

TECHNICAL SPECIFICATION OF THREE PHASE FOUR WIRE CT / PT OPERATED 1 AMP OR 5 AMPS CLASS 0.2S ACCURACY FULLY STATIC AMR COMPATIBLE TOD TRI - VECTOR NET ENERGY METER AS PER CATEGORY "C" OF IS: 15959 / 2011

MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

THREE PHASE FOUR WIRE CT / PT OPERATED
0.2 S CLASS, 1 AMP OR 5 AMPS FULLY STATIC AMR
COMPATIBLE TOD TRI – VECTOR NET ENERGY
METER AS PER CATEGORY "C" OF IS: 15959 / 2011
FOR USE OF HT CONSUMER



TECHNICAL SPECIFICATION NO.
CE/MMC/MS-C-IV/HT/ NET /CAT-C/ T/44, DATE: 22.01.2016

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1.00 SCOPE

This specification covers design; manufacture, testing, supply and delivery of ISI mark HT three phase four wire CT / PT operated 1 Amps or 5 Amps fully Static & AMR compatible TOD Tri - vector Energy Meter import export recording facility as per Category C of IS: 15959 / 2011. The meters shall be suitable for measurement of different electrical parameters listed elsewhere in the document including Active Energy (kWh), Reactive Energy (kVAh), Apparent Energy (kVAh), demand (kVA) Import / Export mode etc. in three phase, four wire balanced / unbalanced loads of HT Consumers. The meter shall also be capable to record measurement of various cumulative energies Import & Export mode separately so as to calculate the Net Energy.

The meter shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to purchaser, who will interpret the meaning of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in these specifications and / or the commercial order or not.

2.00 APPLICATION

For use on HT consumer installations.

3.00 SERVICE CONDITIONS

As per IS: 14697 / 1999 (amended up to date), the meter to perform satisfactorily under Non-Air Conditioned environment (within stipulations of IS). The meters to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

Environmental Conditions

- | | |
|---|-------|
| (a) Maximum ambient temperature | 55° C |
| (b) Maximum ambient temperature in shade | 50° C |
| (c) Minimum temperature of air in shade | 5° C |
| (d) Maximum daily average temperature | 40° C |
| (e) Maximum yearly weighted average temperature | 32° C |

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(f) Relative Humidity	10 to 95 %
(g) Maximum Annual rainfall	1450 mm
(h) Maximum wind pressure	150 Kg/m ²
(i) Maximum altitude above mean sea level	1000 mtrs
(j) Isoceraunic level	50 days/year
(k) Seismic level (Horizontal acceleration)	0.3 g
(l) Climate: Moderately hot and humid tropical climate conducive to rust and fungus growth.	

4.00 STANDARD TO WHICH METER SHALL COMPLY

IS: 15959 / 2011 – Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification for Category – “C” Meters;

IS: 14697 / 1999 (amended up to date) – AC Static Transformer operated Watt-hour and VAR-hour Meters, Class 0.5S – Specification;

CBIP Tech Report 88 amended up to date for AC Static Transformer operated Watt Hour & VAR-Hour Meters (class 0.5S);

IS: 15707 / 2006 Specification for Testing, evaluation, installation & maintenance of AC Electricity Meters-Code of Practice;

CEA regulations and MERC guidelines with latest amendments.

The specifications given in this document supersedes the relevant clauses of IS: 14697 / 1999 (amended up to date) wherever applicable.

The equipment meeting with the requirements of other authoritative standards, which ensures equal or better quality than the standards mentioned above, also shall be considered.

In case the bidder wishes to offer material conforming to the other authoritative standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule.

Copy of such standards with authentic English Translations, shall be furnished along with the offer.

In case of conflict related with communication protocol, the IS: 15959 / 2011 – Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification shall prevail upon.

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For conflict related with other parts of the specification, the order of priority shall be – (i) this technical specification, (ii) IS: 14697 / 1999 (Amended up to date), (iii) IEC, (iv) other authoritative standards.

In case of any difference between provisions of these standards, the provisions of this specification shall prevail.

5.00 GENERAL TECHNICAL REQUIREMENT

1)	TYPE	Three Phase, Four Wire 1 Amp or 5 Amps fully Static AMR compatible TOD Tri - Vector Energy Meter having import export Energy recording facility with Optical & RS 232 Port as per Category C of IS: 15959 / 2011 for use on HT Consumers installation.
2)	FREQUENCY	50 Hz ±5%
3)	ACCURACY CLASS	0.2S
4)	PT SECONDARY VOLTAGE	63.5 V Ph-N
5)	RATED VOLTAGE	110 V Ph-Ph or 3 x 63.5 V Ph-N
6)	VOLTAGE RANGE	+15% to – 30% of rated voltage.
7)	PT RATIO	$\frac{11 \text{ kV}}{\sqrt{3}}$ / $\frac{110 \text{ V}}{\sqrt{3}}$
8)	CT RATIO	1 / 1 Amps; 5 / 5 Amps
9)	BASIC CURRENT (I _b)	1 Amp; 5 Amps.
10)	MAXIMUM CONTINUOUS CURRENT (I _{max})	2 times (200 %) of I _b .
11)	SHORT TIME CURRENT	As per IS: 14697 / 1999.
12)	STARTING CURRENT	0.1% of I _b .
13)	POWER CONSUMPTION	The active and apparent power consumption, in each voltage circuit, at reference voltage,

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		<p>reference temperature and reference frequency shall not exceed 1.0 W and 4 VA.</p> <p>The apparent power taken by each current circuit, at basic current I_b, reference frequency and reference temperature shall not exceed 2 VA.</p>
14)	POWER FACTOR	<p>0.0 Lag – Unity – 0.0 Lead.</p> <p>For leading Power factor, the value of kVAh shall 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.</p> <p>The KVAH calculations (Import mode)= square root of((KWH Import)square+ (KVARH Lag Import) square)</p> <p>In Export Mode= Square root of ((KWH Export)square+(KVARH lag Export+ KVARH Lead Export) square)</p> <p>PF shall be up to 3 decimal.</p>
15)	DESIGN	<p>Meter shall be designed with application specific integrated circuit (ASIC) or micro controller; shall have no moving parts; electronic components shall be assembled on printed circuit board using surface mounting technology; factory calibration using high accuracy (0.1 class) software based test bench.</p>
16)	POWER SUPPLY	SMPS
17)	ISI MARK	The meter shall bear ISI Mark

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18)	TEMPERATURE	The standard reference temperature for performance shall be 27 ^o C. The mean temperature co-efficient shall not exceed 0.03%.
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6.00 CONSTRUCTIONAL REQUIREMENT

6.01 GENERAL MECHANICAL REQUIREMENT

The meter shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially:

- (a) personal safety against electric shock;
- (b) personal safety against effects of excessive temperature;
- (c) safety against spread of fire;
- (d) Protection against penetration of solid objects, dust and water.
- (e) Detection of fraud / pilferage

6.02 The meter shall be projection type and shall be dust and moisture proof. 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.

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

6.04 METER CASE

- 6.04.01 The meter base & cover shall be made out of transparent, unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities.
- 6.04.02 The poly carbonate body of the meter shall conform to IS: 11731 / 1986 (FV-2 Category) besides meeting the test requirement of heat deflection test as per ISO 75, glow wire test as per the IS: 11000 (part 2/SEC-1) 2008 OR IEC PUB 60695-2-12, Ball pressure test as per IEC-60695-10-2 and Flammability Test as per UL 94 or as per IS: 11731 (Part-2) 1986.
- 6.04.03 The transparent Poly-carbonate base and cover of meter shall be ultrasonically welded (continuous welding) so that once the meter is manufactured and tested at factory; it shall 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).

