

MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

LT AC SINGLE PHASE 5-30 AMPS STATIC NET
ENERGY METER



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1.00 SCOPE

This specification covers the Design, Manufacture, Testing and Supply of ISI marked LT AC Static Energy Meters suitable for measurement of Energy (kWh) and Demand (kWMD) in Single Phase, Two wire system of LT Consumers which covers the facility of recording the import & export energy. The meter shall be suitable for measurement of energy of both import and export of electricity so as to calculate Net Active Energy.

2.00 APPLICABLE STANDARDS

IS: 13779 / 1999 (amended up to date) and other relevant IS specifications including CBIP Tech. report 88 amended up to date, CEA regulations & 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 up to date).

3.00 SERVICE CONDITIONS

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 ^o C
b) Maximum ambient temperature in shade	45 ^o C
c) Minimum temperature of air in shade	35 ^o C
d) Maximum daily average temperature	40 ^o C
e) Maximum yearly weighted average temperature	32 ^o C
f) Relative Humidity	10 to 100 %
g) Maximum Annual rainfall	1,450 mm
h) Maximum wind pressure	150 Kg/m ²
i) Maximum altitude above mean sea level	1,000 meters
j) Isoceraunic level	50 days/year
k) Seismic level (Horizontal acceleration)	0.3 g

- 1) Climate: Moderately hot and humid tropical climate conducive to rust and fungus growth.

4.00 GENERAL TECHNICAL PARTICULARS

4.01 The meter shall bear ISI mark.

4.02 Class of Accuracy:

The class of accuracy of the Energy Meter shall be 1.0. The accuracy shall not drift with time.

4.03 Current & Voltage Rating:

- 1) The current rating shall be 5 - 30 Amps.
- 2) Rated basic current (I_b) for LT Energy Meters shall be 5 Amps.
- 3) The maximum continuous current (I_{max}) shall be 600% of rated basic current, i.e. 30 Amps. Moreover the 5 - 30 Amps meters shall work accurately upto 150% of I_{max} , i.e. 45 Amps.
- 4) The Voltage Rating shall be 240 volts. The voltage range shall be (-) 40% to (+) 20% of rated voltage, i.e. 144 Volts to 288 Volts.

4.04 Temperature:

The standard reference temperature for performance shall be 27° C. The mean temperature co-efficient shall not exceed 0.07%. Temperature rise shall be as per IS: 13779 / 1999 (amended up to date).

4.05 Power Factor:

The meter shall work for Zero to unity PF (All lag or lead).

4.06 Power Consumption:

1) Voltage Circuit:

The active & apparent power consumption in each voltage circuit including power supply of meter at reference voltage, reference temperature & frequency shall not exceed 2.0 Watt & 10 VA.

2) Current Circuit:

The apparent power taken by current circuit at basic current, reference frequency & reference temperature shall not exceed 4.0 VA as per IS: 13779 / 1999 (amended upto date).

4.07 Starting Current:

The meter shall start registering the energy at 0.2 % of basic current (I_b).

4.08 Frequency:

The rated frequency shall be 50 Hz with a tolerance of $\pm 5\%$.

5.00 CONSTRUCTION

- 5.01 The meter shall be projection type and dust and moisture proof. The meter base & cover shall be made out of unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities. The meter body shall be type tested for IP 51 degree of protection as per IS: 12063 against ingress of dust, moisture & vermin.
- 5.02 Moulded 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 provided. The termination arrangement shall be provided with an extended transparent / translucent / opaque. terminal cover as per clause number 6.5.2 of IS: 13779 and shall be sealable independently to prevent unauthorized tampering. Proper size of grooves shall be provided at bottom of this terminal cover for incoming and outgoing service wires.
- 5.03 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.
- 5.04 All insulating materials used in the construction of the meter shall be substantially non-hygroscopic, non ageing and of tested quality.
- 5.05 All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results.
- 5.06 Sealing provision shall be made against opening of the terminal cover and front cover. It is necessary to provide screws with two holes for sealing purpose. The meter shall be pilfer-proof & tamper-proof. The provision shall be made on the Meter for at least two seals to be put by utility user.
- 5.07 The transparent / translucent base and transparent cover shall be ultrasonically welded / laser 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 Manufacturer shall put at least one seal on meter body before dispatch. The thickness of material for meter body shall be 2 mm minimum.
- 5.08 The meter shall be completely factory sealed except the terminal block cover.
- 5.09 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 "

5.10 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 time accuracy shall be as per provisions of CBIP Tech Report 88. Facility for adjustment of real time shall be provided through CMRI with proper security.

