

STANDARD FOR SINGLE PHASE LT STATIC WHOLE CURRENT SOLID STATE ELECTRONIC ENERGY METERS WITH BACKLIT LCD DISPLAY

44.1 SCOPE:-

- (a) This specification covers design, engineering, manufacture, stage-inspection, testing and supply of A.C. Single phase two wire current rating 5-30 Amp solid state (static) whole current electronic LT energy meters of accuracy class 1.0 with backlit LCD display and communication port for data downloading as per requirement given in this specification. The meters shall be supplied in a push fit type meter box made of transparent engineering plastic, which shall be weather proof having flame retardant properties conforming to relevant specification. The meter and push fit type meter box shall be supplied in suitable packing so as to withstand transit shocks during road transport.

The meters should be suitable for single phase two wire system, capable to record and display monthly average p.f., energy in KWH, and demand in "KW" including other electrical quantities. The meters shall be capable to record over full power factor range of Zero Lag-Unity- Zero Lead, as per requirement given in this specification. These LT Meters should record total energy at basic frequency & harmonics. In addition the meters shall have provision for recording time of day (TOD) energy parameters.

- (b) It is not the intent to specify completely herein all the details of the design and construction material. However, the material 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 the Purchaser, who will interpret the meanings of drawings and specification and shall have the right to reject any work or material which in his judgment is not in accordance therewith. The offered materials shall be complete with all components, accessories and required software's necessary for their effective and trouble free operation in the System for measurement of electricity supplied to the consumers. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/ or the commercial order or not.

- (c) **It is compulsory that the offered LT meters shall bear BIS certification i.e. the meters shall be ISI marked and the bidder shall have to furnish valid ISI license along with the offer, which, if considered necessary, may be verified by the Purchaser.**

44.2 STANDARDS:

These LT meters and the associated accessories shall conform in all respects to the following relevant Standard Specifications with latest amendment there to:-

Indian Standard No.	Title
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IS:13779-1999 read with latest amendments	Specification for AC static watt hour meter for class 1 & 2
CBIP Technical report No.88 (with latest amendments)	Specification for AC static Electrical Energy Meters
IS:5133-1969 (Part II)	Specification for boxes for the enclosure of electrical accessories
IS:9000	Basic environmental and other Testing for Electronic & Electrical items.
IS:11731	Specification for engineering plastic
IS: 11000	Resistance to heat & fire
CEA Regulation	On installation of meters of. 17/03/06

44.3

SERVICE CONDITIONS (CLIMATIC CONDITIONS):

- (i) The LT meters to be supplied against this specification should be capable of performing and maintaining required accuracy under extreme hot, cold, tropical and dusty climate and solar radiation typically existing in State of M.P. The LT meter shall be required to operate satisfactorily and continuously under the following tropical climatic conditions:

	Maximum ambient air temperature	55°C
	Maximum ambient air temperature in shade	45°C
	Maximum temperature attainable by the meter exposed to sun	60°C
	Minimum ambient temperature	(-) 5°C
	Average daily ambient air temperature	40°C
	Maximum relative humidity	95%
	Number of months of tropical monsoon condition	4 months
	Maximum altitude above mean sea level	1000 meters
	Average annual rain fall	150 cms
	Maximum wind pressure	200 kg/sq.m
	Isokeraunic level (days per year)	40
	Seismic level (horizontal accn.)	0.30 g
	Permitted noise level	45db

All the parts & surface, which are subject to corrosion shall either be made of such material or shall be provided with such protective covering and finish, which ensures total protection from any injurious effect of humidity.

44.4

PRINCIPAL PARAMETERS:

These LT meters shall conform to the following specific parameters:

	Item	Specification
	Type of installation	Indoor/Outdoor
	System voltage (phase to neutral)	240V + 20% to - 40% neutral solidly grounded.
	System frequency	50 Hz \pm 5%
	No. of phases	1 phase 2 wire (single Phase +Neutral)
	System earthing	Solidly grounded
	Resistance to surge voltage of 1.2/50 Micro sec.	As per relevant IS
	Test voltage at 50 Hz	4KV RMS for 1 minute including latest amendments in relevant IS.

44.5

CONSTRUCTIONAL REQUIREMENTS:

The meters including meter case and push fit type meter box shall be fully transparent designed and constructed in a manner to avoid any danger during use under normal working condition including personal safety against electric shock. The meter case and push fit type box should comply following parameters:-

Material Used for Meter case and Push Fit type Meter Box:

- i. The meters shall have a case, which shall be solidly welded to the meter base so that access to the internal parts should not be possible without breaking the meter case. The material of meter body (base and cover) shall be made of Engineering plastic.
- ii. The meter casing material should be glass reinforced, flame retardant, unbreakable engineering plastic material to ensure high reliability, long trouble free life, safety against electric shock, spread of fire and effects of excessive temperature. The material should be corrosion resistant, inert to chemicals, oxidizing agents, petro-chemical products, acids, salts and ultraviolet radiation. The meter chamber shall be dust proof and moisture proof. The supplier should indicate hardness, melting temperature and tensile yield strength of the material and necessary test certificate of the same shall be furnished. The meter base and cover should be sturdy enough to prevent damage during transportation and installation.
- iii. The engineering plastic used shall conform to IS: 11731 besides meeting the test requirement of heat deflection test and as per IS 11000(Part2 sec1) for resistance to heat and fire as per glow wire test specified in the relevant standard.
- iv. All electrically live screws shall be of heavily tinned brass/nickel or zinc plated steel. All other screws shall be electro plated.
- v. The terminal inserts shall be of heavily tinned brass/ nickel or silver plated copper, zinc plated steel.
- vi. The meter shall conform to the degree of protection IP51 of IS: 12063 for protection against ingress of dust, moisture and vermin.

- vii. The meter should be immune against jump during sudden switching of heavy loads or transient voltage spikes.

44.6 RATINGS:

The LT meters as specified in scope of this tender shall be rated as follows:

	Voltage	240V
	Current	
	Basic current (Ib)	5A
	Rated max. continuous current (Imax)	30A
	Frequency	50 Hz
	Accuracy	Class 1.0

44.7 POWER SUPPLY VARIATION:

The extreme power supply variations which the LT meter should withstand without damage and without degradation of its metering characteristics, as it operates under its normal operating conditions would be as under:

Voltage	+20% to – 40% of rated voltage
Current	120% of Imax.
Frequency	± 5% of rated frequency
PF range	Zero (lag) – unity – Zero (lead)

The LT meter shall work over wide PF range and the limits of errors with the variation of PF shall be as per CBIP 88 (latest amendments)/IS: 13779

44.8 POWER CONSUMPTION:

44.8.1 **Voltage Circuit:** The active and apparent power consumption in each voltage circuit (per phase) including power supply of LT meter at reference voltage, reference temperature and reference frequency shall not exceed 1.5 Watts and 8 VA respectively as per IS:13779.

44.8.2 **Current Circuit:** The apparent power taken by each current circuit (per phase) at basic current, reference frequency and reference temperature shall not exceed 4 VA as per IS:13779.

44.8.3 **Auxiliary Power:** The LT meter shall draw power for working of electronic circuit from phase & neutral.

44.9 STARTING CURRENT:

The LT meter should start registering energy at 0.4% of basic current at UPF as per IS: 13779.

44.10 RUNNING WITH NO LOAD:

When 115% of rated voltage is applied with no current flowing in current circuit, the test output of the LT meter shall not produce more than one output pulse count as per IS: 13779.

44.11 INFLUENCE QUANTITIES:

The single & three phase LT meter shall work satisfactory with guaranteed accuracy as per limit prescribed in IS:13779 under presence of the following quantities:-

- (i) External magnetic field
- (ii) Electromagnetic field
- (iii) Radio frequency interference
- (iv) Vibration
- (v) Harmonic wave form
- (vi) Voltage fluctuation
- (vii) Electromagnetic high frequency field

44.12 TEMPERATURE RISE:

- (a) Under normal conditions of use at I_{max} current, winding and insulation shall not reach a temperature, which might adversely affect the operation of these LT meters.
- (b) With each current circuit of the meter carrying rated maximum current and with each voltage circuit (and those auxiliary voltage circuits which are energized for periods of longer duration than their thermal time constant) carrying 1.20 times the rated voltage, the temperature rise of the external surface shall not exceed by more than 20°C, with the ambient temperature between 25°C to 45°C.

44.13 LIMITS OF ERRORS:

When the LT meter is under reference conditions, the percentage errors shall not exceed the limits as specified in IS: 13779.

44.14 DISPLAY:

44.14.1 The LT meters shall have bright LCD Electronic display with backlit & with minimum 6 digits to read up to one tenth of KWh with another digit for legend. The decimal digits shall be clearly distinguished from integer digits. The backlit should not glow during power off condition. The LCD shall be of STN (Super Twist Nematic) type designed suitably to withstand temperature of 80°C (storage) & 65°C (operation).

- (i) When the LT meter remains at a constant temperature of 65°C for a period of 30 minutes, the character of LCD should not deform.
- (ii) After keeping the LT meter at a constant temperature of 80°C for a period of 30 minutes and when restores at normal temperature, LCD display should work as in normal conditions.

The LCD display should have a wide viewing angle of 45° to 60° up to one-meter distance, for clear visibility of the display of the meter reading. Large viewing area with large display icons is desired. The registered parameters shall not be affected by loss of power. The display shall not be affected by electrical and magnetic disturbances. The meter shall make use of non-volatile memory capable of storing and retaining all the data required to be stored, without the help of any power source or battery back up and shall have a minimum retention time of 12 years under un-powered condition. The minimum character height X width shall be 8.5 X 5 mm for whole digits of kWh Display. **Dot-Matrix type LCD display is not acceptable.** The accuracy of display for all parameters shall be matching with the accuracy class of meter as per IS.

44.14.2 The display of various parameters in push button mode shall be scrolling one after another. The display shall have ON time of at least 10 seconds for each measured value.

44.14.3 The meter shall be capable to measure and display continuously "Active Energy KWh" at all loads and in full power factor range of zero lag- unity- zero lead. The LT meter should also have provision for automatic recording and storing of required parameters at 24.00 Hrs on the last day of the month for each calendar month and the same should go to memory.

44.15 DISPLAY SEQUENCE:

The Liquid Crystal Display register for single and three phase LT meter should display the measured value(s). The height of the display character should be minimum 8.5 mm. In addition display of the required parameters should be in two different modes as stated hereunder:-

44.15.1 Auto scroll Display Mode:

The LT meters shall have following parameters in auto scroll display

- i) Date: DD: MM: YY Real Time: HH:MM
- ii) Cumulative Active Energy KWH
- iii) Instantaneous load in Watt.

44.15.2 Display parameter (Push Button) Mode:

The display of the following parameters shall be scrolling one after the other through push button. The display shall have 'ON' time of minimum 10 seconds of each measured value, except LCD segment check. The LCD segment check shall be on meter display for minimum 2 seconds. Display parameters shall move forward if button is pressed prior to the programmed time for display of each parameter.

- (a) LCD segment check
- (b) Meter serial number
- (c) Real date and time (Date DD-MM-YY, Time HH-MM)
- (d) Cumulative active energy (KWH) register.
- (e) Maximum demand of the month in KW by default up to two decimal (since last auto reset) with date & time with 15 minutes integration period.

- (f) Cumulative active energy KWH for each calendar month for previous six months with programmed billing date.
- (g) Maximum Demand in KW up to two decimal for each calendar month for previous six months with date and time of such demand
- (h) Average P.F. for each calendar month and for previous six months.
- (i) Tamper information- this shall be displayed when tampered with following.
 - (a) Date of last tamper occurrence.
 - (b) Time of last tamper occurrence.
 - (c) Number of time meter tampered.
- (j) Instantaneous phase voltage
- (k) Instantaneous line current
- (l) Instantaneous p.f. (With sign of lead/lag)
- (m) Instantaneous load in Watt
- (n) High resolution Energy value (resolution will be sufficient to enable conduction of the starting current and accuracy test in less time.)

Since meters are required duly fitted with push fit type meter box, hence for reading purpose, an arrangement should be made on top cover of push fit type meter box with its mechanical connection to the meter's body as described in the Specification of meter box to activate the display push button of meter.

The display with push button shall be auto off type after completion of the display cycle it should revert back to normal auto scroll mode approximately after 10 seconds. Fresh button press will be required after resumption of auto scroll cycle to display the above parameters again.

44.15.3 Meter Reading during Power Outage:

The meter shall have provision to read the meter in no-power condition. The same push button shall be used for display of parameters of. auto scroll mode during power outage. In any case, RTC Battery Power shall not be used for display under no-power condition.

44.15.4 LCD Least Count:- __

The kWh display shall be with one decimal digit in push button mode and in auto scroll mode. The internal least count of the energy recording shall not be more than 0.01 KWh. and every 0.01 KWh, consumption shall be internally stored.