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- 6.04.04 The meter body shall be type tested for IP51 degree of protection as per IS: 12063 against ingress of dust, moisture & vermin. The type test certificate shall be submitted along with the offer.
- 6.04.05 The meter cover shall be secured to base by means of sealable unidirectional captive screws with two holes.
- 6.04.06 The energy meter shall clearly indicate the Export and Import connection marking on the terminal block and terminal cover. The "I" indicates that import terminal which is for solar system and "E" indicates that Export terminal which is for utility connection.

6.05 TERMINALS & TERMINAL BLOCK

- 6.05.01 The terminal block shall be made from high quality non-hygroscopic, fire retardant, reinforced polycarbonate / non-Bakelite material which shall form an extension of the meter case.
- 6.05.02 The material of which the terminal block is made shall be capable of passing the tests given in IS: 13360 (Part 6/Sec 17), ISO 75-1 (1993) & ISO 75-2 (1993) for a temperature of 135°C and a pressure of 1.8 MPa (Method A).
- 6.05.03 The holes in the insulating material which form an extension of the terminal holes shall be of sufficient size to also accommodate the insulation of the conductors.
- 6.05.04 The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating.
- 6.05.05 Screw connections transmitting contact force and screw fixings which may be loosened and tightened several times during the life of meter shall screw into metal nuts.
- 6.05.06 All parts of every terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized.
- 6.05.07 Electrical connections shall be so designed that contact pressure is not transmitted through insulating material of the terminal block.
- 6.05.08 The terminals, the conductor fixing screws or the external or internal conductors shall not be liable to come into contact with terminal covers.
- 6.05.09 Two screws shall be provided in each current & potential terminal for effectively clamping the external leads or thimbles.

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- 6.05.10 Each clamping screw shall engage a minimum of three threads in the terminal. The ends of screws shall be such as not to pierce and cut the conductors used.
- 6.05.11 The minimum internal diameter of terminal hole shall be as per IS: 14697 / 1999 or CBIP Tech Report 88.
- 6.05.12 The manufacturer shall ensure that the supporting webs between two terminals of the terminal block shall be sufficiently high to ensure that two neighboring terminals do not get bridged by dust and there shall not be any possibility of flash over between adjacent terminals of the terminal block.
- 6.05.13 **TERMINAL COVER**
- 6.05.14 The termination arrangement shall be provided with an extended transparent terminal cover as per clause number 6.5.2 of IS: 14697 / 1999 (amended upto date) irrespective of rear connections.
- 6.05.15 The terminal cover shall be made out of same material as that of meter body. The terminal cover shall be unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities. The terminal cover shall be transparent.
- 6.05.16 The terminal cover shall enclose the actual terminals, the conductor fixing screws and unless otherwise specified, a suitable length of external conductors and their insulation.
- 6.05.17 The terminal cover shall be provided with one side hinge.
- 6.05.18 Independent sealing provision shall be made against opening of the terminal cover and front cover to prevent unauthorized tampering. It is necessary to provide unidirectional screws with two holes for sealing purpose of terminal cover. The meter shall be pilfer-proof & tamper-proof.
- 6.05.19 The fixing screws used on the terminal cover for fixing and sealing in terminal cover shall be held captive in the terminal cover.
- 6.05.20 Proper size of grooves shall be provided at bottom of this terminal cover for incoming service connections.
- 6.05.21 When the meter is mounted, no access to the terminals by any means shall be possible without breaking seals(s) of the terminal cover.

6.06 RESISTANCE TO HEAT AND FIRE

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

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6.07 The meter shall be completely factory sealed except the terminal block cover.

6.08 A sticker label containing warning notice in Marathi language which is to be stick up on meters front cover or printed on meter name plate with easily readable font size not less than 10 in red colour, which reads as "सावधान ! "मीटरला फेरफार करण्याचा प्रयत्न केल्यास अधिकतम वेगाने वीज नोंदणी होणार "

6.09 The provision shall be made on the meter for at least two seals to be put by utility user.

6.10 A Push button facility shall be provided for high resolution reading / alternate mode of display, as brought out elsewhere in this specification.

6.11 The energy meter shall clearly indicate the Export and Import connection marking on the terminal block and terminal cover. The "→" indicates that Import terminal / forward and "←" indicates that Export terminal / reverse energy measurement.

6.12 OUTPUT DEVICE

The meter shall have test output accessible from the front and be capable of being monitored with suitable testing equipment while in operation at site. The operation indicator must be visible from front. The test output device shall be provided in the form of blinking LED or other similar devices like blinking LCD. Resolution of the test output device shall be sufficient to enable the starting current test in less than 10 minutes. The pulse rate of output device which is Pulse / kWh and Pulse / kVArh (meter constant) shall be programmed according to primary values of voltage & current & shall be indelibly provided on the nameplate.

6.13 The meter accuracy shall not be affected by magnetic field (AC / DC / Permanent) upto 0.2 Tesla on all the sides of meter, i.e. front, sides, top and bottom of the meter as per CBIP Technical Report 88 with latest amendments. Under influence of any magnetic field (AC / DC / Permanent) above 0.2 Tesla, if the accuracy of the meter gets affected, then the meter shall record energy considering I_{max} and reference voltage at unity power factor.

6.14 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 without affecting the accuracy.

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

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- 6.16** Non specified display parameters in the meter shall be blocked and it shall not be accessible for reprogramming at site.
- 6.17** Complete metering system shall 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.
- 6.18** Internal CTs are to be provided with magnetic shielding and they shall be tested separately prior to assembly by the meter manufacturer.
- 6.19** PCB used in meter shall be made by Surface Mounting Technology.

6.20 REAL TIME INTERNAL CLOCK (RTC)

The real time quartz clock shall be used in the meter for maintaining time (IST) and calendar. The RTC shall be non - rechargeable and shall be pre-programmed for 30 Years Day / date without any necessity for correction. The maximum drift shall not exceed +/- 300 seconds per year.

The clock day / date setting and synchronization shall only be possible through password / Key code command from one of the following:

- a) Common meter reading instrument (CMRI), Laptop Computer or Meter testing work bench and this shall need password enabling for meter;
- b) From remote server through suitable communication network or Sub-station data logger 'PC'.

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

6.21 The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 14697:1999 amended up to date.

6.22 For any higher signals than the present standards and MSEDCL technical specifications indicated above cl. 6.21, the energy meters shall be immune & the accuracy of energy meters shall not get affected.

6.23 The communication of energy meters shall not be affected considering the above feature state in the clause 6.21 & 6.22.

6.24 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.

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The accuracy of the meter shall not be affected with the application of abnormal voltage / frequency generating device such as spark discharge of approximately 35 kV.

The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

- (i) On any of the phases or neutral terminals
- (ii) On any connecting wires of the meter (Voltage discharge with 0-10 mm spark gap)
- (iii) At any place in load circuit.

The accuracy of meter shall be checked before and after the application of above device.

6.25 SELF DIAGNOSTIC FEATURES

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

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

6.26 The watch dog provided shall invariably protect the hanging of microprocessor during such type of tampering devices.

6.27 METER PROTOCOL

The meter protocol shall be as per Annex E - Category C meters of IS: 15959 / 2011.

6.28 COMMUNICATION CAPABILITY

The meter shall be provided with two ports for communication of the measured / collected data as per IS: 15959 / 2011, i.e. a hardware port compatible with RS-232 specifications (RJ - 11 / RJ - 45 type is also acceptable) which shall be used for remote access through suitable Modem (GPRS / GSM / EDGE / CDMA / PSTN / LPR) and an Optical port complying with hardware specifications detailed in IEC - 62056 - 21. This shall be used for local data downloading through a DLMS compliant CMRI. RS-232 port or TCP / IP port as required on terminal block is also acceptable. Sealing arrangement for Optical & RS 232 port or TCP / IP port as required shall be provided.

Both ports shall support the default and minimum baud rate of 9600 bps.

