counted from the date of receipt of letter of award of the contract. It may clearly be noted that the delivery period will under no circumstances be linked up with other formalities like drawing approval, etc. It is therefore, the responsibility of the successful tenderer 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 TRAINING

All successful tenderers for switchgear shall provide training facilities for the Board's engineers. The training shall be for not less than 8 man weeks. Syllabus and other details of the training shall be finalised in consultation with the MSEDCL. Boarding, lodging and traveling expenses for the deputed trainees will be borne by the Board. Charges for training shall be quoted in the offer separately. These will not be considered for evaluation of the offer.

13.0 SCHEDULES:

- 13.1. 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.

ANNEXURE I ... List of Unit Priced items.

ANNEXURE II-A	... Principal Technical Parameters for Circuit Breaker
ANNEXURE II-B	... Principal Technical Parameters for C&R Panel
ANNEXURE II-C	... Principal Technical Parameters for Isolator
ANNEXURE II-D	... Principal Technical Parameters for C.T.
ANNEXURE II-E	... Principal Technical Parameters for P.T.
ANNEXURE III	... List of Type Test Reports to be enclosed with the offer
Schedule 'A'	... Guaranteed and technical particulars.
Schedule 'B'	... Schedule of deviations from specification.
Schedule 'C'	... Schedule of tenderer's experience.
Schedule 'D'	... Schedule of deviation from specified standards.
Schedule 'E'	... Deviation from specified test requirements.

13.2. All the parameters to be filled in schedule 'A' should be clearly mentioned. Leaving blanks or stating "As per IS", "As per drawing", "As per information elsewhere" etc. is not acceptable. Such offers are liable for rejection.

13.3. All deviations from the specification shall be brought out in the schedules of deviation (Schedules 'B' 'D' & 'E'). Unless otherwise brought out specifically by the tenderer in the schedule of deviations (Schedule 'B', 'D' & 'E'), the items offered shall be deemed to conform to all clauses of the specification. The discrepancies, if any, between the specification and the catalogues 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 offer 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 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 and deviations from the specifications 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. All sets of offer documents shall invariably be identical in all respects.

15.0 GUARANTEED TECHNICAL PARTICULARS

15.1. The bidder should fill up the details in schedule A – 'Guaranteed Technical Particulars' and the statement such as "as per drawing enclosed", "as per MSEDCL requirement", "as per IS", "as per specification" etc. shall be considered as details not furnished and such offers will be rejected.

16.0 Qualifying Requirement : As per tender.

17. Final Inspection :

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

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.

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(HTSTATMET \ SPECTODMET \ :05/05)

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:- As per Tender.

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 °C |
| b) Maximum ambient temperature in shade | 45 °C |
| c) Minimum temperature of air in shade | 35 °C |
| d) Maximum daily average temperature | 40 °C |
| e) Maximum yearly weighted average temperature | 32 °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 $11 \text{ kV}/\sqrt{3}/110 \text{ V}/\sqrt{3}$.

> 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 I_b . The starting current for the meter should be 0.1% of I_b .

4.2 Temperature

The standard reference temperature for performance shall be 27°C . The mean temperature coefficient should not exceed 0.03%.

4.3 Frequency

The rated frequency shall be $50 \text{ Hz} \pm 5\%$.

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 I_{max} 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 09.00 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 (I_{max}) 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 kilowatt-hour (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---- $11000/\sqrt{3}/110/\sqrt{3}$ 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 occurrence 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 I_{max} , I_b and 5% I_b at unity power factor and 50% I_{max} and 10% I_b 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 I_b .

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/repared by the supplier free of cost within one month of receipt of intimation. If the defective meters are not replaced/repared 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.

19.2 The 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 possess 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 °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 occurrence 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.