44.16 COMMUNICATION CAPABILITY

44.16.1 The meter shall have wireless communication facility for remote reading through LPR (low power radio) communication Port. The meter shall have facility for communicating with a hand held terminal (HHT) i.e. Common Meter Reading Instrument (CMRI) through this port to facilitate for auto-reading and downloading the data for billing and historical data to base computer. The interface for communication between MRI & Base computer shall be supplied free of cost. The software required for CMRI and Base Computer System with necessary security provisions shall also be supplied free of cost with the following features:

- a. It shall be possible to read the meter via RF up to minimum 100 metres in any spherical direction from the meter. Longer communication range is preferred.
- b. In LPR communication, it is preferred that the range is further increased through mesh networking of installed meters. However, no pre-installation programming or post installation programming shall be required for this purpose. In such case time of reading for the next layer of meters may vary and the additional time of +3 sec for each added meter layer i.e. for each hop shall be allowed.
- c. In addition to LPR communication, additional infrared port is required to read the meters in case of power outage. In case of infrared communication port, it should be possible to read the meter through external CMRI via infrared media from a minimum distance of 1.5 metres in front of the meter box.
- d. It should not be possible to reset the energy reading in the meter or make any change in the data stored in the meters either current or historical, with the MRI.
- e. The LPR and infrared module of the meter shall have no physical access from outside the meter.
- f. Infrared transmitter and receiver should be compliant to the latest IrDA Physical Layer Standard.
- g. The Frequency range for LPR equipment shall be approved frequency range from Govt. of India.
- h. The meter shall use licence free frequency band for communication so that licence for use of LPR equipment to read energy meter at site not required.
- i. The compatibility of transferring data from the meter to MRI and then to the base computer system (BC) should be easily established; any change in language or any other reasons, the supplier shall modify it at his own cost within the guarantee period.
- j. For the purpose of data security, the data transfer from the meter to CMRI and further to Base computer should be fully secured and any unauthorized attempt/change in data should be indicated on computer system. There should be multi level password on the base computer system and in the meter to prevent any unauthorized change of billing parameters, resetting of demand and tamper in formation.

44.17 BILLING POINT REQUIREMENTS:

The predefined date and time for registering the billing parameters of energy, PF and MD as well as Tamper Count and Power-On hours details shall be at 00.00 hours of the first day of each calendar (billing) month and all the billing parameters shall be transferred to billing registers.

The above billing data, TOD register's data, tamper information and instantaneous parameters data shall all be retrievable through the meter's communication port through a common meter reading instrument (CMRI) and shall be transferred (downloaded) to a PC with Windows based software to get complete details in numerical and/or graphic form. The necessary base computer software (BCS) for this purpose shall be provided by the supplier with complete details.

44.18 TOD TARIFF/DEMAND

The meter should be capable of registering the time-of-day energy (TOD) and maximum demand. The time registers shall be programmable by the purchaser. The meter should have in-built capacity to define up to six registers. The meter should also have capacity to define multiple time zones within the registers. The change of the TOD time-period(s) or defining TOD registers should be possible through CMRI with special authenticated command from the BCS so that only authorized person(s) can make such changes. The main control of this system along with proper security password/code should be available on one or more computers located at the authorized location(s) as per the directions to be given by the Purchaser.

Provision should be made for automatic reset of maximum demand at the end of pre-defined period (e.g. end of the month). The billing parameters at the time of automatic reset of MD shall be programmed such that it will transfer from rate registers to their respective billing registers. The main control of this system along with proper security password/code should be made available on one or more identified computers located at the authorized location(s) as per the directions to be given by the Purchaser

Necessary compatible meter application software for various programmable features as discussed above in the meter and also necessary software for the IBM compatible computer to obtain various details as discussed above shall be provided by the supplier. No separate cost will be borne by the purchaser on this account.

44.19 TEST OUTPUT DEVICE:

The LT meters shall have a test out put device in the form of calibrating LED of red colour having minimum intensity 10 M (Milli-candela) accessible from the meter front and shall be capable of being monitored conveniently with suitable testing equipment while operating at site. The location of the calibrating LED should be such that the calibrating pulses can be sensed easily through sensor for site testing of the LT meter's accuracy.

The LT meters shall also give high-resolution energy values on the display The resolution will be sufficient to enable conduction of the starting current and accuracy test in less time.

44.20 BASE COMPUTER APPLICATION SOFTWARE

For efficient and speedy recovery of data read through CMRI/HHU, Base computer software shall be supplied having the following specifications stated as under:

The BCS software shall be user friendly Windows based. The Base Computer software shall give all details adequate for analysis. The software shall have the facility to convert all the consolidated information / data of selectable parameters into ASCII format. It should be possible for the Purchaser to generate its own DBF (data base files) to down load all the required information into it.

Platform: The BCS shall be executable on all WINDOWS system. The BCS shall be suitable to run on IBM compatible PC hardware platform.

Meter Data Display: The software shall show electrical condition existing at the time of reading the meter in tabular forms as well as graphical format (Phase diagram)

All the information about energy, maximum demand and their respective TOD register reading, billing register readings shall be shown in a manner which user can easily understand.

The software shall be capable of preparing CMRI to read the meter information or time setting of the meter.

Support Display: There shall be "user friendly" approach for viewing meter data for the reading collected now or for the reading collected in the past. All information about a particular consumer will be sorted out and available at one place so that locating any consumer's past data is easy. It shall be possible to retrieve/locate data on the basis of either one of the following particulars:

Consumer's ID/Numbers.

Meter Sr. No.

Date of meter reading.

Location.

The Data Transfer :It shall be possible to transfer data to and fro from CMRI through serial interface.

Configurability: It shall be possible to have selective printing of all available data of the meter. Print out shall not include anything and everything available with the BCS. The software shall support "print wizard" whereby user can decide what to print out. The use of the software need not revert back to the supplier of the software for modifying the software just to print what he desires.

BCS shall have facility to export data to ASCII or spreadsheet format for integrating with the purchaser's billing system. Here again an "Export wizard" or similar utility shall be available whereby user can select file format, what data to export, the field width selection etc.

Security: The BCS shall have multilevel password for data protection and security. The first level shall allow the user to enter the system. The different software features shall be protecting by different passwords. The configurable of passwords shall be user definable. The software installed on one PC shall not be copy able on another PC.

Help: The exhaustive online help shall be available with the software so that user can use all the features of the software by just reading the help contents.

44.21 Common Meter Reading Instrument (MRI)

The Bidder should carefully note that

- a. The MRI shall be supplied in the ratio of **one** for **each 200 nos.** of meters free of cost along with battery charger.
- b. The MRI shall have facility to store minimum **1000 nos.** of meter's data. Further, there should be a facility in MRI to provide the transfer of meter data to computer through RS 232 or USB port.
- c. The MRI shall be capable for down loading readings of other makes of meters. The bidder shall give an undertaking to this effect.
- d. The MRI shall have possibility to read all of the three communication types of meters purchased by MPPKVVCL – optical port, infrared and LPR. MPPKVVCL shall exchange the communication protocols of successful bidders.
- e. The infrared and LPR mode of MRI shall have a feature to read multiple meters within the range without pre-programming the meter serial numbers in advance. Even in case of optical port, pre-programming the meter serial numbers in advance shall not be required.
- f. The data downloading time (from meter to MRI) shall not exceed 5 sec for each meter (with +2 sec. max tolerance time). In case of LPR with mesh networking, time of reading for the next layer of meters may vary and the additional time of +3 sec. for each added meter layer i.e. for each hop shall be allowed.
- g. After successful downloading, indication shall be available on both meter and MRI and repeated downloading from the same meter shall be disabled for a minimum period of 15 min.
- h. The communication software shall be capable to transfer the billing data and meter serial number required for automatic Spot Billing Machine to automatically generate the energy consumption bills at consumer premises without any human intervention after the data is collected by the MRI. The MRI shall continuously transmit the data until an acknowledgement is received from the SBM (Spot Billing Machine). The manufacturer shall provide the protocol and other information to interpret the transmitted billing data. The data storage inside the MRI and communication of MRI with the meter shall be encrypted so that there is no possibility of tampering with the downloaded data.

It shall be responsibility of the meter manufacturer to provide the required software and all the facilities and support required by the purchaser, to use the CMRI for reading and retrieving the data from the meter and to download the data to Base Computer on free of cost basis till the expiry of guarantee period.

44.21.1 Readings to be downloaded with CMRI:

The CMRI should support in down loading all-important data stored in meter whether specified or not required essentially for deriving billing parameters including MD parameters. The following minimum parameters should be downloaded by CMRI.

- i. Sr. No. of meter
- ii. Date & Time
- iii. Instantaneous current
- iv. Instantaneous voltage
- v. Cumulative Active energy (KWh)
- vi. MD during the month
- vii. Instantaneous load in Watt
- viii. Instantaneous Power factor (sign of lag or lead)
- ix. Cumulative active energy in KWh for the last 6 months
- x. Maximum demand in KW for the last 6 months up to two decimal
- xi. Average PF of the last 6 months
- xii. TOD 1,2,---,6 Cum. KWh register(Programmable)
- xiii. TOD 1,2,---,6 MD register KW up to two decimal (Programmable)

- xiv. TOD 1,2,---,6 Billing MD registers
- xv. TOD 1,2,---,6 Billing KWh registers
- xvi. Tamper information including cover open tamper
- xvii. Any other information whether specified or not, which is in the opinion of manufacturer is necessary for satisfactory performance of the meter, the manufacturer shall indicate such features in their offer without demanding additional cost.

The LT meter shall possess a suitable fast and reliable Infrared/RF communication port for automatic transfer of data from Meter to CMRI. Arrangement in the meter should be such that, in case of failure of power supply, it should be possible to download the data.

The CMRI shall possess easily replaceable battery and shall be capable of storing data for at least 1000 nos. meters at one time.

The CMRI shall possess a specific serial number, which cannot be changed/ altered.

The downloaded data along with date and time stamp of such reading shall remain on CMRI with suitable encryption and it should not be possible to pre-program or manipulate the recorded data on the CMRI before downloading the same on computer. The Supplier shall supply Software (compatible with Windows 98 system and/or higher) and training, free of cost for the use of software at multiple data collection and billing premises of the utility.

After successful downloading of meter data to CMRI, an indication on MRI or meter or both for confirmation of successful data transfer shall be provided. During this period the energy recording should not be affected.

Necessary upgrades shall be possible in CMRI software and shall be supplied free of cost for downloading simultaneously the existing parameters and any parameters added in future specifications of meters. A copy of operation manual shall be supplied along with each CMRI.

The Supplier shall provide meter-reading protocols free of cost, which shall not be complicated and shall be easily understandable by utility officials to ensure compatibility between meters and CMRIs of different makes.

44.22 MAXIMUM DEMAND REGISTRATION AND MD RESETS:

The Meter shall continuously monitor and calculate the maximum demand at the point of supply, during any consecutive 15 minutes during the calendar month . It shall store the maximum demand with date and time, when it occurred. The maximum demand shall automatically reset at 24.00 Hrs of the last date of each calendar month for which minimum 30 years calendar shall be programmed by the manufacturer.

Maximum demand of the month shall be in KW up to two decimal digits.

44.23 REAL TIME CLOCK AND BATTERY:

The MD integration cycle shall be on the basis of Real time clock of the meter. The maximum drift in real time clock of the meter shall not exceed ± 3 minutes per year and crystal should be temperature compensated for temperature range of 0°C to 50°C. A lithium battery of adequate storage energy shall be used for energy supply to real time clock during no

voltage or power off condition. The metering data stated above including integration etc shall be independent of battery. The minimum life of battery should be ten years.

44.24 CALIBRATION:

The meters should be software based factory calibrated and there shall not be any mechanical adjustment in calibration after freezing the parameters at works. This is to ensure that the meter cannot be calibrated at site.

44.25 CONSTRUCTION:

Meter shall be designed and constructed to be capable of withstanding all severe stresses and vibration and dust environments likely to be encountered in actual field conditions. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.

44.26 TERMINALS AND TERMINAL BLOCK:

- 44.26.1 The terminals may be grouped in a terminal block having adequate insulating properties and mechanical strength. The terminal block should be made from best quality non-hygroscopic, flame retardant material (capable of passing the flammability tests given in IS:11731) with nickel plated brass for connecting terminals. It shall be an integral part of the meter base.
- 44.26.2 Terminal holes shall be of minimum 6.5mm to accommodate the insulation of conductor and shall be of adequate length in order to have proper grip of conductor with cage clamp arrangement /crimping pins with the help of two screws such that there is no risk of loosening or undue heating. Electrical connection shall be so designed that contact pressure is not transmitted through insulating material. Required number of pins along with one additional pair shall be supplied with each meter.
- 44.26.3 Sufficient clearance shall be allowed between terminals. Further, the supporting webs between the two terminals of the terminal block should be sufficiently high to ensure that the two neighbouring terminals do not get bridged by dust or it is not possible to have flashed over between adjacent terminals of terminal block.
- 44.26.4 The terminals shall be of suitable rating to carry 200% of I_{max} and shall be made of electro-plated (or tinned) brass.
- 44.26.5 All connection screws and washers should be tinned/ nickel-plated brass/ Zinc plated steel. The terminal screws shall not have pointed end at the bottom. All terminals shall have two screws. The terminals shall be properly bound in the insulating material of terminal block.

44.26.6 The terminal block shall have provision with single/two screws for fixing to the meter board. It shall not be possible to remove the meter from the hanging screw without removing the screws from the terminal block.

44.26.7 The voltage circuit and current circuit shall be solidly connected inside the meter body without any link. A firm connection shall be established within the meter case to energize the voltage/current circuit. The connections shall be as per the recommended methods given in IS-13779.

44.27 CURRENT AND VOLTAGE CIRCUITS:

The current and voltage circuits shall be made of appropriate material such as enamelled copper wire of EC grade. The current circuit shall be appropriately insulated and potential circuit shall be appropriately encapsulated. The cross section of current circuit shall be designed to withstand the temperature rise of 50°C over the ambient temperature at maximum current. PT less design shall be used for power supply to PCB. The meter design shall be based on CT or CT and shunt combination or shunts. It is necessary to ensure accurate recording by the meters during the condition when DC component exists in the load, EM CT/Shunt currents should be compared and higher of the two should be used for measurement. Specific confirmation shall be submitted by the bidders that accuracy of measurement will not suffer due to utilization of shunt on account of thermal variation and temperature coefficient up to an operational temperature of 80°C.