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Necessary chord for Optical Port of minimum length of 1 metre in the ratio 50:1 shall be provided free of cost

The minimum requirements for RS-232 based systems are described below:

- i. The system should support 4 -wire system as per the configuration given as below.

Meter end, starting 1 to 8 from Left to Right

Pin no 8 => RX (+)

Pin no 7 => RX (-)

Pin no 3 => TX(+)

Pin no 6 => TX(-)

- ii. The interface shall meet all the requirements of RS-232 specifications in terms of Physical media, Network topologies, maximum devices, maximum distance, mode of operation, etc.
- iii. Screw type connectors or RJ45 type connectors have to be provided to easily terminate the twisted pair.

6.29 The meter shall have facility to read the default display parameters during Power supply failure. For this purpose an internal battery may be provided.

The internal battery shall be Ni-mh or Li-ion or NI CD maintenance free battery of long life of 10 years. A suitable Push Button arrangement for activation of this battery shall be provided.

6.30 WIRE / CABLE LESS DESIGN

The meter PCB shall be wireless to avoid improper and loose connections/ contacts.

6.31 Reverse reading lock of main KWh reading is to be incorporated with necessary software modification if required additionally.

6.32 The meter shall record and display Fundamental energy excluding Harmonic energy. The energy meter shall record & display harmonic energy separately.

6.33 The data stored in the meters shall not be lost in the event of power failure. The meter shall have Non Volatile Memory (NVM), which does not need any battery backup. The NVM shall have a minimum retention period of 10 years.

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7.00 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 by manufacturer only at site / factory.

At present the time zones shall be programmed as below:

ZONE "A" (TZ1): 0000 Hrs to 0600 Hrs and 2200 Hrs to 2400 Hrs.

ZONE "B" (TZ2): 0600 Hrs to 0900 Hrs and 1200 Hrs to 1800 Hrs.

ZONE "C" (TZ3): 0900 Hrs to 1200 Hrs.

ZONE "D" (TZ4): 1800 Hrs to 2200 Hrs.

8.00 DEMAND INTEGRATION PERIOD

The maximum demand integration period shall be set at 15 minute or 30 minute as per requirement.

9.00 MD RESET

The meter shall have following MD resetting options.

- i) Communication driven reset;
- ii) Manual resetting arrangement with sealing facility;
- iii) Automatic reset at the end of certain predefined period (say, end of the month).

10.00 TAMPER AND FRAUD MONITORING FEATURES

10.01 ANTI TAMPER FEATURES.

The meter shall detect and correctly register energy under following tamper conditions:

- (a) The meter accuracy shall not be affected by change of phase sequence. It shall maintain the desired accuracy in case of reversal of phase sequence.
- (b) The meter shall continue to work even without neutral.
- (c) The meter shall work in absence of any two phases i.e. it shall work on any one phase wire and neutral, to record relevant energy.
- (d) If the accuracy of the meter gets affected under the influence of magnetic field more than 0.2 Tesla, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering the maximum value current (I_{max}) at ref. voltage and unity PF in all the three phases.

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In case of magnetic tamper during export / reverse mode, the energy meter shall record & add the same energy considering I_{max} in import / forward mode.

- (e) If a consumer tries to steal power by disconnecting the voltage supply of one or two phases of the meter externally or by tampering so that no voltage or partial voltage ($< 50\%$ of V_{ref}) is available to voltage circuit of meter & current is flowing in that phase, the meter shall record energy at V_{ref} , current available in these phases & UPF.
- (f) The meter shall be capable of detecting and recording occurrences and restoration for reverse current of any one or two phases with date & time of occurrence and restoration.
- (g) The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 14697:1999 amended up to date. For any higher signals than the present standards and MSEDCL technical specifications indicated above, the energy meters shall be immune & the accuracy of energy meter shall not get affected.

The separate slot with 10 no. occurrences of EMI/EMC tamper along with date & time stamp shall be provided.

10.02 TAMPER EVENTS

- 10.02.01 The meter shall work satisfactorily under presence of various influencing conditions like External Magnetic Field, Electromagnetic Field, Radio Frequency Interference, Harmonic Distortion, Voltage / Frequency Fluctuations and Electromagnetic High Frequency Fields, etc. as per relevant IS.
- 10.02.02 The meter shall record the occurrence and restoration of tamper events of current, voltages, kWh, power factor, event code, date & time etc. listed in Table 32 to 37 of IS: 15959 / 2011.
- 10.02.03 In the event the meter is forcibly opened, even by 2 to 4 mm variation of the meter cover, same shall be recorded as tamper event with date & time stamping as per table 37 of IS: 15959 / 2011 and the meter shall continuously display that the cover has been tampered.
- 10.02.04 The detection of the tamper event shall be registered in the tamper event register. The no. of times the tampering has been done shall also be registered in the meter.

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10.02.05 Tamper details shall be retrieved by authorized personnel through either of the following:

- i) CMRI.
- ii) Remote access through suitable communication network.

10.02.06 Minimum 200 numbers of events (occurrences & restoration with date & time) shall be available in the meter memory. The recording of abnormal events shall be on FIFO basis.

All the information of data shall be made available in simple & easy to understand format.

10.03 The threshold values for various tampers are as below.

Sr. No.	Description	Occurrence (With Occ. Time 5 min.)	Restoration (With Rest. Time 5 min.)
1.	PT link Missing (Missing potential)	< 50% of Vref and current in that phase is > 5% Ib	> 50 % of Vref
2.	Over voltage in any phase	> 115 % of Vref	< 115 % of Vref
3.	Low voltage in any phase	< 70 % of Vref	> 70 % of Vref
4.	Voltage Unbalance	Vmax - Vmin > 10 % Vmax	Vmax - Vmin < 10 % Vmax
5.	CT Open.	Zero Amps in one or two phases and current in at least 1 phase is > 5% Ib for 15 minutes.	> 3 % Ib for 15 min in the tampered phase for 15 min.
6.	Current Unbalance. (Diff. of phase currents)	> 30 % Iref* for 15 min	< 30 % Iref* for 15 min

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7.	Current Bypass	Bypass Current > 50 % I _b for 15 min	Bypass Current < 30 % I _b for 15 min
8.	Current Reversal	Immediate in case of reverse of any one or two phases.	Direction of all the currents are same.
9.	Over Current in any Phase	> 120 % I _b	< 120 % I _b
10.	Influence of permanent magnet or AC / DC electromagnet / permanent magnet	Immediate	1 minute after removal
11.	Neutral Disturbance	--	--
12.	Power failure	For minimum 5 minutes	Immediate
13.	Very Low PF	--	--
14.	Meter Cover Opening	(2 to 4 mm) Immediate (Occurrence only)	
* Higher of 3 phase currents shall be taken as reference for this purpose.			

* The energy meter shall be capable to record & display all tamper with indication of "Import / Export" tamper separately with date and time stamping.

11.00 QUANTITIES TO BE MEASURED & DISPLAYED

The meter shall be capable of measuring and displaying the following electrical quantities within specified accuracy limits for polyphase balanced or unbalanced loads:

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- a) Instantaneous Parameters such as phase and line voltages, currents, power factors, overall kVA, kW, kVAh, power factor, frequency etc as per details given in the table below and IS: 15959 / 2011.
- b) Block Load Profile Parameters such as kVAh / kWh / kVAh (lag / lead) / Maximum Demand (MD) in kW / kVA / power factor / phase and line voltages / currents etc. as per details given in the table below and IS: 15959 / 2011 AMENDED UP TO DATE.
- c) Billing Profile Parameters such as cumulative energy kWh / cumulative kVAh / cumulative energy kVAh, etc. as per details given in the table below and IS: 15959 / 2011 AMENDED UP TO DATE.

In addition to above the meter shall also record the Name plate details, programmable parameters (readable as profile), occurrence and restoration of tamper events along with the parameters (Table 30, 31 32, 33, 34, 35, 36, 37 & 39 respectively) of IS: 15959 / 2011 AMENDED UP TO DATE.

