



Maharashtra State Electricity Distribution Co. Ltd.

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**SPEC NO.STORES:MSC-II/33kv C&R panel/2011.**

**SPECIFICATION**

**FOR**

**Control & Relay Panel for 33 kV Lines and 33/11 kV Transformer Panel with & Without Differential Protection**

**FOR**

**VARIOUS 33/11 kV SUBSTATIONS**

**IN**

**MAHARASHTRA**

**I N D E X**

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**SPECIFICATION FOR 33 KV C&R PANELS**  
**SPEC NO.STORES:MSC-II/33kv C&R panel/2011.**

**1. SCOPE:**

- 1.1. This specification covers design, manufacture, assembly, testing before supply, inspection, packing and delivery and other basic technical requirements in respect of control and relay panels for 33 kV lines, 33/11KV Power Transformers without differential protection and 33/11KV Power Transformers with differential protection 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. The equipment offered shall be complete with all parts necessary for their effective and trouble-free operation. Such parts will be deemed to be within the scope of the supply irrespective of whether they are specifically indicated in the commercial order or not.
- 1.3. 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. If 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.
- 1.4. The Tenderer/supplier shall bind himself to abide by these considerations to the entire satisfaction of the purchaser and will be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.

**2. SERVICE CONDITIONS:**

- 2.1. System particulars:
  - a. Nominal system voltage ... 33 kV & 11 kV
  - b. Corresponding highest system voltage ... 36 kV & 12 kV
  - c. Frequency ... 50 Hz±3%
  - d. Number of phases ... 3
  - e. Neutral earthing ... Solidly grounded
- 2.2. Equipment supplied against the specification shall be suitable for satisfactory operation under the following tropical conditions:-
  - a. Max. ambient air temperature : 50 ° C
  - b. Max. relative humidity : 100 %
  - c. Max. annual rainfall : 1450 mm
  - d. Max. wind pressure : 150 kg/sq.m.
  - e. Max. altitude above mean sea level : 1000 mtrs.
  - f. Isoceranic level : 50
  - g. Seismic level(Horizontal acceleration) : 0.3 g.

h. Climatic Condition Moderately hot and humid tropical climate conducive to rust and fungus growth.

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

2.3. 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.

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

2.4.1. 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 $\pm 3\%$

2.5. The control & Relay Panels and various sub-units/components mounted on the panels shall conform to the latest revisions of the following standards :

a)	IS 12063/1987	Degree of Protection provided for enclosure of electrical equipment.
b)	IS 5/2004	Colour for ready mixed paints & enamels.
c)	IS 3231 / 1986 & 1987	Electrical relays for power system protection
d)	IEC 60255 amended upto date	Numerical biased protection relay
d)	IS 8686/1977	Static Protective Relays
e)	IS 1248/2003	Indicating instruments
f)	IS 14697/1999	HT Static Tri vector TOD Energy meter
g)	IS 6875 amended up to date	Control switches
h)	IS 4794/1968 & 1986	Push buttons
i)	IS:5578/1984	Marking of insulated conductors.

### 3. **CONSTRUCTIONAL DETAILS :**

3.1 The C&R panels against this specification shall be simplex type with all controls, indications, meters and protective relays mounted on the front.

3.2 Each C&R panel for 33 kV lines shall accommodate all the necessary equipment required for one 33 kV feeder circuits.

3.3 Control and relay panels meant for 33/11 kV transformer shall accommodate all the necessary equipment for one transformer circuit.

3.4 The panels shall be free-standing , floor mounting type suitable for indoor installation. Panels 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 with offer.

3.5 Panels shall be made of folded construction rigid structural frames enclosed completely with smooth finished rolled sheet steel of thickness not less than 3 mm for front portion of panel and 2 mm for other portions of panels. Sufficient re-inforcement shall be provided for level surfaces, so as to have resistance to vibration and rigidity during transport, installation and operation.

3.6 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 panels shall be fitted with removable gland plates to allow cable entries from the bottom. Gland plates shall be suitable for fixing the cable glands at an elevated height of at least 100 mm above the ground level. Terminal Connectors and Test terminal blocks for cables shall be fixed at an elevated height of at least 200 mm above the Bottom plate.

3.7 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 panels 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.

3.8 All wiring shall be carried out with 1100 volts grade single core, multistrand flexible tinned copper wires with PVC insulation. The conductor size shall be 2.5 sq. mm. (minimum). Wiring troughs shall be used for routing the cables. Wire numberings and colour code for wiring shall be as per IS IS:5578/1984. The wiring should be encased in suitable width PVC casing. 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 rear door marked

3.9 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.

3.10 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.

3.11 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.

3.12 MCBs of appropriate rating shall be provided for DC positive and negative of each circuit/sub-circuit. MCBs shall also be provided for AC (240V) circuits. However HRC fuses of suitable rating shall be provided for PT circuits.

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

3.14 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.

3.15 Each panel shall be provided with one earth bus of size 25 x 3 mm (minimum) . The earth bus shall be of tinned plated copper, and all metallic cases of relays, instruments etc. shall be connected to this earth bus independently for their effective earthing. The wire used for earth connections shall have green insulation.

3.16 The panels shall be of overall dimensions 700 x 750 x 2310 (W x D x H ) mm. The height 2310 mm is inclusive of the height of base frame. The height of base frame is generally 100 mm , and shall be painted black.

3.17 The constructional details and mounting arrangement for various front mounted equipments shall be as per the enclosed drawings. The center lines of any relays, if additionally provided, shall not be less than 450 mm from ground level.

3.18 In addition to the main circuit label, each panel shall be provided with a label indicating the following details :

Name of supplier :

Purchase order ref: (T-                      dtd.                      )

DC voltage:

Panel sr.no :

3.19 This label shall be provided on the rear side close to the door handle. A sticker type label indicating the above details shall be provided on the packing case for easy identification.

#### **4. PROTECTIVE RELAYS AND CONTROL / INDICATION EQUIPMENTS :**

4.1 The relays, switches, meters and other accessories offered shall be subject to a maximum of three reputed make and of proven design. The bidders may offer more than one alternative, for each equipment, provided all the alternatives meet the requirement of the technical specification. In case any or all the alternatives offered is/are found to be not acceptable to MSEDCL, the bidder shall be ready to offer any alternative equivalent which is acceptable to MSEDCL.

##### **4.2 Protective relays :**

4.2.1 For 33 KV lines, Non directional 2 O/C & 1 E/F relay with High set Relay should be provided. 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. 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%.

4.2.2 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.

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

4.2.4 For 33/11 kV transformers of rating 10 MVA, differential protection shall be provided. Transformer differential relay shall be numeric type differential relay, with in built current amplitude & vector group compensation feature & also with differential high set element for two winding power transformer conforming IEC 60255. (principle requirements are given in annexure- II B)

4.2.5 All the relays meant for panels shall be suitable for 30 V DC.

4.2.6 In case any special software/devices are required for the testing/setting of the protective relays, the bidder shall include one set of such accessories in the offer free of cost. The unit price for such items shall be indicated in the offer so as to enable the purchaser to order out more sets if required.

4.2.7 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.

4.2.8 In case the protective relays offered are not manufactured by the tenderer, an undertaking from the respective relay manufacturer indicating his readiness to extend necessary technical support and back-up guarantee as brought out in Schedule-V for the satisfactory operation of the relay shall be furnished by the tenderer in his offer. The tenderer shall also furnish an undertaking (from the relay manufacturers) confirming that the relay offered is in the current range of manufacture and will not be phased out for at least 10 years from the date of supply.

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

#### **5. MIMIC DIAGRAM:**

5.1 Mimic diagrams depicting the bus and the relative position of circuit breakers and isolators shall be provided on each control panel. Mimic diagram shall be neatly painted with the below listed colours to shades mentioned below. The mimic shall have 10 mm width. Non-Discrepancy control switch for the C.B. shall be mounted within the mimic, indicating the C.B. ON/OFF status.