44.28 **CT/Shunt Fixing arrangement:-** The CTs/Shunts & other measurement devices when provided in the meter shall be mounted through proper fixing arrangement so that it should have a firm support and should not move from its position in any case.

44.29 METER FIXING ARRANGEMENT:

Every meter shall have at least three fixing holes one at the top and two at the bottom. The top hole shall be provided with a special clip at the back of the meter so that holding screw is not accessible after the fixing of the meters. The lower fixing screws shall be provided under the terminal block. The requisite fixing screws shall be supplied with each meter.

44.30 CONNECTION DIAGRAM & TERMINAL MARKINGS:

The connection diagram of the meter shall be clearly shown on the nameplate of meter and shall be of permanent nature. The meter terminals shall also be marked and this marking should appear in the above diagram.

44.31 TERMINAL ARRANGEMENT:

Connecting terminals of the meter shall be in the following sequence:

Phase (in) Neutral (in), Neutral (out), Phase (out)

44.32 NON FLAMMABILITY:

The terminal block, and the meter case shall be such as to ensure reasonable safety against spread of fire. It shall not be ignited by thermic over load of live parts in contact with them. To

comply with this requirement, all the parts shall fulfill the conditions of the glow wire test as per relevant standard.

44.33 SEALING ARRANGEMENT:

44.33.1 The meters should be software calibrated at factory and sealed suitably before dispatch.

44.33.2 The meter shall be provided with 2 nos. polycarbonate tamper evident seals which shall be marked with "MPEZ", company logo and shall be additionally laser marked with serial no. matching with that of meter. The serial number of meter is to be laser –etched on the base as well as the cover of the meter box, and can be easily viewed to check duplication attempts for the purpose of keeping track of meter seals. All the seals should be provided on front side only. Access to the working part should not be possible without breaking the seals.

The provision shall also be made to provide additional lash wire seals on the meter body by the MPPKVCL.

44.34 TAMPER AND FRAUD PROTECTION:

Logics for design of various tampers, the value of voltage, current, time etc. to be selected for design of tamper shall be done in consultation with the purchaser. It may be noted that the approved logics used in designing tampers are explained to our field officers, and based on their input the bidder have to modify logic if necessary (The last tamper date and time of occurrence and tamper counts must appear in the DISPLAY and rest of the details in VIEW PARAMETERS).

The meter shall record and store last 100 events of tampers (occurrence + restoration) along with date and time of occurrence and restoration of each and every event. The event recording shall be roll over type i.e. it shall always maintain record of last 100 events occurred of selected tampers for logging.

The meter should have tamper & fraud protection features and shall record selected tamper information with date & time stamp. The meter shall continue to register active energy accurately even under following conditions:

44.34.1 The meter should register energy consumption correctly in forward direction irrespective of the direction of current in the current circuit (i.e. input and output interchange, phase and neutral connections interchange etc.).

44.34.2 Load Earthing:

- (i) The meter shall record correctly when earth is used as a return path for load fully or partially even when phase and neutral connection are reversed.
- (ii) When incoming neutral is disconnected, outgoing neutral is connected to earth through resistance and load is connected to earth, the arrangement should be provided such that power LED starts blinking when incoming voltage is below 200 Volts. The energy register shall advance for low voltage up to 120 Volts.

44.34.3 **Neutral Missing:**

The single-phase meter should register energy even if both the incoming and outgoing neutrals are disconnected and load is drawn through local earth. This should be irrespective of the position of phase. The threshold current for this feature should not exceed 20% of I_b and the assumption should be rated voltage, rated frequency and Unity power factor in proportion to the current drawn, as per class of accuracy of meter. Meter shall have provision to record the tamper of **Neutral Missing** with date and time of occurrence and restoration.

The meter shall record energy proportional to the current and rated voltage with Unity pf when any of the enclosed tamper circuits are used to tamper energy by more than 10% using a diode, or a variable resistance or a variable capacitance. The meter will be tested in these conditions such that the measured terminal voltage is reduced by 10%, 20% and 30% of rated voltage. The meter accuracy at 0.3 lag and 0.5 lead power factor shall be verified immediately after this test.

44.34.4 **Cover opening :**

If attempt is made to open the meter body, the meter shall **detect /log with date and time** of meter body opening tamper, even in absence of supply. This tamper shall also be displayed on the meter LCD with tamper information.

44.34.5 **DC Immunity:**

The meter should not saturate on passing of direct current which can cause the meter either to stop recording or record inaccurately as per IS: 13779 (latest version).

44.34.6 **External Magnetic Influence:**

The meter shall not get influenced by any external magnetic fields (AC Electro Magnet or DC Magnet) in accordance with the test procedures specified in IS: 13779 with its latest amendment for AC Magnetic Field. However, the meter alone should comply up to 0.27 Tesla DC.

The meter accuracy or accuracy in display under normal conditions shall not be affected by placement of a permanent magnet of not less than 0.27 Tesla anywhere on the surface of meter without meter box.

Meter shall have provision to record the tamper of abnormal magnetic induction with date and time of occurrence and restoration.

On application of external DC magnetic field of higher intensity against which meter is not immune, the meter should log the events of abnormal magnetic induction with date and time. The positive error may be beyond the limit of 4% but not exceeding power value equivalent to the product of rated voltage and maximum current.

44.34.7 Application of abnormal voltage /frequency:

A) The accuracy of the meter, Real time clock disturb, Memory data corruption, meter functioning hang up etc. should not occur with the application of abnormal voltage/frequency such as spark discharge of approximately 35KV with 0.01-10 mm spark gap in any of the following manner when applied for 10 minutes:

- a) On any of the phases or neutral terminals
- b) On any connecting wires of the meter
- c) At any place in load circuit
- d) Spark on meter body.

B) Meter should also be immune for tamper by application of remote loop induction device (jammer).

When meter is subjected to approx. 35 KV abnormal high voltage/ frequency burst and remote loop induction device (jammer), it should not hang and in case if it hang once it should remain hanged permanently.

44.34.8 EMC/EMI Test:

The meter shall also pass all EMC/EMI tests as per IS:13779 with latest amendments.

44.34.9 Further the bidder shall carefully note and confirm that:

- 1.The measurement of meter shall not be influenced by injection of AC voltages/ chopped signal/DC signal and harmonics on the outgoing leads of the meter.
- 2.The meter shall not get affected by any remote device.
- 3.The bidder should furnish detailed explanation as to how the meter is able to detect/Protect recording the above tamper and fraud features with sketches and phaser Diagram. Additional features, if any, in the meter may also be clearly indicated.

Along with the tamper information, the meter shall also record the instantaneous values of voltages, currents and power factors to simulate and elaborate the existing condition during the tamper events.

44.35 LED INDICATIONS :

The following LED indications must be provided on single and Three phase indication:

- (i) KWh indicator for Meter calibration - Red (Calibration LED-Imp/KWh)
- (ii) Input and output reversal -Yellow LED indicator or ICON on Indication /
current reversal LCD
- (iii) Earth Tamper indication - Green LED indicator or Icon on LCD
- (iv) Power supply ON and Phase indication - LED or ICON on LCD for line 'ON'

All the LEDs shall be of low power consumption and distinctly visible from distance. Except KWh indicator, all the other indications may be provided as Icon on backlit LCD. The earth LED should glow only when measurement is through neutral circuit.

44.36 SALIENT FEATURES:

The meter shall have the following additional features.

44.36.1 The meter shall be compact in design. The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation/loading/unloading etc. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.

44.36.2 The short time over current rating shall be 30 I_{max} for one half cycle at rated frequency as per clause No.9.2.3 of IS:13779.

44.36.3 The meters shall remain within $\pm 1\%$ accuracy when tested at basic current at rated voltage at 0.3lag and 0.5 lead power factor.

44.36.4 Meter shall work within accuracy up to max. loading up to 120%I_{max}.

44.36.5 Even if phase to phase voltage (i.e. 440 Volts) is applied for 5 minutes between phase and neutral of the meter, the meter should not get damaged and continue to record correctly within class 1.0 accuracy after restoration of normal supply.

- 44.36.6 The meter shall also withstand impulse Voltage without any damage in accordance with the clause 12.7.6.2 of IS: 13779:1999.
- 44.36.7 The meter shall make use of Non Volatile Memory capable of storing & retaining all the data required to be stored, without the help of any power source or battery back up.
- 44.36.8 Computation of demand shall be on the basis of Real Time Clock of the meter itself.
- 44.36.9 Provision shall be there to do the billing operation automatically at a predefined date by programming the meter.
- 44.36.10 Meters covered under this specification shall be fully static type with non-volatile memory to register various billing parameters and complete with other features as detailed out in this specification. Any other design meeting technical specification or features/accuracy etc., better than this specification and manufactured as per relevant IEC/IS/CBIP report shall also be acceptable.
- 44.36.11 Meter shall be suitable for accurate measurement and display of energy and other billing parameters within the specified limits of errors under balance and unbalanced load conditions in a poly phase network.
- 44.36.12 Indication shall be provided on display to show the healthiness of phase voltage.
- 44.36.13 The meter shall be fully programmable by the user for TOD timing and billing dates etc. For security reasons the meter operating software should have at least "two level write protection" against any modification/editing of the parameters, data, settings etc. except those required for billing data, TOD metering.
- 44.36.14 The meter shall conform to the degree of protection IP51 of IS: 12063/IEC: 529 for protection against ingress of dust, moisture and vermin's.
- 44.36.15 The meter base & meter cover shall be made of high grade, fire-resistant, non-inflammable high-grade and good quality engineering plastic.
- 44.36.16 The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling transportation. The meter shall be convenient to transport and immune to shock and vibrations during transportation and handling.
- 44.36.17 The voltage circuit and current circuit shall be solidly connected inside the meter body without any link. A firm connection shall be established within the meter case to energize the voltage/current circuit. The connections shall be as per the recommended methods given in IS-13779

44.37 SELF DIAGNOSTIC FEATURE

The meter shall be capable of performing complete self-diagnostic check and continuously monitor all the circuits for any malfunctioning and ensure integrity of data memory location at all time.

The meter shall have display indication for unsatisfactory/nonfunctioning/malfunctioning of the following:

- a) Time and date on meter display
- b) All display segments on meter display
- c) Real Time Clock (RTC) status in meter reading print out at BCS end
- d) Non-volatile Memory (NVM) status in meter reading prints out at BCS end.

44.38 ELECTROMAGNETIC COMPATIBILITY AND INTERFERENCE REQUIREMENT:

44.38.1 The meter shall meet EMI/EMC requirements as specified in the relevant standards and shall also be protected against radiated interference from either magnetic or radio frequency sources.

44.38.2 The offered whole current meter shall also withstand DC Immunity test for main and neutral circuit at $I_{ref} = I_{max} / \sqrt{2}$ as per IS:13779 so as to ensure that the meter current circuits do not saturate on passing of direct current.

44.38.3 The meter shall be designed in such a way that the conducted or radiated electromagnetic disturbances as well as electrostatic discharge do not damage or influence the meter.

44.38.4 The disturbance(s) to be considered are:

- (i) Harmonics
- (ii) Voltage dips and short interruptions
- (iii) Fast transient burst test
- (iv) External D.C. and A.C. magnetic fields
- (v) Electromagnetic H.F. fields
- (vi) Electrostatic discharges
- (vii) Radio frequency interference suppression.

44.39 GUARANTEED TECHNICAL PARTICULARS:

The bidder shall furnish all the necessary information as desired in the Schedule of Guaranteed Technical Particulars and data, appended with this specification. If the bidder desires to furnish any other information(s) in addition to the details as asked for, the same may be furnished against the last item of that Annexure.

44.40 NAME PLATE AND MARKING:

Every meter shall have a name plate clearly visible and indelible and distinctly marked in accordance with IS:13779 (latest version). The following information should appear on the name plate affixed on to the meter:-

- (i) Manufacturer's name or trade-mark and place of manufacture.
- (ii) Designation of type
- (iii) Number of phases and number of wires for which the meter is suitable.
- (iv) Guarantee period – 5 years from the date of commissioning or 5-1/2 years from the date of supply , whichever occurs first.
- (v) Purchase Order No. & Date.
- (vi) Property of MPPKVCL.
- (vii) Bar coding of SN, Month & Year of manufacture
- (viii) Sign of Insulation Class
- (ix) Connection diagram
- (x) Serial number, year and month of manufacture
- (xi) Principal unit in which the meter records Reference voltage
- (xii) Basic current and rated maximum current
- (xiii) Reference frequency in Hz
- (xiv) Meter constant (Imp/KWh)
- (xv) Accuracy class
- (xvi) Reference temperature
- (xvii) ISI mark and license number

44.40 TESTS:

(A) Type Test:

The type test certificate for all tests as indicated in IS:13779-1999 (with latest amendments) shall be furnished along with the bid. Type test certificates from any one of the standard laboratories NABL accredited for particular equipment/test shall only be considered. Type test report, amongst other details, should contain the following information clearly:

- (i) Type of meter and display
- (ii) Class of Accuracy.

Type test certificate from educational institute(s) will not be accepted. The type test certificate shall not be more than 24 months old as on the date of opening of bid.

(B) Additional Type Test:

In addition to the tests mentioned at **(A)** above, bidder shall have to furnish the type test reports of compliance of anti-tamper features as per tender specification.

(C) Acceptance tests:

All Acceptance tests as laid down in this tender specification shall be carried out.

(D) Verification during Inspection:

Inspecting officer shall verify that no DC supply/ signal is given to reference meter during the DC injection test. The accuracy of display parameters shall be verified at the time of inspection in line with class of accuracy of meter.

- i. Voltage variation test
- ii. Accuracy tests under all anti tamper conditions.