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 under 5&9 of IS-14697/1999
2	Measurement or computing chips	The measurement or computing chips used in the Meter should be with the Surface mount type along with the ASICs.	USA: Analog 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 communication with meter reading instruments & the other hardwired RS 232 port to communicate with various modems for AMR)	USA: National Semiconductors 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 / Korea : 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, Texas 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 controller.	The accuracy of RTC shall be as per relevant IEC / IS standards.	USA : Philips, 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 _____

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. destination.
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- 1.0 Outdoor switchgear 11 kV, 12.5 kA, 800 A VCB with operating mechanism box but without C&R panel for incommer bay
- 2.0 3. Outdoor switchgear 11 kV, 12.5 kA, 400 A VCB with operating mechanism box but without C&R panel for feeder bay
- 3.0 Outdoor Control, Relay & Metering panel
 (a) for Incomer
 (b) for (outgoing) feeder
- 4.0 Indoor Indication Panel
 (a) for Incomer
 (b) for (outgoing) feeder
- 5.0 Outdoor 800amp Isolator without earth switch.
- 6.0 Outdoor 400amp. Isolator with earths witch
- 7.0 Outdoor 400amp. isolator without earthswitch
- 8.0 Current transformer:
 i. 600-300/5-5 A
 ii. 400-200-100/5-5 A
- 9.0 $\frac{11 \text{ kV}}{\sqrt{3}}$ / $\frac{110 \text{ V}}{\sqrt{3}}$ Single ph. PTs
- 10.0 Non-discrepancy type or O.D.S. type T-N-C switch for CB
- 11.0 Local/remote selector switch
- 12.0 Indicating lamp
- 13.0 Push button

- 14.0 Three element, non-directional, combined 2 O/C + 1E/F IDMT 3 sec numerical relay
- 15.0 High speed trip numerical relay (3 N/O+2 N/C)
- 16.0 Static TOD meter with RS-232 port (3 Ph, 4 wire)
- 17.0 TTB for Static TOD meter
- 18.0 Any other equipment (if felt necessary by the tenderer)

Note: This price list will not be related in any way to the rates offered in the main price bid for the tendered items as advertised.

ANNEXURE II-A

Principal Technical Parameters of Circuit breaker

I	Reference Standard	IS 13118
II	System voltage a. Normal b. Highest	11 kV 12 kV
III	Supply frequency	50 Hz
IV	System Neutral earth	Effectively earthed
V	Installation	Outdoor
VI	Current a. Normal b. Short time rating	800 Amp for Incomer 400 Amp for feeder 12.5 kArms for 3 sec
VII	Insulation level a. Impulse b. 1 min Power Frequency Voltage	75 kVp 28 kVrms
VIII	Operating duty cycle	O-0.3 sec-CO-3 min-CO
IX	First phase to clear factor	1.5
X	Clearances a. Between adjuscent poles b. Between live part to earth	280 mm 370 mm
XI	Creepage distance for bushing	25 mm/kV (300 mm)

ANNEXURE II B

Principal requirements of protective relays, metering equipment, auxiliary relays, breaker control switches etc. to be mounted on control & Relay Board are as follows:

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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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) rotary 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

7.3 Phase 4 Wire Static TOD Energy Meter:

3Phase 4 Wire Static TOD Energy Meter with RS-232 or RS-485 communication port and optical port shall be provided, for remote meter reading facility and data retrieval, through this port using CMRI, LAP Top, PC and if possible through-line carrier communication. The total time required for downloading billing, tamper and load survey data for 45 days should be less than or equal to 3 minutes and with following parameters. Detailed technical specifications are enclosed Annexure

Class of accuracy	0.5
IS	14697: 1999 amended upto date
C.T. Ratio	i) 400/5A for feeder panels ii)600/5A for Transformer 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	Customized 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.

ANNEXURE II-C

Principal Technical Parameters for Isolator

I	Reference Standard	IS 9921 (Part 1-4)
II	System voltage c. Normal d. Highest	11 kV 12 kV
III	Supply frequency	50 Hz
IV	System Neutral earth	Effectively earthed
V	Current a. Normal b. Short time rating	800 Amp for Incomer 400 Amp for feeder 12.5 kArms for 3 sec
VI	Insulation level c. Impulse d. 1 min Power Frequency Voltage(wet)	75 kVp 28 kVrms
VII	Phase to phase centre distance	1000 mm
VIII	Current density at minimum cross section at any place in current path.	Not more than 1.6 A/sq mm
IX	Clearances c. Between adjacent poles d. Between live phase to earth	850 mm 370 mm
X	Interlock	Mechanical interlock between Main switch and earth switch.
XI	Operating mechanism	Manual
XII	Type of connection between earth blade (rotary contact) and earthing	Flexible copper contact

