

TECHNICAL SPECIFICATION OF LT AC THREE PHASE, FOUR WIRE, 10 - 40 AMPS AMR COMPATIBLE STATIC TOD TRI - VECTOR ENERGY METER WITH NET METERING ARRANGEMENT AS PER CATEGORY - C OF IS: 15959 / 2011.

MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

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TECHNICAL SPECIFICATION NO.

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1.00 SCOPE

This specification covers the design, engineering, manufacture, assembly, stage testing, inspection and testing before dispatch and delivery at designated stores of ISI marked LT AC Three Phase, Four wire, 10 - 40 Amps fully Static AMR compatible TOD Tri – vector Energy Meters with Net Metering arrangement consumer as per Category – C of IS: 15959 / 2011 of class 1.0 accuracy confirming to IS: 13779 / 1999 amended upto date suitable for measurement of different electrical parameters listed elsewhere in the document including Active Energy (kWh), Reactive Energy (kVArh), Apparent Energy (kVAh) Import / Export mode etc. in three phase, four wire balanced / unbalanced loads of LT 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 MINIMUM TESTING FACILITIES

2.01 Manufacturer shall possess fully computerized Meter Test Bench System for carrying out routine and acceptance Tests as per IS: 13779 / 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 errors directly. The list of testing equipments shall be enclosed.

2.02 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

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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 0.1 accuracy.
18.	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 errors directly.

2.03 Meter Software

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

2.04 Notwithstanding anything stated herein under, the Purchaser reserves the right to assess the capacity and capability of the bidder to execute the

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work, shall the circumstances warrant such assessment in the overall interest of the Purchaser.

3.00 STANDARDS TO WHICH METERS SHALL COMPLY

IS: 15959 / 2011 Data Exchange for Electricity Meter Reading, Tariff and Load Control – companion specification for **Category C Meters**.

IS: 13779 / 1999 amended upto date and other relevant IS specifications including CBIP Tech report 88 amended upto date,

CEA regulations and MERC guidelines with latest amendments.

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

The specification given in this document supersedes the relevant clauses of IS: 13779 / 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 standard mentioned above, also shall be considered. For conflict related with other parts of the specification, the order of priority shall be – (i) this technical specification, (ii) IS: 13779 / 1999 amended upto date.

Bidder must possess the following certifications at the time of submission of the bid.

(a) ISO 9000.

(b) ISO 14000.

4.00 SERVICE CONDITIONS

As per IS: 13779 / 1999 (amended upto date), the meter to perform satisfactorily under Non - Air Conditioned environment (within stipulations of IS).

Meter body shall conform to IP 51 degree of protection.

The meter shall be suitably designed for satisfactory operation under the hot and hazardous tropical climate conditions and shall be dust and vermin proof. All the parts and surface, which are subject to corrosion, shall either be made of such material or shall be provided with such protective finish, which provided suitable protection to them from any injurious effect of excessive humidity.

The meter to be supplied against this specification shall be suitable for

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satisfactory continuous operation under the following tropical conditions:

Environmental Conditions

- | | |
|--|-----------------------|
| a) Maximum ambient temperature | 55 ⁰ C |
| b) Maximum ambient temperature in shade | 45 ⁰ C |
| c) Minimum temperature of air in shade | 35 ⁰ C |
| d) Maximum daily average temperature | 40 ⁰ C |
| e) Maximum yearly weighted average temperature | 32 ⁰ C |
| f) Relative Humidity | 10 to 95 % |
| g) Maximum Annual rainfall | 1450 mm |
| h) Maximum wind pressure | 150 kg/m ² |
| i) Maximum altitude above mean sea level | 1000 meter |
| 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. | |

5.00 GENERAL TECHNICAL REQUIREMENTS

1	TYPE	ISI marked LT AC, Three Phase, four wire, 10 - 40 Amps fully Static AMR compatible TOD Tri - vector Energy Meters with Net Metering Arrangement as per Category C of IS: 15959 / 2011 for measurement of different electrical parameters including Active Energy (kWh), Reactive Energy (kVARh), Apparent Energy (kVAh) in import & Export mode etc. in three phase, four wire balanced / unbalanced loads of LT Consumers
2	ACCURACY CLASS	1.0
3	CURRENT RATING	10 – 40 Amps
4	RATED BASIC CURRENT (I _b)	10 Amps per phase.
5	MAXIMUM	4 times (400 %) of I _b .

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	CONTINUOUS CURRENT (Imax)	The meter shall work accurately at 150% of Imax.
6	STARTING CURRENT	0.2% of Ib.
7	SHORT TIME CURRENT	As per IS 13779 / 1999.
8	RATED VOLTAGE	3 x 240 Volts Ph-N.
9	VOLTAGE RANGE	+ 20 % to - 40 % of rated voltage.
10	TEMPERATURE	The standard reference temperature for performance shall be 27°C. The mean temperature co-efficient shall not exceed 0.07%.
11	FREQUENCY	50 Hz ±5%.
12	POWER FACTOR	0.0 Lag – Unity - 0.0 Lead. 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.
13	POWER CONSUMPTION	(i) The active and apparent power consumption in each voltage circuit at reference voltage, reference temperature and reference frequency shall not exceed 1.0 W and 4 VA. (ii) The apparent power taken by each current circuit, at basic current Ib, reference frequency and reference temperature shall not exceed 2 VA.
14	DESIGN	Meter shall be designed with application specific integrated circuit (ASIC) or micro controller; shall have no moving parts; electronic components shall be assembled on

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		printed circuit board using surface mounting technology; factory calibration using high accuracy (0.1 class) software based test bench.
15	POWER SUPPLY	SMPS.
16	ISI MARK	The meter so supplied must bear ISI Mark.