- iii. Permanent magnet test
- iv. Special accuracy test – the meters shall remain within $\pm 1\%$ accuracy when tested at basic current at rated voltage at 0.3lag and 0.5 lead power factor.
- iv. The accuracy of the meter, Real time clock disturb, Memory data corruption, meter functioning hang up etc. should not occur with the application of abnormal voltage/ frequency such as spark discharge of approximately 35KV with 0.01-10 mm spark gap in any of the following manner when applied for 10 minutes:
 - a) On any of the phases or neutral terminals
 - b) On any connecting wires of the meter
 - c) At any place in load circuit
 - d) Spark on meter body.
- v. Immunity from remote loop induction device (jammer)

The accuracy and above indicated parameters of meter shall be checked before and after the application of above device(s) with site conditions. It is desired that when meter is subjected to approx. 35 KV high voltage /frequency burst and remote loop induction device(jammer) it should not hang and in case if it hangs once it should remain hanged permanently.

(E) Routine Tests:

All the routine tests as stipulated in IS:13779 and in addition tamper and fraud protection tests as per TS shall be carried out and test certificates shall be furnished for approval of the Purchaser.

44.41 TEST FACILITIES AVAILABLE WITH THE MANUFACTURER:

The tests shall be carried out as per relevant Standards and test certificates shall be furnished for approval. The Supplier shall indicate the details of the equipment available with him for carrying out the various tests as per relevant Standards. The bidder shall indicate the sources of all materials.

Bidders should carefully note that the standard meters used for conducting tests shall be calibrated periodically at NABL Accredited Test Laboratories and test certificates shall be available at Works for verification by Purchaser's representative.

The Supplier/Manufacturer shall have at least the following testing facilities to ensure accurate calibration:

- (i) Insulation resistance measurement
- (ii) Running at no load
- (iii) Starting current test
- (iv) Limits of error
- (v) Power loss in voltage and current circuit
- (vi) Repeatability of error
- (vii) Transportation test
- (viii) Low load run test

(ix) Heating test

44.42 INSPECTION:

44.42.1 The Purchaser's authorized representative may carry out the inspection at any stage of manufacture. The Supplier/Manufacturer shall grant free access to the Purchaser's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the Purchaser shall not absolve the Supplier of his obligation of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

44.42.2 All acceptance tests and inspection shall be made at the place of Supplier/Manufacturer. The Supplier shall provide all reasonable facilities without demanding any charge to the inspector representing the Purchaser to satisfy him that the equipment is being furnished in accordance with this specification.

44.42.3 The Supplier/Manufacturer shall keep the Purchaser informed in advance, about the manufacturing/readiness activities so that arrangement can be made for inspection.

44.42.4 The Purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The Supplier shall give 15 days advance intimation to enable the Purchaser to depute his representative for witnessing the acceptance and routine tests.

44.42.5 The Purchaser reserves the right to get type tests done in respect of any meter, or Box from any of the lots received at any Destination Stores at Supplier's expenses.

44.43 SAMPLE: Sample before Commencement of supplies:

The Supplier shall submit sample of offered meter along with the meter box having all the features conforming to the prescribed specification for our approval before commencement of supply.

44.44 RANDOM SAMPLE TESTING AFTER RECEIPT OF METERS AT STORES:

The consignment of meters received at Area Store shall be accepted only after testing of sample meters at CPRI/ERDA/ERTL/any NABL accredited testing **laboratory** as stated in the Schedule-II(D). The sample meters shall be selected randomly from the lot and will be sent to CPRI for acceptance test as per relevant ISS and as per procedure prescribed in schedule-II(D). If the sample fails in the above tests, the entire lot will be rejected and testing charges shall be recovered from the supplier. Purchaser may select meters at random from a lot of meters supplied and sent to CPRI/ERDA/ERTL/any NABL accredited testing **laboratory for acceptance test as per relevant ISS. If the sample fails in the above tests, the entire lot will be rejected and testing charges shall be recovered from the Supplier.**

44.45 QUALITY ASSURANCE PLAN:

44.45.1 The designed life of the meter shall be minimum of 20 years and to prove the designed life, the firm shall have to follow at least the following Quality Assurance Plan:-

- (i) The factory shall be completely dust proof.
- (ii) The testing rooms shall be temperature and humidity controlled as per relevant standards.

The testing and calibrating equipments should be automatic and all test equipment shall have their valid calibration certificates.

- (iii) Power supplies used in testing equipment shall be distortion free with sinusoidal, wave forms and maintaining constant voltage, current and frequency as per the relevant standards.

- (iv) During the manufacturing of the meters the following checks shall be carried out.

- (a) Meter frame dimensions.

- (b) The assembly of parts shall be done with the help of jigs and fixtures so that human errors are eliminated.

- (c) The meters shall be batch tested on automatic, computerized test bench and the results shall be printed directly without any possibility of human errors.

44.45.2 The Supplier/Manufacturer shall furnish the following information. Information shall be separately given for individual type of meters 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 material in presence of Supplier's representative and 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 Supplier for final testing of equipment specified and test-plant limitations, if any, vis-à-vis type, special acceptance and routine tests specified in the relevant standards and this specification. These limitations shall be very clearly brought out in schedule of deviations.

44.45.3 The Supplier/Manufacturer's laboratory must be well equipped for testing of the meters. They must have computerized standard power source and standard equipment calibrated not later than a year (or as per standard practice). The details of testing facilities available for conducting (a) The routine tests and (b) Acceptance tests shall be furnished in Schedule annexed with tender document.

44.46 MANUFACTURING ACTIVITIES:

- (i) All the materials, electronics and electrical components, ICs used in the manufacture of the meter shall be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.
- (ii) The Manufacturer should use Application Specific Integrated Circuit ASIC or Micro controller for metering functions.
- (iii) The electronic components shall be mounted on the printed circuit board using latest Surface Mounted Technology (SMT) except power components by deploying automatic SMT pick and place machine and re-flow solder process. The electronic components used in the meter shall be of high quality. Further, the Supplier should own or have assured access (through hire, lease or sub-contract) of the above mentioned facilities. The PCB material should be of glass epoxy FR-4 grade conforming to relevant standards.
- (iv) All insulating materials used in the construction of meters shall be non-hygroscopic, non-aging and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.
- (v) Quality should be ensured at the following stages :
 - (a) At PCB manufacturing stage, each board shall be subjected to bare board testing.
 - (b) At insertion stage, all components should undergo testing for conforming to design parameters and orientation.
 - (c) Complete assembled and soldered PCB should undergo functional testing using test equipments (testing jig).
 - (d) Prior to final testing and calibration, all meters shall be subjected to accelerated ageing test to eliminate infant mortality.
- 1. The calibration of meters shall be done in-house.
- 2. The Supplier/Manufacturer should submit the list of all components used in the meter along with the offer.
- 3. A detailed list of bought-out items which are used in the manufacture of the meter should be furnished indicating the name of firms from whom these items are procured. The Supplier shall also give the details of quality assurance procedures followed by him in respect of the bought-out items.
- 4. The details of testing facilities available for conducting the routine and acceptance tests and other special tests on the meter shall be furnished with the bid. The facility available if any for conducting type test may also be furnished.

44.47 DOCUMENTATION:

44.47.1 All drawings shall conform to International Standards Organization (ISO "A" series of drawing sheet/India Standards Specifications IS: 656. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. Units.

44.47.2 List of drawings and documents:

The Supplier/Manufacturer shall furnish the following:

- (i) Two sets of drawing clearly indicating the general arrangements, fitting details, electrical connections etc.
- (ii) Technical leaflets (user's manual) giving operating instructions.

- (iii) Three copies of dimensional drawings of the quoted item.

44.47.3 The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication works in connection with the equipment prior to the approval of the drawing shall be at the Supplier's risk.

44.47.4 Approval of drawings by Purchaser shall not absolve the Supplier of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirements of the latest revision of application standards, rules and codes of practices. The equipment shall conform in all respect to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and Purchaser shall have the power to reject the materials which, in his judgment, is not fully in accordance therewith.

44.47.5 The successful Supplier shall, within 2 weeks of notification of award of contract, submit three sets of final versions of all the drawings as stipulated in the contract for Purchaser's approval. The Purchaser shall communicate his comments/ approval on the drawings to the Supplier within two weeks. The Supplier shall, if necessary, modify the drawings and resubmit three copies of the modified drawings for approval. The Supplier shall within two weeks, submit 10 prints and two good quality report copies of the approved drawings for Purchaser's use.

44.47.6 Each meter shall be accompanied with a manual in English and Hindi detailing the LCD display parameters (with illustration) and installation procedure. Similarly each CMRI shall accompany with detail operational manual.

44.47.7 One set of routine test certificates shall accompany each dispatched consignment.

44.47.8 The acceptance test certificates in case of pre-despatch inspection or routine test certificates in cases where inspection is waived shall be got approved by the Purchaser

44.48 GUARANTEE:

- (i) The meters shall be guaranteed for a period of **5 years from the date of commissioning or 5-1/2 years from the date of supply, whichever occurs first.**
- (ii) The meter found defective within the above guarantee period shall be replaced by the supplier free of cost within one month of the receipt of intimation. If the defective meters are not replaced within the above specified period, the same shall be treated as breach of performance of the contract and shall be liable for consequential penal action.

44.49 PACKING & FORWARDING:

44.49.1 The equipment shall be packed in crates suitable for vertical/horizontal transport as the case may be, and suitable to withstand handling during transport and outdoor storage during transit. The Supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbol. Wherever necessary, proper

arrangement for lifting, such as lifting hooks etc., shall be provided. Any material found short inside the packing cases shall be supplied immediately by Supplier without any extra cost.

44.49.2 Each consignment shall be accompanied with a detailed list containing the following information.

- a) Name of the consignee
- b) Details of consignment
- c) Destination
- d) Total Weight of Consignment
- e) Handling and packing instruction
- f) Bill of material indicating contents of each package

44.49.3 The packing shall be done as per the Manufacturer's standard practice. However, he should ensure the packing is such that the material should not get damaged during transit by Rail/Road.

44.50 GENERAL :

44.50.1 Principle of operation of the meter, outlining the methods and stages of computation of various parameters starting from input voltage and current signals including the sampling rate, if applicable, shall be furnished by the bidder.

44.50.2 The Supplier shall indicate the method adopted to transform the voltage and current to the desired low values with explanation on devices used such as CT, VT or potential divider as to how they can be considered superior in maintaining ratio and phase angle for variation of influencing quantities during its service period.

44.50.3 The Supplier shall furnish details of memory used in the meter.

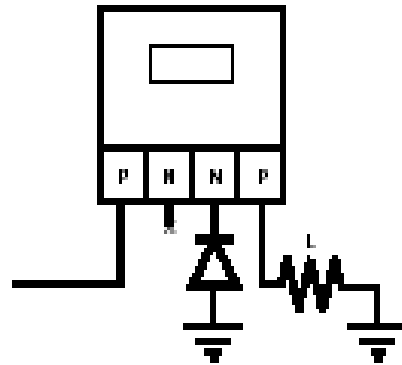
44.50.4 The Technical Specification of Push Fit Type Meter Box Made Of Engineering plastic has been described in Schedule-II(B)

44.50.5 The procedure for Verification/Testing of Material supplied described in Schedule-II(D) shall be followed

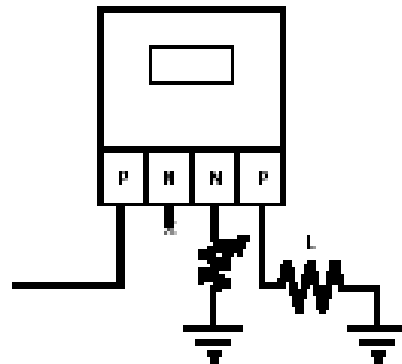
44.50.6 It is mandatory to conform compliance of guaranteed technical particular of ac single phase electronic KWH meter with LCD display as per Schedule-III

Tamper circuits

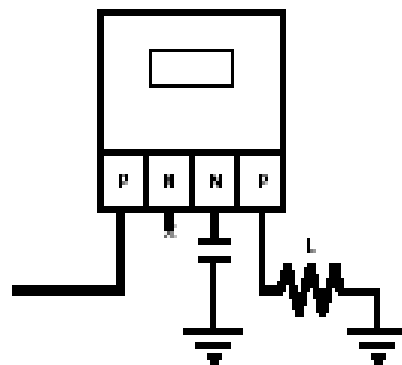
Tamper Circuit 1



Tamper Circuit 2



Tamper Circuit 3



**STANDARD FOR THREE PHASE LT STATIC WHOLE CURRENT SOLID STATE
ELECTRONIC ENERGY METERS WITH BACKLIT LCD DISPLAY**

45.1 SCOPE:-

(a) This specification covers design, engineering, manufacture, stage-inspection, testing and supply of A.C. Three Phase 4 Wire current rating 10-40 Amperes solid state (static) whole current electronic LT energy meters of accuracy class 1.0 with backlit LCD display and communication port for data downloading as per requirement given in this specification. The meters shall be supplied in a push fit type meter box made of transparent engineering plastic, which shall be weather proof having flame retardant properties conforming to relevant specification. The meter and push fit type meter box shall be supplied in suitable packing so as to withstand transit shocks during road transport.

The meters should be suitable for single phase two wire system, capable to record and display monthly average p.f., energy in KWH, and demand in "KW" including other electrical quantities. The meters shall be capable to record over full power factor range of Zero Lag-Unity- Zero Lead, as per requirement given in this specification. These LT Meters should record total energy at basic frequency & harmonics. In addition the meters shall have provision for recording time of day (TOD) energy parameters.

(b) It is not the intent to specify completely herein all the details of the design and construction material. However, the material 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 the Purchaser, who will interpret the meanings of drawings and specification and shall have the right to reject any work or material which in his judgment is not in accordance therewith. The offered materials shall be complete with all components, accessories and required software's necessary for their effective and trouble free operation in the System for measurement of electricity supplied to the consumers. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/ or the commercial order or not.