Detail of category wise parameters requirement suitable for HT (CT / PT) consumer metering is given in following tables of IS: 15959 / 2011 AMENDED UP TO DATE.

Category C	Parameter group	Annexure Table No.
HT (CT / PT) consumers Energy Meters	Instantaneous parameters	27
	Block Load Profile parameters	28
	Billing Profile Parameters	29
	Name Plate details	30
	Programmable Parameters	31
	Event Conditions	32 to 37
All logging parameters for each of the event condition for 3 Φ / 4W	Capture parameters for event (Event Log Profile)	39

12.00 DISPLAY OF MEASURED VALUES

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12.01 DISPLAY INDICATORS

The supply indication shall be displayed permanently by LED / LCD as a minimum and shall be visible from the front of the meter. In case of non available of voltage to any phase(s), the LEDs of that particular phase shall stop glowing or those particular indicator(s) shall start blinking on the LCD display of meter.

12.02 Permanently backlit LCD panel shall show the relevant information about the parameters to be displayed. The corresponding non-volatile memory shall have a minimum retention time of 10 years.

In the case of multiple values presented by a single display it shall be possible to display the content of all relevant memories. When displaying the memory, the identification of each parameter applied shall be possible.

The principal unit for the measured values shall be the kilowatt-hour kWh for active energy, kVARh for reactive energy and kVAh for apparent energy.

12.03 The meter shall have 6 digits (with +/- indication), parameter identifier, permanently backlit Liquid Crystal Display (LCD) with wide viewing angle. The size of digit shall be minimum 8x5 mm. The decimal units shall not be displayed in auto scroll mode. However it shall be displayed in push button mode or alternate mode for high resolution display for testing. Auto display cycling push button is required with persistence time of 10 Seconds. LCD shall be suitable for temperature withstand of 70⁰ C; adequate back up arrangement for storing of energy registered at the time of power interruption shall be provided.

12.04 The meters shall be pre-programmed for following details.

- a) PT Ratio: $\frac{11}{\sqrt{3}}$ kV / $\frac{110}{\sqrt{3}}$ V
- b) CT Ratio: 1/1 Amps or 5/5 Amps as per requirement.
- c) MD resetting shall be auto as per clause no. 9.00 (iii).
- d) MD Integration Period is 30 Minutes real time based.
- e) Average power factor with 2 decimal digits shall be displayed.
- f) The array of data to be retained inside the meter memory shall be for the last 45 days for a capture period of 30 minutes. Load survey data shall be first in first out basis (FIFO).
- g) The display of various parameters in Normal Mode & Alternate mode shall be as per table 27 & 29 (except 8 & 9) of Annex E of IS: 15959

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/ 2011 AMENDED UP TO DATE in the sequence as below. Display other than specified below shall be blocked. The scroll period for auto scroll shall be 10 secs

SN	PARAMETERS
A	NORMAL DISPLAY (DEFAULT DISPLAY)
1.	LCD Test
2.	Real Time Clock – Date & Time
3.	Cumulative Energy – kWh (Import)
4.	Cumulative Energy – kVAh - Lag (Import)
5.	Cumulative Energy –kVAh - Lead (Import)
6.	Cumulative Energy – kVAh (Import)
7.	MD – kVA with occurrence date & time
8.	Three Phase Power Factor – PF (Import)
9.	Cumulative Energy – kWh (Export)
10.	Cumulative Energy – kVAh - Lag (Export)
11.	Cumulative Energy –kVAh - Lead (Export)
12.	Cumulative Energy – kVAh (Export)
13.	MD – kVA with occurrence date & time
14.	Three Phase Power Factor – PF (Export)
15.	Number of MD – kVA reset
16.	Cumulative Tamper Count
17.	Meter Cover Opening – Occurrence with date and time.
18.	Rising MD with elapsed time
B	ON DEMAND DISPLAY (ALTERNATE MODE)

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1.	Cumulative Energy – kWh - TOD Zone A (TZ1) (Import)
2.	Cumulative Energy – kWh - TOD Zone B (TZ2) (Import)
3.	Cumulative Energy – kWh - TOD Zone C (TZ3) (Import)
4.	Cumulative Energy – kWh - TOD Zone D (TZ4) (Import)
5.	Cumulative Energy – kVAh - TOD Zone A (TZ1) (Import)
6.	Cumulative Energy – kVAh - TOD Zone B (TZ2) (Import)
7.	Cumulative Energy – kVAh - TOD Zone C (TZ3) (Import)
8.	Cumulative Energy – kVAh - TOD Zone D (TZ4) (Import)
9.	MD - kVA – TOD Zone A (TZ1) with occurrence date & time (Import)
10.	MD - kVA – TOD Zone B (TZ2) with occurrence date & time (Import)
11.	MD - kVA – TOD Zone C (TZ3) with occurrence date & time (Import)
12.	MD - kVA – TOD Zone D (TZ4) with occurrence date & time (Import)
13.	Cumulative Energy – kWh - TOD Zone A (TZ1) (Export)
14.	Cumulative Energy – kWh - TOD Zone B (TZ2) (Export)
15.	Cumulative Energy – kWh - TOD Zone C (TZ3) (Export)
16.	Cumulative Energy – kWh - TOD Zone D (TZ4) (Export)
17.	Cumulative Energy – kVAh - TOD Zone A (TZ1) (Export)
18.	Cumulative Energy – kVAh - TOD Zone B (TZ2) (Export)
19.	Cumulative Energy – kVAh - TOD Zone C (TZ3) (Export)
20.	Cumulative Energy – kVAh - TOD Zone D (TZ4) (Export)
21.	MD - kVA – TOD Zone A (TZ1) with occurrence date & time (Export)
22.	MD - kVA – TOD Zone B (TZ2) with occurrence date & time (Export)
23.	MD - kVA – TOD Zone C (TZ3) with occurrence date & time (Export)

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24.	MD - kVA – TOD Zone D (TZ4) with occurrence date & time (Export)
25.	MD – kVA reset count
26.	Last date & time of MD - kVA reset
27.	Current – I _R
28.	Current – I _Y
29.	Current – I _B
30.	Voltage – V _R
31.	Voltage – V _Y
32.	Voltage – V _B
33.	Signed Power Factor – R Phase (Import)
34.	Signed Power Factor – Y Phase (Import)
35.	Signed Power Factor – B Phase (Import)
36.	Signed Power Factor – R Phase (Export)
37.	Signed Power Factor – Y Phase (Export)
38.	Signed Power Factor – B Phase (Export)
39.	Frequency
40.	High resolution kWh (for calibration)
41.	High resolution kVArh (for calibration)
42.	M1 MD - kVA – TOD Zone A (TZ1) with occurrence date & time (Import)
43.	M1 MD - kVA – TOD Zone B (TZ2) with occurrence date & time (Import)
44.	M1 MD - kVA – TOD Zone C (TZ3) with occurrence date & time (Import)
45.	M1 MD - kVA – TOD Zone D (TZ4) with occurrence date & time (Import)
46.	M2 MD - kVA – TOD Zone A (TZ1) with occurrence date & time (Import)