6.00 CONSTRUCTIONAL REQUIREMENT / METER COVER & SEALING ARRANGEMENT

6.01 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) protection against spread of fire;
- (d) protection against penetration of solid objects, dust & water in meter.

6.02 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 Any protective coating shall not be liable to damage by ordinary handling nor damage due to exposure to air, under normal working conditions.

6.04 The electrical connections shall be such as to prevent any opening of the circuit under normal conditions of use as specified in the standard.

6.05 The construction of the meter shall be such as to minimize the risks of short-circuiting of the insulation between live parts and accessible conducting parts due to accidental loosening or unscrewing of the wiring, screws, etc. The meter shall not produce appreciable noise in use.

6.06 MATERIAL USED.

6.06.1 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. The meter case shall also have high impact strength.

6.06.2 The entire design and construction shall be capable of withstanding likely to occur in components is preferred for this purpose. Components used

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shall be of high quality and comply with International Industrial Standard practices.

6.06.3 Construction of the meter shall be such as to permit sealing of meter cover, terminal cover, etc. independently to ensure that the internal parts are not accessible for tampering without breaking the seals and ultrasonic welding of meter body.

6.07 METER BODY.

6.07.1 The poly carbonate body of the meter shall conform to IS: 11731 (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) 1984 or IEC-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. The type test certificate shall be submitted along with the offer.

6.07.2 The meter shall be projection type and shall be dust and moisture proof. The meter cover shall be secured to base by means of sealable unidirectional captive screws. The provision shall be made on the Meter for at least two seals to be put by utility user.

6.07.3 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.

6.07.4 The transparent polycarbonate 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).

6.07.5 Independent 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.

6.08 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.

6.09 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 "

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6.10 TERMINALS & TERMINAL BLOCK

- 6.10.1 The terminals shall be of suitable rating and shall be capable of carrying 150% I_{max} and made of electro-plated (or tinned) brass and shall be of replaceable type.
- 6.10.2 The terminal block for current and voltage connections conforming to IS: 13779 / 1999 (amended up to date) to meet the requirement of terminal connection arrangement shall be made from high quality non-hygroscopic, fire retardant, reinforced, moulded polycarbonate (non-Bakelite) which shall form an extension of the meter body.
- 6.10.3 The material of which the terminal block is made shall be capable of passing the tests given in IS: 13360 (Part 6/Sec 17) for a temperature of 135°C and a pressure of 1.8 MPa (Method A).
- 6.10.4 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.
- 6.10.5 The conductors where terminated to the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating.

Screw connections transmitting contact force and screw fixings, which may be loosened and tightened several times during the life of the meter, shall screw into a metal nut or shall be welded. All parts of each terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized.

- 6.10.6 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.
- 6.10.7 Electrical connections shall be so designed that contact pressure is not transmitted through insulating material.
- 6.10.8 Two screws shall be provided in each current terminal for effectively clamping the external leads or thimbles.

Each clamping screw shall engage a minimum of five threads in the terminal. The ends of screws shall be such as not to pierce and cut the conductors used.

- 6.10.9 The minimum internal diameter of terminal hole shall be as per IS.

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- 6.10.10 The terminals, the conductor fixing screws or the external or internal conductors shall not be liable to come into contact with terminal covers.
- 6.10.11 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.

6.11 TERMINAL COVER

- 6.11.1 The terminal cover shall be made out of unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities. The terminal cover shall be transparent.
 - 6.11.2 The termination arrangement shall be provided with an extended type transparent terminal cover as per clause number 6.5.2 of IS 13779 / 1999 amended upto date and shall be sealable independently to prevent unauthorized tampering.
 - 6.11.3 The extended terminal cover shall be fixed to the meter terminal block by means of screws and with one side hinge. The screws shall not be detachable from the cover and shall have provision for sealing. Proper size of grooves shall be provided at bottom of this terminal cover for incoming and outgoing service wires.
 - 6.11.4 The terminal cover of a meter shall be sealable independently of the meter cover to prevent unauthorized tampering. 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.
 - 6.11.5 The fixing screws used on the terminal cover for fixing and sealing in terminal cover shall be held captive in the terminal cover.
 - 6.11.6 When the meter is mounted, no access to the terminals shall be possible without breaking seals(s) of the terminal cover.
- 6.12 All insulating materials used in the construction of the meter shall be substantially non-hygroscopic, non ageing and of tested quality.

6.13 RESISTANCE TO HEAT AND FIRE

The terminal block, the terminal cover, the insulating material retaining the main contacts in position and the meter body shall ensure reasonable safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them. The material of the terminal block shall not deflect under heating. To comply therewith, they must fulfill the tests as specified in 12.4 of IS: 13779 / 1999 amended upto date.

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6.14 OUTPUT DEVICE

Energy 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 the 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 and accuracy test at the lowest load shall be completed with desired accuracy within 5 minutes. The pulse rate of output device which Pulse / kWh or pulse / kVArh (meter constant) shall be indelibly provided on the nameplate. It shall be possible to check the accuracy of active energy measurement of the meter on site by means of LED output.

- 6.15 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 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.

- 6.16 The meter shall have CTs with magnetic shielding and same shall be tested separately prior to assembly.
- 6.17 Power supply unit shall be micro control type instead of providing conventional transformer and then conversion to avoid magnetic influence.

6.18 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. Facility for adjustment of real time shall be provided with proper security. The calendar and the clock shall be correctly set to Indian Standard Time.

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

- a) Meter testing work bench and this shall need password enabling for meter or a DLMS compliant **CMRI**.

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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.