(c) **It is compulsory that the offered LT meters shall bear BIS certification i.e. the meters shall be ISI marked and the bidder shall have to furnish valid ISI license along with the offer, which, if considered necessary, may be verified by the Purchaser.**

45.2 STANDARDS:-

These LT meters and the associated accessories shall conform in all respects to the following relevant Standard Specifications with latest amendment there to:-

Indian Standard No.	Title
IS:13779-1999 read with	Specification for AC static watt hour meter for class 1 & 2

latest amendments	
CBIP Technical report No.88 (with latest amendments)	Specification for AC static Electrical Energy Meters
IS:5133-1969 (Part II)	Specification for boxes for the enclosure of electrical accessories
IS:9000	Basic environmental and other Testing for Electronic & Electrical items.
IS:11731	Specification for engineering plastic
IS: 11000	Resistance to heat & fire
CEA Regulation	On installation of meters of. 17/03/06

45.3 SERVICE CONDITIONS (CLIMATIC CONDITIONS):

- (i) The LT meters to be supplied against this specification should be capable of performing and maintaining required accuracy under extreme hot, cold, tropical and dusty climate and solar radiation typically existing in State of M.P. The LT meter shall be required to operate satisfactorily and continuously under the following tropical climatic conditions:

	Maximum ambient air temperature	55°C
	Maximum ambient air temperature in shade	45°C
	Maximum temperature attainable by the meter exposed to sun	60°C
	Minimum ambient temperature	(-) 5°C
	Average daily ambient air temperature	40°C
	Maximum relative humidity	95%
	Number of months of tropical monsoon condition	4 months
	Maximum altitude above mean sea level	1000 meters
	Average annual rain fall	150 cms
	Maximum wind pressure	200 kg/sq.m
	Isokeraunic level (days per year)	40
	Seismic level (horizontal accn.)	0.30 g
	Permitted noise level	45db

All the parts & surface, which are subject to corrosion shall either be made of such material or shall be provided with such protective covering and finish, which ensures total protection from any injurious effect of humidity.

45.4 PRINCIPAL PARAMETERS:

These LT meters shall conform to the following specific parameters:

	Item	Specification
	Type of installation	Indoor/Outdoor
	System voltage (phase to neutral)	3X240 V + 20% to - 40%; neutral solidly grounded.
	System frequency	50 Hz $\pm 5\%$
	No. of phases	3 Phase 4 wire (three phase + neutral)
	System earthing	Solidly grounded
	Resistance to surge voltage of 1.2/50 Micro sec.	As per relevant IS
	Test voltage at 50 Hz	4 KV RMS for 1 minute including latest amendments in relevant IS.

45.5 CONSTRUCTIONAL REQUIREMENTS:

The meters including meter case and push fit type meter box shall be fully transparent designed and constructed in a manner to avoid any danger during use under normal working condition including personal safety against electric shock. The meter case and push fit type box should comply following parameters:-

Material Used for Meter case and Push Fit type Meter Box:

- i. The meters shall have a case, which shall be ultrasonically welded to the meter base so that access to the internal parts should not be possible without breaking the meter case. The material of meter body (base and cover) shall be made of Engineering plastic.
- ii. The meter casing material should be glass reinforced, flame retardant, unbreakable engineering plastic material to ensure high reliability, long trouble free life, safety against electric shock, spread of fire and effects of excessive temperature. The material should be corrosion resistant, inert to chemicals, oxidizing agents, petro-chemical products, acids, salts and ultraviolet radiation. The meter chamber shall be dust proof and moisture proof. The supplier should indicate hardness, melting temperature and tensile yield strength of the material and necessary test certificate of the same shall be furnished. The meter base and cover should be sturdy enough to prevent damage during transportation and installation.
- iii. The engineering plastic used shall conform to IS: 11731 besides meeting the test requirement of heat deflection test and as per IS 11000(Part2 sec1) for resistance to heat and fire as per glow wire test specified in the relevant standard.
- iv. All electrically live screws shall be of heavily tinned brass/nickel or zinc plated steel. All other screws shall be electro plated.

- v. The terminal inserts shall be of heavily tinned brass/ nickel or silver plated copper or zinc plated steel.
- vi. The meter shall conform to the degree of protection IP51 of IS: 12063 for protection against ingress of dust, moisture and vermin.
- vii. The meter should be immune against jump during sudden switching of heavy loads or transient voltage spikes.

45.6 RATINGS:

The LT meters as specified in scope of this tender shall be rated as follows:

	Voltage	3x240 V
	Current	
	Basic current (Ib)	10 A
	Rated max. continuous current (Imax)	40A
	Frequency	50Hz
	Accuracy	Class 1.0

45.7 POWER SUPPLY VARIATION:

The extreme power supply variations which the LT meter should withstand without damage and without degradation of its metering characteristics, as it operates under its normal operating conditions would be as under:

Voltage	+20% to – 40% of rated voltage
Current	120% of Imax.
Frequency	± 5% of rated frequency
PF range	Zero (lag) – unity – Zero (lead)

The LT meter shall work over wide PF range and the limits of errors with the variation of PF shall be as per CBIP 88 (latest amendments)/IS: 13779

45.8 POWER CONSUMPTION:

- 45.8.1 **Voltage Circuit:** The active and apparent power consumption in each voltage circuit (per phase) including power supply of LT meter at reference voltage, reference temperature and reference frequency shall not exceed 1.5 Watts and 8 VA respectively as per IS:13779.
- 45.8.2 **Current Circuit:** The apparent power taken by each current circuit (per phase) at basic current, reference frequency and reference temperature shall not exceed 4 VA as per IS:13779.
- 45.8.3 **Auxiliary Power:** The LT meter shall draw power for working of electronic circuit from phase & neutral.

45.9 STARTING CURRENT:

The LT meter should start registering energy at 0.4% of basic current at UPF as per IS: 13779.

45.10 RUNNING WITH NO LOAD:

When 115% of rated voltage is applied with no current flowing in current circuit, the test output of the LT meter shall not produce more than one output pulse count as per IS: 13779.

45.11 INFLUENCE QUANTITIES:

The single & three phase LT meter shall work satisfactory with guaranteed accuracy as per limit prescribed in IS:13779 under presence of the following quantities:-

- (i) External magnetic field
- (ii) Electromagnetic field
- (iii) Radio frequency interference
- (iv) Vibration
- (v) Harmonic wave form
- (vi) Voltage fluctuation
- (vii) Electromagnetic high frequency field

45.12 TEMPERATURE RISE:

- (a) Under normal conditions of use at I_{max} current, winding and insulation shall not reach a temperature, which might adversely affect the operation of these LT meters.
- (b) With each current circuit of the meter carrying rated maximum current and with each voltage circuit (and those auxiliary voltage circuits which are energized for periods of longer duration than their thermal time constant) carrying 1.20 times the rated voltage, the temperature rise of the external surface shall not exceed by more than 20°C, with the ambient temperature between 25°C to 45°C.

45.13 LIMITS OF ERRORS:

When the LT meter is under reference conditions, the percentage errors shall not exceed the limits as specified in IS:13779.

45.14 DISPLAY:

- 45.14.1 The LT meters shall have bright LCD Electronic display with backlit & with minimum 6 digits to read up to one tenth of KWh with another digit for legend. The decimal digits shall be clearly distinguished from integer digits. The backlit should not glow during power off condition. The LCD shall be of STN (Super Twist Nematic) type designed suitably to withstand temperature of 80°C (storage) & 65°C (operation).

- (i) When the LT meter remains at a constant temperature of 65°C for a period of 30 minutes, the character of LCD should not deform.
- (ii) After keeping the LT meter at a constant temperature of 80°C for a period of 30 minutes and when restores at normal temperature, LCD display should work as in normal conditions.

The LCD display should have a wide viewing angle of 45° to 60° up to one-meter distance, for clear visibility of the display of the meter reading. Large viewing area with large display icons is desired. However, the display size area shall be approx 60x20 mm (1200 sq.mm.). The registered parameters shall not be affected by loss of power. The display shall not be affected by electrical and magnetic disturbances. The meter shall make use of non-volatile memory capable of storing and retaining all the data required to be stored, without the help of any power source or battery back up and shall have a minimum retention time of 12 years under un-powered condition. The minimum character height X width shall be 8.5 X 5 mm. for whole digits of kWh Display. **Dot-Matrix type LCD display is not acceptable.** The accuracy of display for all parameters shall be matching with the accuracy class of meter as per IS.

45.14.2 The display of various parameters in push button mode shall be scrolling one after another. The display shall have ON time of at least 10 seconds for each measured value.

45.14.3 The meter shall be capable to measure and display continuously "Active Energy KWh" at all loads and in full power factor range of zero lag- unity- zero lead. The LT meter should also have provision for automatic recording and storing of required parameters meter at 24.00 Hrs on the last day of the month for each calendar month and the same should go to memory.

45.15 DISPLAY SEQUENCE:

The Liquid Crystal Display register for single and three phase LT meter should display the measured value(s). The height of the display character should be minimum 8.5 mm. In addition display of the required parameters should be in two different modes as stated hereunder:-

45.15.1 Auto scroll Display Mode:

The LT meters shall have following parameters in auto scroll display

- i) Date: DD: MM: YY Real Time: HH:MM
- ii) Cumulative Active Energy KWH
- iii) Instantaneous load in KW by default and programmable to KVA.

45.15.2 Display parameter (Push Button) Mode:

The display of the following parameters shall be scrolling one after the other through push button. The display shall have 'ON' time of minimum 10 seconds of each measured value, except LCD segment check. The LCD segment check shall be on meter display for minimum 2 seconds. Display parameters shall move forward if button is pressed prior to the programmed time for display of each parameter.

- (a) LCD segment check
- (b) Meter serial number

- (c) Real date and time (Date DD-MM-YY, Time HH-MM)
- (d) Cumulative active energy (KWH) register.
- (e) Maximum demand of the month in KW by default up to two decimal (since last auto reset) with date & time. The MD shall be programmable from KW to KVA with 15 minutes integration on sliding window principle with sub integration period of not greater than 5 minutes.
- (f) Cumulative active energy KWH for each calendar month for previous six months with programmed billing date .
- (g) Maximum Demand in KW by default up to two decimal (programmable for KVA when ever desired by the purchaser.) each calendar month for previous six months with date and time of such demand.
- (h) Average P.F. for each calendar month and for previous six months.
- (i) Tamper information- This shall be displayed when tampered with following.
 - (a) Date of last tamper occurrence.
 - (b) Time of last tamper occurrence.
 - (c) Number of time meter tampered.
- (j) Instantaneous phase voltage
- (k) Instantaneous line current
- (l) Instantaneous p.f. (With sign of lead/lag)
- (m) Instantaneous load in KW by default and programmable to KVA
- (n) High resolution Energy value (resolution will be sufficient to enable conduction of the starting current and accuracy test in less time.)

Since meters are required duly fitted with push fit type meter box, hence for reading purpose, an arrangement should be made on top cover of push fit type meter box with its mechanical connection to the meter's body as described in the Specification of meter box to activate the display push button of meter.

The display with push button shall be auto off type after completion of the display cycle it should revert back to normal auto scroll mode approximately after 10 seconds. Fresh button press will be required after resumption of auto scroll cycle to display the above parameters again.

45.15.3 Meter Reading during Power Outage:

The meter shall have provision to read the meter in no-power condition. The same push button shall be used for display of parameters of auto scroll mode during power outage. In any case, RTC Battery Power shall not be used for display under no-power condition.

45.15.4 LCD Least Count:- __

The kWh display shall be with one decimal digit in push button mode and in auto scroll mode. The internal least count of the energy recording shall not be more than 0.01 kWh. and every 0.01 kWh, consumption shall be internally stored.

45.16 COMMUNICATION CAPABILITY

- 45.16.1 The meter shall have wireless communication facility for remote reading through LPR (low power radio) communication Port. The meter shall have facility for communicating with a hand held terminal (HHT) i.e. Common Meter Reading Instrument (CMRI) through this port to facilitate for auto-reading and downloading the data for billing and historical data to base computer. The interface for communication between MRI & Base computer shall be supplied free of cost. The software required for CMRI and Base Computer System with necessary security provisions shall also be supplied free of cost with the following features:
- a. It shall be possible to read the meter via RF up to minimum 100 metres in any spherical direction from the meter. Longer communication range is preferred.
 - b. In case of LPR communication, it is preferred that the range is further increased through mesh networking of installed meters. However, no pre-installation programming or post installation programming shall be required for this purpose. In such case time of reading for the next layer of meters may vary and the additional time of +3 sec for each added meter layer i.e. for each hop shall be allowed.
 - c. For meters with LPR communication, additional infrared port is required to read the meters in case of power outage. In case of infrared communication port, it should be possible to read the meter through external CMRI via infrared media from a minimum distance of 1.5 metres in front of the meter box.
 - d. It should not be possible to reset the energy reading in the meter or make any change in the data stored in the meters either current or historical, with the MRI.
 - e. The infrared module or LPR module of the meter shall have no physical access from outside the meter.
 - f. Infrared transmitter and receiver should be compliant to the latest IrDA Physical Layer Standard.
 - g. The Frequency range for LPR equipment shall be approved frequency range from Govt. of India.
 - h. The meter shall use licence free frequency band for communication so that licence for use of LPR equipment to read energy meter at site not required.
 - i. The compatibility of transferring data from the meter to MRI and then to the base computer system (BC) should be easily established; any change in language or any other reasons, the supplier shall modify it at his own cost within the guarantee period.
 - j. For the purpose of data security, the data transfer from the meter to CMRI and further to Base computer should be fully secured and any unauthorized attempt/change in data should be indicated on computer system. There should be multi level password on the base computer system and in the meter to prevent any unauthorized change of billing parameters, resetting of demand and tamper in formation.