Sr. No.	Voltage grade	Colour	Shade no.
1	33 kV	Brilliant green	221 as per IS 5
2	11 kV	Traffic yellow	368 as per IS 5

#### **6. Circuit breaker Control Switch :**

- 6.1 Non- discrepancy type T-N-C type switch shall be provided for remote operation of circuit breaker. The switch shall be mounted in the mimic diagram itself such that the stay-put ('N') position will render the continuity of the mimic. One green LED for 'breaker open' indication and one red LED for 'breaker closed' indication shall also be provided adjacent to the T-N-C switch.
- 6.2 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.
- 6.3 Terminal screws must be captive to avoid misplace during maintenance.
- 6.4 Switch shall be with 48 mm x 48 mm escutcheon plate marked with Trip & Close.
- 6.5 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.
- 6.6 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.

#### **7. Semaphore Indicators :**

- 7.1 When semaphore indicators are used for equipment positions, they shall be mounted in the mimic, such that the equipment closed position shall complete the continuity of the mimic. Similarly, when control switch of discrepancy type is used for equipment control, it shall be mounted in the mimic such that the equipment closed position (i.e. control switch knob) shall complete the continuity of the mimic.
- 7.2 Semaphore indicators shall be provided for isolators. The semaphore indicators shall be three position type, having one intermediate position to indicate the "DC supply fail" condition.

#### **8. Annunciators:**

- 8.1 12 Window annunciators suitable for the visual and audible alarm annunciation shall be provided on the control panel. These shall be micro processor based units using bright LEDs.
- 8.2 Annunciator facia units shall have translucent plastic windows for each alarm point.
- 8.3 Annunciator facia plate shall be engraved in black lettering with respective alarm inscription as specified. Alarm inscriptions shall be engraved on each window in not more than three lines and size of the lettering shall be about 5 mm. The inscriptions shall be visible only when the respective facia LED is glow.
- 8.4 Annunciator facia units shall be suitable for flush mounting on panels. Replacement of individual facia inscription plate and LED shall be possible from front of the panel.
- 8.5 Unless otherwise specified, one alarm buzzer meant for non-trip alarms and one bell meant for trip alarms shall be provided in each control panel (mounted inside).
- 8.6 Each annunciator shall be provided with 'Accept', 'Reset' and 'Test' push buttons, coloured red, yellow and blue respectively.
- 8.7 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.
- 8.8 In case 'RESET' push button is pressed before abnormality is cleared, the LEDs shall continue to glow steady and shall go out only when normal condition is restored.

8.9 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.

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

12 Window Annunciation Scheme to indicate following functions.		
i)	Differential protection operated	1 no.
ii)	Back up protection (O/C+E/F) operated ..	1 no.
iii)	Oil Temp. Alarm for transformer	1 no.
iv)	Oil Temp. Trip for transformer	1 no.
v)	Winding Temp. Alarm for transformer	1 no.
vi)	Winding Temp. Trip for transformer	1 no.
vii)	Buchholz Alarm for transformer	1 no.
viii)	Buchholz Trip for transformer	1 no.
ix)	OLTC Buchholz alarm for transformer	1 no.
x)	OLTC Buchholz Trip for transformer	1 no.
xi)	Spare	1 no.
xii)	Spare	1 no.

Mounting	Flush
No. of facia windows	12
No. of windows per row	6
Supply voltage	30 V DC
No. of LEDs per window	2
Lettering on facia plate	Properly engraved

#### 9. **Indicating LEDs :**

9.1 Indicating LEDs shall be panel mounting type with rear terminal connections. LED shall be provided with series connected resistors preferably built-in in the LED assembly. LEDs shall have translucent LED covers to diffuse lights, coloured red, green, amber, clear white or blue as specified. The LED cover shall be preferably of screw-on type, unbreakable and moulded from heat resisting material.

9.2 All indicator shall have bright LEDs having long life. Conventional bulbs are not acceptable.

9.3 The indicating LEDs with resistors shall withstand 120% of rated voltage on a continuous basis.

#### 10. **Trip circuit supervision scheme :**

10.1 Trip circuit supervision scheme shall be such that testing of trip circuit healthiness is possible irrespective of whether the C. B. is in the closed or open position. **The Trip Circuit Healthy LED should glow continuously in CB 'ON' Position and on demand in C.B. 'OFF' position. The rating of dropping resistance in series with Trip Circuit Healthy LED shall be such that the Trip Coil should not get damaged because of continuous current flowing through it.**

#### 11. **Master Trip relays :**

11.1 The trip relays shall be high set, hand reset type. The relay shall have heavy duty contacts suitable for tripping function. Relay shall have minimum 2NO + 2NC contacts.



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

**12.1 Ammeter:**

12.1.1 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	1 A from CT Secondary.
Type	Panel Mounting with 3 <sup>1</sup> / <sub>2</sub> Digital Display

**12.2 Ammeter selector switch:**

12.2.1 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

**12.3 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 <sup>1</sup> / <sub>2</sub> Digital Display

**12.4 Volt Meter selector switch:**

12.4.1 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

**12.5 Frequency Meter.**

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

**12.6 Heater**

Capacity	80 Watts
Voltage	240 V AC
Type	Strip type

**12.7 Semaphore indicator**

Type	3 Position type or Equivalent
Mounting	Flush
Coil rating	30 V DC
Burden	Less than 2 VA
Terminals	3 nos, central terminal is common for negative, positive is connected to 1 or/and 2.

**12.8 Self resetting buzzer**

Self resetting buzzer should sound for fixed time of 60 seconds interval and stop automatically

**12.9 Numerical non directional 2 O/C + 1 E/F with high set relay for lines.**

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"> <li>1. IDMT - 3 Sec.</li> <li>2. IDMT- 1.3 sec.</li> <li>3. Very Inverse</li> <li>4. Extremely Inverse</li> <li>5. Definite time</li> </ol>
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 over current	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"> <li>1. power ON – green colour</li> <li>2. pick up – yellow colour</li> <li>3. Trip- red colour</li> <li>4. HF – Red colour</li> </ol>
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"> <li>1. make &amp; carry AC : 1250VA, 5A, 660V DC : 1250W, 5A,660V.</li> <li>2. Contact breaking : AC: 1250VA,5A,660V DC: 100W resistive , 50 W inductive</li> </ol>
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

### 12.9.1 Three elements Auxiliary Relay hand reset type conforming IS 3231 for Transformer

Aux.voltage	30 V D.C.
Coil rating	30V D.C., voltage band for satisfactory operation : 50 to 120% of rated voltage
Operating Time	25 m. seconds nominal at rated voltage
Burden of relay coil watts (Max)	40 Watt at rated voltage for each coil
Operating temp	-10 deg C to 55 deg C .
Operational indication for each element	Mechanical red colour Flag : Hand Reset Type

Contact Configuration	2 NO + 2 NC for each element
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, 50Hz for 1 min. 2.5 KV/1 sec between all terminals & case as per IS 3231. 1 KV RMS, 50Hz for 1 min. across open contact
Type of mounting	Flush

**12.10 High speed tripping relay hand resetted type confirming to IS – 3231**

Aux.voltage	30 V D.C.
Coil rating	30V D.C., voltage band for satisfactory operation : 50 to 120% of rated voltage
Operating Time	10 m. seconds nominal at rated voltage
Burden of relay coil watts (Max)	Low burden 40 Watt at rated voltage
Operating temp	-10 deg C to 55 deg C .
Operational indication for each element	Mechanical red colour Flag : Hand Reset Type
Contact Configuration	3 NO + 2 NC combination with additional hand reset coil cut of contact (Seal in contact)
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, 50Hz for 1 min. 2.5 KV/1 sec between all terminals & case as per IS 3231. 1 KV RMS, 50Hz for 1 min. across open contact
Type of mounting	Flush

**12.11 Numerical based differential protection relay with inbuilt current amplitude & vector group compensation feature & also with differential high set element for two winding power transformer to IEC 60255**