6.19 Non-specified display parameters in the meter shall be blocked and same shall not be accessible for reprogramming at site through any kind of communication.

6.20 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. The Meter shall meet the requirement of CBIP Tech-report 88 (amended up to date).

6.21 A push button shall be provided for high-resolution reading of display with two decimal digits as brought out elsewhere in this specification (optional). Likewise, a push button shall be provided for scrolling the parameters in Alternate Display (On Demand) mode.

6.22 The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date.

6.23 For any higher signals than the present standards and MSEDCL technical specifications indicated above, the accuracy of meter shall not get affected, i.e. the energy meter shall remains immune.

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

6.25 SELF DIAGNOSTIC FEATURES

(a) The meter shall keep log in its memory for unsatisfactory / non - functioning of Real Time Clock battery and can be downloaded for reading through RS – 232 port to read in base computer.

(b) The meter shall be capable of performing complete self diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data memory location all the time.

(c) LED / LCD Test display shall be provided for checking of all display Segments.

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

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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. Alternatively, push button provided for displaying alternate mode (On Demand Mode) parameters shall also be acceptable for activation of battery during power OFF condition.

After activating the battery during power OFF condition, the meter shall display all Default Display (Auto Scrolling Mode) parameters only once, after which the battery shall switch OFF automatically. The battery shall be locked after 3 operations during one power OFF cycle. As soon as the supply is resumed to meter, the battery shall automatically come to normal.

If external battery is provided, the battery shall be with inductive coupling arrangement. The external battery is to be provided with inbuilt charger, in the ratio of one battery pack per 50 nos. meter.

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

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

6.29 COMMUNICATION CAPABILITY

The meter shall be provided with two ports for communication of the measured / collected data as per the IS: 15959 / 2011 amended upto date, 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.

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

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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.
- 6.30 Reverse reading lock of main KWh reading is to be incorporated with necessary software modification if required additionally.
- 6.31 The meter shall be capable to withstand and shall not get damaged if phase to phase voltage is applied between phase to neutral for 5 minutes.
- 6.32 The accuracy of the meter and the measurement by meter shall not get influenced by injection of high frequency AC Voltage / chopped signal / DC signal and harmonics on the terminals of the meter. The meter accuracy shall not be affected by magnetic field from all sides of the meter i.e. front, sides, top and bottom of the meter.
- 6.33 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. 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:
- (a) On any of the phases or neutral terminals
 - (b) On any connecting wires of the meter (Voltage discharge with 0-10 mm spark gap)
 - (c) At any place in load circuit.

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

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6.34 RETENTION TIME OF THE NON-VOLATILE MEMORY

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.

6.35 WIRE / CABLE LESS DESIGN

The meter PCB shall be wireless to avoid improper soldering & loose connection / contact.

6.36 The measurement by meter shall not get influenced by injection of High frequency AC Voltage / chopped signal / DC signal and harmonics on the terminals of the meter.

6.37 Meter shall be tamper proof. No tampering shall be possible through Optical port or RS 232 port.

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

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.

At present the time zones shall be programmed as below.

Zone "A" : 00=00 Hrs. to 06=00 Hrs. and 22=00 Hrs. to 24=00 Hrs

Zone "B" : 06=00 Hrs. to 09=00 Hrs. and 12=00 Hrs. to 18=00 Hrs

Zone "C" : 09=00 Hrs. to 12=00 Hrs

Zone "D" : 18=00 Hrs. to 22=00 Hrs.

8.00 MAXIMUM DEMAND INTEGRATION PERIOD

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

9.00 MD RESET

It shall be possible to reset MD by the following options:

a) Communication driven reset through Optical port of meter.

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- b) Auto reset MD at 24:00 hrs at the end of each billing cycle or automatic reset at the end of certain predefined period (say, end of the month). Auto reset option of MD reset shall be programmable as per actual day / date requirement. No push button shall be provided for MD reset.

10.00 TAMPER & FRAUD MONITORING FEATURES

10.01 ANTI TAMPER FEATURES

The meter shall detect and correctly register energy only in forward direction under following tamper conditions:

- (i) Change of phase sequence: 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.
- (ii) Drawing of current through local Earth: the meter shall register accurate energy even if load is drawn partially or fully through a local earth.
- (iii) The three-phase meter shall continue to work even without neutral.
- (iv) The three-phase 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.
- (v) The meter shall work without earth.
- (vi) The potential link shall not be provided.
- (vii) Visual indication shall be provided to safeguard against wrong connections to the meter terminals.
- (viii) The meter shall be immune to the external magnetic field (AC / DC / Permanent) upto 0.2 Tesla. 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.

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.

- (ix) The meter shall be immune to abnormal voltage / frequency generating devices.
- (x) The meter shall remain immune for the test of electromagnetic HF/RF

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defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date. For any higher signals than the present standards and MSEDCL technical specifications indicated above, the accuracy of meter shall not get affected, i.e. the energy meter shall remain immune.

10.02 TAMPER EVENTS

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

10.03 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.

10.04 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.

10.05 The detection of the tamper event shall be registered in the tamper event register for retrieval by authorized personnel through Optical port via CMRI and through DLMS compliant CMRI & Remote access through suitable communication network.

The no. of times the tampering has been done shall also be registered in the meter.

10.06 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.

The meter shall have features to detect the occurrence and restoration of the following abnormal events:

(a) 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

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(10% or more for 5 Minutes.) Higher of the 3 phase voltages shall be considered as reference for this purpose.

(b) 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.

(c) 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.

(d) Current Reversal.

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.

(e) High Neutral Current (CT bypass)

The meter shall be capable of recording incidences of excess neutral current (if it is in excess 10% of I_b for more than 5 minutes).