ANNEXURE II-D

Principal Technical Parameters of 11 kV CTs

I	Reference Standard	IS 2705 (Part I to IV)/IEC 185	
II	System voltage e. Normal f. Highest	11 kV 12 kV	
III	Supply frequency	50 Hz	
IV	System Neutral earth	Effectively earthed	
V	Insulation level e. Impulse f. 1 min Power Frequency Voltage	75 kVp 28 kVrms	
V	CT Installation	Outdoor, single phase unit	
VI	Type	Oil insulated or dry type	
VII	Current a. Normal b. Short time rating	600 Amp / 400 Amp 12.5 kArms for 3 sec	
VIII	Installation safety factor	Less than 5	
IX	Clear height of bushing	370 mm (Bird clearance)	
X	Minimum creepage	25 mm/kV	
XI	CT details	Incommer	Outgoing
	i) Ratio	600-300/5-5 A	400-200-100/5-5 A
	ii) Class of accuracy		
	a) Core I (Metering)	0.5	0.5
	b) Core II (O/C protection)	5 P 10	5 P 10
	iii) Burden (every core)	15 VA	15 VA
XII	Mounting details	350 x 350 mm (\pm 5mm)	

ANNEXURE II-E

Principal Technical Parameters of 11 kV outdoor PTS

I	Reference Standard	IS 3146/IEC 186
II	Installation	Single phase, Outdoor
III	Connection	Star/Star-open delta
IV	Type	Oil cooled
V	System voltage a. Normal b. Highest	11 kV 12 kV
VI	Supply frequency	50 Hz
VII	Insulation level a. Impulse b. 1 min Power Frequency Voltage	75 kVp 28 kVrms
VIII	Rated voltage factor	1.2 continuous & 1.5 for 30 sec
IX	Clear height of bushing	370 mm (Bird clearance)
X	Minimum creepage	25 mm/kV of highest system voltage
XI	PT details	
	i) Burden a) Core I b) Core II	50 VA 50 VA
	ii) Class of accuracy a) Core I b) Core II	Class 0.5 3 P
	ii) Purpose a) Core I b) Core II	Metering Protection
XII	Mounting details	350 x 350 mm (± 5 mm)

Annexure III

List of Type Test Reports to be enclosed with the offer (Ref.Cl.No.22.2.1)

Circuit Breaker: IS:13118/IEC-56		
Sr. No	Description of Type Test	IS Clause No.
1.	Lightning Impulse Voltage withstand Test	6.1.6
2.	Power Frequency Voltage Withstand Test a) Dry b) Wet	6.1.7
3.	Temperature Rise Test of main circuit	6.3
4.	Measurement of resistance of main circuit	6.4
5.	Short Time Withstand Current and Peak Withstand Current Test	6.5
6.	Mechanical Operation Test	6.101.2
7.	Short Circuit Making and Breaking current Tests a) No load operation before and after test b) Basic test duties no. 1 to 5 c) Single Phase Short circuit test d) Condition of breaker after short circuit test.-6.102.8	6.102 to 6.110
Isolators (with and without E.B.) IS:9921 (Part IV)		
Sr. No.	Description of Type Test	IS Clause No.
1.	Lightning Impulse Voltage withstand Test	3.1.6
2.	Power Frequency Voltage Withstand Test a) Dry b) Wet	3.1.8
3.	Temperature Rise Test	3.1.1
4.	Short Time Withstand Current and Peak Withstand Current Test	3.3
5.	Mechanical Endurance Test	3.5
Current Transformers IS:2705		
Sr. No.	Description of Type Test	IS Clause No.
1.	Short Time Current Test	9.6
2.	Lightning Impulse Voltage withstand Test	9.8
3.	Temperature Rise Test	9.7
Potential Transformers IS:3156		
Sr. No.	Description of Type Test	IS Clause No.
1.	Lightning Impulse Voltage withstand Test	9.6
2.	Temperature Rise Test	9.5
Outdoor Control, Relay & Metering Panel		
1	Degree of protection test IP 55	5.3.1.3
Indoor Indication Panel		
1	Degree of protection test IP 30	5.3.1.3
Numerical relays IS: -----		
Sr.No.	Description of type test	IS Clause No.
1	Insulation Test	
2	Relay characteristics, performance & accuracy test	
3	Steady State characteristics & Operating Time test	
4	High frequency Disturbance test	
5	Electrical fast transient test	
6	Thermal test	
7	Mechanical test	
8	Rated Burden test	
9	Contact performance test	