Aux.voltage	24 to 110 V D.C.
C.T. secondary	Selectable 1 amps / 5 amps for both HV & LV sides
Online display of HV & LV phase currents & differential current	
Adjustable bias setting	10 to 50% In.
Operation based on fundamental frequency	
Programmable HV/LV CT ratio of T/F vector group	
Inbuilt REF protection	
Inbuilt HV & LV side over current & earth fault protection	
Inbuilt transformer trouble auxiliary relay	
Backlit LCD display	
Harmonic restrain feature	
Storing facility of latest 5 fault events with real time clock	
Password protection	
DC burden	Quiescent condition – approx 4 watt Under trip condition – 30 Volt - approx 4 watt, 110 Volt - approx 7 watt.
AC burden	Through current only – approx 0.15 VA for 1 amp & 0.30 VA for 5 amp (per bias circuit) Bias & differential Ckt only : 2.8 VA for 1 amp & 3.2 VA for 5 amp.
Contact arrangements	Two change over self reset tripping contacts & two annunciation contacts
Contact rating	Make & carry 7500VA for 0.2 sec. with max 30 A & 300 V AC or DC carry continuously 5 amp AC or DC break 1250 VA AC or 50 W DC resistive, 25 W L/R – 0.04 s subject to max. 5 amp & 300 Volts.
Current Input	Six for differential & one for REF
Self diagnosis feature for healthiness of relay	
Flush mounted / drawout type	
Communication port for compatibility to SCADA	

**13. METERING :**

**13.1 HT Static Trivector TOD Energy Meter:**

13.1.1 3 Phase 4 wire HT TOD Static Tri-vector Energy Meter having kWh element of class 0.5 accuracy with following parameters (Detail Technical specification are enclosed)

Class of accuracy	0.5
IS	14697 / 1999 upto date
C.T. Ratio	i) 100/1A for feeder panels ii)100/1A for Transformer Panels
V.T. Ratio	33000/110V

Type	Static
Mounting	Flush
Measuring parameters	kWh, kVARh, kVAh, instantaneous P.F., kW, kVA, supply frequency, phase voltages and phase currents.
Make	Secure Meters/L&T/L&G/Elster or Equivalent.
Display	Customised backlit liquid crystal display

#### **14. GENERAL REQUIREMENTS :**

- 14.1 The panels shall be delivered to the various consignees of the MSEDCL as will be informed to the successful tenderers. The panels shall be transported only by road and shall be suitably packed to avoid damages during transit.
- 14.2 Equipment covered in this specification shall be guaranteed for a period of 66 months from the date of dispatch or 60 months from the date of commissioning, whichever is earlier. However, any engineering error, omission, wrong provision, etc. which do not have any direct effect on the time period shall be attended to as and when observed/ pointed out, without any extra price.
- 14.3 Three sets of drawings shall be submitted for approval within 30 days from the date of issue of the Letter Of Award . The suppliers shall furnish 3 sets of the final drawings with copies of technical literature and commissioning manuals along with panel. All drawings shall be A3 size.

#### **15. TESTS :**

##### **15.1 Type Test :**

- 15.1.1 Control & Relay Panels offered in the Tender should have been successfully type tested at NABL in line with relevant Standards and the Technical Specification within the last 5(five) years prior to the date of opening of the Tender.
- 15.1.2 Protective relays, MF meter, annunciator, etc. should have been successfully type tested at Independent Government Laboratories in line with relevant Standards and the Technical Specification within the last 5(five) years prior to the date of opening of the Tender.
- 15.1.3 Copies of type test reports in respect of all offered equipment/material shall invariably be submitted along with the offer . Incomplete type test reports will be treated as invalid and the offer will be liable for rejection.
- 15.1.4 If offered equipment/material are type tested before 5 years from the opening of tender, the same was considered for placement of order. However, bidder has to carry out these test at his own cost before commencement of first supply. Undertaking in this respect have to be submitted along with offer otherwise the offer will be liable for rejection.
- 15.1.5 The bidder shall submit copies of the valid Type Test Reports for approval immediately on receipt of LOA.
- 15.1.6 Even if the equipment/material has been type tested within five years, the purchaser reserves the right to demand repetition of one or more tests included in the list of type tests in the presence of purchaser's representative.
- 15.1.7 The MSEDCL shall have the option to carry out various tests including type tests as per specification on the samples selected at random from the supplies effected, to ensure that the supplies conform in quality and workmanship to the relevant specification. The testing shall be done at independent laboratory at MSEDCL's cost. Due notice shall be given to supplier for such sample selection and such testing thereof to enable him to be present for the same if so desired by him. If the supplier or his authorized representative fails to attend the sample selection and testing, the same shall be carried out unilaterally by the MSEDCL and the result thereof shall be binding upon the supplier. In case the sample selected from the supplies fails to withstand the required tests, then

- 15.1.8 for first time failure of sample,
  - 15.1.8.1.1 Supplier shall have to replace the full quantity of the respective inspected lot supplied to various Stores and lying unused at Stores.
  - 15.1.8.1.2 For the quantity already accepted against the order and used, deduction in price of 10% of the value of material supplied shall be made

AND

- 15.1.9 in respect of further supplies made against the order, if failure of samples is noticed (i.e. second time failure against the order)
  - 15.1.9.1.1 The quantity lying unused at various Stores shall be rejected.
  - 15.1.9.1.2 for the quantity already accepted against the order and used, deduction in price of 10% of the value of material supplied shall be made.
  - 15.1.9.1.3 Balance quantity against the order including the rejected qty. shall be cancelled without any liability on either side,
  - 15.1.9.1.4 The firm will be debarred from dealing with the MSEDCL upto a period of three years from the date of rejection.
- 15.1.10 The purchaser reserves the right to conduct tests included in the list of Type Tests on requisite number of samples/items from any of the lots during the tenure of the supply, at the purchaser's cost in the presence of manufacturer's representatives. If the equipment/material does not withstand the type test, then the equipment/material supplied till then will be liable for rejection. The supplier, in such an eventuality, shall be allowed to modify the equipment and type test the same again at his cost in the presence of the purchaser's representative. These type tests shall however be conducted by the supplier within 15 days. After successful passing of the type tests, all the equipments/materials supplied earlier shall be modified in line with the equipment/materials which have successfully passed the type test. In case the supplier fails to carry out the Type Test within reasonable time or does not agree to carry out the type tests at his cost, his equipment/material supplied earlier shall be rejected and the order placed shall be cancelled and payments made earlier for these supplies shall be recovered by the purchaser.

## **16. INSPECTION:**

- 16.1 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.
- 16.2 The supplier shall keep the purchaser informed in advance, about the manufacturing programme so that arrangement can be made from stage inspection.
- 16.3 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.

## **17. PERFORMANCE GUARANTEE:**

- 17.1 All equipments supplied against this specification shall be guaranteed for a period of 30 months from the date of receipt at the consignee's or 24 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 implications.

## **18. Acceptance and Routine Tests :**

- 18.1 All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in the presence of the Purchaser's representative without any extra cost.
- 18.2 Immediately after finalisation of the programme of type/acceptance/routine testing, the supplier shall give four weeks advance intimation to the purchaser, to enable him to depute his representative for witnessing the tests.
- 18.3 The supplier shall carryout all the relevant physical verifications and functional tests as applicable at his works on all the finished C&R panels. Copies of these test certificates duly endorsed by the supplier's testing engineer shall be furnished to the inspecting officer of the MSEDCL. The inspecting officer reserves the right to insist for repetition of functional tests on any or all of the panels offered for inspection, and the supplier shall arrange for the same:

## **19. DOCUMENTATION**

- 19.1 After issue of letter of Award, the successful tenderers shall submit 3 sets of complete drawings alongwith detailed bill of materials for approval to **the Chief Engineer, (Stores), Ist floor, Prakashgad, MSEDCL, Bandra (E)**. 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 normal practice, the documents submitted for approval will be commented upon or approved if in order, within 30 days from the date of receipt of the same in the Distribution Department. The period of commencement of delivery shall include submission and approval of drawings/BOM.
- 19.2 The manufacturing of the equipments 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 equipments prior to the approval of the drawings shall be at the supplier's risk.
- 19.3 After approval of the drawings and bills of materials, the suppliers shall submit detailed packing lists for approval. After approval, copies of these packing lists shall be forwarded to the respective consignees. Copies of packing lists shall also be submitted to the Chief Accounts Officer (SB), MSEDCL, alongwith the bills for payment.
- 19.4 In case the supplier fails to furnish the required 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.
- 19.5 List of drawings to be submitted alongwith the offer is as under:
  - 19.5.1.1.1 GA drawing for C & R panel.
  - 19.5.1.1.2 Schematic drawing.
  - 19.5.1.1.3 Typical single line diagram.
  - 19.5.1.1.4 Bill of material for complete C & R panel.
  - 19.5.1.1.5 Terminal block details .
- 19.6 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.