The meter shall record the total duration of the above abnormalities, time and date of their occurrences and restorations with snapshot of instantaneous electrical conditions viz. System Voltages, Phase Currents & System PF.

(f) Power ON / OFF

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

(g) Meter Cover Open

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 and the meter shall continuously display that the cover has been tampered. It is suggested that the manufacturer shall develop their software such that there will be some time delay for activation of this tamper feature and during that period only the meter cover shall be

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fitted. The delay in activation of software shall be for one instance only. After the meter cover is fitted, it shall get activated immediately without any delay.

10.07 The threshold values for various tamper 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	> 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 (Diff. of phase voltages)	> 10 % Vref	< 10 % Vref
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 % Ib for 15 min	< 30 % Ib for 15 min
7.	Current Bypass	Bypass Current > 10 % Ib for 15 min	Bypass Current < 10 % Ib 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 _{max}	< 120 % I _{max}
10.	Influence of permanent magnet or AC / DC	Immediate	1 minute after removal

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	electromagnet / permanent magnet		
11.	Neutral Disturbance	--	--
12.	Power failure	Immediate	
13.	Very Low PF	--	--
14.	Meter Cover Opening	2 to 4 mm	--

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

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 RS-232 port with the help of DLMS compliant CMRI & downloaded the same to the base computer.

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

11.00 DISPLAY INDICATORS.

The meter shall display permanently by LED / LCD as a minimum and shall be visible from the front of the meter.

- (a) Supply indication
- (b) Calibration (pulse indication)

12.00 DISPLAY OF MEASURED VALUES

12.01 The display shall be permanently backlit Liquid Crystal Display LCD with wide viewing angle & shall be visible from the front of the meter.

12.02 Liquid Crystal Display (LCD) shall be suitable for temperature withstand of 70° C. Adequate back up arrangement for storing of energy registered at the time of power interruption shall be provided.

12.03 The display shall be electronic and when the meter is not energized, the electronic display need not be visible.

12.04 MINIMUM CHARACTER SIZE

- (a) The meter shall have 5 digits with parameter identifier,
- (b) The height of the display characters for the principal parameters values

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shall not be less than 5 mm. The size of digit shall be minimum 10x5 mm.

- 12.05 The decimal units shall not be displayed in auto scroll mode. However it shall be displayed in push button mode for high resolution display for testing. In case of multiple values presented by single display, it shall be possible to display the contents of all relevant memories. When displaying the memory, the identification of each parameter applied shall be possible. The principle unit for measured values shall be the kilowatt-hour (kWh) for active energy, kVArh for reactive energy & kVAh for apparent energy.
- 12.06 Auto display cycling push button is required with persistence time of 10 Seconds.
- 12.07 The meter shall be pre-programmed for following details.
- (a) Voltage rating: 240 V Phase to Neutral.
 - (b) MD Integration Period: 30 Minutes.
 - (c) The meter shall Auto reset kVAMD at 24.00 Hrs. of last day of the month and this value shall be stored in the memory along with the cumulative kWh reading. No reset push button shall be provided.
 - (d) Average power factor with 2 decimal digits shall be displayed.
 - (e) 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. The load survey data shall be first in first out basis (FIFO).
 - (f) The Default Display (Auto scrolling mode) shall switch to Alternate Display (On Demand Display Mode) after pressing the push button continuously for 5 seconds.
 - (g) The meter display shall return to Default Display Mode if the "On Demand" Push Button is not operated for 15 sec.

12.08 MINIMUM DISPLAY CAPABILITY (MEASURING PARAMETERS)

The sequence of display of various electrical parameters in auto scroll & On Demand mode shall be as per table 27 & 29 (except 8 & 9) of Annex E of IS: 15959 / 2011.

Display other than specified below shall be blocked.

The scroll period for auto scroll shall be 10 sec.

Default Display Mode (Auto Scroll) (Scrolling Time 10 Secs.)

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1.0	LCD Test
2.0	Real Time Clock – Date and Time
3.0	Cumulative Energy kWh (Import)
4.0	Cumulative Energy kWh TOD Zone A(Import)
5.0	Cumulative Energy kWh TOD Zone B (Import)
6.0	Cumulative Energy kWh TOD Zone C (Import)
7.0	Cumulative Energy kWh TOD Zone D (Import)
8.0	MD – kVA (Import)
9.0	MD – kVA TOD Zone A (Import)
10.0	MD – kVA TOD Zone B (Import)
11.0	MD – kVA TOD Zone C (Import)
12.0	MD – kVA TOD Zone D (Import)
13.0	Cumulative Energy kWh (Export)
14.0	Cumulative Energy kWh TOD Zone A (Export)
15.0	Cumulative Energy kWh TOD Zone B (Export)
16.0	Cumulative Energy kWh TOD Zone C (Export)
17.0	Cumulative Energy kWh TOD Zone D (Export)
18.0	MD – kVA (Export)
19.0	MD – kVA TOD Zone A (Export)
20.0	MD – kVA TOD Zone B (Export)
21.0	MD – kVA TOD Zone C (Export)
22.0	MD – kVA TOD Zone D (Export)
23.0	MD – kW TOD Zone A (Import)
24.0	MD – kW TOD Zone B (Import)
25.0	MD – kW TOD Zone C (Import)
26.0	MD – kW TOD Zone D (Import)
27.0	MD – kW TOD Zone A (Export)
28.0	MD – kW TOD Zone B (Export)
29.0	MD – kW TOD Zone C (Export)
30.0	MD – kW TOD Zone D (Export)
31.0	Three Phase Power Factor (Average P.F. based on kVAh) (Import)
32.0	Three Phase Power Factor (Average P.F. based on kVAh) (Export)
33.0	Cumulative Tamper Count
34.0	Tamper event of Meter Cover Open with date and time. “ C Open “
On – Demand Display (Alternate Display) through Push Button	
1.0	Real Time Clock – Date and Time
2.0	Voltage V_{RN}
3.0	Voltage V_{YN}
4.0	Voltage V_{BN}
5.0	Current I_R
6.0	Current I_Y
7.0	Current I_B