The clock day / date setting and synchronization shall only be possible through password / Key code command from CMRI or Meter testing work bench and this shall need password enabling for meter.

The RTC shall have long life (10 Years) Non rechargeable battery. The RTC battery & the battery for display in case of power failure shall be separate.

5.11 A push button shall be provided for scrolling the parameters in Alternate Display (On Demand) mode.

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

5.13 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.

5.14 OUTPUT DEVICE

The meter shall be provided with flashing LED to represent the pulse output for testing the meter accuracy by suitable testing equipment. The operation indicators must be visible from front. The test output devices shall be provided in the form of blinking LED or other similar devices like blinking LCD. The pulse rates of output devices which is Pulse / kWh (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. Resolution of the test 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.

5.15 There shall be one CT in Neutral circuit and one shunt / CT in phase circuit. The current whichever is measured as higher either by CT or shunt shall be used for processing / computing energy. The shunt shall be manganin based and e-beam welded for the construction purpose.

5.16 The meter shall have CTs with magnetic shielding and same shall be tested separately prior to assembly

- 5.17 PCB used in meter shall be made by Surface Mounting Technology.
- 5.18 The meter shall be capable to withstand phase to phase voltage (440 V) if applied between phase to neutral for minimum 5 min.
- 5.19 Power supply unit in the meter shall not be affected by magnetic influence.
- 5.20 Non specified display parameters in the meter shall be blocked. Display parameters in the meter shall not be accessible for reprogramming at site through any kind of communication.
- 5.21 Complete metering system & measurement 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) except 0.2 Tesla AC magnet test.
- 5.22 The meter shall remain immune for the test of electromagnetic HF/RF field defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date.
- 5.23 For any higher signals than the present standards for Electromagnetic HF/RF field and MSEDCL technical specifications indicated above, the energy meters shall be immune & the accuracy of meter shall not get affected.
- 5.24 The communication of energy meters shall not be affected considering the above feature stated in the clause 5.22 & 5.23.
- 5.25 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.
- 5.26 The watch dog provided shall invariably protect the hanging of microprocessor during such type of tampering devices.
- 5.27 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.
- 5.28 The meter shall record and display Fundamental energy excluding Harmonic energy. The energy meter shall record & display harmonic energy separately.
- 5.29 Self Diagnostic Features.
 - (a) The meter shall display unsatisfactory functioning or nonfunctioning of Real Time Clock battery.
 - (b) All display segments: "LCD Test" display shall be provided for this purpose.

5.30 Wireless / Cable less design:

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

5.31 **COMMUNICATION CAPABILITY**

Meter shall have minimum two communication ports.

i. One serial port shall be a standard optical port complying with hardware specifications detailed in IEC – 62056 - 21 which shall be used for meter read out using CMRI/PC or for any configuration by authorized personals.

ii. The second serial port shall be used for remote communications. Preference will be given for communication technologies that demonstrate minimum recurring charges and total cost of ownership. The communication technologies envisaged are RS-232.

iii. 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.

5.32 The meter shall be supplied with battery back up feature for displaying the parameters during power OFF condition. Battery life shall be minimum ten years.

Separate push button shall be provided for activation of battery during power OFF condition. 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.

5.33 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
- d) Anywhere on meter body

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

5.34 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.

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

6.00 TOD TIMING

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 (TZ1): 00=00 Hrs. to 06=00 Hrs. and 22=00 Hrs. to 24=00 Hrs

Zone B (TZ2): 06=00 Hrs. to 09=00 Hrs. and 12=00 Hrs. to 18=00 Hrs

Zone C (TZ3): 09=00 Hrs. to 12=00 Hrs.

Zone D (TZ4): 18=00 Hrs. to 22=00 Hrs.

7.00 MAXIMUM DEMAND (KWMD)INTEGRETION PERIOD

The maximum demand (KWMD) integration period shall be set at 15 minute or 30 minute real time based as per requirement.

8.00 MD RESET

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

- a) Communication driven reset through hand held terminal (CMRI).
- b) Auto reset at 24:00 hrs at the end of each billing cycle: Automatic reset at the end of certain predefined period (say, end of the month). This option shall be blocked by default and made programmable

through hand held terminal (CMRI) for the actual date required. No push button shall be provided for MD reset.