## **20. PACKING AND FORWARDING**

- 20.1 Duly wired-up C & R panel with all relays and equipments mounted, 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 within 7 days without any extra cost.

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

- 20.2.1.1.1 Name of the consignee
- 20.2.1.1.2 Details of consignment.
- 20.2.1.1.3 Destination
- 20.2.1.1.4 Total weight of consignment
- 20.2.1.1.5 Sign showing upper/lower side of the crate.
- 20.2.1.1.6 Handling and unpacking instructions.
- 20.2.1.1.7 Bill of material indicating contents of each package.

20.3 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.

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

## **21. QUALIFYING REQUIREMENT : As per Tender Clause**

### **22. DOCUMENTS TO BE SUBMITTED ALONGWITH THE OFFER :**

The tenderers shall invariably submit the following documents failing which the offers are liable for rejection:

- 22.1 Bill of Material (schedule-IA/IB/IC).
- 22.2 Documents supporting the qualifying requirements/past performance reports schedule-III).
- 22.3 Undertakings from relay manufacturer regarding :
  - 22.3.1 Non-phasing out of the relays for at least 10 years from the date of supply (Schedule-IV (a))
  - 22.3.2 For extending technical support and back-up guarantee (when the relay is not manufactured by the tenderer) (Schedule-IV (b))
- 22.4 Undertakings from relay manufacturer regarding :
  - 22.4.1 Non-phasing out of the relays for at least 10 years from the date of supply (Schedule-V (a))
  - 22.4.2 For extending technical support and back-up guarantee (when the relay is not manufactured by the tenderer) (Schedule-V (b))
- 22.5 Detailed catalogue/technical literature in respect of all components/accessories including bought-out items.
- 22.6 List of drawings to be submitted alongwith the offer is as under:
  - 22.6.1.1.1 GA drawing for C & R panel.
  - 22.6.1.1.2 Schematic drawing.
  - 22.6.1.1.3 Typical single line diagram.

22.6.1.1.4 Bill of material for complete C & R panel.

22.6.1.1.5 Terminal block details .

22.7 Names of supplier of bought out item.

22.8 List of testing equipment available with the tenderer.

SCHEDULE-I A

(To be submitted, duly filled in, alongwith the offer)

**Bill of materials for 33 KV feeder C&R panels**

Sr.No	Description	Quantity	Make and Type design
1	Circuit label	1 No.	
2	Mimic section(Brilliant green paint to shade No.221 of IS 5 to be used)	1 No	
3	T-N-C type control switch for circuit breaker.	1 No.	
4	Semaphore indicators for Isolators.	2 Nos	
5	Indicating LEDs for Spring charge indication(white) Trip circuit healthy indication.(Amber) Breaker 'ON' indication(Red) Breaker 'OFF' indication(Green)	1 No. 1 No. 1 No. 1 No.	
6	Push button for Trip circuit test Alarm Accept	1 No 1 No.	
7	Numerical non-directional IDMT over current and earth fault relay with highset instantaneous trip feature.	1 No.	
8	High speed Master tripping relay (H/R type)	1 No	
9	HT Static TOD Trivector Energy meter with RS-232 port and TTB.	1 Set	
10	Frequency Meter		
11	Ammeter (48 mm x 96 mm.) & selector switch.	1 Set	
12	Voltmeter (48 mm x 96 mm.) & selector switch.	1 Set	
<b>Internally mounted</b>			
1	Space heater and control switch	1 Set	
2	Cubicle illumination lamp and door switch.	1 Set	
3	Power Plug, socket and control switch	1 Set	
4	Alarm bell for trip	1 No.	
5	Alarm cancellation relay	1 No.	
6	Alarm buzzer for non trip with auto-stop feature (with variable time setting 0-60 seconds)	1 No.	
7	MCBs, fuses, links, control wiring, etc.	As required	

**SCHEDULE-I B**

**Bill of materials for 33/11KV Transformer C&R panels with differential protection.**

Sr.No	Description	Quantity	Make and Type design
1	Circuit label	1 No.	
2	Mimic section (Brilliant green paint to shade No.221 of IS 5 to be used)	1 Set	
3	T-N-C type control switch for circuit breaker.	1 Nos	
4	Semaphore indicators for Isolators.	2 Nos	
5	Indicating LEDs for		
	Spring charge indication(white)	1 Nos.	
	Trip circuit healthy indication.(Amber)	1 Nos.	
	Breaker 'ON' indication(Red)	1 Nos.	
	Breaker 'OFF' indication(Green)	1 Nos.	
6	Push button for		
7	Trip circuit Healthy test	1 Nos	
8	Numerical non-directional IDMT over current and earth fault relay with high set instantaneous trip feature.	1 Nos.	
9	High speed master tripping relay (H/R type)	1 No	
10	HT Static TOD Trivector Energy meter and TTB.	1 No	
11	Frequency Meter		
12	Ammeter (48 mm x 96 mm.) & selector switch.	1 Sets	
13	Voltmeter (48 mm x 96 mm.) & selector switch.	1 Sets	
14	Transformer differential numerical relay	1 No.	
15	12 window annunciation scheme with accept, reset and LED test push button with self resetting audible alarm.	1 No.	
16	Auxiliary relay for Buchholz Alarm/trip (2-element)	1 Set	
17	Aux. relay for winding temp Alarm/trip(2-element)	1 Set	
18	Aux. relay for OLTC Buchholz Alarm/trip(2-element)	1 Set	
Internally mounted			
1	Space heater and control switch	1 No.	
2	Cubicle illumination lamp with door switch.	1 No.	
3	Power plug with control switch	1 No.	
4	MCBs, fuses, links, control wiring, etc.	As required.	

## SCHEDULE-IC

(To be submitted duly filled in alongwith the offer)

### **Bill of materials for 33/11KV Transformer C&R panels without differential protection.**

Sr.No	Description	Quantity	Make and Type design
1	Circuit label	1 No.	
2	Mimic section(Brilliant green paint to shade No.221 of IS 5 to be used)	1 Set	
3	T-N-C type control switch for circuit breaker.	1 Nos	
4	Semaphore indicators for Isolators.	2 Nos	
5	Indicating LEDs for		
	Spring charge indication(white)	1 Nos.	
	Trip circuit healthy indication.(Amber)	1 Nos.	
	Breaker 'ON' indication(Red)	1 Nos.	
	Breaker 'OFF' indication(Green)	1 Nos.	
6	Push button for Trip circuit Healthy test	1 Nos	
7	Numerical non-directional IDMT over current and earth fault relay with highset instantaneous trip feature.	1 No.	
8	High speed tripping relay (H/R type)	1 No.	
9	HT TOD Trivector Energy meter and TTB.	1 No.	
10	Frequency Meter	1 No.	
11	Ammeter (48 mm x 96 mm.) & selector switch.	1 Sets	
12	Voltmeter (48 mm x 96 mm.) & selector switch.	1 Sets	
13	12 window annunciation scheme with accept, reset and LED test push button with self resetting audible alarm.	1 No.	
14	Auxiliary relay for Buchholz Alarm/trip (2-element)	1 Set	
15	Aux. relay for winding temp Alarm/trip(2-element)	1 Set	
16	Aux. relay for OLTC Buchholz Alarm/trip(2-element)	1 Set	
Internally mounted			
1	Space heater and control switch	1 No.	
2	Cubicle illumination lamp with door switch.	1 No.	
3	Power plug with control switch	1 No.	
4	MCBs, fuses, links, control wiring, etc.	As required.	