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47.	M2 MD - kVA – TOD Zone B (TZ2) with occurrence date & time (Import)
48.	M2 MD - kVA – TOD Zone C (TZ3) with occurrence date & time (Import)
49.	M2 MD - kVA – TOD Zone D (TZ4) with occurrence date & time (Import)
50.	M1 MD - kVA – TOD Zone A (TZ1) with occurrence date & time (Export)
51.	M1 MD - kVA – TOD Zone B (TZ2) with occurrence date & time (Export)
52.	M1 MD - kVA – TOD Zone C (TZ3) with occurrence date & time (Export)
53.	M1 MD - kVA – TOD Zone D (TZ4) with occurrence date & time (Export)
54.	M2 MD - kVA – TOD Zone A (TZ1) with occurrence date & time (Export)
55.	M2 MD - kVA – TOD Zone B (TZ2) with occurrence date & time (Export)
56.	M2 MD - kVA – TOD Zone C (TZ3) with occurrence date & time (Export)
57.	M2 MD - kVA – TOD Zone D (TZ4) with occurrence date & time (Export)
58.	Last Tamper Event with date and time.
(C) Test mode display:	
59.	High Resolution total kWh Import
60.	High Resolution total kVArh Import Lag
61.	High Resolution total kVArh Import Lead
62.	High Resolution total kVAh Import
63.	Rising Demand Import kVA with elapsed time (Simultaneously displayed)
64.	High Resolution total kWh Export
65.	High Resolution total kVArh Export Lag
66.	High Resolution total kVArh Export Lead
67.	High Resolution total kVAh Export

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68.	High Resolution total kWh Import
69.	Rising Demand Export kVA with elapsed time (Simultaneously displayed)

h) Other KVA MD values shall be available in reset backup data for 6 months.

i) The meter display shall return to Default Display mode (mentioned above) if the 'Push button' is not operated for 15 seconds.

All test mode parameters shall have resolution of 4 decimal places.

NOTE:

- a. It shall be possible to scroll through the parameters (up & down) manually in all the three display modes.
- b. Manual display Hold / Unhold facility shall be provided. The meter shall return to Auto scrolling mode if Unhold activation is not done for 30 minutes.

13.00 BILLING DATA, BILLING HISTORY & BLOCK LOAD SURVEY

13.01 BILLING DATA

The billing data shall be as per table 29 of Annex E of IS: 15959 / 2011 AMENDED UP TO DATE for category C and is summarised as below.

Sr. No.	Parameters
1.	Billing Date
2.	System Power Factor for Billing Period
3.	Cumulative Energy – kWh (Import)
4.	Cumulative Energy – kWh - TOD Zone A (TZ1) (Import)
5.	Cumulative Energy – kWh - TOD Zone B (TZ2) (Import)
6.	Cumulative Energy – kWh - TOD Zone C (TZ3) (Import)
7.	Cumulative Energy – kWh - TOD Zone D (TZ4) (Import)
8.	Cumulative Energy – kWh (Export)

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9.	Cumulative Energy – kWh - TOD Zone A (TZ1) (Export)
10.	Cumulative Energy – kWh - TOD Zone B (TZ2) (Export)
11.	Cumulative Energy – kWh - TOD Zone C (TZ3) (Export)
12.	Cumulative Energy – kWh - TOD Zone D (TZ4) (Export)
13.	Cumulative Energy – kVARh – Lag (Import)
14.	Cumulative Energy – kVARh – Lead (Import)
15.	Cumulative Energy – kVARh – Lag (Export)
16.	Cumulative Energy – kVARh – Lead (Export)
17.	Cumulative Energy – kVAh (Import)
18.	Cumulative Energy – kVAh - TOD Zone A (TZ1) (Import)
19.	Cumulative Energy – kVAh – TOD Zone B (TZ2) (Import)
20.	Cumulative Energy – kVAh – TOD Zone C (TZ3) (Import)
21.	Cumulative Energy – kVAh – TOD Zone D (TZ4) (Import)
22.	Cumulative Energy – kVAh (Export)
23.	Cumulative Energy – kVAh - TOD Zone A (TZ1) (Export)
24.	Cumulative Energy – kVAh – TOD Zone B (TZ2) (Export)
25.	Cumulative Energy – kVAh – TOD Zone C (TZ3) (Export)
26.	Cumulative Energy – kVAh – TOD Zone D (TZ4) (Export)
27.	MD – kVA with occurrence date & time (Import)
28.	MD – kVA – TOD Zone A (TZ1) with occurrence date & time (Import)
29.	MD – kVA – TOD Zone B (TZ2) with occurrence date & time (Import)
30.	MD – kVA – TOD Zone C (TZ3) with occurrence date & time (Import)
31.	MD – kVA – TOD Zone D (TZ4) with occurrence date & time (Import)

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32.	MD – kVA with occurrence date & time (Export)
33.	MD – kVA – TOD Zone A (TZ1) with occurrence date & time (Export)
34.	MD – kVA – TOD Zone B (TZ2) with occurrence date & time (Export)
35.	MD – kVA – TOD Zone C (TZ3) with occurrence date & time (Export)
36.	MD – kVA – TOD Zone D (TZ4) with occurrence date & time (Export)
37.	MD – kW occurrence date & time (Import)
38.	MD – kW – TOD Zone A (TZ1) with occurrence date & time (Import)
39.	MD – kW – TOD Zone B (TZ2) with occurrence date & time (Import)
40.	MD – kW – TOD Zone C (TZ3) with occurrence date & time (Import)
41.	MD – kW – TOD Zone D (TZ4) with occurrence date & time (Import)
42.	MD – kW occurrence date & time (Export)
43.	MD – kW – TOD Zone A (TZ1) with occurrence date & time (Export)
44.	MD – kW – TOD Zone B (TZ2) with occurrence date & time (Export)
45.	MD – kW – TOD Zone C (TZ3) with occurrence date & time (Export)
46.	MD – kW – TOD Zone D (TZ4) with occurrence date & time (Export)
47.	Harmonic Energy HkWh (Import)
48.	Harmonic Energy HkWh (Export)

13.02 BILLING HISTORY

The meter shall have sufficient non-volatile memory for recording history of billing parameters for last 13 months.

13.03 BLOCK LOAD SURVEY

The Block Load survey data shall be logged on non time based basis, i.e. if there is no power for more than 24 hours, the day shall not be recorded. Whenever meter is taken out and brought to laboratory, the load survey data shall be retained for the period of actual use of meter. This load survey data can be retrieved as and when desired and

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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.

The Block Load survey data shall be for specified parameters as per table 28 (except 8 & 9) for 3 Φ /4W system of measurement with NEUTRAL as reference point of Annex E of IS: 15959 / 2011 AMENDED UP TO DATE. The specified parameters are as below.

Sr. No.	Parameters
1.	Real Time Clock – Date and Time
2.	Current - I _R
3.	Current – I _Y
4.	Current – I _B
5.	Voltage – V _{RN}
6.	Voltage – V _{YN}
7.	Voltage – V _{BN}
8.	Block Energy – kWh Import mode
9.	Block Energy – kVAh – Lag Import mode
10.	Block Energy – kVAh – Lead Import mode
11.	Block Energy – kVAh Import mode
12.	Block Energy – kWh Export mode
13.	Block Energy – kVAh – Lag Export mode
14.	Block Energy – kVAh – Lead Export mode
15.	Block Energy – kVAh Export mode
16.	Voltage THD in Import Mode
17.	Voltage THD in Export Mode

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18.	Current THD in Import Mode
19.	Current THD in Export Mode

14.00 DEMONSTRATION

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

15.00 PERFORMANCE UNDER INFLUENCE QUANTITIES

The meters performance under influence quantities shall be governed by IS: 14697 / 1999 (amended upto date) and CBIP Tech. Report 88. The accuracy of meter shall not exceed the permissible limits of accuracy as per standard IS: 14697 / 1999 (amended upto date). In case of conflict, the priority shall be as per clause no. 5.00 of this specification.

16.00 COMMON METER READING INSTRUMENT (CMRI)

16.01 To enable local reading of meters data, a DLMS compliant CMRI shall be provided.

16.02 The CMRI shall be as per specification given in Annex J of IS: 15959 / 2011 AMENDED UP TO DATE.

16.03 It shall be compatible to the DLMS compliant energy meters that are to be procured / supplied on the basis of this specification.

16.04 The CMRI shall be supplied by the meter manufacturer along with the meter free of cost in the ratio of one for each 100 Nos. meters supplied including user manual and a set of direct communication cords for data downloading to the Laptop or PC for each CMRI.