9.00 ANTI TAMPER FEATURES

The meter shall detect and register the energy correctly only in forward direction under any one or combination of following tamper conditions:

9.01 Load through local Earth.

9.02 The meter shall work accurately without earth.

9.03 Where neutral is disconnected from the load or from the supply side or both the load and supply side, the meter shall record the energy proportionate to the current drawn through the meter (min 20 % I_b for 5-30 A) at reference voltage and unity Power Factor. $\pm 5\%$ error in recording is admissible.

All the above tampers shall be verified at basic current at reference voltage.

The potential link shall not be provided on terminal block outside the main meter cover.

Visual indication shall be provided to show tamper conditions stated above.

9.04 The meter shall be immune to the magnetic field (AC / DC / Permanent) up to 0.2 Tesla (except 0.2 Tesla AC). Under influence of any magnetic field (AC / DC / Permanent) more than 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 maximum value current (I_{max}) at reference voltage & unity power factor.

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.

9.05 In the event the meter body cover (lid) 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 shall be some time delay for activation of this tamper feature and during that period only the meter cover shall be fitted. After the meter cover is fitted, it shall get activated immediately with out any delay. The delay in activation of software shall be for one instance only.

9.06 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 energy meters shall be immune & the accuracy of meter shall not get affected.

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

10.00 DISPLAY OF MEASURED VALUES

10.01 The display shall be permanently backlit LCD, visible from the front of the meter. The display shall be electronic and when the meter is not energized, the electronic display need not be visible.

10.02 MINIMUM CHARACTER SIZE

The energy display shall be minimum 5 digits. The height of the display characters for the principal parameters values shall not be less than 5 mm. The size of digit shall be minimum 9x5 mm.

10.03 The principal unit for the measured values shall be the kilowatt hour (kWh) and the maximum demand in kW (kWMD) alongwith the time.

10.04 The decimal units shall not be displayed for cumulative kWh in auto scroll mode. However it shall be displayed in push button mode for high resolution display for testing.

10.05 The meter shall be pre-programmed for following details.

Voltage: 240 V

Integration period for kWMD shall be of 30 minutes real time based.

The meter shall auto reset kW maximum demand (kWMD) at 2400 Hrs. of last day of each calendar month and this value shall be stored in the memory along with the cumulative kWh reading.

No reset push button shall be provided.

10.06 DISPLAY MEASURING PARAMETERS

There shall be two modes of display - (a) Auto Scrolling mode (Default Display) and (b) On Demand Mode (Push Button Mode (Alternate Display)

(A) DEFAULT DISPLAY (AUTO SCROLLING MODE)

All the following parameters shall be available in Default Display (Auto Scrolling Mode).

Sr. No.	Parameters
1.00	LCD Check

2.00	Real time & date.
3.00	Instantaneous active load in Kilowatt.
4.00	Active Energy (kWh) (Export mode)
5.00	Maximum demand (kWMD) with date & time. (Export mode)
6.00	Active Energy (kWh) (Import Mode)
7.00	Maximum demand (kWMD) with date & time (Import Mode)
8.00	Harmonic Energy (HkWh) (Export)
9.00	Harmonic Energy (HkWh) (Import)
10.00	Tamper event of Meter Cover Open with Date & Time
<p>Note:</p> <p>(1) Active cumulative energy shall be displayed for minimum 20 seconds. All other parameters shall be displayed for minimum 6 seconds including LCD check.</p> <p>(2) The meter shall display the tamper event of Meter Cover Open with Date & Time in auto scroll mode along with other parameters.</p> <p>(3) The meter shall display the tamper meter cover open with date & time in auto scroll mode along with other parameters.</p> <p>(4) The Default Display (Auto scrolling mode) shall switch to Alternate Display (On Demand Display Mode) after pressing the push button continuously for 5 seconds.</p> <p>(5) The Alternate Display shall switch over to Default Display if the push button is not operated for 15 seconds.</p>	

(B) ON-DEMAND MODE THROUGH PUSH BUTTON (ALTERNATE DISPLAY MODE).

- Cumulative Active Energy (kWh) for each calendar month for previous six months with display of month. (Export mode)
- Maximum demand (kWMD) in a calendar month for previous six months with date & time. (Export mode)
- Cumulative Active Energy (kWh) for each calendar month for previous six months with display of month. (Import mode)
- Maximum demand (kWMD) in a calendar month for previous six

months with date & time. (Import mode)

- Magnetic tamper event with date / time: This shall be displayed as per the requirement of clause no. 9.04.

The meter shall have a non-volatile memory, so that the registered parameters will not be affected by the loss of power.