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8.0	Last date & time of reset (kVA MD)
9.0	Cumulative Energy kVAh (Import)
10.0	Cumulative Energy kVAh TOD Zone A (Import)
11.0	Cumulative Energy kVAh TOD Zone B (Import)
12.0	Cumulative Energy kVAh TOD Zone C (Import)
13.0	Cumulative Energy kVAh TOD Zone D (Import)
14.0	Cumulative kVArh lag (Import)
15.0	Cumulative kVArh lead (Import)
16.0	Cumulative Energy kVAh (Export)
17.0	Cumulative Energy kVAh TOD Zone A (Export)
18.0	Cumulative Energy kVAh TOD Zone B (Export)
19.0	Cumulative Energy kVAh TOD Zone C (Export)
20.0	Cumulative Energy kVAh TOD Zone D (Export)
21.0	Cumulative kVArh lag (Export)
22.0	Cumulative kVArh lead (Export)
23.0	High resolution kWh (For calibration)
24.0	Rising MD with remaining time up to EOI (For calibration)
25.0	Signed Power Factor – R Phase
26.0	Signed Power Factor – Y Phase
27.0	Signed Power Factor – B Phase
28.0	Frequency
29.0	Last Tamper Event with date and time.
Note: (1) Other kVA MD values shall be available in reset backup data for 13 months. (2) The meter display shall return to Default Display Mode if the “On Demand Push Button” is not operated for 15 sec. The meter shall display the tamper meter cover open with date & time in auto scroll mode along with other parameters	

13.00 BILLING DATA, BILLING HISTORY, LOAD SURVEY & TAMPER DATA

13.01 BILLING DATA

The billing data is summarised as below.

Sr. No.	Parameters
1.0	Date & Time
2.0	Cumulative Energy – kWh(Import)
3.0	Maximum demand (kVAMD) with date & time. (Import)
4.0	Cumulative Energy – kWh (Export)

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5.0	Maximum demand (kVAMD) with date & time. (Export)
6.0	Harmonic Energy – HkWh (Import)
7.0	Harmonic Energy – HkWh (Export)

The Net Energy shall be calculated as per following formula:

Net Energy = Import Energy – Export Energy

13.02 BILLING HISTORY

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 13 months.

Legends for kWh and MD shall be as below:

	E: Export →			I Import ←		
Months	MD	Energy	PF	MD	Energy	PF
March(Current Month)	MD	kWh	PF	MD	kWh	PF
Feb	MD1	kWh1	PF1	MD1	kWh1	PF1
Jan	MD2	kWh2	PF2	MD2	kWh2	PF2
Dec	MD3	kWh3	PF3	MD3	kWh3	PF3
Nov	MD4	kWh4	PF4	MD4	kWh4	PF4
Oct	MD5	kWh5	PF5	MD5	kWh5	PF5
Sept	MD6	kWh6	PF6	MD6	kWh6	PF6
Aug	MD7	kWh7	PF7	MD7	kWh7	PF7
July	MD8	kWh8	PF8	MD8	kWh8	PF8
June	MD9	kWh9	PF9	MD9	kWh9	PF9
May	MD10	kWh10	PF10	MD10	kWh10	PF10
Apr	MD11	kWh11	PF11	MD11	kWh11	PF11
March	MD12	kWh12	PF12	MD12	kWh12	PF12

Details of the legends shall be self-explanatory with signed legend like

Import → ← export.

13.03 LOAD SURVEY PARAMETERS

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. The load survey data shall be first in first out basis (FIFO). 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

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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. The 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.

The load survey parameters are as below.

(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 with Import & Export Mode.
(9)	Block Energy – kVarh – lag with Import & Export Mode.
(10)	Block Energy – kVarh – lead with Import & Export Mode.
(11)	Block Energy – kVAh with Import & Export Mode.
(12)	Maximum demand (kVAMD) with date & time. (Import).
(13)	Maximum demand (kVAMD) with date & time. (Export).
(14)	Voltage THD in Import Mode
(15)	Voltage THD in Export Mode
(16)	Current THD in Import Mode
(17)	Current THD in Export Mode

14.00 QUANTITIES TO BE MEASURED & DISPLAYED:

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

- 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 / kVArh (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.
- c) Billing Profile Parameters such as cumulative energy kWh cumulative kVAh / cumulative energy kVArh, 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 and 32 to 39 except 38 respectively of IS: 15959 / 2011).

Detail of parameters requirement is given in following tables of document enclosed as annexure II:

Category C	Parameter group	ANNEX Table No.
LT 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

15.00 DEMONSTRATION

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

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16.00 METERING PROTOCOL:

As per Category – C of IS: 15959 / 2011.

17.00 COMMON METER READING INSTRUMENT (CMRI)

- 17.01 To enable local reading of meters data, a DLMS compliant CMRI shall be provided.
- 17.02 The CMRI shall be as per specification given in Annex J of IS: 15959 / 2011.
- 17.03 It shall be compatible to the DLMS compliant energy meters that are to be procured / supplied on the basis of this specification.
- 17.04 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.
- 17.05 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.
- 17.06 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.
- 17.07 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.
- 17.08 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.
- 17.09 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.