16.05 There shall be a provision for auto power save on CMRI, which shall force the instrument in the power saving mode in case of no-activity within 5 minutes. The data shall not be lost in the event the batteries are drained or removed from the CMRI.

16.06 The CMRI shall have a memory capacity of 8 MB SRAM (Static RAM) with battery backup & upgradeable and BIOS / OS on FLASH / EEPROM Memory of 256 KB.

16.07 The manufacturer / supplier shall modify the compatibility of CMRI with the meter and the base computer system due to any change in language or any other reasons at their own cost within guarantee period.

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- 16.08** The CMRI shall be type tested for (a) Tests of Mechanical requirement such as Free fall test, Shock Test, Vibration test, (b) Tests of Climatic influences such as Tests of Protection against Penetration of Dust and Water (IP 6X), Dry Heat test, Cold Test, Damp Heat Cyclic Test, (c) Tests for Electromagnetic Compatibility (EMC), (d) Test of Immunity to Electromagnetic HF Fields and (e) Radio Interference Measurement.
- 16.09** The equipments offered shall be fully type tested at approved laboratory by National Accreditation Board for Testing and Calibration Laboratories (NABL) as per relevant standards within last 5 years from the date of opening of tender & the type test reports shall be enclosed with the offer.
- 17.00 COMPUTER SOFTWARE.**
- 17.01** For efficient and speedy recovery of data downloaded through CMRI on base computer, licensed copies of base computer software shall have to be supplied free of cost. This software will be used at number of places up to Division level. As many copies of base computer software as required up to Division level shall be provided by Supplier.
- 17.02** The meter shall be capable to communicate directly with laptop computer. Base Computer Software shall be suitable for all types of printers such as dot matrix, inkjet, deskjet and laser printers.
- 17.03** The Base Computer Software shall be "Windows" based & user friendly. The data transfer shall be highly reliable and fraud proof (No editing shall be possible on base computer as well as CMRI by any means). The software shall have capability to convert all the data into ASCII format/XML format as per MIOS.
- 17.04** The Base Computer Software should be password protected.
- 17.05** The total time taken for downloading Billing, Tamper and Load Survey Data for 45 days shall be less than or equal to 5 minutes.
- 17.06** Downloading time of only Billing data shall be less than or equal to 20 secs.
- 17.07** The BCS software shall create one single file for the uploaded data, e.g. if CMRI contains the meter readings of, say, 2,000 consumer meters and the said data is uploaded to BCS, then the BCS shall create a single file containing separate records for each consumer meter reading in ASCII format or XML file as per MIOS for individual meter reading.
- 17.08** Meter manufacturers should also need to submit Convert API (API3) as per MIOS universal standard along with Base Computer System free of

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cost. This API should be capable of converting both data i.e. AMR data collected from Read API (API1) and MRI data collected from CMRI.

17.09 Also there shall be a provision to give filenames while creating the file.

17.10 As and when the meter manufacturer releases new or latest or advanced versions of meter hardware / firmware / software (such as Base Computer System, API3 etc), the same shall be made available to purchaser immediately on the release date free of cost. The latest version shall support all existing hardware / meters in the field. The meter manufacturer should also provide support for changes and integration of Base Computer System and API3.

17.11 The meter samples shall be tested by our IT Department for the time required for downloading the data as per specifications and as confirmed by the bidder.

17.12 Downloading software shall also be provided so as to install on our Laptop for downloading data directly on Laptop from meter without the use of CMRI.

17.13 The software provided on laptop or PC shall be compatible to read the data from USB drive and for that purpose a sample cable (1 No.) shall be provided with USB termination. USB being the de-facto standard, this is the requirement.

17.14 MSEDCL is procuring large quantity of meters. As such manufacturer have to depute Hardware Engineers and Software Engineers on call basis, who shall have thorough knowledge of meter hardware / software used for downloading and converting so as to discuss the problems, if any, or new development in the hardware / software with Chief Engineer, MM Cell / Chief General Manager (IT), MSEDCL, Prakashgad, Bandra (E), Mumbai – 400051 without any additional charge.

18.00 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 shall appear in the above diagram. The diagram & terminal marking on sticker shall not be allowed.

19.00 NAME PLATE AND MARKING OF METERS

Meter shall have a name plate 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

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Coded along with numeric number. The size of bar coded number shall 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.

The meter shall also store name plate details as given in the table 30 of Annex F of IS: 15959 / 2011 AMENDED UP TO DATE. These shall be readable as a profile as and when required.

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

- (i) Purchase order no. & date
- (ii) Month and Year of manufacture
- (iii) Name of purchaser, i.e. MSEDCL
- (iv) Guarantee Five Years
- (v) ISI mark
- (vi) Category of Meter: **Category C – HT (PT / CT) Consumer Meter.**
The lettering shall be bold in 3 mm font.

A sticker label containing warning notice in Marathi language which is to be stick up on meters front cover or printed on meter name plate with easily readable font size not less than 10 in red colour, which reads as " सावधान ! "मीटरला फेरफार करण्याचा प्रयत्न केल्यास अधिकतम वेगाने वीज नोंदणी होणार "

20.00 TESTS

20.01 TYPE TESTS

The meter offered shall have successfully passed all the type tests described in IS: 14697 / 1999 (amended upto date), external AC / DC / permanent magnetic influence tests as per CBIP Tech Report 88 with latest amendments and this specification and the meter Data Transfer and Communication capability as per IS: 15959 / 2011 AMENDED UP TO DATE.

The type test reports shall clearly indicate the constructional features of the type tested meter. Separate type test reports for each offered type of meter shall be submitted.

The type test certificates as per IS: 14697 / 1999 (amended upto date) shall be submitted along with the offer. The type test certificate carried out during last three years from the date of opening the tender shall be valid. The Type test certificate of metering protocol as per IS: 15959 /

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2011 AMENDED UP TO DATE shall be submitted alongwith the offer, and the same shall not be more than 36 months old at the time of submission.

The Type test certificate of metering protocol as per - Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification may also be acceptable alongwith offer for evaluation purpose only.

All the type test including Additional acceptance test as per cl. no. 20.04 & Metering protocol report as per IS 15959 : 2011 shall be got approved from the Chief Engineer, MSEDCL, Material Management Cell, Prakashgad, Mumbai before commencement of supply.

All the Type Tests specified in the technical specifications shall be carried out at laboratories which are accredited by the National Board of Testing and Calibration Laboratories (NABL) of Govt. of India such as ERDA, ERTL, CPRI, etc. Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.

Further Purchaser shall reserve the right to pick up energy meters at random from the lots offered and get the meter tested at third party lab i.e. CPRI / agencies listed at Appendix - C of Latest – standardization of AC static electrical energy meters – CBIP publication No. 304 / NPL / CQAL / ERTL / ERDA at the sole discretion of the purchaser at the purchaser's cost. The supplier shall have no right to contest the test results of the third party lab or for additional test and has to replace / take corrective action at the cost of the supplier. 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.

Make & type of major components used in the type-tested meter shall be indicated in the QAP.

20.02 ACCEPTANCE TESTS

Criteria for selection for such tests and performance requirements shall be as per IS: 14697 / 1999 (reaffirmed 2004).

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

All acceptance tests as per IS: 11731 (Part-2)/ 1986 shall be carried out on the meter body, heat deflection test as per ISO:75, glow wire test as per the IS:11000 (part 2/SEC-1) 1984 OR IEC PUB 60695-2-12, Ball pressure test as per IEC--60695-10-2 and Flammability Test as per UL 94 or as per IS: 11731 (Part-2)/ 1986.

