

TECHNICAL SPECIFICATION FOR SINGLE PHASE WHOLE CURRENT 5-30A ELECTRONIC IrDA BI-DIRECTIONAL ENERGY METER (SOLAR NET METERS)

SCOPE:

- 1.1 This specification covers design, engineering, manufacture, assembly, stage testing, inspection and testing before supply and delivery free at destination stores of Single Phase Whole Current Electronic Bi-Directional Energy Meters of 5-30A rating of 1.0 class of accuracy with IrDA physical layer, Super Capacitor, Non-Push fit Meter Terminal cover, Non Push fit type PP Meter box with Inlet and Outlet glands on the left side and right side of the box. AC Single Phase, two wires long range kWh Electronic Energy Meters of accuracy class 1.0 (Solar Net meters). The above meters shall be supplied in a pilfer proof box which shall be weather proof made out of poly carbonate with flame retardant properties. The meter and box should be supplied in suitable packing so as to withstand transit shocks.

The manufacturer shall differentiate the import & export energy clearly (by inward / outward arrow marking etc.) Energy supplied to the consumer is import energy & Energy received from the consumer is export energy.

- 1.2 It is not the intent to specify completely herein all the details of the design and construction of 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 power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such, components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

2.0 STANDARDS:

- 2.1 The materials shall conform in all respects to the following relevant Standard Specifications with latest amendments thereto.

Indian Standard No.	Title
IS 13779/1999	Specification for AC Static Watt hour Meter for class 1 & 2
CBIP TR No.325 (with latest amendments)	Specification for AC static electrical energy meters.
IS 5133/1969	Specification for boxes for the enclosure of electrical accessories
IS 9000	Basic environmental Testing procedures for Electronic & Electrical items.

2.2 CONFLICT OF STANDARDS:

Material conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above would also be acceptable. In case the

Bidders who wish to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Two copies of such standards with authentic English Translations shall be furnished along with the offer. In case of conflict the order of precedence shall be (i) IS 13779 with latest amendments (ii) CBIP and (iii) Other standards. In case of any differences between provisions of these standards and provisions of this specification, the provisions contained in IS and in this specification shall prevail.

3.0 CLIMATIC CONDITIONS:

The meters shall be suitably designed and treated for normal life and satisfactorily operation under the hot and hazardous tropical climate conditions typically existing in state of Andhra Pradesh (India) and shall be dust and vermin proof. All the parts and surfaces which are subjected to corrosion shall either be made of such material or shall be provided with such protective finish which provides suitable protection to them from any injuries effect of excessive humidity. The meter shall be required to operate satisfactorily and continuously under the following tropical climatic conditions :

Sl.No	Location	At various locations in Andhra Pradesh
1.	Max. ambient air temperature (deg. C)	50
2.	Max.ambient air temperature in a closed box (deg. C)	60
3.	Min. ambient air temperature (deg. C)	7.5
4.	Average daily ambient air temp. (deg.C)	35
5.	Max. Relative Humidity (%)	100
6.	Max. altitude above mean sea level (m)	1000
7.	Average Annual rainfall (mm)	925
8.	Max. wind pressure (kg/sq. m.)	200
9.	Isoceraunic level (days per year)	40 to 50
10.	Seismic level (Horizontal acceleration)	0.3 g.
11.	Permitted Noise Level	45 dB

4.0 PRINCIPAL PARAMETERS :

The equipment shall conform to the following specific parameters:

Sl.No.	Item	Specification
1.	Type of Installation	Indoor/Outdoor
2.	System voltage	240V + 20%, -40% Phase to neutral
3.	System frequency	50 Hz +/- 5%
4.	No. of phases	Single Phase 2wire
5.	System of earthling	Solidly grounded
6.	Resistance to Surge Voltage	6 KV peak (testing procedures as per IS 13779) of 1.2/50micro sec

5.0 TECHNICAL REQUIREMENTS:

The meter and box shall be as per the following parameters and no deviations are acceptable.

5.1 Materials used :

5.1.1. The meter shall be made out of high quality materials to ensure high reliability and long life with a self extinguishing type superior grade polycarbonate meter casing with minimum 2mm thickness and complaint to IS11000 with latest amendment. The entire design and construction shall be capable of withstanding the severest stresses likely to occur in actual service. The latest state of art technology of surface mounting of components is preferred for this purpose. Soldering used if any, shall be perfect without dry solders. The components used shall be of high quality and comply with international industrial standard practices. The construction of the meter shall be such as to permit sealing of the meter cover, terminal cover etc. independently to ensure that the internal parts are not accessible for tampering etc. without breaking the seals. The meter cover should be transparent and shall be made out of scratch and break resistant transparent silicon coated polycarbonate. The firm has to submit type test reports along with the bids.