11.00 DEMONSTRATION

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

12.00 BILLING HISTORY & LOAD SURVEY

12.01 BILLING HISTORY.

The meter shall have sufficient non-volatile memory for recording history of billing parameters (Cumulative kWh (Import & Export) at the time of reset and kWMD) for last 13 months.

Legends for kWh and MD shall be as below:

	I : Import		E : Export ←	
Months	MD	Energy	MD	Energy
March(Current Month)	MD	kWh	MD	kWh
Feb	MD1	kWh1	MD1	kWh1
Jan	MD2	kWh2	MD2	kWh2
Dec	MD3	kWh3	MD3	kWh3
Nov	MD4	kWh4	MD4	kWh4
Oct	MD5	kWh5	MD5	kWh5
Sept	MD6	kWh6	MD6	kWh6
Aug	MD7	kWh7	MD7	kWh7
July	MD8	kWh8	MD8	kWh8
June	MD9	kWh9	MD9	kWh9
May	MD10	kWh10	MD10	kWh10
Apr	MD11	kWh11	MD11	kWh11
March	MD12	kWh12	MD12	kWh12

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

Export → :

Import ←

12.02 LOAD SURVEY PARAMETERS.

The load survey parameters shall be selectable, however standard energy parameters like kWh (Import & Export), kWMD (Import & Export), Voltage, Current, Voltage THD (Import & Export), Current THD (Import &

Export) & PF (Import & Export) shall be mandatory to be available for selection.

The logging interval for load survey shall be 30 minutes. Load survey data shall be logged for last 45 days 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 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.

13.00 COMPUTER SOFTWARE.

- 13.01 For efficient and speedy recovery of data downloaded through CMRI on base computer, licensed copies of base computer software shall be supplied free of cost.
- 13.02 This BCS software shall be password protected.
- 13.03 The computer software shall be "Windows" based of latest version & user friendly & shall support all versions of "Windows". Also when ever there is new upgrade version operating system is released, the computer software compatible to that version should be provided within 3 months free of cost.
- 13.04 The data transfer from meter to CMRI & from CMRI to laptop computer or PC shall be highly reliable and fraud proof. (No editing shall be possible on base computer as well as on CMRI by any means).
- 13.05 This software shall be used at number of places up to Division / Sub Division level. Hence as many copies of base computer software as required up to Division / Sub Division level shall be provided by supplier.
- 13.06 BCS software shall have the facility to import consumer master data from MSEDCL billing system to BCS. Format is as follows:
- a) BU.
 - b) PC.
 - c) MR.
 - d) Route.
 - e) Sequence.
 - f) Consumer Number.
 - g) Consumer Name.
 - h) Consumer Address.

- i) Meter Serial Number.
- j) Meter Make Code.
- k) DTC code.

13.07 Import / Export shall happen on any USB port & RS - 232 port of PC / Laptop.

13.08 Every report shall have the facility to print/export as text/export as pdf.

13.09 Exporting of meter number from BCS to CMRI shall be selective on meter number or group of meters of particular MR-Route-Sequence or DTC code.

13.10 The software shall have capability to convert all the data into ASCII format as per MSEDCL requirement.

13.11 Billing Data:

Active Energy (kWh) Import

Active Energy (kWh) Export

Harmonic Energy (HkWh) Import

Harmonic Energy (HkWh) Export

13.12 Load Survey

As per clause no. 12.02 above.

13.13 Tamper Data

S.N.	Name of Tamper Event as per Clause No. 12.00	Occurance date & time	Restoration date & time
1]	Load through local Earth		
2]	Neutral disconnected		
3]	Magnetic Tamper		
4]	Meter cover Open with date & time	Only occurrence	

13.14 BCS shall maintain the audit log for connection and disconnection of CMRI to BCS. The BCS shall have the option of downloading the audit log.

13.15 BCS shall maintain the downloaded billing history.

13.16 BCS shall store the data to database in encrypted format. Encryption used shall be provided free of cost to MSEDCL.