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20.03 ROUTINE TESTS

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

20.04 ADDITIONAL ACCEPTANCE TESTS

The following additional tests shall be carried out in addition to the acceptance tests specified in IS: 14697 / 1999 (amended up to date)

(a) TRANSPORTATION TEST

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

(b) 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 tests 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 T for minimum period of 15 minutes shall be carried out by putting the magnet on the meter body. If, during the test, the accuracy of the meter gets affected, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering I_{max} and reference voltage at unity power factor in all the three phases. After removal of magnet, meter shall be subjected to accuracy test as per IS: 14697 / 1999 (amended upto date). No deviation in error is allowed in the class index as per IS: 14697 / 1999 (amended upto date) & this specification.
- v) The meter shall withstand impulse voltage at 10 kV.

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- vi) The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 14697:1999 amended up to date.

Jammer test for sample meters shall be carried out at MSEDCL's Testing Division.

The tests 20.04 (b) (i) to (iii) shall be carried out at factory for each inspected lot at the time of pre dispatch inspection.

The tests 20.04 (b) (iv) to (vi) shall be carried out on one sample from first lot as per procedure laid down in IS: 14697 / 1999 (amended up to date), CBIP Tech Report 88 (with latest amendments) at Third party NABL Accredited lab . The test report shall be got approved from Chief Engineer, MM Cell before commencement of supply.

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

21.00 GUARANTEED TECHNICAL PARTICULARS

The tenderer shall furnish the particulars giving specific required details of meters in schedule 'A' attached. The offers without the details in Schedule 'A' stand rejected.

22.00 PRE-DESPATCH INSPECTIONS

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 MSEDCL'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 Executive Engineer, Testing Division & the Executive Engineer, Inspection Wing.

23.00 JOINT INSPECTION AFTER RECEIPT AT STORES (Random Sample Testing)

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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 (meters received in damage condition shall not be selected as samples) and these meters will be tested by our Testing Engineer in presence of Supplier's representative jointly for (i) no load condition test, (ii) limits of error test (iii) starting current test, (iv) repeatability of error test (v) tamper conditions and (vi) data downloading time as per this specification.

The 5 days advance intimation will be given to the supplier and if the suppliers fail to attend the joint inspection on the date informed, the Testing will be carried out by our Testing Engineer in absence of supplier's representative. If the meters failed in above random sample testing, the lot will be rejected.

24.00 GUARANTEE

The meter & CMRI supplied shall be guaranteed for a period of 66 months from the date of supply or 60 months from the date of commissioning, whichever is earlier. Bidders shall guarantee to replace free of cost the meters which are found defective / inoperative at the time of installation, or become inoperative / defective during guarantee period. Replacements shall be effected within one month from the date of intimation. If the defective meters are not replaced within the specified period above, MSEDCL shall recover an equivalent amount plus 15% supervision charges from any of the bills of the supplier.

25.00 PACKING

25.01 The meters & CMRIs shall be suitably packed in order to avoid damage or disturbance during transit or handling. Each meter & CMRI 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.

25.02 The following information shall be furnished with the consignment:

- Name of the consignee
- Details of consignment

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- Destination
- Total weight of the 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 & spare material.

26.00 TENDER SAMPLE

Tenderer are required to submit 11 (Eleven) nos. of sample meters and 1 (One) no. of sample CMRI of offered type / item as per technical specifications from any one of the factories on or before the time & date stipulated for submission of offer for testing the sample meters in third party NABL Lab like ERDA, CPRI, CIPET, ERTL, etc. The offer of those eligible bidders shall only be considered if the sample passes the tests at NABL Lab. The results of NABL Lab shall not be disputed and same shall be binding on the bidder. The required information such as Manufacturer's Name or Trade Name, Sr. No., ISI Certification No., etc. shall be on stickers to be affixed on outer portion of sample meters being submitted along with the offer. Such information shall not be embossed or printed on any part of the sample meter.

Out of these, two samples shall be without Ultrasonic welding to confirm constructional features.

27.00 QUALITY CONTROL

The purchaser shall send a team of experienced engineers for assessing the capability of the firm for manufacturing of meters as per this specification. The team should be given all assistance and co-operation for inspection and testing at the bidder's works. 3 tender samples should be kept ready for assessing and testing. The tenderer has to give all facilities for carrying out the testing of these samples.

28.00 MINIMUM TESTING FACILITIES

28.01 Manufacturer shall possess fully computerized Meter Test Bench System for carrying out routine and acceptance Tests as per IS: 14697 / 1999 (amended up to date). In addition, this facility shall produce Test Reports for each and every meter. The bidder shall have fully automatic Test Bench having in-built constant voltage, current and frequency source with facility to select various loads automatically and print the

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errors directly. The list of testing equipments shall be enclosed. The manufacturer shall have the necessary minimum testing facilities for carrying out the following tests:

Sr. No.	Name of Test
(1)	A.C. Voltage test
(2)	Insulation Resistance Test
(3)	Test of Accuracy Requirement
(4)	Test on limits of errors
(5)	Test on meter constant
(6)	Test of starting condition
(7)	Test of no-load condition
(8)	Repeatability of error test
(9)	Test of power Consumption
(10)	Vibration test
(11)	Shock Test
(12)	Transportation Test - as per MSEDCL specification
(13)	Tamper conditions - as per MSEDCL specification
(14)	Glow Wire Test
(15)	Long duration test
(16)	Flammability Test
(17)	The manufacturer shall have duly calibrated RSS meter of class 0.01 accuracy

28.02 METER SOFTWARE

The Bidders will have to get appraised & obtain CMMI – Level III within one year from date of letter of award.

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28.03 Notwithstanding anything stated herein under, the Purchaser reserves the right to assess the capacity and capability of the bidder to execute the work, shall the circumstances warrant such assessment in the overall interest of the Purchaser.

29.00 MANUFACTURING PROCESS, ASSEMBLY, TESTING.

29.01 Meters shall be manufactured using latest and 'state of the art' technology and methods prevalent in electronics industry. The meter shall be made from high accuracy and reliable surface mount technology (SMT) components. All inward flow of major components and sub assembly parts (CT, PT, RTCs / Crystal, LCDs, LEDs, power circuit electronic components, etc.) shall have batch and source identification. Multilayer 'PCB' assembly with 'PTH' (Plated through Hole) using surface mounted component shall have adequate track clearance for power circuits. SMT component shall be assembled using automatic 'pick-and-place' machines, Reflow Soldering oven, for stabilized setting of the components on 'PCB'. For soldered PCBs, cleaning and washing of cards, after wave soldering process is to be carried out as a standard practice. Assembly line of the manufacturing system shall have provision for testing of sub-assembled cards. Manual placing of components and soldering, to be minimized to items, which cannot be handled by automatic machine. Handling of 'PCB' with ICs / C-MOS components, to be restricted to bare minimum and precautions to prevent 'ESD' failure to be provided. Complete assembled and soldered PCB shall undergo functional testing using computerized Automatic Test Equipment.

Test points shall be provided to check the performance of each block / stage of the meter circuitry. RTC shall be synchronized with NPL time at the time of manufacture. Meters testing at intermediate and final stage shall be carried out with testing instruments, duly calibrated with reference standard, with traceability of source and date.

The manufacturer shall submit the list of plant and machinery along with the offer.

29.02 MANUFACTURING ACTIVITIES

Quality shall be ensured at the following stages:

- (a) At PCB manufacturing stage each board shall be subjected to computerized bare board testing.
- (b) At insertion stage all components should under go computerized testing for conforming to design parameters and orientation.