18.00 COMPUTER SOFTWARE.

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- 18.01 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.
- 18.02 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.
- 18.03 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.
- 18.04 The total time taken for downloading Billing, Tamper and Load Survey Data for 45 days shall be less than or equal to 5 minutes.
- 18.05 Downloading time of only Billing data shall be less than or equal to 20 secs.
- 18.06 It shall be possible to upload the CMRI data to any PC having CMRI software. A consumer based data uploading facility is required so that CMRI shall upload data only in that PC which has the concerned consumers` data. The consumer code + meter no. shall be the key for creating consumers` files or overwriting consumers` files in PC. The software system files and data files shall be stored in different directories.
- 18.07 The "record number field shall be 10 digits Alphanumeric (2 digits for Zones, 2 for Circle & 6 for consumer No.). Before accepting the data for "Record Number" the system shall wait for pressing of "Enter" key.
- 18.08 Two separate fields shall be provided for consumer name and address – one name field of one line, and other Address field of two lines.
- 18.09 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.
- 18.10 Also there shall be a provision to give filenames while creating the file.
- 18.11 As and when the meter manufacturer releases new or latest or advanced versions of meter hardware / firmware / software, the same shall be made available to purchaser immediately on the release date free of cost.

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The latest version shall support all existing hardware / meters in the field.

18.12 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.

18.13 As and when the meter manufacturer releases new or latest or advanced versions of meter hardware / firmware / software, 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.

18.14 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.

18.15 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.

18.16 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.

19.00 CONNECTION DIAGRAM AND TERMINAL MARKINGS:

The connection diagram of the meter shall be clearly shown on inside portion of the terminal cover & 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 will not be allowed.

20.00 NAME PLATE AND MARKING OF METERS:

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 manufacturer's meter constant shall be marked on the nameplate. The size of bar coded number shall not be less than 35x5 mm. Meter serial number & bar code on sticker will not be allowed. In addition to the requirement as per IS, following shall be

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marked on the nameplate.

- (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) **Communication port: RS 232 WITH CAT. C** . The character height of the same shall be minimum 3 mm in capital letters.

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 नॉदणी होणार "

21.00 TESTS:

21.01 TYPE TESTS:

The meter offered shall have successfully passed all type tests described in the IS: 13779 /1999 (amended up to date), external AC / DC magnetic influence tests as per CBIP Tech Report 88 with latest amendments.

The Type Test Reports shall clearly indicate the constructional features including Optical port & RS-232 port connectivity of the type tested meter. The type test reports of the meter shall be same as the meter offered. Separate type Test Reports for each offered type of meter shall be submitted.

All the Type Tests shall be carried out from Laboratories which are accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) of Govt. of India such as CPRI, ERDA, ERTL, etc. to prove that the meter meets the requirements of specification. Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.

The Type Test Certificate as per IS: 13779 / 1999 shall be submitted along with the offer. The Type Test certificate carried out during last five years shall be valid. However, the Type Test Certificate the optical port & RS-232 port connectivity as per Category C of IS: 15959 / 2011 of the type tested meter shall be submitted before commencement of supply and the same shall be got approved from the CE, MM Cell. The Type test certificate of metering protocol as per IS: 15959 / 2011 shall not be more than 36 months old.

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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. The supplier has 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. It shall be the responsibility of the supplier to arrange such tests and Purchaser shall be informed of the date and time of conduction of tests well in advance to enable him to witness such tests. Test charges of the testing authority, for such successful repeat type tests, shall be reimbursed at actual by the Purchaser.

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

- 21.02 All acceptance tests as per IS: 11731 (Part-2)/ 1986, 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 shall be carried out on the meter body. The meter shall pass all the acceptance and routine tests as laid down in IS: 13779 / 1999 (amended up to date) and also additional acceptance tests as prescribed in this specification. (3 to 8 meters from a lot more than 1,000 will be sealed randomly in the factory and will be tested for tamper events).

Additional Acceptance test of offered Energy meters as stated at cl. No. 21.03 carried out at third party NABL accredited lab shall be submitted and got approved from office of Chief Engineer (MM Cell), MSEDCL Mumbai before commencement of supply.

21.03 **ADDITIONAL ACCEPTANCE TESTS:**

The following additional tests shall be carried out in addition to the acceptance tests specified in IS: 13779 / 1999 (amended up to date).

(a) **TRANSPORTATION TEST:**

At least 50% of the samples of the meter 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 meter be put in their normal packing

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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 Ib.

(b) OTHER ACCEPTANCE TESTS:

- i. The meter shall withstand continuously for a period of at least 5 minutes at a voltage of 440 V between phase and neutral without damage / problems.
- ii. Meter shall be tested for tamper conditions as stated in this specification.
- iii. Glow wire testing for poly-carbonate body.
- iv. Power consumption tests shall be carried out.
- v. 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 Tesla 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: 13779 /1999 (amended up to date).

No deviation in error is allowed in the class index as per IS: 13779 /1999 (amended up to date) & this specification.

- vi. The meter shall withstand impulse voltage at 10 kV.
- vii. The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date. For any higher signals than the present standards and MSEDCL technical specifications indicated above, the accuracy of meter shall not get affected, i.e. the energy meter shall remains immune.

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

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The test 21.03 (b) (i) to (iv) shall be carried out at factory for each inspected lot at the time of pre dispatch inspection.

The tests 21.03 (b) (v), (vi) & (vii) shall be carried out on one sample from first lot as per procedure laid down in IS: 13779 / 1999 (amended up to date) and CBIP Tech Report 88 (with latest amendments) in NABL LAB.

The test report shall be got approved from the Office of the Chief Engineer, MSEDCL, Material Management Cell, 1st Floor, Prakashgad, Bandra (East), Mumbai – 400 051 before commencement of supply.