- 13.17 BCS shall generate Exceptional report of new meters (Meters not available in CMRI initially) reading.
- 13.18 Meter manufacturer shall provide API / Exe file with documentation for downloading the data from the meter along with the sample meter.
- 13.19 Checksum logic shall also be provided for the downloaded data along with the sample meter.
- 13.20 Checksum checking Exe / API shall also be given for validating downloaded meter data as well as generated XML file with sample meter.
- 13.21 The total time taken for downloading Billing, Tamper and Load Survey Data for 45 days shall be 8 minutes.
- 13.22 Downloading time of only Billing data, i.e. kWh shall be less than 5 secs inclusive of handshaking.
- 13.23 The display parameters shall be preprogrammed at factory as per cl. no. 13.06.
- 13.24 Tamper data shall be stored in memory and retrieved by CMRI with necessary software.
- 13.25 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 number + meter number + make code shall be the key for creating consumers' files or overwriting consumers' files in PC.
- 13.26 The BCS software shall create one single file for the uploaded data, e.g. if CMRI contains the meter readings of 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.
- Also there shall be a provision to give filenames while creating the file. 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.
- 13.27 Two separate fields shall be provided for consumer name and address – one name field of one line, and other Address field of two lines.
- 13.28 The meter samples with CMRI shall be tested by our IT Department for the time required for downloading the data as confirmed by the bidder.

- 13.29 API which will be residing on CMRI will be given free of cost with all its documentation and training. Without API, meter samples shall not be approved.
- 13.30 BCS shall support all current operating system versions and shall provide new version of BCS wherever the new version of operating system released.
- 13.31 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.

14.00 COMMON METER READING INSTRUMENT (CMRI)

- 14.01 After starting the CMRI, by default it shall be in Meter Reading mode.
- 14.02 Memory of CMRI shall be 8 MB min.
- 14.03 The CMRI shall possess a specific Serial No. which cannot be changed. Every CMRI shall be properly labeled with serial number/tender number/program name/program version.
- 14.04 There shall be test option for just checking the connectivity between CMRI and meter.
- 14.05 The CMRI shall be supplied including user manual, AA size batteries and a set of direct communication cords for data downloading to the Laptop or PC for each CMRI.
- 14.06 There shall be a provision for AUTO POWER SAVE, 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.
- 14.07 The CMRI shall be capable to download following data individually after respective command to CMRI.
- (a) Only Billing Data,
 - (b) Only Billing History,
 - (c) Only Tamper Data,
 - (d) Only Load Survey Data,
 - (e) All Data.
- 14.08 CMRI shall be capable of downloading billing data of at least 2,000 (Two thousand) meters at a time. The CMRI supplied shall be capable for downloading data of multiple designs and make of meters as well as for

meters added in next 5 years for the common communication protocol attached herewith.

- 14.09 The meter specific MRI programs shall have the ability to use CMRI real time clock to tag all time related events.
- 14.10 A real time clock shall be provided in the CMRI. The clock shall have a minimum of 15 days battery backup with 30 year calendar. The time drift of the real time clock, considering all influencing quantities shall not exceed + / - 300 seconds per year.
- 14.11 After successful downloading of meter data to CMRI, an indication on both, CMRI and meter for confirmation of successful data transfer shall be provided for each set of data, viz. billing, load survey & tamper data. During this period, the energy recording in meter shall not be affected. Repeated downloading from the same meter shall be disabled for a minimum period of 15 minutes for each set of data, viz. billing, load survey & tamper data. For example, if only the Billing Data is downloaded, then further downloading of Billing Data shall be disabled for further 15 minutes.
- 14.12 CMRI shall not accept any external file other than BCS.
- 14.13 CMRI shall have the audit trail log of connection and disconnection of CMRI with BCS.
- 14.14 After downloading the data from meters, it shall be possible to create a single file for all records. The contents of this file shall not be editable.
- 14.15 Further, there shall be facility in CMRI to provide the transfer of meter data to base computer through RS 232 port as well as USB port.
- 14.16 The interface for communication between CMRI & Base computer shall be supplied free of cost. Two nos. of chords of minimum length of 1 mtr. shall be provided with each CMRI for downloading the data from CMRI to base computer.
- 14.17 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.
- 14.18 The CMRI shall have facility for re-entering the meter serial numbers directly from base computer system so that once these meters are read and the data is uploaded on base computer system, the serial numbers of existing meters could be deleted from the CMRI and the meter serial numbers of other meters can be entered in the CMRI.

CMRI shall download the data of all the meters, irrespective of meter serial number present in CMRI.

It shall show listed (meter serial number available in CMRI) and not listed meters whose data has been downloaded.

While exporting the fresh (new) meter data from BCS to CMRI, there shall have the option for downloading or deleting the old data present in CMRI.

Before deleting the data from CMRI ask (prompt) (Yes/No) twice the user for confirmation to delete the data.