## SCHEDULE – II

(To be submitted, duly filled in, alongwith the offer)

### Schedule of Unit Rates

Sr.No.	Description	Unit Price (in Rs.)
1	TTB for TOD meter ( 3 phase, 4 wire)	
2	T-N-C type control switch for circuit breaker.	
3	12-window annunciator	
4	Semaphore indicator for Isolator.	
5	Indicating LED (LED).	
6	Push button.	
7	Numerical non-directional IDMT O/C & E/F relay with high set instantaneous trip feature.	
8	Alarm Bell.	
9	Alarm Cancellation relay.	
10	Trip relay (a) (4 NO + 2 NC)	
	(b) (2 NO + 2 NC)	
11	HT Trivector TOD meter with RS 232 port (SCADA compatible) capable of reading voltage, current, frequency, power factor, energy and other parameters.	
12	Ammeter	
13	Ammeter Selector switch	
14	Voltmeter	
15	Voltmeter Selector switch	
16	Transformer differential relay	
17	Aux. relay for supervision of T/F problems.	
18	Self reset type alarm buzzer (with built-in or external timer having variable setting range 0-60 sec.)	

**SCHEDULE - III**

**Past Supply Details**

Sr No	Item Description:	Qty	Order ref	Supplied to	Year of supply	Contact person & address

**SCHEDULE - IV**

**Undertaking from Relay manufacturer :**

We hereby confirm that the protective relay(s) type \_\_\_\_\_

i)

ii)

iii)

offered by us against your tender No. \_\_\_\_\_ through M/s. \_\_\_\_\_ are in our current range of production. We also confirm that these relays will not be phased out by us in the next 10 years from the date of supply. Necessary repairs/replacements if necessary during this period will be made available by us.

Name & Designation : \_\_\_\_\_

Company Seal : \_\_\_\_\_

We have offered our relay(s) type \_\_\_\_\_

i)

ii)

iii)

to M/s. \_\_\_\_\_ against MSEDCL's tender no. \_\_\_\_\_. In this connection we hereby confirm that we would be extending all the required technical support and back-up guarantee to M/s. \_\_\_\_\_ for the above mentioned relay(s).

Name & Designation : \_\_\_\_\_

Company Seal : \_\_\_\_\_



**SCHEDULE - V**

**Undertaking from meter manufacturer :**

We hereby confirm that the Meter(s) type \_\_\_\_\_

i)

ii)

iii)

offered by us against your tender No. \_\_\_\_\_ through M/s. \_\_\_\_\_ are in our range of production. We also confirm that these meters will not be phased out by us in the next 10 years from the date of supply. Necessary repairs/replacements if necessary during this period will be made available by us.

Name & Designation : \_\_\_\_\_

Company Seal : \_\_\_\_\_

We have offered our meter(s) type \_\_\_\_\_

i)

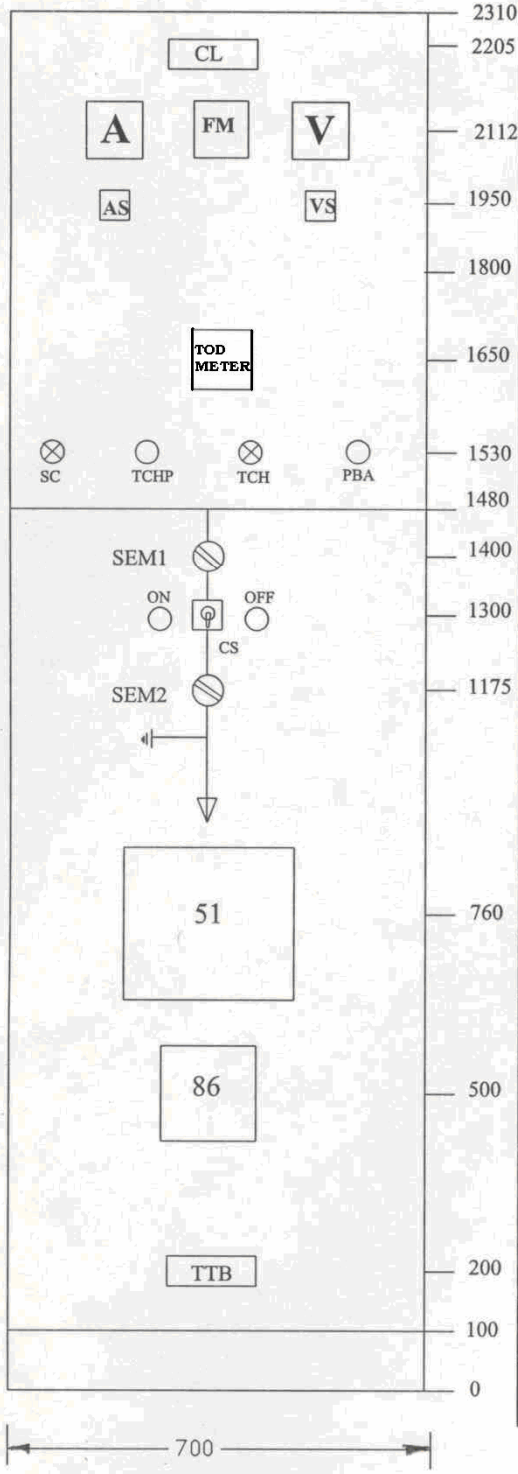
ii)

iii)

to M/s. \_\_\_\_\_ against MSEDCL's tender no. \_\_\_\_\_. In this connection we hereby confirm that we would be extending all the required technical support and back-up guarantee to M/s. \_\_\_\_\_ for the above mentioned relay(s).