(c) Limits of error:

(i) Limits of variation in percentage error due to change in voltage shall not exceed the values given in the following table:

SN	Influence quantities	Value of current (Balanced, unless otherwise stated)	Power factor	Limits of variation in % error for class 1 meter
(a)	Voltage variation – 15% to +10%	Ib	1	0.7
		Ib	0.5 lag	1.0
(b)	Voltage variation – 40%, + 20% & + 10%	Ib	1	1.1
		Ib	0.5 lag	1.5

(ii) The meter shall be tested at (-) 15% and at (-) 40% of reference voltage as well as (+) 10% & (+) 20% of reference voltage & shall record energy within limits of variation indicated above. However the meter shall continue to register energy upto 50% of rated voltage.

(iii) For other influence quantities like frequency variation, voltage unbalance etc. the limits of variation in percentage error will be as per IS: 13779 / 1999 (amended up to date).

22.00 GUARANTEED TECHNICAL PARTICULARS:

The tenderer shall furnish the particulars giving specific required details of Meters in schedule ‘A’. The offers without the details in Schedule ‘A’ shall stand rejected.

23.00 PRE DESPATCH INSPECTIONS:

All Acceptance tests and inspection shall be carried out at the place of

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manufacturer unless otherwise specially agreed upon by the manufacturer and purchaser at the time of purchase. 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 on suitable number of meter as per sampling procedure laid down in IS: 13779 / 1999 (amended up to date) and additional acceptance test as per this specification and issue test certificate approval to the manufacturer and give clearance for dispatch. The meter shall be sealed after inspection at works.

The first lot of meter may be jointly inspected by the Executive Engineer, Testing Division and the Executive Engineer, Inspection Wing.

24.00 JOINT INSPECTION AFTER RECEIPT AT STORES (Random Sample Testing):

For carrying out Random Sample Testing (RST), the sample meters shall be drawn from any one of the stores against inspected lot and shall be tested at any of the Testing and Quality Assurance Units at Aurangabad, Bhandup, Kolhapur, Nagpur, Nashik and Pune. Sample meters shall be drawn as per Annex H (Recommended Sampling Plan) of IS: 13779 / 1999 (amended upto date). Sample meters shall be tested by MSEDCL Testing Engineer in presence of supplier's representative jointly for (i) Starting Current, (ii) Limits of error, (iii) Repeatability of error, (iv) No Load Test as per IS: 13779 / 1999 (amended upto date) & (v) tamper conditions as per technical specifications and (vi) Data downloading time as per specifications.

The 5 days advanced intimation shall be given to the supplier and if the supplier fails to attend the joint inspection on the date informed, the testing shall be carried out by our Testing Engineer in absence of supplier's representative. If the meters failed in above Random Sample Testing, the lot shall be rejected.

25.00 GUARANTEE:

The meter and CMRI shall be guaranteed for the period of five years from the date of commissioning or five and half year from the date of dispatch whichever is earlier. The meter / CMRI found defective within above guarantee period shall be replaced / repaired by the supplier free of cost, within one month of receipt of intimation. If defective meter / CMRI are not replaced / repaired within the specified period as above, the Company

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shall recover an equivalent amount plus 15% supervision charges from any of the bills of the supplier.

26.00 PACKING:

26.01 The meters & CMRI 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.

26.02 The following information shall be furnished with the consignment:

- Name of the consignee
- Details of consignment
- 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

27.00 TENDER SAMPLE:

Tenderer are required to submit 13 (Thirteen) nos. of sample meters of offered type as per technical specifications alongwith 2 no. of sample CMRI (IR Compliant 1 no. & DLMS compliant 1 No.) and the API software & documentation, etc. to EE (SM) in the office of the Chief Engineer, Material Management Cell, 1st Floor, Prakashgad, Bandra (East), Mumbai – 400 051 one working day 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. and testing the offered API by our IT Department as per technical specifications.

The offer of those eligible bidders shall only be considered if the samples pass the tests at NABL Lab as well as necessary certification from our IT Department for the offered API. The results of NABL Lab and the

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certification from IT Department for offered API shall not be disputed and it 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.

28.00 QUALITY CONTROL:

28.01 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 shall be given all assistance and co-operation for inspection and testing at the bidder's works. 3 tender samples shall be kept ready for assessing and testing. The tenderer shall extend all facilities for carrying out the testing of these samples.

28.02 The meters supplied shall give service for a long period with out drifting from the original calibration & performance must be near to zero percent failure.

29.00 MANUFACTURING ACTIVITIES:

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.

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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.

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

29.03 Meter shall be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and reflow solder process.

Further, the Bidder shall own or have assured access (through hire, lease or sub-contract, documentary proof shall be attached with the offer) of above facilities. The calibration of meter shall be done in-house.

29.04 Quality shall be ensured at the following stages.

29.04.1 At PCB manufacturing stage, each Board shall be subjected to computerized bare board testing.

29.04.2 At insertion stage, all components shall under go computerized testing for conforming to design parameter and orientation.

29.04.3 Complete assembled and soldered PCB shall under go functional testing using Automatic Test Equipments (ATEs).

29.04.4 Prior to final testing and calibration, all meter shall be subjected to ageing test ('burn-in' test process) (i.e. Meter will be kept in ovens for 72 hours at 55 deg C temperature & at full load current. After 72 hours meter shall work satisfactory) to eliminate infant mortality.

29.05 The calibration of meter shall be done in-house.

29.06 The bidders shall submit the list of all imported and indigenous components separately used in meter along with the offer.

29.07 Bought out items:

A detailed list of bought out items, which are used in the manufacturing 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.