Meters shall be designed and constructed in such a way as to avoid introducing any danger in use so as to ensure specially.

- i) Personnel safety against electric shock.
- ii) Personnel safety against effects of excessive temperature.
- iii) Protection against spread of fire.
- iv) Protection against penetration of solid objects, dust and water.

In addition necessary documentary evidence shall be made available by the supplier for having used Industrial Grade components.

Further, meter should be provided with a) Surge protection and b) Over voltage protection in case phase to phase voltage appears across the voltage terminals.

5.1.2 Ratings :

The single phase meters as specified in clause 1.0 shall be rated as follows.

a)	Voltage	240V
b)	Current	
	i) Basic current (I_b)	5A
	ii) Rated max. continuous current (I_{max})	30A
c)	Frequency	50 Hz
d)	Accuracy	Class 1.0

5.1.3 Power Supply Variation:

The extreme power supply variation and abrupt supply interruptions, which the meter should withstand without damage and without degradation of its meteorological characteristics when it is subsequently operated under its normal operating conditions:

Voltage	-40% to +20%
Frequency	+/- 5%
PF range	Zero lag-unity-zero lead *

However manufacturer can offer meters, which can withstand higher variations. The meter should have BROWN OUT capability to activate the internal circuitry on tracking and ascertaining supply stabilization (to avoid program corruption etc.).

* The meter shall work over wide PF range and Voltage and the limits of errors with the variation of PF shall be as per IS 13779.

5.1.4 Name Plate marking:

The name plate drawing shall be got approved from the purchaser before commencement of manufacture.

5.1.5 Accuracy:

Class of accuracy of meter shall be 1.0. The accuracy should not drift with time.

5.1.6 Power consumption:

5.1.6.1 **Voltage circuit:** The active and apparent power consumption in each voltage circuit including power supply of meter at reference voltage, reference temperature and reference frequency shall not exceed 1.0 Watt and 8 VA respectively.

5.1.6.2 **Current circuit:** The apparent power taken by each current circuit at basic current, reference frequency and reference temperature shall not exceed 1VA.

The above losses are maximum allowable and there shall not be any positive tolerance.

5.1.7 Starting current:

The meter should start registering energy at 0.2% of basic current (I_b) at unity power factor and shall be fully functional within five seconds after the rated voltage is applied.

5.1.8 RUNNING WITH NO LOAD:

When the voltage of 120% of rated voltage is applied with no current flowing in the circuit, the test output of the meter shall not produce more than one pulse/count. The minimum Time test limit shall be as per IS 13779/99.

5.1.9 TEMPERATURE RISE

- a) Under normal conditions of use, winding and insulation shall not reach a temperature, which might adversely affect the operation of the meters.
- b) With each current circuit of meter carrying rated maximum current and with each voltage circuit (and those auxiliary voltage circuits which are energized for a period of longer duration than their normal time constant) carrying 1.25 times the reference voltage, the temperature rise of the respective parts shall not exceed the following values over and above an ambient temperature of 50°C.

i)	Measuring elements	50°C.
ii)	External surface of the case	15°C.

5.1.9.1 INFLUENCE QUANTITIES: As per IS 13779 (latest version).

5.1.10 LCD Display:

5.1.10.1 The meters shall have bright LCD Electronic display with backlit and with minimum 6 digits. The backlit should not glow during power off condition. The LCD shall be industrial grade with multi layer & of STN (Super Twisted Nematic) type construction suitable for temperature withstand of 80°C (storage) & 65°C (operation) i.e.,

- a. When the meter is placed over at a constant temperature of 65°C for a period of 30 minutes, the character of LCD should not deform.
- b. After keeping the meter at a constant temperature of 80°C for a period of 30 minutes and when restores at normal temperature, LCD display shall work satisfactorily.

Note: The LCD should be hard pin type and soldered to PCB

5.1.10.2. The LCD display should have a wide viewing angle of 120° and up to one-meter distance, for clear visibility of the display of the meter reading at distance with backlight in green and characters/digits in black. Large viewing area with large display icons is preferred. However, the display size area should not be less than 55 x 14 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 10 years under un-powered condition.

The minimum character height x width shall be 10x5mm. Dot matrix type LCD display is not acceptable.

All important data such as calibration data, billing parameters and cumulative KWh should be stored in Non-Volatile Memory (NVM) internal to the main processing circuit and it should not be possible to change the data through any standard serial communication.

The accuracy of display parameters on LCD display for all parameters shall be matching with the accuracy class of meters as per IS.