Name & Designation : \_\_\_\_\_

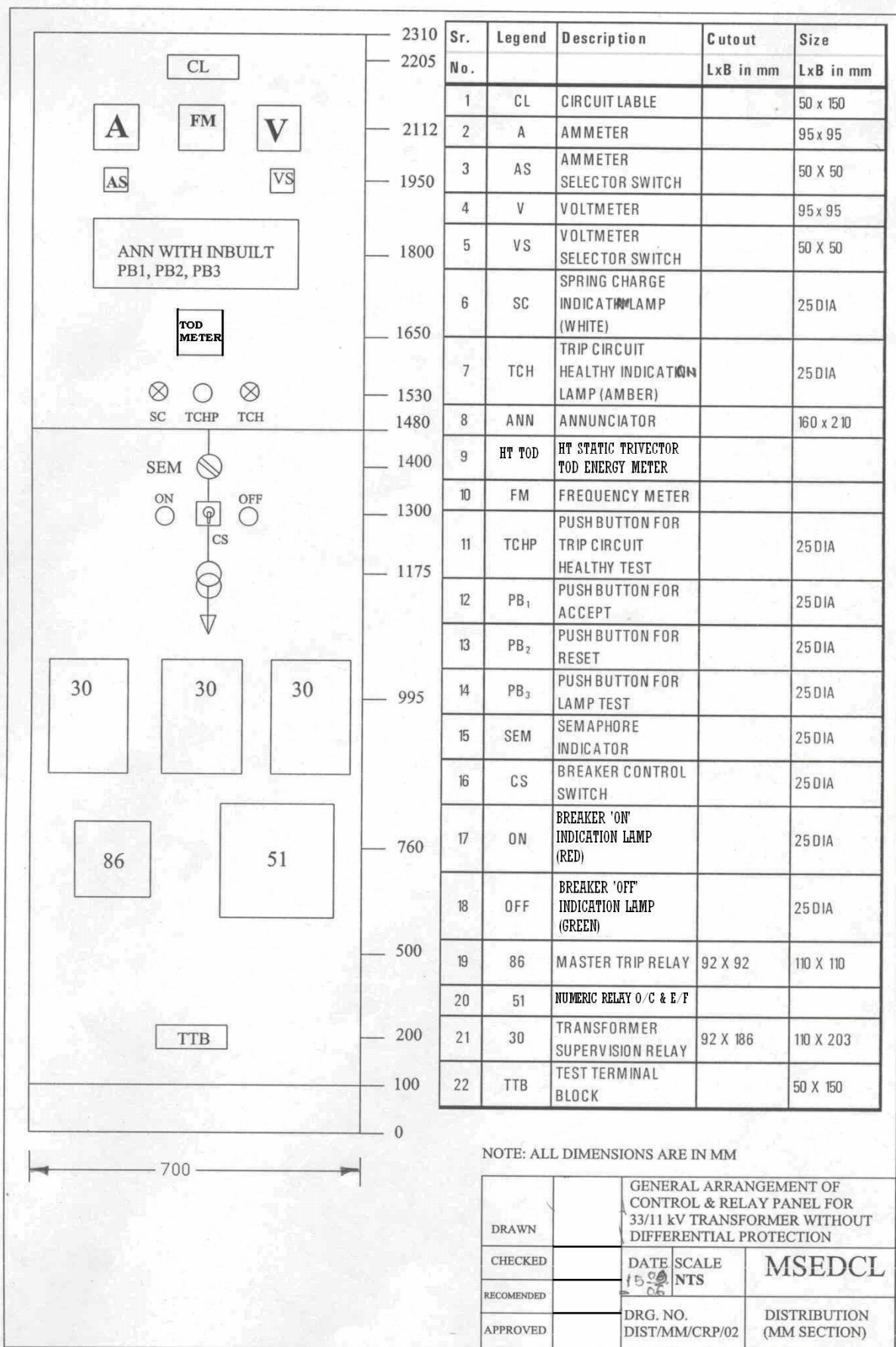
Company Seal : \_\_\_\_\_



Sr. No.	Legend	Description	Size LxB in mm
1	CL	CIRCUIT LABLE	50 x 150
2	A	AMMETER	95 x 95
3	AS	AMMETER SELECTOR SWITCH	50 X 50
4	V	VOLTMETER	95 x 95
5	VS	VOLTMETER SELECTOR SWITCH	50 X 50
6	HT TOD	HT STATIC TRIVECTOR TOD ENERGY METER	
7	FM	FREQUENCY METER	
8	SC	SPRING CHARGE INDICATION LAMP (WHITE)	25 DIA
9	TCH	TRIP CIRCUIT HEALTHY INDICATION LAMP (AMBER)	25 DIA
10	TCHP	PUSH BUTTON FOR TRIP CIRCUIT HEALTHY TEST	25 DIA
11	PBA	PUSH BUTTON FOR ALARM ACCEPT	25 DIA
12	SEM <sub>1</sub>	SEMAPHORE INDICATOR	25 DIA
13	CS	BREAKER CONTROL SWITCH	25 DIA
14	SEM <sub>2</sub>	SEMAPHORE INDICATOR	25 DIA
15	ON	BREAKER 'ON' INDICATION LAMP (RED)	25 DIA
16	OFF	BREAKER 'OFF' INDICATION LAMP (GREEN)	25 DIA
17	86	MASTER TRIP RELAY	110 x 110
18	51	NUMERIC RELAY O/C & E/F	
19	TTB	TEST TERMINAL BLOCK	50 X 150

NOTE :- ALL DIMENSIONS ARE IN MM

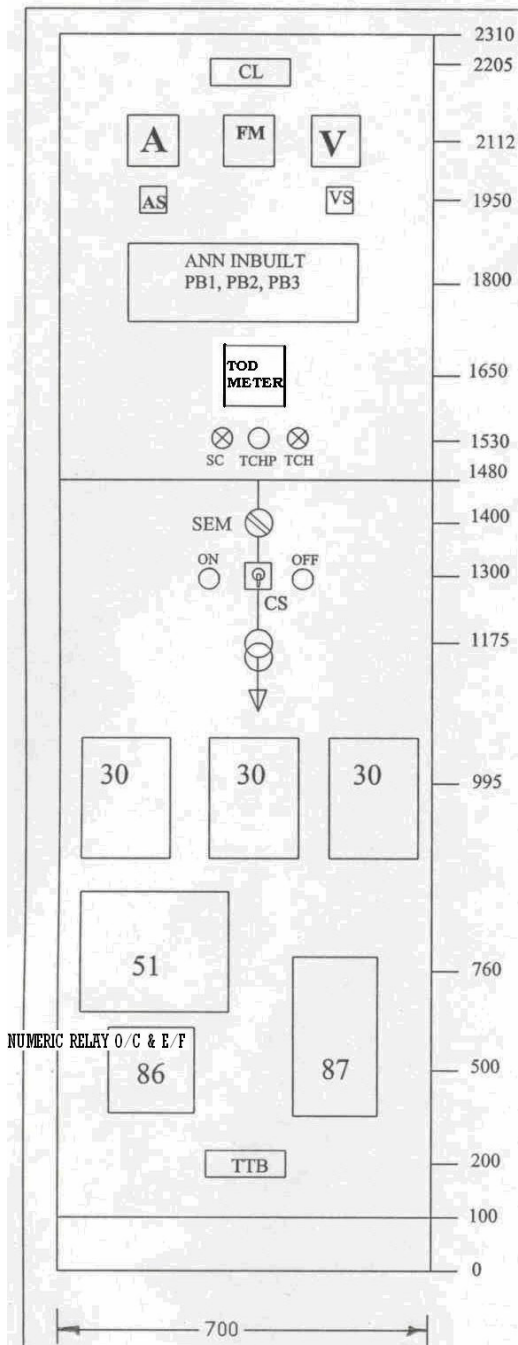
DRAWN		GENERAL ARRANGEMENT OF CONTROL & RELAY PANEL FOR 33 kV FEEDER	
CHECKED		DATE 15/08/20	SCALE NTS
RECOMENDED		MSEDCL	
APPROVED			



Sr. No.	Legend	Description	Cutout LxB in mm	Size LxB in mm
1	CL	CIRCUIT LABLE		50 x 150
2	A	AMMETER		95 x 95
3	AS	AMMETER SELECTOR SWITCH		50 X 50
4	V	VOLTMETER		95 x 95
5	VS	VOLTMETER SELECTOR SWITCH		50 X 50
6	SC	SPRING CHARGE INDICATION LAMP (WHITE)		25 DIA
7	TCH	TRIP CIRCUIT HEALTHY INDICATION LAMP (AMBER)		25 DIA
8	ANN	ANNUNCIATOR		160 x 210
9	HT TOD	HT STATIC TRIVECTOR TOD ENERGY METER		
10	FM	FREQUENCY METER		
11	TCHP	PUSH BUTTON FOR TRIP CIRCUIT HEALTHY TEST		25 DIA
12	PB <sub>1</sub>	PUSH BUTTON FOR ACCEPT		25 DIA
13	PB <sub>2</sub>	PUSH BUTTON FOR RESET		25 DIA
14	PB <sub>3</sub>	PUSH BUTTON FOR LAMP TEST		25 DIA
15	SEM	SEMAPHORE INDICATOR		25 DIA
16	CS	BREAKER CONTROL SWITCH		25 DIA
17	ON	BREAKER 'ON' INDICATION LAMP (RED)		25 DIA
18	OFF	BREAKER 'OFF' INDICATION LAMP (GREEN)		25 DIA
19	86	MASTER TRIP RELAY	92 X 92	110 X 110
20	51	NUMERIC RELAY O/C & E/F		
21	30	TRANSFORMER SUPERVISION RELAY	92 X 186	110 X 203
22	TTB	TEST TERMINAL BLOCK		50 X 150

NOTE: ALL DIMENSIONS ARE IN MM

DRAWN		GENERAL ARRANGEMENT OF CONTROL & RELAY PANEL FOR 33/11 kV TRANSFORMER WITHOUT DIFFERENTIAL PROTECTION		
CHECKED		DATE	SCALE	MSEDCL
RECOMENDED		15/06/06	NTS	
APPROVED		DRG. NO.	DISTRIBUTION	
		DIST/MM/CRP/02	(MM SECTION)	