Details of type tests conducted for Circuit Breaker

Sr No.	Description of Type Test	Type & Make of Circuit Breaker & its rating	IS/IEC Clause No.	Testing Lab. & Date of Testing	Type test report No.,dt & pages	Whether certificate of compliance with IS/IEC is enclosed with T.R.
1.0	Lightning Impulse Voltage withstand Test					
2.0	Power Frequency Voltage Withstand Test Dry Wet					
3.0	Temperature Rise Test of main circuit					
4.0	Measurement of resistance of main circuit					
5.0	Short Time Withstand Current and Peak Withstand Current Test					
6.0	Mechanical Operation Test					
7.0	Short Circuit Making and Breaking current Tests a) No load operation before and after test b) Basic test duties no. 1 to 5 c) Single Phase Short circuit test d) Condition of breaker after short circuit test. e) Capacitor Bank & Cable charging test. (to be added or not)					

Details of type tests conducted for Control & Relay Panel

Sr No.	Description of Type Test	IS/IEC Clause No.	Testing Lab. & Date of Testing	Type test report No.,dt & pages	Whether certificate of compliance with IS/IEC is enclosed with T.R.
1.0	Degree of protection				

Details of type tests conducted for Isolator

Sr No.	Description of Type Test	IS/IEC Clause No.	Testing Lab. & Date of Testing	Type test report No.,dt & pages	Whether certificate of compliance with IS/IEC is enclosed with T.R.
1.0	Lightning Impulse Voltage withstand Test				
2.0	Power Frequency Voltage Withstand Test a) Dry b) Wet				
3.0	Temperature Rise Test				
4.0	Short Time Withstand Current and Peak Withstand Current Test				
5.0	Mechanical Operation Test				

Details of type tests conducted for CTs

Sr No.	Description of Type Test	IS/IEC Clause No.	Testing Lab. & Date of Testing	Type test report No.,dt & pages	Whether certificate of compliance with IS/IEC is enclosed with T.R.
1.0	Lightning Impulse Voltage withstand Test				
2.0	Temperature Rise Test of main circuit				
3.0	Short Time Withstand Current and Peak Withstand Current Test				

Details of type tests conducted for PTs

Sr No.	Description of Type Test	IS/IEC Clause No.	Testing Lab. & Date of Testing	Type test report No.,dt & pages	Whether certificate of compliance with IS/IEC is enclosed with T.R.
1.	Lightning Impulse Voltage withstand				

	Test				
2.	Temperature Rise Test of main circuit				

Details of type tests conducted on Relay

Sr No.	Description of Type Test	IS/IEC Clause No.	Testing Lab. & Date of Testing	Type test report No.,dt & pages	Whether certificate of compliance with IS/IEC is enclosed with T.R.
1.0	Description of type test				
2.0	Insulation Test				
3.0	Relay characteristics, performance & accuracy test				
4.0	Steady State characteristics & Operating Time test				
5.0	High frequency Disturbance test				
6.0	Electrical fast transient test				
7.0	Thermal test				
8.0	Mechanical test				
9.0	Rated Burden test				
10.0	Contact performance test				
11.0	Vibration test				

SCHEDULE - B
SCHEDULE OF DEVIATIONS FROM SPECIFICATION

SR.NO.	CLAUSE NO.	DETAILS OF DEVIATION
--------	------------	----------------------

NAME OF FIRM _____

NAME & SIGNATURE OF TENDERER _____

DESIGNATION _____

DATE _____

SCHEDULE - C

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-'D'