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- (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 ageing test (i.e. Meters shall 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 shall work satisfactory to eliminate infant mortality.
- (e) The calibration of meters shall be done in-house.
- (f) The bidders shall 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 shall 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.
- (h) List of Plant and Machinery:

Sr. No.	List of Plant and Machinery used for Energy meter Production	
1	Fully automatic testing Bench with ICT for testing link less meters	Routine Testing and Calibration of Meters
2	Semi automatic testing Bench with MSVT	Routine Testing and Calibration of Meters
3	IR Tester	Insulation testing
4	HV Tester	Insulation testing
5	Error calculators	Error testing
6	Long duration Running test set ups	Reliability Testing
7	Reference Meters Class 0.1 accuracy	Error calculation
8	Ultrasonic welding Machines	Welding of meters

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9	Automatic Pick and Place Machines	Automatic placing of SMT components
10	Solder Paste Printing Machine	SMT soldering
11	Soldering Furnace IR reflow	SMT soldering
12	PCB Scanner	For testing of PCBs
13	ATE functional tester	For testing of Components
14	Programmiers and Program Loaders	Chip Programming Tools
15	CAD PCB designing setups	PCB designing
16	Furnace IR type for Hybrid Micro Circuits	resistance network and HMC manufacturing
17	Laser Trimming Machines	trimming of resistances for higher accuracy measurement
18	Wave Soldering Machines	Wave soldering of PCBs
19	Humidity Chamber	Accelerated testing for Life cycle
20	Dry Heat Test Chamber	Accelerated testing for Life cycle
21	Thermal Shock Chamber	Accelerated testing for Life cycle
22	PRO - E Mechanical Design Stations	Mechanical CAD stations
23	Spark Erosion Tool fabricating Machine	Tool fabrication and Die manufacturing
24	CNC wire Cut Tool Fabrication machine	Tool fabrication and Die manufacturing

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25	CNC Milling Machine for composite tool fabrication	Tool fabrication and Die manufacturing
26	Injection Moulding Machine	Moulding of plastic parts
27	Vibration testing Machine	Vibration testing of Meters
28	Glow Wire Test machine	Testing of Plastic Material
29	Fast transient burst testing setup	Type testing of Meters
30	Short term over Current testing setup	Type testing of Meters
31	Magnetic and other tamper testing setups	Tamper Testing
32	Impulse Voltage Testing Setup	Type testing of Meters
33	Composite Environmental testing chambers	Type testing of Meters

30.00 QUALITY ASSURANCE PLAN

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

30.02 Precautions taken for ensuring usage of quality raw material and sub component shall be stated in QAP.

31.00 COMPONENT SPECIFICATION.

As per Annexure II enclosed.

32.00 SCHEDULES.

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

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Schedule 'A' ... Guaranteed and technical particulars. (As per GTP uploaded on e -tendering site)

Schedule 'C' ... Tenderer 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 shall not be entertained. If it is observed that there are deviations in the offer in Guaranteed Technical Particulars, then, such deviations shall be treated as deviations.

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SCHEDULE 'C'

TENDERER'S EXPERIENCE

Tenderer shall furnish here a list of similar orders executed / under execution for supply of CT Operated Static TOD Energy Meters by them to whom a reference may be made by purchaser in case he consider such a reference necessary.

Sr. No.	Name of client	Order No. & Date	Qty. Ordered	Qty. Supplied
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NAME OF FIRM _____

NAME & SIGNATURE OF TENDERER _____

DESIGNATION _____

DATE _____

**TECHNICAL SPECIFICATION OF THREE PHASE FOUR WIRE CT / PT OPERATED 1 AMP
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ANNEXURE I

QUALITY ASSURANCE PLAN

- A) The bidder shall invariably furnish the following information along with 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 limitations 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 along with 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 plan 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:

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

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ANNEXURE II

COMPONENT SPECIFICATION

Sr. No.	Component function	Requirement	Makes and Origin
1	Current Transformers	The Meters shall be with the current transformers as measuring elements.	The current transformer shall 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 shall be with the Surface mount type along with the ASICs.	<p>USA: Analog Devices, Cyrus Logic, Atmel, Philips Teridian, Dallas, ST, Texas Instruments, Motorola, National Semi-conductor, Maxim, Onsemiconductors, Freescale</p> <p>Germany: Siemens, Infineon, Toshiba, Renasas, Hitachi.</p> <p>Austria: AMS</p> <p>Holland: Philips (N X P)</p> <p>South Africa: SAMES</p> <p>Japan: NEC</p>
3	Memory chips	The memory chips shall not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. There shall be security isolation between metering circuit, communication circuit, and power circuit.	<p>USA: Atmel, Teridian, Philips ST, National Semiconductors, Texas Instruments, Microchip, Spanson (Fujitsu), Ramtron.</p> <p>Japan: Hitachi, Renasas.</p> <p>Germany: Siemens</p>
4	Display modules	a) The display modules shall be well protected from the	Singapore: Bonafied Technologies, E-smart

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		<p>external UV radiations.</p> <p>b) The display visibility shall be sufficient to read the Meter mounted at height of 0.5 meter as well as at the height of 2 meters.</p> <p>c) The construction of the modules shall be such that the displayed quantity shall not disturbed with the life of display (PIN Type).</p> <p>d) It shall be trans-reflective HTN (Hyper Twisted Nematic (120°)) or STN (Super Twisted Nematic (160°)) type industrial grade with extended temperature range.</p>	<p>Displaytech,</p> <p>Korea: Union Display Inc. Advantek, Jebon,</p> <p>Japan: Hitachi, Sony, L & G.</p> <p>Malaysia: Crystal Clear Technology.</p> <p>Hongkong: Genda</p> <p>China: Success, Tinma, Haijing, Truly.</p>
5	Communication Modules	<p>Communication modules shall 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)</p>	<p>USA: HP, Optonica, National Semiconductors,</p> <p>Holland/Korea: Phillips</p> <p>Japan: Hitachi</p> <p>Taiwan: Ligitek</p>
6	Optical port	<p>Optical port shall be used to transfer the meter data to meter reading instrument.</p> <p>The mechanical construction of the port shall be such to facilitate the data transfer easily.</p>	<p>USA: HP, National Semiconductors, Maxim</p> <p>Holland/Korea: Phillips</p> <p>Japan: Hitachi</p> <p>Taiwan: Ligitek</p>
7	Power supply	<p>The power supply shall be with the Capabilities as per</p>	<p>SMPS Type</p>

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		the relevant standards. The power supply unit of the meter shall not be affected in case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections	
8	Electronic components	The active & passive components shall be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	<p>USA: Atmel, National Semiconductors, Texas Instruments, Philips, BC Component, Analog devices, ST, Freescale, Onsemiconductors, Maxim, AVX,, Intersil, Raltron, Sipex,, Kemet, Fairchild, Fox, Muruta, Agilent, Abracon, Diode Inc, Honeywell, Power Integration, Roham.</p> <p>Japan: Hitachi, Oki, AVZ or Ricon, Toshiba, Epson, Kemet, Alps Muruta, TDK, Sanyo, Samsung.</p> <p>India: KELTRON, Incap, VEPL, PEC, RMC, Gujarat, Polyavx, Cermet, Prismatic, MFR Electronic Components Pvt. Ltd,</p> <p>Korea: Samsung</p> <p>Japan: Panasonic</p> <p>Germany: Vishay, Epcos, Diotech, Kemet.</p>
9	Mechanical parts	(i) The internal electrical components shall be of	

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		<p>electrolytic copper & shall be protected from corrosion, rust etc.</p> <p>(ii) The other mechanical components shall be protected from rust, corrosion etc. by suitable plating / painting methods.</p>	
10	Battery	Chargeable maintenance free guaranteed life of 10 years.	<p>USA: Maxell, Renata, Tedirun,</p> <p>Japan: Sony, National, Panasonic, Mitsubishi, Sanyo.</p> <p>Germany: Varta</p> <p>France: Saft</p> <p>Korea: Tekcell, Vitzrocell.</p>
11	RTC & Micro controller.	The accuracy of RTC shall be as per relevant IEC / IS standards.	<p>USA: Philips, Dallas Atmel, Motorola, Microchip, Epson, ST, Teridian</p> <p>Japan: NEC or Oki.</p>
12	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm.	