Sr. No.	Legend	Description	Cutout LxB in mm	Size LxB in mm
1	CL	CIRCUIT LABEL		50 x 150
2	A	AMMETER		95 x 95
3	AS	AMMETER SELECTOR SWITCH		50 X 50
4	V	VOLTMETER		95 x 95
5	VS	VOLTMETER SELECTOR SWITCH		50 X 50
6	SC	SPRING CHARGE INDICATION LAMP (WHITE)		25 DIA
7	TCH	TRIP CIRCUIT HEALTHY INDICATION LAMP (AMBER)		25 DIA
8	ANN	ANNUNCIATOR		160 x 210
9	HT TOD	HT STATIC TRIVECTOR TOD ENERGY METER		
10	FM	FREQUENCY METER		
11	TCHP	PUSH BUTTON FOR TRIP CIRCUIT HEALTHY TEST		25 DIA
12	PB <sub>1</sub>	PUSH BUTTON FOR ACCEPT		25 DIA
13	PB <sub>2</sub>	PUSH BUTTON FOR RESET		25 DIA
14	PB <sub>3</sub>	PUSH BUTTON FOR LAMP TEST		25 DIA
15	SEM	SEMAPHORE INDICATOR		25 DIA
16	CS	BREAKER CONTROL SWITCH		25 DIA
17	ON	BREAKER 'ON' INDICATION LAMP (RED)		25 DIA
18	OFF	BREAKER 'OFF' INDICATION LAMP (GREEN)		25 DIA
19	87	DIFFERENTIAL RELAY	138 x 282	
20	86	MASTER TRIP RELAY	92 X 92	110 X 110
21	51	NUMERIC RELAY O/C & E/F		
22	30	TRANSFORMER SUPERVISION RELAY	92 X 186	110 X 203
23	TTB	TEST TERMINAL BLOCK		50 X 150

NOTE:- ALL DIMENSIONS ARE IN MM.

DRAWN		GENERAL ARRANGEMENT OF CONTROL & RELAY PANEL FOR 33/11 kV TRANSFORMER WITH DIFFERENTIAL PROTECTION		
CHECKED		DATE	SCALE	MSEDCL
RECOMMENDED		15/02/2026	NTS	
APPROVED		DRG. NO.	DISTRIBUTION (MM SECTION)	
		DIST/MM/CRP/03		

**MAHARASHTRA STATE ELECTRICITY DISTRIBUTION COMPANY LTD.**  
**TECHNICAL SPECIFICATION FOR HT STATIC TRI-VECTOR TOD METER**

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

**1.0 SCOPE:**

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

**2.0 QUALIFYING REQUIREMENTS:-**

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

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

- a) The bidder/manufacturer should have turnover of Rs.80 crores during any one of the last three financial years.
- b) The bidder/manufacturer should have supplied 12.5 lakhs static meters during the last three financial years.
- c) The bidder/manufacturer should have minimum experience of three years of supply or manufacturing for static meters upto the end of the last financial year.

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

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

**3.0 SERVICE CONDITIONS:**

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

3.1 Environmental Condition

- |   |       |
|---|-------|
| a) Maximum ambient temperature          | 55 °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) Isoceranic 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 Ib. The starting current for the meter should be 0.1% of Ib.

#### 4.2 Temperature

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

#### 4.3 Frequency

The rated frequency shall be 50 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<sub>max</sub> 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 kilowatthour (kWh) for active energy, kVARh for reactive energy and kVAh for apparent energy.

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

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

P.T.Ratio----  $11000/\sqrt{3}/110/\sqrt{3}$  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<sub>max</sub>, I<sub>b</sub> and 5% I<sub>b</sub> at unity power factor and 50% I<sub>max</sub> and 10% I<sub>b</sub> at 0.5 lagging Power Factor besides checking them for starting current. This test shall be conducted on ready to install meter i.e. meter cover

ultrasonically welded & sealed. After recording these errors, the meters be put in their normal packing and transported for at least 50 km in any transport vehicle such as pick up van, Jeep, etc. on uneven rural roads and then re-tested at all these loads after the transportation. The variation in errors recorded before and after transportation should not exceed 1% at higher loads and 1.5% at loads below Ib.

#### 15.5 Other Acceptance Tests :

- i. Meters shall be tested for tamper conditions as stated in this specification.
- ii. Glow wire testing for poly-carbonate body.
- iii. Power consumption tests shall be carried out.
- iv. The meter shall comply all the test for external AC/DC magnetic field as per CBIP Tech Report 88 with latest amendments. Moreover, the magnetic influence test for permanent magnet of 0.5 Tesla for minimum period of 15 minutes shall be carried out. After removal of magnet. meter shall be subjected to accuracy test as per IS 14697/1999 (amended up to date). No deviation in error is allowed in the accuracy as per specification.
- v. The meter shall withstand impulse voltage at 10 kV.

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

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

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SR.NO	Order number	Number of Meters supplied-
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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 authorize 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 \_\_\_\_\_

<b>Guaranteed Technical Particulars of 33 kV C&amp;R Panel</b>	
1.Make of Panel	Text
Type of Panel.	Text
Overall dimensions (HxWxD) of panel shall be 700 x 750 x 2310 mm	Text
Thickness of Sheet Steel shall not be less than 3 mm for front panel	Numeric
Thickness of Sheet Steel shall not be less than 2 mm for doors of panel	Numeric
Thickness of Sheet Steel shall not be less than 2 mm for sides of panel	Numeric
Thickness of Sheet Steel shall not be less than 2 mm for top portion of panel	Numeric
Thickness of Sheet Steel shall not be less than 2 mm for bottom portion of panel	Numeric
Final painting of panels shall be done with Light Grey colour to shade no.631 as per IS-5, for interior. (Yes/No)	Boolean
Final painting of panels shall be done with Light Grey colour to shade no.631 as per IS-5, for exterior. (Yes/No)	Boolean
Mimic section shall have Brilliant green paint to shade No.221 of IS 5 for 33 kV (Yes/No)	Boolean
Mimic section shall have Traffic yellow paint to shade No.368 of IS 5 for 33 kV (Yes/No)	Boolean
C&R Panel for feeder shall have 1 circuits (Yes/No)	Boolean
C&R Panel for Transformer without differential protection panel shall have 1 circuits (Yes/No)	Boolean
C&R Panel for Transformer with differential protection panel shall have 1 circuits (Yes/No)	Boolean
Wiring troughs shall be used for routing the cables Yes/No	Boolean
The panels shall provide degree of protection not less than IP 30 in accordance with IS 12063/1987	Text
Wiring numberings shall be as per IS 5578/1964	Text
Terminal connectors shall be stud type, clip-on type. (Yes/No)	Boolean
Terminal connectors shall be made of Brass material. (Yes/No)	Boolean
The conductor size shall be 2.5 mm (minimum).	Numeric
Make of MCBs.	Text
Type of MCBs.	Text
Whether equipment identification labels provided. (Yes/No)	Boolean
<b>2. Protective relays</b>	
Make of Non directional 2 Over Current & 1 Earth Fault with high set relay.	Text
Type of 2 Over Current & 1 Earth Fault relay.	Text
Designation of 2 Over Current & 1 Earth Fault relay.	Text
General design of 2 Over Current & 1 Earth Fault relay	Text
Reference standards	Text
Number of poles (elements) of 2 Over Current & 1 Earth Fault relay.	Text
Auxiliary supply DC voltage required.	Boolean
Relay operating characteristic IDMT 0-3 sec	Text
Time of operation at 10 times current setting	Text
High Fault setting for over current	Text
High Fault setting for Earth fault	Text
Current setting available for O/C elements of Over Current & Earth Fault relay shall be 50% to 200% of Base Current in steps of 10 %.	Text
Current setting available for E/F element of Over Current & Earth Fault relay.10% to 40% of Base Current in steps of 5%	Text
Number of output contacts of Over Current & Earth Fault relay shall be 2 trip and 2 alarm.	Text