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

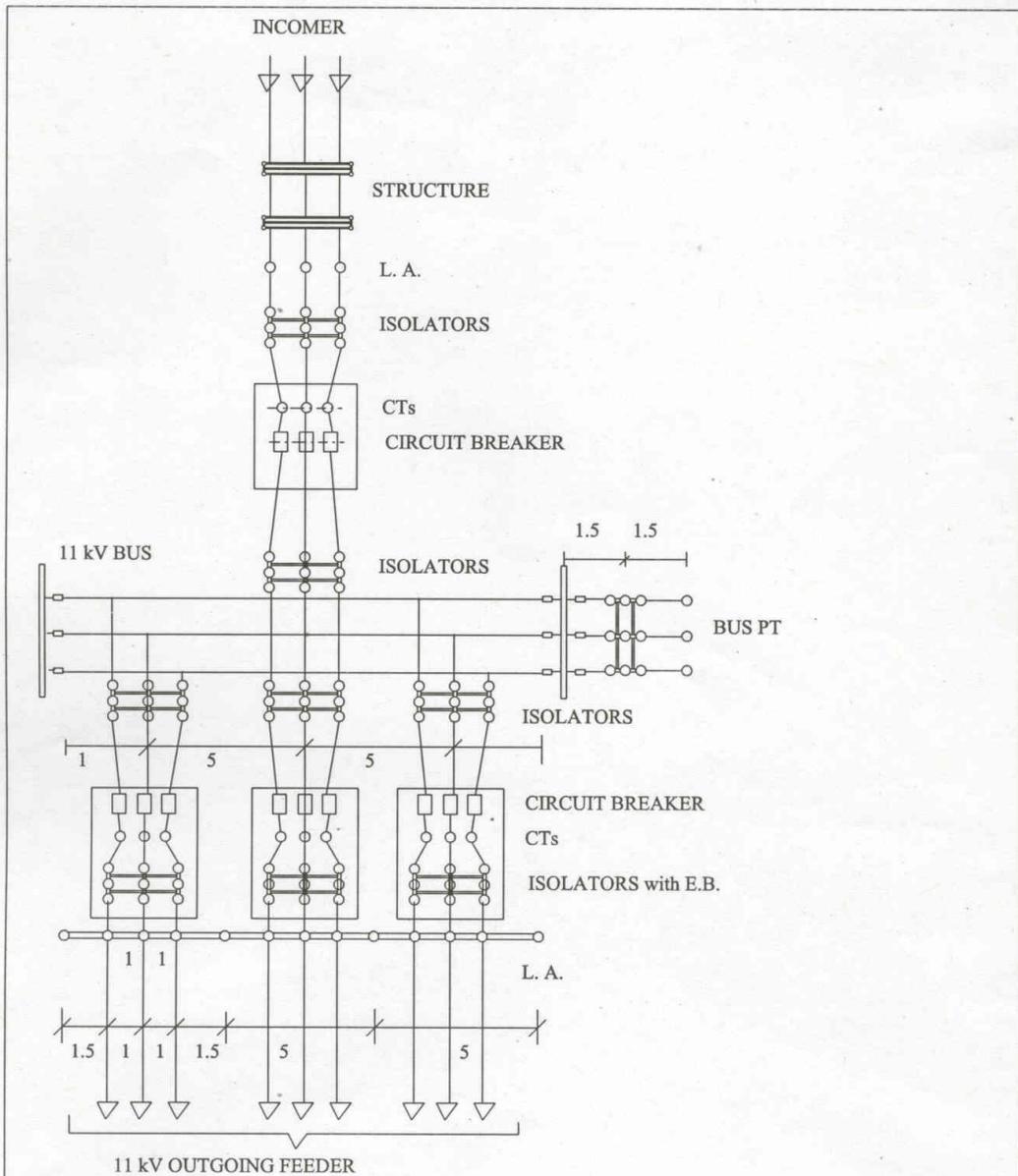
Sr. No.	Name of Test	Standard No. & Clause No.	Requirement of standards	Proposed deviation	Reasons for deviation.
1.	TYPE TEST				
2	ADDITIONAL TEST				
3	ACCEPTANCE TEST				
4	ROUTINE TEST				