45.17 BILLING POINT REQUIREMENTS:

The predefined date and time for registering the billing parameters of energy, PF and MD as well as Tamper Count and Power-On hours details shall be at 00.00 hours of the first day of each calendar (billing) month and all the billing parameters shall be transferred to billing registers.

The above billing data, TOD register's data, tamper information and instantaneous parameters data shall all be retrievable through the meter's communication port through a common meter reading instrument (CMRI) and shall be transferred (downloaded) to a PC with Windows based software to get complete details in numerical and/or graphic form. The necessary base computer software (BCS) for this purpose shall be provided by the supplier with complete details.

45.18 TOD TARIFF/DEMAND

The meter should be capable of registering the time-of-day energy (TOD) and maximum demand. The time registers shall be programmable by the purchaser. The meter should have in-built

capacity to define up to six registers. The meter should also have capacity to define multiple time zones within the registers. The change of the TOD time-period(s) or defining TOD registers should be possible through CMRI with special authenticated command from the BCS so that only authorized person(s) can make such changes. The main control of this system along with proper security password/code should be available on one or more computers located at the authorized location(s) as per the directions to be given by the Purchaser.

Provision should be made for automatic reset of maximum demand at the end of pre-defined period (e.g. end of the month). The billing parameter at the time of automatic reset of the maximum demand shall be programmable. The main control of this system along with proper security password/code should be made available on one or more identified computers located at the authorized location(s) as per the directions to be given by the Purchaser

Necessary compatible meter application software for various programmable features as discussed above in the meter and also necessary software for the IBM compatible computer to obtain various details as discussed above shall be provided by the supplier. No separate cost will be borne by the purchaser on this account.

45.19 TEST OUTPUT DEVICE:

The LT meters shall have a test out put device in the form of calibrating LED of red colour having minimum intensity 10 M (Milli-candela) accessible from the meter front and shall be capable of being monitored conveniently with suitable testing equipment while operating at site. The location of the calibrating LED should be such that the calibrating pulses can be sensed easily through sensor for site testing of the LT meter's accuracy.

The LT meters shall also give high-resolution energy values on the display. The resolution will be sufficient to enable conduction of the starting current and accuracy test in less time.

45.20 BASE COMPUTER APPLICATION SOFTWARE

For efficient and speedy recovery of data read through CMRI/HHU, Base computer software shall be supplied having the following specifications stated as under:

The BCS software shall be user friendly Windows based. The Base Computer software shall give all details adequate for analysis. The software shall have the facility to convert all the consolidated information / data of selectable parameters into ASCII format. It should be possible for the Purchaser to generate its own DBF (data base files) to download all the required information into it.

Platform: The BCS shall be executable on all WINDOWS system. The BCS shall be suitable to run on IBM compatible PC hardware platform.

Meter Data Display: The software shall show electrical condition existing at the time of reading the meter in tabular forms as well as graphical format (Phase diagram)

All the information about energy, maximum demand and their respective TOD register reading, billing register readings shall be shown in a manner which user can easily understand.

The software shall be capable of preparing CMRI to read the meter information or time setting of the meter.

Support Display: There shall be "user friendly" approach for viewing meter data for the reading collected now or for the reading collected in the past. All information about a particular consumer will be sorted out and available at one place so that locating any consumer's past data is easy. It shall be possible to retrieve/locate data on the basis of either one of the following particulars:

Consumer's ID/Numbers.

Meter Sr. No.

Date of meter reading.

Location.

The Data Transfer :It shall be possible to transfer data to and fro from CMRI through serial interface.

Configurability: It shall be possible to have selective printing of all available data of the meter. Print out shall not include anything and everything available with the BCS. The software shall support "print wizard" whereby user can decide what to print out. The use of the software need not revert back to the supplier of the software for modifying the software just to print what he desires.

BCS shall have facility to export data to ASCII or spreadsheet format for integrating with the purchaser's billing system. Here again an "Export wizard" or similar utility shall be available whereby user can select file format, what data to export, the field width selection etc.

Security: The BCS shall have multilevel password for data protection and security. The first level shall allow the user to enter the system. The different software features shall be protecting by different passwords. The configurable of passwords shall be user definable. The software installed on one PC shall not be copy able on another PC.

Help: The exhaustive online help shall be available with the software so that user can use all the features of the software by just reading the help contents.

45.21 Common Meter Reading Instrument (CMRI)

The Bidder should carefully note that

- i. The MRI shall be supplied in the ratio of **one** for **each 200 nos.** of meters free of cost along with battery charger.
- j. The MRI shall have facility to store minimum **1000 nos.** of meter's data. Further, there should be a facility in MRI to provide the transfer of meter data to computer through RS 232 or USB port.
- k. The MRI shall be capable for down loading readings of other makes of meters. The bidder shall give an undertaking to this effect.
- l. The MRI shall have possibility to read all of the three communication types of meters purchased by MPPKVVCL – optical port, infrared and LPR. MPPKVVCL shall exchange the communication protocols of successful bidders.
- m. The infrared and LPR mode of MRI shall have a feature to read multiple meters within the range without pre-programming the meter serial numbers in advance. Even in case of optical port, pre-programming the meter serial numbers in advance shall not be required.
- n. The data downloading time (from meter to MRI) shall not exceed 5 sec for each meter (with +2 sec. max tolerance time). In case of LPR with mesh networking, time of reading for the next layer of meters may vary and the additional time of +3 sec. for each added meter layer i.e. for each hop shall be allowed.
- o. After successful downloading, indication shall be available on both meter and MRI and repeated downloading from the same meter shall be disabled for a minimum period of 15 min.
- p. The communication software shall be capable to transfer the billing data and meter serial number required for automatic Spot Billing Machine to automatically generate the energy consumption bills at consumer premises without any human intervention after the data is collected by the MRI. The MRI shall continuously transmit the data until an acknowledgement is received from the SBM (Spot Billing Machine). The manufacturer shall provide the protocol and other information to interpret the transmitted billing data. The data storage inside the MRI and communication of MRI with the meter shall be encrypted so that there is no possibility of tampering with the downloaded data.

It shall be responsibility of the meter manufacturer to provide the required software and all the facilities and support required by the purchaser, to use the CMRI for reading and retrieving the data from the meter and to download the data to Base Computer on free of cost basis till the expiry of guarantee period.

45.21.1 Readings to be downloaded with CMRI:

The CMRI should support in down loading all-important data stored in meter whether specified or not required essentially for deriving billing parameters including MD parameters that shall be by default in KW programmable to KVA respectively. The following minimum parameters should be downloaded by CMRI.

- i. Sr. No. of meter
- ii. Date & Time
- iii. Instantaneous current
- iv. Instantaneous voltage
- v. Cumulative Active energy (KWh)
- vi. MD during the month
- vii. Instantaneous load in KW
- viii. Instantaneous Power factor (sign of lag or lead)
- ix. Cumulative active energy in KWh for the last 6 months

- x. Maximum demand in KW for the last 6 months upto two decimal (It shall support MD in KVA if programmed)
- xi. Average PF of the last 6 months
- xii. TOD 1,2,---,6 Cum. KWh register(Programmable)
- xiii. TOD 1,2,---,6 MD register. in KW up to two decimal (Programmable)
- xiv. TOD 1,2,---,6 Billing MD registers
- xv. TOD 1,2,---,6 Billing KWh registers
- xvi. Phase wise power ON time in HH:MM in a calendar month for last 6 months
- xvii. Tamper information including cover open tamper

Any other information whether specified or not, which is in the opinion of manufacturer is necessary for satisfactory performance of the meter, the manufacturer shall indicate such features in their offer without demanding additional cost.

The LT meter shall possess a optical port or suitable fast and reliable Infrared/ RF communication port for automatic transfer of data from Meter to CMRI. Arrangement in the meter should be such that, in case of failure of power supply, it should be possible to download the data.

The CMRI shall possess easily replaceable battery and shall be capable of storing data for at least 1000 nos. meters at one time. In case of wireless communication port the data transfer rate (from meter to MRI) should be at-least 100 kbps. However, the total downloading time (from meter to MRI) shall not exceed 5 sec for all types of communication for each meter (with +2 sec. max tolerance time). In case of optical communication port the data transfer rate (from meter to CMRI) should not be less than 9.6 kbps. However, the total downloading time (from meter to CMRI) shall be approx. 5 Minute.

The CMRI shall possess a specific serial number, which cannot be changed/ altered.

The downloaded data along with date and time stamp of such reading shall remain on CMRI with suitable encryption and it should not be possible to pre-program or manipulate the recorded data on the CMRI before downloading the same with the serial number of CMRI on computer. The Supplier shall supply Software (compatible with Windows 98 system and/or higher) and training, free of cost for the use of software at multiple data collection and billing premises of the utility.

After successful downloading of meter data to CMRI, an indication on MRI or meter or both for confirmation of successful data transfer shall be provided. During this period the energy recording should not be affected.

Necessary upgrades shall be possible in CMRI software and shall be supplied free of cost for downloading simultaneously the existing parameters and any parameters added in future specifications of meters. A copy of operation manual shall be supplied along with each CMRI.

The Supplier shall provide meter-reading protocols free of cost, which shall not be complicated and shall be easily understandable by utility officials to ensure compatibility between meters and CMRIs of different makes.

45.22 MAXIMUM DEMAND REGISTRATION AND MD RESETS:

The Meter shall continuously monitor and calculate the maximum demand at the point of supply, during any consecutive 15 minutes during the calendar month as per sliding window principle with sub integration period not greater than 5 minutes. It shall store the maximum demand with date and time, when it occurred. The maximum demand shall automatically reset at 24.00 Hrs of the last date of each calendar month for which minimum 30 years calendar shall be programmed by the manufacturer.

Maximum demand of the month shall be in KW by default & up to two decimal digits. The MD shall be programmable from KW to KVA

45.23 REAL TIME CLOCK AND BATTERY:

The MD integration cycle shall be on the basis of Real time clock of the meter. The maximum drift in real time clock of the meter shall not exceed ± 3 minutes per year and crystal should be temperature compensated for temperature range of 0°C to 50°C. A lithium battery of adequate storage energy shall be used for energy supply to real time clock during no voltage or power off condition. The metering data stated above including integration etc shall be independent of battery. The minimum life of battery should be ten years.

45.24 CALIBRATION:

The meters should be software based factory calibrated and there shall not be any mechanical adjustment in calibration after freezing the parameters at works. This is to ensure that the meter cannot be calibrated at site.

45.25 CONSTRUCTION:

Meter shall be designed and constructed to be capable of withstanding all severe stresses and vibration and dust environments likely to be encountered in actual field conditions. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.

45.26 TERMINALS AND TERMINAL BLOCK:

45.26.1 The terminals may be grouped in a terminal block having adequate insulating properties and mechanical strength. The terminal block should be made from best quality non-hygroscopic, flame retardant material (capable of passing the flammability tests given in IS:11731) with nickel plated brass for connecting terminals. It shall be an integral part of the meter base.

45.26.2 Terminal holes shall be of minimum 9.5mm to accommodate the insulation of conductor and shall be of adequate length in order to have proper grip of conductor/crimping pins with the help of two screws such that there is no risk of loosening or undue heating. Electrical

connection shall be so designed that contact pressure is not transmitted through insulating material. Required number of pins along with one additional pair shall be supplied with each meter.

45.26.3 Sufficient clearance shall be allowed between terminals. Further, the supporting webs between the two terminals of the terminal block should be sufficiently high to ensure that the two neighbouring terminals do not get bridged by dust or it is not possible to have flashed over between adjacent terminals of terminal block.

45.26.4 The terminals shall be of suitable rating to carry 200% of I_{max} and shall be made of electro-plated (or tinned) brass.

45.26.5 All connection screws and washers should be tinned/ nickel-plated brass. The terminal screws shall not have pointed end at the bottom. All terminals shall have two screws. The terminals shall be properly bound in the insulating material of terminal block.

45.26.6 The terminal block shall have provision with single/two screws for fixing to the meter board. It shall not be possible to remove the meter from the hanging screw without removing the screws from the terminal block.

45.26.7 The voltage circuit and current circuit shall be solidly connected inside the meter body without any link. A firm connection shall be established within the meter case to energize the voltage/current circuit. The connections shall be as per the recommended methods given in IS-13779.

45.27 CURRENT AND VOLTAGE CIRCUITS:

The current and voltage circuits shall be made of appropriate material such as enamelled copper wire of EC grade. The current circuit shall be appropriately insulated and potential circuit shall be appropriately encapsulated. The cross section of current circuit shall be designed to withstand the temperature rise of 50°C over the ambient temperature at maximum current. PT less design shall be used for power supply to PCB. The meter design shall be based on CT or CT and shunt combination or shunts. It is necessary to ensure accurate recording by the meters during the condition when DC component exists in the load, EM CT/Shunt currents should be compared and higher of the two should be used for measurement. Specific confirmation shall be submitted by the bidders that accuracy of measurement will not suffer due to utilization of shunt on account of thermal variation and temperature coefficient up to an operational temperature of 80°C.

45.28 **CT/Shunt Fixing arrangement:-** The CTs/Shunts & other measurement devices when provided in the meter shall be mounted through proper fixing arrangement so that it should have a firm support and should not move from its position in any case.

45.29 METER FIXING ARRANGEMENT:

Every meter shall have at least three fixing holes one at the top and two at the bottom. The top hole shall be provided with a special clip at the back of the meter so that holding screw is not accessible after the fixing of the meters. The lower fixing screws shall be provided under the terminal block. The requisite fixing screws shall be supplied with each meter.