14.19 CMRI shall show the following statistic of meters:

- (a) Total listed meters for reading in CMRI.
- (b) Total meter reading downloaded in CMRI (excluding the new meters),
- (c) New meters reading downloaded in CMRI.
- (d) Meter Readings not downloaded in CMRI.

14.20 CMRI shall have the option to check the reading status (Downloaded or Not Downloaded) for any particular meter.

14.21 The CMRI shall indicate the status of total consumers / meters, number of consumers / meters read and balance consumers / meters. The search facility for the balance meters shall be provided on the CMRI.

14.22 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.

14.23 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.

15.00 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. **Stickers of any kind shall not be accepted.**

16.00 NAME PLATE AND MARKING

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. The manufacturer's meter constant shall be marked on the Name Plate.

In addition to the requirement as per IS, following shall be marked on the Name Plate.

Purchase Order No.

Month and Year of manufacture

Name of purchaser: MSEDCL

Guarantee Five Years

ISI mark

Communication Capability: LPRF

The meter Serial No. shall be Bar Coded along with Numeric No. The size of Bar Code shall not be less than 35x5 mm. Stickers in any case shall not be accepted.

17.00 TESTS

17.01 TYPE TESTS

Meter shall be fully type tested as per IS: 13779 / 1999 (amended up to date) and external AC (except 0.2 T AC magnet) / DC magnetic influence tests as per CBIP Tech-Report 88 with latest amendments. The Type Test Reports shall clearly indicate the constructional features of the type tested meters. Separate Type Test Reports for each offered type of meters shall be submitted. All the Type Tests shall have been carried out from Laboratories which are accredited by the National Board of Testing and Calibration Laboratories (NABL) of Govt. of India such as CPRI, Bangalore / Bhopal, ERDA Vadodara, ETDC, ERTL to prove that the meters meet the requirements of the specification.

Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.

Type test reports shall be submitted along with offer. The type test report of meter having identical constructional and other features carried out during last three years shall be valid. The purchaser reserves the right to demand repetition of some or all the type tests in presence of purchaser's representative at purchaser's cost.

17.02 Meters shall pass the entire 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 shall be sealed randomly in the factory and shall be tested for tamper events).

17.03 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).

i. 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. The meter shall be tested with meter cover duly tightened and sealed properly.

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 low loads.

ii. 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) Tamper conditions as stated in this specification,
- iii) Glow wire testing for polycarbonate material.
- iv) Power consumption tests,
- v) Verification of data transfer / downloading via RF port as per technical specifications,
- vi) The meter shall comply all the tests for external AC / DC (except 0.2 Tesla AC magnet test) magnetic field as per CBIP Tech Report 88 with latest amendments.

Moreover, the magnetic influence test for permanent magnet of 0.5 Tesla for a minimum period of 15 minutes shall be carried out by putting the magnet on the meter body.

If the accuracy of the meter gets affected during the test, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering maximum value current (I_{max}) and reference voltage at unity power factor.

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.

- vii) The meter shall withstand impulse voltage at 10 kV.

- viii) 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 energy meters shall be immune & the accuracy of meter shall not get affected.

Jammer Test shall be carried out at MSEDCL testing Division lab.

The test 20.03.2 (i) to (v) shall be carried out at factory for each inspected lot at the time of pre-dispatch inspection.

The tests 20.03.2 (vi) & (vii) & (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 in NABL LAB.

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

17.04 LIMITS OF ERROR

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

Sr. No.	Influence quantities	current Value	Power factor	Limits of variation in % error for class 1 meters
a)	Voltage variation – 15% to +10%	I _b	1	0.7
		I _b	0.5 lag	1.0
b)	Voltage variation – 40% & + 20%	I _b	1	1.1
		I _b	0.5 lag	1.5

- i) The meters shall be tested at (-) 15% and at (-) 40% of reference voltage as well as (+) 10% and (+) 20% of reference voltage and shall record energy within limits of variation indicated above.
- ii) For other influence quantities like frequency variation the limits of variation in percentage error shall be as per IS: 13779 / 1999 (amended up to date).

18.00 GUARANTEED TECHNICAL PARTICULARS

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

19.00 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 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 Company's representative / Engineer attending the above testing shall carry out testing on suitable number of meters 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. All the meters offered for inspection shall be in sealed condition. The seals of sample meters taken for testing & inspection shall be break open & resealed after inspection. The first lot of meter may be jointly inspected by the Executive Engineer, Testing Division and the Executive Engineer, Inspection Wing.