29.08 List of Plant and Machinery used for production of energy meter:

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SN	List of Plant and Machinery used for Energy meter Production	
1	Fully automatic testing Bench with ICT for testing link less meter	Routine Testing and Calibration of Meter
2	Semi automatic testing Bench with MSVT	Routine Testing and Calibration of Meter
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 Meter Class 0.1 accuracy	Error calculation
8	Ultrasonic welding Machines	Welding of meter
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

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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
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 Meter
28	Glow Wire Test machine	Testing of Plastic Material
29	Fast transient burst testing setup	Type testing of Meter
30	Short term over Current testing setup	Type testing of Meter
31	Magnetic and other tamper testing setups	Tamper Testing
32	Impulse Voltage Testing Setup	Type testing of Meter
33	Composite Environmental testing chambers	Type testing of Meter

30.00 QUALITY ASSURANCE PLAN:

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- 30.01 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.
- 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.

Schedule 'A' Guaranteed and technical particulars.

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.

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SCHEDULE 'C'

TENDERER'S EXPERIENCE

Tenderer shall furnish here a list of similar orders executed / under execution for supply of three phase static energy meter by him 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 _____

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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 tests 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 equipments available with the bidder for final testing of equipment specified and test plan limitation, if any, vis-à-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 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:

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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 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 purchaser does not attend after receiving documented notification in accordance with the agreed procedures and with the correct period of notice, then the 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 arrangement for contractor's internal auditing.
 - > A list of administration and work procedures required to achieve and verify contractor'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 contractor's work procedures appropriate to each activity.

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- > Inspection during fabrication / construction.
- > Final inspection and test.

ANNEXURE - II

COMPONENT SPECIFICATION

SN	Component Function	Requirement	Makes & 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: 13779 / 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.	USA: Teridian, Analog Devices, Cyrus Logic, Atmel, Philips, Dallas, ST, Motorola, Texas Instruments, Maxim, Freescale, National Semiconductor, Onsemiconductors. Germany: Siemens. South Africa: SAMES. Japan: NEC, Toshiba, Renesas, Hitachi. Austria: AMS. Holland: Philips (N X P)
3.	Memory chips	Memory chips shall not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. Meter shall have nonvolatile memory (NVM). No other type of memory	USA: Teridian, Atmel, Philips, ST, National Semiconductors, Texas Instruments, Microchip, Spansion (Fujitsu), Ramtron.

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		shall be used for data recording and programming. (The life of the NVM is highest). There shall be security isolation between metering circuit, communication circuit, and power circuit.	Japan: Hitachi, Renasas. Germany: Siemens
4.	Display modules	<p>The display modules shall be well protected from the external UV radiations.</p> <p>The display visibility shall be sufficient to read the Meter mounted at a height of 0.5 meter as well as at the height of 2 meters (refer 3.2 d for viewing angle).</p> <p>The construction of the modules shall be such that the displayed quantity shall not disturb with the life of display (PIN Type).</p> <p>It shall be Tran-reflective HTN or STN type industrial grade with extended temperature range.</p>	<p>Singapore: Bonafied Technologies, Displaytech, E-smart</p> <p>Korea: Advantek, Jebon, Union Display Inc.</p> <p>Hong Kong: Genda</p> <p>China: Success, Truly,</p> <p>Japan: Hitachi, Sony, L & G.</p> <p>Malaysia: Crystal Clear Technology.</p>
5.	Communication Modules	Communication modules shall be compatible for the two ports (one for Optical port for communication with meter reading instruments (CMRI) & the other for the hardwired RS-232 port to communicate with various modems for AMR)	<p>USA: Agilent, HP, Fairchild, National Semiconductors, Optonica.</p> <p>Holland: Philips.</p> <p>Korea: Phillips.</p> <p>Japan: Hitachi.</p> <p>Taiwan: Ligitek</p>
6.	Power supply	The power supply shall be with the Capabilities as per 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	SMPS Type

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		to faults or due to wrong connections. It shall not also be affected by magnet	
7.	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, BC Component, Philips, Texas Instruments, Analog Devices. ST, Onsemiconductors, Maxim, Muruta, Kemet, Freescale, AVX, Intersil, Raltron, Fox, Fairchild, Agilent, Abracon, Diode Inc., Honeywell, Sipex Power Integration, Roham.</p> <p>Japan: Hitachi, Oki, AVZ, Ricon, Toshiba, Epson, Kemet, Alps, Muruta, TDK, Sanyo, Samsung.</p> <p>India: RMC, VEPL, KELTRON, Incap, PEC, Cermet, Gujarat Polyavx, Prismatic, MFR Electronic Components Pvt. Ltd.</p> <p>Korea: Samsung</p> <p>Japan: Panasonic</p> <p>Germany: Kemet, Vishay, Epcos, Diotech,</p>
8.	Mechanical parts	<p>The internal electrical components shall be of electrolytic copper & shall be protected from corrosion, rust etc.</p> <p>The other mechanical components shall be protected from rust, corrosion etc. by suitable plating /</p>	

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		painting methods.	
9.	Battery	Maintenance free battery (Ni-mh or Li-ion) of long life of 15 years. Only non-rechargeable battery shall be used for RTC as well as display in absence of Power since the life & Reliability of these are better than the rechargeable batteries.	USA: Varta, Tedirun, Sanyo or National, Maxell, Renata. Japan: Panasonic, Sony. France: Saft. Korea: Tekcell. Germany: Varta.
10.	RTC & Micro controller.	The accuracy of RTC shall be as per relevant IEC / IS standards.	USA: ST, Teridian, Philips, Dallas, Atmel, Motorola, Microchip. Japan: NEC, Oki, Epson.
11.	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm.	