45.30 CONNECTION DIAGRAM & TERMINAL MARKINGS:

The connection diagram of the meter shall be clearly shown on the nameplate of meter and shall be of permanent nature. The meter terminals shall also be marked and this marking should appear in the above diagram.

45.31 TERMINAL ARRANGEMENT:

Connecting terminals of meter shall be in the following sequence:

R(in) R(out), Y(in) Y(out), B(in) B(out), N(in) N(out),

45.32 NON FLAMMABILITY:

The terminal block, and the meter case shall be such as to ensure reasonable safety against spread of fire. It shall not be ignited by thermic over load of live parts in contact with them. To comply with this requirement, all the parts shall fulfill the conditions of the glow wire test as per relevant standard.

45.33 SEALING ARRANGEMENT:

45.33.1 The meters should be software calibrated at factory and sealed suitably before dispatch.

45.33.2 The meter shall be provided with 2 nos. polycarbonate tamper evident seals which shall be marked with "MPEZ", company logo and shall be additionally laser marked with serial no. matching with that of meter. The serial number of meter is to be laser –etched on the base as well as the cover of the meter box, and can be easily viewed to check duplication attempts for the purpose of keeping track of meter seals. All the seals should be provided on front side only. Access to the working part should not be possible without breaking the seals. Provision shall also be made to seal the extended optical port on the side of the meter box.

The provision shall also be made to provide additional lash wire seals on the meter by the MPPKVVCL

45.34 TAMPER AND FRAUD PROTECTION:

Logics for design of various tampers, the value of voltage, current, time etc. to be selected for design of tamper shall be done in consultation with the purchaser. It may be noted that the approved logics used in designing tampers are explained to our field officers, and based on their input the bidder have to modify logic if necessary (The last tamper date and time of occurrence and tamper counts must appear in the DISPLAY and rest of the details in VIEW PARAMETERS).

The meter shall record and store last 200 events of tampers (occurrence + restoration) along with date and time of occurrence and restoration of each and every event. The event recording shall be roll over type i.e. it shall always maintain record of last 200 events occurred of selected tamper for logging.

The tamper information shall be available along with date & time of occurrence and restoration of the event and phase indication on which tamper was attempted.

The meter shall to continue to register active energy accurately even under following conditions:

45.34.1 The meter should register energy consumption correctly in forward direction irrespective of the direction of current in the current circuit (i.e. main and load wire interchange .).

45.34.2 The meter should continue to record energy even when

(a) Any two phases are disconnected i.e. in presence of any one phase and neutral. Under this condition the meter should record correctly.

(b) One phase and neutral are disconnected i.e. in presence of any two phases and the load is drawn through local earth. Under this condition, earth load LED indication shall appear on meter and the maximum limit of error allowed is $\pm 3\%$ from the reference condition.

(c) When incoming neutral is disconnected, outgoing neutral is connected to earth through resistance and load is connected to earth, the arrangement should be provided such that power LED starts blinking when incoming voltage is below 200 Volts. The energy register shall advance for low voltage up to 120 Volts in each phase.

45.34.3 Current Imbalance (CT shorting/by-passing) :

In case of CT open or shorting, which may result in the current imbalance between the phases, the tamper indication should appear by means of measuring neutral current. Meter shall store the date & time of occurrence and restoration in the non-volatile memory.

45.34.4 Power ON Time: The meter shall have provision to record the phase wise power ON time in HH:MM in a calendar month for last 6 months

45.34.5 The meter should record energy as per IS for balanced and unbalanced load.

45.34.6 Meter should continue to record in unbalance load condition when neutral is removed. In this condition maximum limit of the error allowed is $\pm 3\%$ from the reference condition.

45.34.7 The meter should record energy accurately irrespective of the phase sequence of supply.

45.34.8 The three phase LT meter should continue to function when DC signals through Diodes from any or all three phases are injected on the neutral of the meter.

45.34.9 **Cover opening :**

If attempt is made to open the meter body, the meter shall **detect /log** with date and time of meter body opening tamper, even in absence of supply. **This tamper shall also be displayed on the meter LCD with tamper information.**

45.34.10 DC Immunity:

The meter should not saturate on passing of direct current which can cause the meter either to stop recording or record inaccurately as per IS: 13779 (latest version).

45.34.11 External Magnetic Influence:

The meter shall not get influenced by any external magnetic fields (AC Electro Magnet or DC Magnet) in accordance with the test procedures specified in IS: 13779 with its latest amendment for AC Magnetic Field. However, the meter alone should comply up to 0.27 Tesla DC.

The meter accuracy or accuracy in display under normal conditions shall not be affected by placement of a permanent magnet of not less than 0.27 Tesla anywhere on the surface of meter without meter box.

Meter shall have provision to record the tamper of abnormal magnetic induction with date and time of occurrence and restoration.

On application of external DC magnetic field of higher intensity against which meter is not immune, the meter should log the events of abnormal magnetic induction with date and time. The positive error may be beyond the limit of 4% but not exceeding power value equivalent to the product of rated voltage and maximum current.

45.34.12 Application of abnormal voltage /frequency:

A) The accuracy of the meter, Real time clock disturb, Memory data corruption, meter functioning hang up etc. should not occur with the application of abnormal voltage/frequency such as spark discharge of approximately 35KV with 0.01-10 mm spark gap in any of the following manner when applied for 10 minutes:

- a) On any of the phases or neutral terminals
- b) On any connecting wires of the meter
- c) At any place in load circuit
- d) Spark on meter body.

B) Meter should also be immune for tamper by application of remote loop induction device (jammer).

When meter is subjected to approx. 35 KV high voltage/ frequency burst and remote loop induction device (jammer), it should not hang and in case if it hang once it should remain hanged permanently.

45.34.13 EMC/EMI Test:

The meter shall also pass all EMC/EMI tests as per IS:13779 with latest amendments.

45.34.14 Further the bidder shall carefully note and confirm that:

- (i).The measurement of meter shall not be influenced by injection of AC voltages/ chopped signal/DC signal and harmonics on the outgoing leads of the meter.
- (ii).The meter shall not get affected by any remote device.
- (iii)The bidder should furnish detailed explanation as to how the meter is able to detect/Protect recording the above tamper and fraud features with sketches and phaser Diagram. Additional features, if any, in the meter may also be clearly indicated.

Along with the tamper information, the meter shall also record the phase wise instantaneous values of voltages, currents and phase power factors to simulate and elaborate the existing condition during all type of tamper events.

45.35 LED INDICATIONS :

The following indications must be provided on the meter:

- (i) KWh indicator for Meter calibration - Red (Calibration LED-Imp/KWh)
- (ii) Input and output reversal - Yellow LED indicator or ICON on LCD
Indication / current reversal
- (iii) Earth Tamper indication - Green LED indicator or Icon on LCD
- (iv) Power supply ON and Phase indication - LED or ICON on LCD for line1, 2 & 3.

All the LEDs shall be of low power consumption and distinctly visible from distance. Except KWh indicator, all the other indications may be provided as Icon on backlit LCD. The earth LED should glow only when measurement is through neutral circuit.

45.36 SALIENT FEATURES:

The meter shall have the following additional features.

- 45.36.1 The meter shall be compact in design. The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation/loading/unloading etc. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.
- 45.36.2 The short time over current rating shall be 30 I_{max} for one half cycle at rated frequency as per clause No.9.2.3 of IS:13779.
- 45.36.3 The meters shall remain within $\pm 1\%$ accuracy when tested at basic current at rated voltage at 0.3lag and 0.5 lead power factor.
- 45.36.4 Meter shall work within accuracy up to max. loading up to $120\% I_{max}$.
- 45.36.5 Even if phase to phase voltage (i.e. 440 Volts) is applied for 5 minutes between phase and neutral of the meter, the meter should not get damaged and continue to record correctly within class 1.0 accuracy after restoration of normal supply.
- 45.36.6 The meter shall also withstand impulse Voltage without any damage in accordance with the clause 12.7.6.2 of IS: 13779:1999.
- 45.36.7 The meter shall make use of Non Volatile Memory capable of storing & retaining all the data required to be stored, without the help of any power source or battery back up.
- 45.36.8 Computation of demand shall be on the basis of Real Time Clock of the meter itself.
- 45.36.9 Provision shall be there to do the billing operation automatically at a predefined date by programming the meter.
- 45.36.10 Meters covered under this specification shall be fully static type with non-volatile memory to register various billing parameters and complete with other features as detailed out in this specification. Any other design meeting technical specification or features/accuracy etc., better than this specification and manufactured as per relevant IEC/IS/CBIP report shall also be acceptable.
- 45.36.11 Meter shall be suitable for accurate measurement and display of energy and other billing parameters within the specified limits of errors under balance and unbalanced load conditions in a poly phase network.
- 45.36.12 Indication shall be provided on display to show the healthiness of phase voltage.
- 45.36.13 The meter shall be fully programmable by the user for TOD timing and billing dates etc. For security reasons the meter operating software should have at least "two level write protection" against any modification/editing of the parameters, data, settings etc. except those required for billing data, TOD metering.
- 45.36.14 The meter shall conform to the degree of protection IP 51 of IS: 12063/IEC: 529 for protection against ingress of dust, moisture and vermin's.

45.36.15 The meter base & meter cover shall be made of high grade, fire-resistant, non-inflammable high-grade and good quality engineering plastic.

45.36.16 The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling transportation. The meter shall be convenient to transport and immune to shock and vibrations during transportation and handling.

45.36.17 The voltage circuit and current circuit shall be solidly connected inside the meter body without any link. A firm connection shall be established within the meter case to energize the voltage/current circuit. The connections shall be as per the recommended methods given in IS-13779

45.37 SELF DIAGNOSTIC FEATURE

The meter shall be capable of performing complete self-diagnostic check and continuously monitor all the circuits for any malfunctioning and ensure integrity of data memory location at all time. The meter shall have display indication for unsatisfactory/nonfunctioning/malfunctioning of the following:

- a) Time and date on meter display
- b) All display segments on meter display
- c) Real Time Clock (RTC) status in meter reading print out at BCS end
- d) Non-volatile Memory (NVM) status in meter reading prints out at BCS end.

45.38 ELECTROMAGNETIC COMPATIBILITY AND INTERFERENCE REQUIREMENT:

45.38.1 The meter shall meet EMI/EMC requirements as specified in the relevant standards and shall also be protected against radiated interference from either magnetic or radio frequency sources.

45.38.2 The offered whole current meter shall also withstand DC Immunity test for main and neutral circuit at $I_{ref} = I_{max} / \sqrt{2}$ as per IS:13779 so as to ensure that the meter current circuits do not saturate on passing of direct current.

45.38.3 The meter shall be designed in such a way that the conducted or radiated electromagnetic disturbances as well as electrostatic discharge do not damage or influence the meter.

45.38.4 The disturbance(s) to be considered are:

- (i) Harmonics
- (ii) Voltage dips and short interruptions
- (iii) Fast transient burst test
- (iv) External D.C. and A.C. magnetic fields
- (v) Electromagnetic H.F. fields
- (vi) Electrostatic discharges

- (vii) Radio frequency interference suppression.

45.39 GUARANTEED TECHNICAL PARTICULARS:

The bidder shall furnish all the necessary information as desired in the Schedule of Guaranteed Technical Particulars and data, appended with this specification. If the bidder desires to furnish any other information(s) in addition to the details as asked for, the same may be furnished against the last item of that Annexure.

45.40 NAME PLATE AND MARKING:

Every meter shall have a name plate clearly visible and indelible and distinctly marked in accordance with IS:13779 (latest version). The following information should appear on the name plate affixed on to the meter:-

- (i) Manufacturer's name or trade-mark and place of manufacture.
- (ii) Designation of type
- (iii) Number of phases and number of wires for which the meter is suitable.
- (iv) Guarantee period – 5 years from the date of commissioning or 5-1/2 years from the date of supply , whichever occurs first.
- (v) Purchase Order No. & Date.
- (vi) Property of MPPKVVCL.
- (vii) Bar coding of SN, Month & Year of manufacture
- (viii) Sign of Insulation Class
- (ix) Connection diagram
- (x) Serial number, year and month of manufacture
- (xi) Principal unit in which the meter records Reference voltage
- (xii) Basic current and rated maximum current
- (xiii) Reference frequency in Hz
- (xiv) Meter constant (Imp/KWh)
- (xv) Accuracy class
- (xvi) Reference temperature
- (xvii) ISI mark and license number

45.41 TESTS:

(A) Type Test:

The type test certificate for all tests as indicated in IS:13779-1999 (with latest amendments) shall be furnished along with the bid. Type test certificates from any one of the standard laboratories NABL accredited for particular equipment/test shall only be considered. Type test report, amongst other details, should contain the following information clearly:

- (i) Type of meter and display
- (ii) Class of Accuracy.

Type test certificate from educational institute(s) will not be accepted. The type test certificate shall not be more than 24 months old as on the date of opening of bid.

(B) Additional Type Test:

In addition to the tests mentioned at (A) above, bidder shall have to furnish the type test reports of compliance of anti-tamper features as per tender specification.

(C) Acceptance tests:

All Acceptance tests as laid down in this tender specification shall be carried out.

(D) Verification during Inspection:

Inspecting officer shall verify that no DC supply/ signal is given to reference meter during the DC injection test. The accuracy of display parameters shall be verified at the time of inspection in line with class of accuracy of meter.