20.00 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 same shall be tested at respective Testing and Quality Assurance Units at Aurangabad, Bhandup, Kolhapur, Nagpur, Nashik and Pune. Sample meters shall be drawn as per Annex H 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.

21.00 GUARANTEE

The meter & 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 by the supplier free of cost, within one month of receipt of intimation. If defective meter / CMRI is not replaced within the specified period as above, the Company shall recover an equivalent amount plus 15% supervision charges from any of the bills of the supplier.

22.00 PACKING

22.01 The meters shall be suitably packed in order to avoid damage during transit or handling. Each meter may be suitably packed in the first

instance to prevent ingress of moisture and dust and then placed in a cushioned carton of a suitable material to prevent damage due to shocks during transit. The lid of the carton may be suitably sealed. A suitable number of sealed cartons may be packed in a case of adequate strength with extra cushioning. 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.

22.02 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 Material indicating contents of each package and spare material.

23.00 TENDER SAMPLE

Tenderer are required to submit 15 (Fifteen) nos. of sample meters and 1 (One) no. of sample CMRI of offered type and 2 (Two) Nos. of meter enclosures as per technical specifications along with the API software, BCS, checksum logic & documentation to Executive Engineer (Store Management) in the office of the Chief Engineer, MSEDCL, Material Management Cell, 1st Floor, Prakashgad, Bandra (E), Mumbai – 400 051 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, ETDC and testing the offered API with BCS software, checksum logic & documentation by our IT Department as per technical specifications for testing TOD tariff protocol & interoperability, etc. The offer of those eligible bidders shall only be considered if the sample passes the tests at NABL Lab as well as necessary certification from our IT Department for the offered API, TOD tariff protocol & interoperability, etc. The results of NABL Lab and the certification from IT Department shall not be disputed and shall be binding on the bidder. The required information such as Manufacturer's Name or Trade Name, Sr. No. ISI Certification No. API specification 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 / laser welding to confirm constructional features.

24.00 QUALITY CONTROL

- 24.01 The purchaser has a right to send a team of experienced engineers for assessing the capability of the firm for manufacturing and testing 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.
- 24.02 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.

25.00 MINIMUM TESTING FACILITIES

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). Test Reports for each and every meter shall be generated. The list of testing equipments shall be enclosed.

The manufacturer shall have the necessary minimum testing facilities for carrying out the following tests:

- (i) Insulation resistance measurement,
- (ii) No load condition,
- (iii) Starting current,
- (iv) Accuracy requirement,
- (v) Power consumption,
- (vi) Repeatability of error,
- (vii) Transportation test – as per clause no. 19.03.1,
- (viii) Tamper conditions - as per clause no. 10.00,
- (ix) LPRF communication connectivity Test as per clause no. 5.23.
- (x) The manufacturer shall have duly calibrated RSS meter of class 0.1 or better accuracy.
- (xi) The manufacturer shall have Glow Wire Testing facility.
- (xii) 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.

26.00 MANUFACTURING ACTIVITIES

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

i) Meter shall be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and reflow solder process. The loops/wired joints must be avoided on PCB. 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.

ii) Quality shall be ensured at the following stages:

- At PCB manufacturing stage, each Board shall be subjected to computerized bare board testing.
- At insertion stage, all components shall undergo computerized testing for conforming to design parameters and orientation.
- Complete assembled and soldered PCB shall undergo functional testing using Automatic Test Equipments (ATEs).
- Important: - Prior to final testing and calibration, all meters shall be subjected to ageing test (i.e. Meters shall be kept in heating chamber for 72 hours at 55°C temperature at full load current. After 72 hours, meters shall work satisfactory) to eliminate infant mortality.

iii) The calibration of meters shall be done in-house on a computerized testing bench having stabilized power supply.

iv) The bidders shall submit the list of all (imported as well as indigenous) components to be used in meter, separately along with the offer. List of makes of components is attached herewith as a guide line (Annexure II).

v) 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.

vi) List of Plant and Machinery used for production of energy meters.

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
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
25	Injection Moulding Machine	Moulding of plastic parts
26	CNC Milling Machine for composite tool fabrication	Tool fabrication and Die manufacturing
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

27.00 QUALITY ASSURANCE PLAN

27.01 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.

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

28.00 COMPONENT SPECIFICATION

As per Annexure II enclosed.

29.00 SCHEDULES

The tenderer shall fill in the following schedules and submit along with the offer. If the schedules are not submitted duly filled in with the offer, the offer shall be rejected.