NAME OF FIRM_____

NAME & SIGNATURE OF TENDERER_____

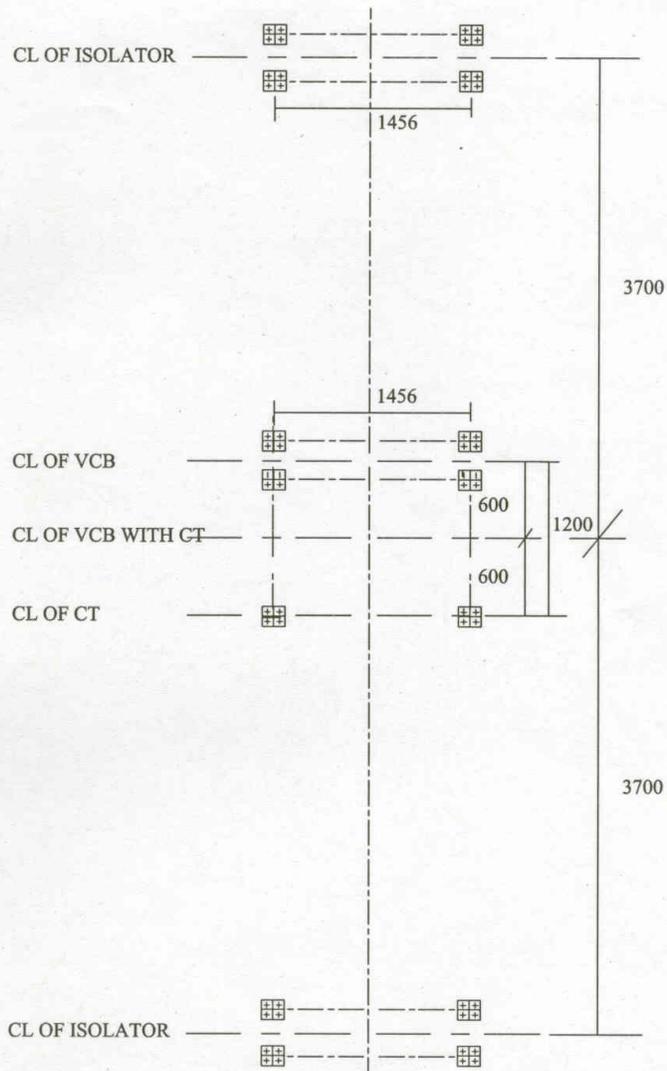
DESIGNATION_____

DATE: _____



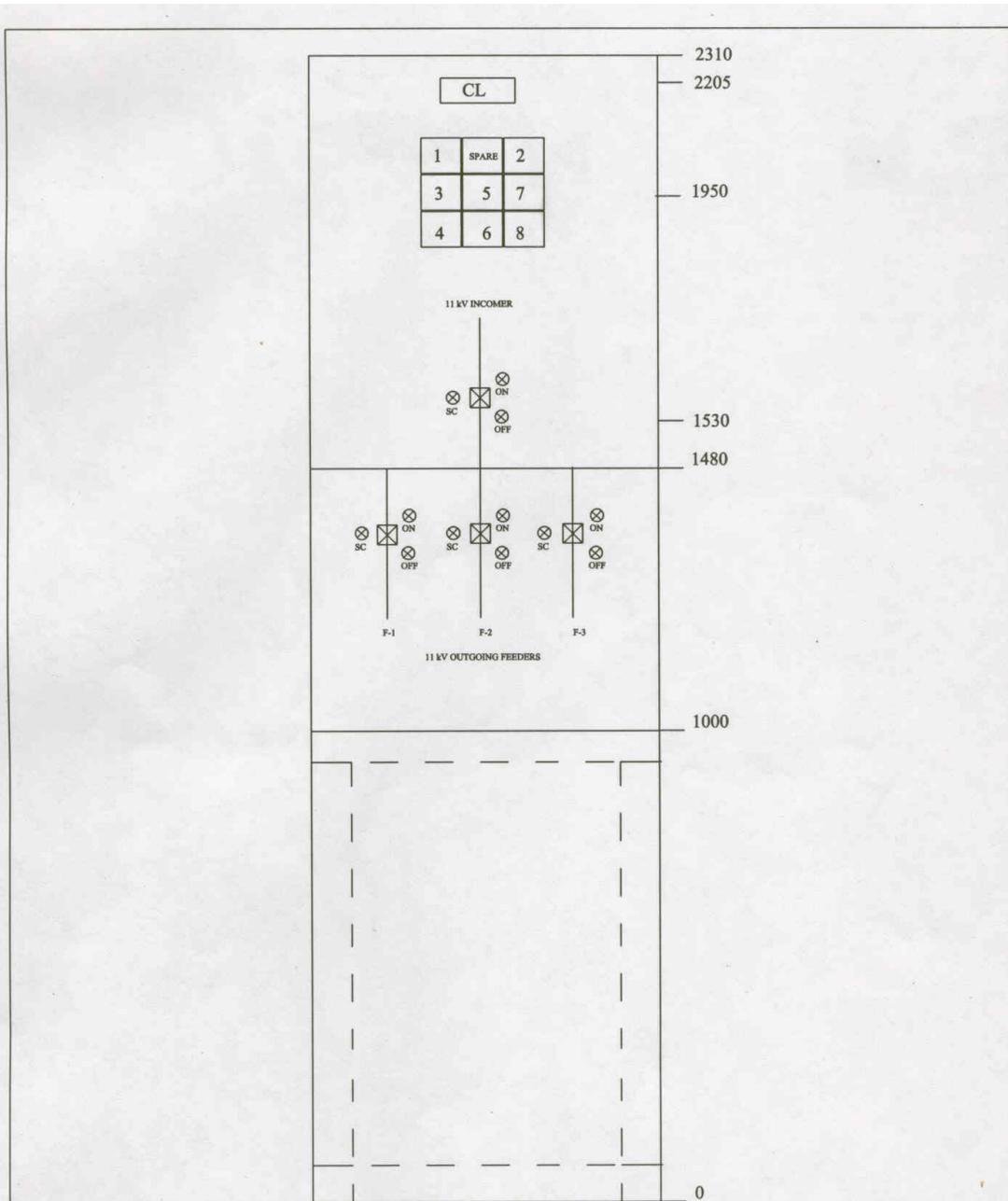
Note: All dimensions are in meters.

DRAWN BY	<i>[Signature]</i> 28/06/06	LAYOUT FOR 11 kV SWITCHYARD (1 I/C + 3 O/G)
CHECKED BY	<i>[Signature]</i> 29/11/06	DATE MSEDCL
RECOMMENDED BY	<i>[Signature]</i> 28/06/06	SCALE NTS
APPROVED BY	<i>[Signature]</i> 28/06/06	DISTRIBUTION SECTION MM CELL
		DRG NO. DIST/MM/11 kV ODSWG/LAYOUT/01



Note: All dimensions are in mm.

DRAWN BY	<i>[Signature]</i> AP(MM II)	FOUNDATION PLAN FOR 11 kV OUTDOOR SWITCHGEAR (INCOMMING & OUTGOING)	
CHECKED BY	<i>[Signature]</i> EE(MM II)	DATE	MSEDCL
RECOMMENDED BY	<i>[Signature]</i> SE(MM)	SCALE	DISTRIBUTION SECTION
APPROVED BY	<i>[Signature]</i> CE(DISTN)	NTS	MM CELL
		DRG NO.	
		DIST/MM/11 kV ODSWG/FP/02	



NOTE :- ALL DIMENSIONS ARE IN MM

DRAWN	<i>[Signature]</i> X.E.(P)	INDOOR INDICATION PANEL FOR OUTDOOR SWITCHGEAR	
CHECKED	<i>[Signature]</i> E.E.(MM-IT)	DATE	SCALE
RECOMENDED	<i>[Signature]</i> S.E.(MM)	8/8/03	NTS
APPROVED	<i>[Signature]</i> CE(DIST)	DRG. NO.	DISTRIBUTION
		DIST/MM/ODS/03	(MM SECTION)