- i. Voltage variation test
- ii. Accuracy tests under all anti tamper conditions.
- iii. Permanent magnet test
- iv. Special accuracy test – the meters shall remain within $\pm 1\%$ accuracy when tested at basic current at rated voltage at 0.3lag and 0.5 lead power factor.
- v. The accuracy of the meter, Real time clock disturb, Memory data corruption, meter functioning hang up etc. should not occur with the application of abnormal voltage/ frequency such as spark discharge of approximately 35KV with 0.01-10 mm spark gap in any of the following manner when applied for 10 minutes:
 - a) On any of the phases or neutral terminals
 - b) On any connecting wires of the meter
 - c) At any place in load circuit
 - d) Spark on meter body.
- vi. Immunity from remote loop induction device (jammer)

The accuracy and above indicated parameters of meter shall be checked before and after the application of above device(s) with site conditions. It is desired that when meter is subjected to approx. 35 KV abnormal high voltage/ frequency burst and remote loop induction device(jammer) it should not hang and in case if it hangs once it should remain hanged permanently.

(E) Routine Tests:

All the routine tests as stipulated in IS:13779 and in addition tamper and fraud protection tests as per TS shall be carried out and test certificates shall be furnished for approval of the Purchaser.

45.42 TEST FACILITIES AVAILABLE WITH THE MANUFACTURER:

The tests shall be carried out as per relevant Standards and test certificates shall be furnished for approval. The Supplier shall indicate the details of the equipment available with him for carrying out the various tests as per relevant Standards. The bidder shall indicate the sources of all materials.

Bidders should carefully note that the standard meters used for conducting tests shall be calibrated periodically at NABL Accredited Test Laboratories and test certificates shall be available at Works for verification by Purchaser's representative.

The Supplier/Manufacturer shall have at least the following testing facilities to ensure accurate calibration:

- (i) Insulation resistance measurement
- (ii) Running at no load
- (iii) Starting current test
- (iv) Limits of error
- (v) Power loss in voltage and current circuit
- (vi) Repeatability of error
- (vii) Transportation test
- (viii) Low load run test
- (ix) Heating test

45.43 INSPECTION:

45.43.1 The Purchaser's authorized representative may carry out the inspection at any stage of manufacture. The Supplier/Manufacturer shall grant free access to the Purchaser's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the Purchaser shall not absolve the Supplier of his obligation of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

45.43.2 All acceptance tests and inspection shall be made at the place of Supplier/Manufacturer. The Supplier shall provide all reasonable facilities without demanding any charge to the inspector representing the Purchaser to satisfy him that the equipment is being furnished in accordance with this specification.

45.43.3 The Supplier/Manufacturer shall keep the Purchaser informed in advance, about the manufacturing/readiness activities so that arrangement can be made for inspection.

45.43.4 The Purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The Supplier shall give 15 days advance intimation to enable the Purchaser to depute his representative for witnessing the acceptance and routine tests.

45.43.5 The Purchaser reserves the right to get type tests done in respect of any meter, or Box from any of the lots received at any Destination Stores at Supplier's expenses.

45.44 SAMPLE: Sample before Commencement of supplies:

The Supplier shall submit sample of offered meter along with the meter box having all the features conforming to the prescribed specification for our approval before commencement of supply.

45.45 RANDOM SAMPLE TESTING AFTER RECEIPT OF METERS AT STORES:

The consignment of meters received at Area Store shall be accepted only after testing of sample meters at CPRI/ERDA/ERTL/any NABL accredited testing **laboratory** as stated in the Schedule-II(D). The sample meters shall be selected randomly from the lot and will be sent to CPRI for acceptance test as per relevant ISS and as per procedure prescribed in schedule-II(D). If the sample fails in the above tests, the entire lot will be rejected and testing charges shall be recovered from the supplier. Purchaser may select meters at random from a lot of meters supplied and sent to CPRI/ERDA/ERTL/any NABL accredited testing **laboratory for acceptance test as per relevant ISS. If the sample fails in the above tests, the entire** lot will be rejected and testing charges shall be recovered from the Supplier.

45.46 QUALITY ASSURANCE PLAN:

45.46.1 The designed life of the meter shall be minimum of 20 years and to prove the designed life, the firm shall have to follow at least the following Quality Assurance Plan:-

- (i) The factory shall be completely dust proof.
- (ii) The testing rooms shall be temperature and humidity controlled as per relevant standards.

The testing and calibrating equipments should be automatic and all test equipment shall have their valid calibration certificates.

- (iii) Power supplies used in testing equipment shall be distortion free with sinusoidal, wave forms and maintaining constant voltage, current and frequency as per the relevant standards.
- (iv) During the manufacturing of the meters the following checks shall be carried out.
 - (i) Meter frame dimensions.

- (ii) The assembly of parts shall be done with the help of jigs and fixtures so that human errors are eliminated.

- (iii) The meters shall be batch tested on automatic, computerized test bench and the results shall be printed directly without any possibility of human errors.

45.46.2 The Supplier/Manufacturer shall furnish the following information. Information shall be separately given for individual type of meters 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 material in presence of Supplier's representative and 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 Supplier for final testing of equipment specified and test-plant limitations, if any, vis-à-vis type, special acceptance and routine tests specified in the relevant standards and this specification. These limitations shall be very clearly brought out in schedule of deviations.

45.46.3 The Supplier/Manufacturer's laboratory must be well equipped for testing of the meters. They must have computerized standard power source and standard equipment calibrated not later than a year (or as per standard practice). The details of testing facilities available for conducting (a) The routine tests and (b) Acceptance tests shall be furnished in Schedule annexed with tender document.

45.47 MANUFACTURING ACTIVITIES:

- (i) All the materials, electronics and electrical components, ICs used in the manufacture of the meter shall be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.
- (ii) The Manufacturer should use Application Specific Integrated Circuit ASIC or Micro controller for metering functions.
- (iii) The electronic components shall be mounted on the printed circuit board using latest Surface Mounted Technology (SMT) except power components by deploying automatic SMT pick and place machine and re-flow solder process. The electronic components used in the meter shall be of high quality. Further, the Supplier should own or have assured access (through hire, lease or sub-contract) of the above mentioned facilities. The PCB material should be of glass epoxy FR-4 grade conforming to relevant standards.
- (iv) All insulating materials used in the construction of meters shall be non-hygroscopic, non-aging and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.
- (v) Quality should be ensured at the following stages :
 - (a) At PCB manufacturing stage, each board shall be subjected to bare board testing.
 - (b) At insertion stage, all components should undergo testing for conforming to design parameters and orientation.
 - (c) Complete assembled and soldered PCB should undergo functional testing using test equipments (testing jig).
 - (d) Prior to final testing and calibration, all meters shall be subjected to accelerated ageing test to eliminate infant mortality.
- 1. The calibration of meters shall be done in-house.
- 2. The Supplier/Manufacturer should submit the list of all components used in the meter along with the offer.
- 3. A detailed list of bought-out items which are used in the manufacture of the meter should be furnished indicating the name of firms from whom these items are procured. The Supplier shall also give the details of quality assurance procedures followed by him in respect of the bought-out items.
- 4. The details of testing facilities available for conducting the routine and acceptance tests and other special tests on the meter shall be furnished with the bid. The facility available if any for conducting type test may also be furnished.

45.48 DOCUMENTATION:

45.48.1 All drawings shall conform to International Standards Organization (ISO "A" series of drawing sheet/India Standards Specifications IS: 656. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. Units.

45.48.2 List of drawings and documents:

The Supplier/Manufacturer shall furnish the following:

- (i) Two sets of drawing clearly indicating the general arrangements, fitting details, electrical connections etc.
- (ii) Technical leaflets (user's manual) giving operating instructions.
- (iii) Three copies of dimensional drawings of the quoted item.

45.48.3 The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication works in connection with the equipment prior to the approval of the drawing shall be at the Supplier's risk.

45.48.4 Approval of drawings by Purchaser shall not absolve the Supplier of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirements of the latest revision of application standards, rules and codes of practices. The equipment shall conform in all respect to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and Purchaser shall have the power to reject the materials which, in his judgment, is not fully in accordance therewith.

45.48.5 The successful Supplier shall, within 2 weeks of notification of award of contract, submit three sets of final versions of all the drawings as stipulated in the contract for Purchaser's approval. The Purchaser shall communicate his comments/ approval on the drawings to the Supplier within two weeks. The Supplier shall, if necessary, modify the drawings and resubmit three copies of the modified drawings for approval. The Supplier shall within two weeks, submit 10 prints and two good quality report copies of the approved drawings for Purchaser's use.

45.48.6 Each meter shall be accompanied with a manual in English and Hindi detailing the LCD display parameters (with illustration) and installation procedure. Similarly each CMRI shall accompany with detail operational manual.

45.48.7 One set of routine test certificates shall accompany each dispatched consignment.

45.48.8 The acceptance test certificates in case of pre-despatch inspection or routine test certificates in cases where inspection is waived shall be got approved by the Purchaser

45.49 GUARANTEE:

- (i) The meters shall be guaranteed for a period of **5 years from the date of commissioning or 5-1/2 years from the date of supply, whichever occurs first.**

- (ii) The meter found defective within the above guarantee period shall be replaced by the supplier free of cost within one month of the receipt of intimation. If the defective meters are not replaced within the above specified period, the same shall be treated as breach of performance of the contract and shall be liable for consequential penal action.

45.50 PACKING & FORWARDING:

45.50.1 The equipment shall be packed in crates suitable for vertical/horizontal transport as the case may be, and suitable to withstand handling during transport and outdoor storage during transit. The Supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbol. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc., shall be provided. Any material found short inside the packing cases shall be supplied immediately by Supplier without any extra cost.

45.50.2 Each consignment shall be accompanied with a detailed list containing the following information.

- a) Name of the consignee
- b) Details of consignment
- c) Destination
- d) Total Weight of Consignment
- e) Handling and packing instruction
- f) Bill of material indicating contents of each package

45.50.3 The packing shall be done as per the Manufacturer's standard practice. However, he should ensure the packing is such that the material should not get damaged during transit by Rail/Road.

45.51 GENERAL :

45.51.1 Principle of operation of the meter, outlining the methods and stages of computation of various parameters starting from input voltage and current signals including the sampling rate, if applicable, shall be furnished by the bidder.

45.51.2 The Supplier shall indicate the method adopted to transform the voltage and current to the desired low values with explanation on devices used such as CT, VT or potential divider as to how they can be considered superior in maintaining ratio and phase angle for variation of influencing quantities during its service period.

45.51.3 The Supplier shall furnish details of memory used in the meter.

45.51.4 The Technical Specification of Push Fit Type Meter Box Made Of Engineering plastic has been described in Schedule-II(B)

45.51.5 The procedure for Verification/Testing Of Material Supplied described in Schedule-II(D) shall be followed

45.51.6 It is mandatory to conform compliance of guaranteed technical particular of ac three phase electronic KWH meter with LCD display as per Schedule-III

i.

46 TECHNICAL SPECIFICATION OF PUSH FIT TYPE METER BOX MADE OF ENGINEERING PLASTIC

- 46.1 The meter box shall be weather proof, tamper proof and made of transparent engineering plastic conforming to IS: 11731. Type test of material is required to be furnished along with the sample.
- 46.2 The meter box should be unbreakable un-deformable and should withstand the temperature up to 140 deg. cent.
- 46.3 Thickness of the base should be at least 2 mm and cover should be of not less than 0.8 mm.
- 46.4 Clearance of 30 mm shall be maintained from top and both sides of the meter. However, the clearance at bottom should be of 75 mm. from the meter and 45mm from the terminal block. Besides, there should be minimum clearance of 15 mm in the front from the face of meter.
- 46.5 The top cover of the meter box should be of push fit type having at least 4 self locks so that once the top cover of the box is fitted with the base it cannot be removed without breaking the top cover. The cover and base shall have groove all along with the fitting edge, so that after fixing the top cover, no wire or any device can be, temporary or permanently, inserted in the box. The top cover of the box, provided with self-lock, should have arrangement/barrier so that after getting locked, it cannot be detached from latches even by applying external pressure through any means. The locks will be moulded in the cover and base and will not be separate pieces fixed later. There will be no holes to access the locks from any side.

Additional provision to provide lash wire utility seals on meter box shall be made.

- 46.6 Meter shall be fitted with the base of box through unidirectional type screw or by some other better means in such a way so that once the meter is fitted with the base; it cannot be removed from the base and become an integral part with base. The meters shall be supplied duly mounted on the base of meter box and the cover shall be placed separately in the cartoon.
- 46.7 Suitable circular holes with adjustable cable glands shall be provided at the bottom of the meter box for inlet and outlet of consumer's service cables. The incoming and outgoing gland shall be positioned such that they disable direct access to terminals through glands.
- 46.8 The meter box cover or base shall have a barrier so positioned that any possibility of fiddling the meter terminal from outside of the meter box through cable entry holes is not possible. The barrier shall have reinforce/locked at both sides to restrict its movement up and down even by applying external pressure through any tools.
- 46.9 The top cover of meter Box should have spring loaded push button with spindle in moulded barrel perfectly in alignment to operate push button of the meter to read display parameter on push button mode.
- 46.10 The boxes shall be specific to the meter mounted in it. Thus, the Serial Number of the meter should be indelibly engraved /marked on the base of meter box as well as on the cover of meter box.
- 46.11 The box should have proper mounting arrangement so that it could be mounted on the wall or the pole, as the case may be.
- 46.12 The meter box comprises of base and cover shall pass the following tests;
 - i) **Unbreakability test**:- Shall not get damage or deform while dropping from a height of 10 ft. and hammered with 2 kg. hammer to test its unbreakability.
 - ii) **Boiling water test** :- It should pass the boiling water test as prescribed in IS:13010.
- 46.13 The overall dimensions of the meter box shall vary according to the different make of meters. However, it shall comply with the minimum requirements as described above.

- 46.14 The individual meter manufacturers shall submit the specific drawing and sample accordingly to accommodate there make meter only.