Schedule 'A' ... Guaranteed Technical particulars (As per GTP parameters 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, shall not be considered and representations in this regard will not be entertained. If it is observed that there are deviations in the offer in Guaranteed Technical Particulars other than those specified in the deviation schedules then such deviations shall be treated as deviations.

SCHEDULE 'C'

TENDERER'S EXPERIENCE

Tenderer shall furnish here list of similar orders executed /under execution for supplying meters boxes by him to whom a reference may be made by purchaser in case he considers 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 _____

DESIGNATION _____

DATE _____

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 plan and purchaser's hold points shall be discussed between the purchaser and bidder before the QAP is finalized.
- C) The contractor shall operate systems which implement the following:
- i) Hold point: A stage in the material procurement or workmanship process beyond which work shall not proceed without the documental approval of designated individuals organizations. The purchaser's written approval is

required to authorize work to progress beyond the hold points indicated in quality assurance plans.

- ii) Notification point: A stage in the material procurement or workmanship process for which advance notice of the activity is required to facilitate witness. If the 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 the contractor's work procedures appropriate to each activity.
- > Inspection during fabrication / construction.
- > Final inspection and test.

ANNEXURE II

COMPONENT SPECIFICATION

Sr. No.	Component function	Requirement	Makes
1	Measurement or computing chips	The measurement or computing chips used in the Meter shall be with the Surface mount type.	<p>USA: Analog Devices, Cyrus Logic, Atmel, Philips, Teridian. Dallas, ST, Texas Instruments, Motorola, Maxim, National Semiconductors, Freescale, Onsemiconductors</p> <p>Germany: Siemens.</p> <p>South Africa: SAMES.</p> <p>Japan: NEC, Toshiba, Renasas, Hitachi.</p> <p>Austria: AMS</p> <p>Holland: Philips (N X P)</p>
2	Memory chips	<p>The memory chips shall not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. Meter shall have non volatile memory (NVM). No other type of memory shall be used for data recording and programming. (The life of the NVM is highest)</p> <p>There shall be security isolation between metering circuit, communication circuit, and power circuit.</p>	<p>USA: Atmel, Teridian, National Semiconductors, Philips, Texas Instruments, ST, Microchip, Spanson (Fujitsu), Ramtron</p> <p>Japan: Hitachi, Renasas</p> <p>Germany: Siemens</p>
3	Display modules	a) The display modules shall be well protected	Singapore: E-smart, Bonafied Technologies, Display Tech,

		<p>from the 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 (refer 3.2 d for viewing angle).</p> <p>c) The construction of the modules shall be such that the displayed quantity shall not be disturbed with the life of display (PIN Type).</p> <p>d) It shall be trans-reflective HTN (HTN – Hyper Twisted Nematic (120°)) or STN (STN – Super Twisted Nematic (160°)) type industrial grade with extended temperature range. HTN – Hyper Twisted Nematic (120°) STN – Super Twisted Nematic (160°)</p>	<p>Korea: Advantek, Jebon, Union Display Inc.,</p> <p>Japan: Hitachi, Sony, L&G.</p> <p>Malaysia: Crystal Clear Technology.</p>
4	Electronic components	<p>The active & passive components shall be of the surface mount type & are to be handled & soldered by the state of art assembly processes.</p>	<p>USA: National Semiconductors, Atmel, Philips, Texas Instruments, BC Component Analog devices, ST, Maxim, Kemet Onsemiconductors, Freescale, Intersil, Raltron, Fairchild, Muruta, Agilent, AVX, Abracon, Sipex, Diode Inc., Honeywell, Power Integration, Fox, Roham</p> <p>Japan: Hitachi, Oki, AVZ or</p>

			<p>Ricon, Toshiba, Epson, Kemet, Alps, Murata, TDK, Sanyo, Samsung</p> <p>India: Keltron, Incap, VEPL, PEC, RMC, Gujarat Polyavx, Prismatic, MFR Electronic components Pvt. Ltd., Cermet</p> <p>Korea: Samsung</p> <p>Japan: Panasonic</p> <p>Germany: Vishay, Epcos, Diotech, Kemet</p>
5	Battery	<p>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.</p>	<p>USA: Maxell, Renata</p> <p>Japan: Panasonic, Sony, Mitsubishi, Sanyo</p> <p>Germany: Varta</p> <p>France: Saft</p> <p>Korea: Tekcell, Vitzrocell</p> <p>Israel: Tadiran.</p>