Output contact rating of 2 Over Current & 1 Earth Fault relay.	Text
Current coil rating (Amps) of Over Current & Earth Fault relay shall be 1 A	Text
Operational indicator of Over Current & Earth Fault relay shall be flag.	Text
Mounting of Over Current & Earth Fault relay shall be flush type	Text
LED Indications for power ON, pickup , Trip & High fault	Text
Communication port RS 232 is provided (Yes/No)	Boolean
Password protection provided (Yes/No)	Boolean
Memory storage capacity for fault information for five latest faults with date& time stamping, fault amplitude , type of fault with FIFO feature	Text
Whether any special equipment/tools required for testing/maintenance of Over Current & Earth Fault relay.	Text
If yes, whether the same is offered as optional items.(Yes/No)	Boolean
Whether relay is type tested.(Yes/No)	Boolean
<b><u>High speed Trip Relays</u></b>	
Reference standard	Text
Make of Trip Relays	Text
Type & designation of Trip Relays	Text
General design of Trip Relays shall be electromechanical. (Yes/No)	Boolean
Coil rating (voltage) of Trip Relays shall be 30 V DC.	Text
VA burden of Trip Relays	Text
Operating time of Trip Relays shall be 25 ms at nominal rated voltage.	Text
Number of output contacts of Trip Relays : 3 NO + 2 NC	Text
Type of indication of Trip Relays shall be hand reset type mechanical flag in window.	Text
Mounting of Trip Relays shall be flush type.	Text
Any other details.	Text
<b><u>HT Static Trivector TOD Energy Meter :</u></b>	
Reference standard	Text
Make of HT Static Trivector TOD Energy meter.	Text
Type of HT Static Trivector TOD Energy meter.	Text
Over all dimensions of HT Static Trivector TOD Energy meter.	Text
Cut out size of HT Static Trivector TOD Energy meter	Text
Accuracy class of HT Static Trivector TOD Energy meter shall be 0.5	Text
Auxiliary supply voltage for HT Static Trivector TOD Energy meter shall be 110 V AC	Text
Measuring Parameters of HT Static Trivector TOD Energy meter	Text
Type of display of HT Static Trivector TOD Energy meter	Text
Height of character provided for HT Static Trivector TOD Energy meter.	Text
No of digits provided for HT Static Trivector TOD Energy meter.	Text
Type of push buttons of HT Static Trivector TOD Energy meter	Text
Whether HT Static Trivector TOD Energy meter are direct reading type	Text
<b><u>Semaphore indicator</u></b>	
Make of Semaphore	Text
type designation of Trip Relays	Text
Size of dial of Trip Relays	Text
Rating of Trip Relays	Text
Consumption of Trip Relays	Text
Number of position of Trip Relays	Numeric
<b><u>Push Buttons</u></b>	
Make of Push Buttons	Text

Designation of Push Buttons	Text
Momentary contact type	Text
Number of contacts of Push Buttons	Text
Colour	Text
<b><u>Alarm Cancellation Relay</u></b>	
Make of Alarm Cancellation Relay	Text
Type designation of Alarm Cancellation Relay	Text
Number of output contacts of Alarm Cancellation Relay	Text
DC voltage of Alarm Cancellation Relay	Text
Burden of Alarm Cancellation Relay	Text
Type of mounting	Text
<b><u>Transformer Differential Relay</u></b>	
Make of Transformer Differential Relay	Text
Type Designation of Transformer Differential Relay.	Text
Whether percentage biased type	Text
Whether built-in highest units available.	Text
DC Aux. Voltage of Transformer Differential Relay	Text
CT rating of Transformer Differential Relay	Text
Number of out put contact of Transformer Differential Relay	Text
Output contact rating of Transformer Differential Relay	Text
Type of operation indicator of Transformer Differential Relay	Text
<b><u>Aux. relay for T/F fault supervision</u></b>	
Make of Aux. relay for Transformer fault supervision	Text
Type & designation of Aux. relay for Transformer fault supervision.	Text
Number of elements of Aux. relay for Transformer fault supervision.	Text
DC voltage of Aux. relay for Transformer fault supervision	Text
Burden of Aux. relay for Transformer fault supervision	Text
No.of out put contacts of Aux. relay for Transformer fault supervision	Text
Contact rating of Aux. relay for Transformer fault supervision	Text
Type of flag of Aux. relay for Transformer fault supervision	Text
<b><u>Buzzer with auto-stop feature</u></b>	
Make of Buzzer with auto-stop feature	Text
type designation of Buzzer with auto-stop feature	Text
Whether built-in timer provided for Buzzer with auto-stop feature	Text
Timer range & settings of Buzzer with auto-stop feature.	Text
If external timer is envisaged for Buzzer with auto-stop feature, make & type designation	Text
<b><u>Annunciator</u></b>	
Make of Annunciator	Text
Type of Annunciator	Text
General design of Annunciator shall be static	Text
Annunciator shall have 12 nos of windows.	Text
No. of LED per window for Annunciator	Text
Whether annunciator relays of Annunciator is built in.	Text
DC Rating of Annunciator shall be 30 VDC	Text
Burden per window in mA	Text
<b><u>Ammeter</u></b>	
Make	Text
Type	Text
Accuracy of Ammeter shall be 0.5% of FSD + 5 Digits	Text

Size of Ammeter shall be 48 x 96 sq. mm.	Text
Response Time of Ammeter shall be 1 Second	Text
Operating Temperature of Ammeter shall be Up to 55°C	Text
Dielectric strength of Ammeter shall be 2 kV RMS for 1 minute.	Text
Power Consumption of Ammeter shall be less than 3 VA	Text
Ammeter shall be suitable for 50Hz frequency	Boolean
Operating current of Ammeter shall be 1 A	Text
<b><u>Ammeter Selector Switch</u></b>	
Make of Ammeter Selector Switch	Text
Type of Ammeter Selector Switch	Text
Size of Ammeter Selector Switch	Text
Rated insulation Voltage of Ammeter Selector Switch shall be 660 volts	Text
Rated Impulse withstand voltage of Ammeter Selector Switch shall be 6 kV	Text
Rated operational Current of Ammeter Selector Switch shall be 12 A.	Text
<b><u>Voltmeter</u></b>	
Make of Voltmeter	Text
Type of Voltmeter	Text
Accuracy of Voltmeter shall be 0.5% of FSD + 5 Digits	Text
Size of Voltmeter shall be 48 x 96 sq. mm.	Text
Response Time of Voltmeter shall be 1 Second	Text
Operating Temperature of Voltmeter shall be Up to 55°C	Text
Dielectric strength of Voltmeter shall be 2 kV RMS for 1 minute.	Text
Power Consumption of Voltmeter shall be less than 3 VA	Text
Voltmeter shall be suitable for 50Hz frequency	Boolean
Operating current of Voltmeter shall be 1 A	Text
<b><u>Voltmeter Selector Switch</u></b>	
Make of Voltmeter Selector Switch	Text
Type of Voltmeter Selector Switch	Text
Size of Voltmeter Selector Switch	Text
Rated insulation Voltage of Voltmeter Selector Switch shall be 660 volts	Text
Rated Impulse withstand voltage of Voltmeter Selector Switch shall be 6 kV	Text
Rated operational Current of Voltmeter Selector Switch shall be 12 A.	Text
<b><u>Frequency Meter</u></b>	
Make of Frequency Meter	Text
Type of Frequency Meter	Text
Power Consumption of Frequency Meter shall be less than 6 VA	Text
Dielectric strength of Frequency meter shall be 2 kV RMS for 1 minute.	Text
Range of frequency meter shall be 45 Hz to 55 Hz.	Text
Size of Frequency meter shall be 96 sq. mm.	Text
<b><u>General</u></b>	
Whether Type Test reports for test IP:30 as per IS: 2147/ are submitted.	Text
Whether Type Test reports for MEF Meter is submitted.	Text
Whether Type Test reports for Triple Pole Combined non directional 2 O/C + 1 E/F Relay is submitted.	Text
Whether Type Test reports for D. C. Under Voltage Relay is submitted.	Text
Whether Type Test reports for Auxiliary Relay is submitted.	Text
Whether Type Test reports for Master Trip Relay is submitted.	Text
Whether Type Test reports for differential protection Relay is submitted.	Text