5.1.11 Display parameters: The meter shall display the required parameters in two different modes as follows:

5.1.11.1 The single phase meters shall be capable to measure and display continuously “Active Energy kWh” at all loads and power factors i.e., zero lag-unity-zero lead and current “Maximum demand KW” one after another with a time gap of 10 sec.

Auto display mode (Scrolling): The following parameters shall be displayed in an Auto display mode in the following sequence. Import & Export parameters shall marked clearly.

1. LCD Test
2. Real Time
3. Date
4. Cumulative Active energy import reading (kWh)
5. Cumulative Active energy export (kWh)
6. Last Bill Active import and export energy
7. Instantaneous Load (KW)
8. Last Bill Maximum demand in KW (Imp. & Export)
9. Billing counts
10. Cumulative Tamper Occurrence Count

All the above parameters shall be displayed one after the other with a time gap of 10 sec. The meter should also have provision for automatic recording of cumulative kWh reading (import & export) at 24.00 Hrs on the last day of the month for each calendar month and the same should go to memory. The display shall never blank out in all conditions.

5.1.11.2 Push button:

The display of the following parameters shall be continuously scrolling one after the other through push button. The display shall have ‘ON’ time of 10 seconds for each measured value for display cycling. After 10 seconds push mode has to go to Auto mode.

1. LCD Test
2. Real Time
3. Date
4. Instantaneous phase voltage
5. Phase and neutral line current
6. Instantaneous power factor
7. Cumulative Active energy import reading (kWh)
8. Cumulative Active energy export (kWh)
9. Frequency
10. Maximum demand KW for Current month (Import & Export)
11. Tamper information (Last occurred and restored event with date and time)
12. Cumulative Active energy import reading (kWh) Import & export for each calendar month for previous 12 months.

13. Maximum Demand KW with 30 minutes integration and maximum of these in a calendar month for previous 12 months.(Import & Export)

14. Harmonic content (TDH)

The meter shall also be capable of offering a high resolution display mode which shall enable conducting of dial testing by the user in the shortest possible time and hence as a minimum; the meter shall be capable of offering a resolution of 4 digits after decimal (and 2 digits before decimal) for the high resolution KWh display.

5.1.11.3 METER READING AT POWER OUTAGE

With Super capacitor: Provision to read the meter in no power condition shall be made. The same push button shall be used for displaying push-button parameters only i.e. auto scroll mode during power outage. **Such a provision shall be provided in the form of rechargeable super capacitor back up and primary battery both as under:**

1. In the form of **rechargeable super capacitor back up** for continuous auto-scroll display parameters for 48 hours from instant of power failure without back lit.
2. With primary battery activated through push button during power failure capable of at least 50,000 such operations during the meter lifetime. No power shall be consumed from this circuit when mains are available.
3. In power off condition the meter shall have a facility for communicating with **ISBM/Scanner**.
4. The performance of Super capacitor may be verified by removing the battery from circuit in any meter during sample testing or inspection.

In any case, RTC Battery Power shall not be used for display under Power off condition.

Makes of super capacitor: Panasonic, National, Elna, Starcap (from Korchip), NEC, any other CACT or LCSO .

5.1.11.4 IrDA PORT COMMUNICATION CAPABILITY

The meters shall have facility for remote reading through remote **IrDA Physical layer port from a minimum distance of 1.5 meters with the help of ISBM/Scanner. (Integrated Spot Billing Machine)** to facilitate the utility for auto reading, billing the consumer at spot and downloading of six months of data for future use. The meter shall possess suitable fast and reliable infrared communication for data transfer. There should not be any possibility of tampering of data stored in meter even after getting the password of the software. It should be locked at the time of manufacturing. There should not be any RTC adjustment/correction. Adequate tamper proofing shall be provided to disallow any change of such auto recorded reading by the meter reader.

All sorts of communication between meter and **ISBM/Scanner** shall be of “One way” type. Data could only be downloaded from meter to **ISBM/Scanner** but no command regarding data alteration in the meter should be possible in any case.

The meter shall have communication facility of metered data through IrDA physical layer standard. “IR Transceiver: Should be compliant to the latest IrDA Physical layer standard” (Speed 115.2 kbit/s).

The meters should have compatibility with the various makes of ISBM/Scanner existing in the utility so as to generate consumer bill instantaneously.

The supplier has to submit the protocols used for IrDA meters to EPDCL so that the meters can be read by common ISBM/Scanner / SBMs through Hand Held Devices (scanner) and the protocols must be compatible with the protocol already adopted in the existing meters which is enclosed in the Annexure – 3a and the same may be altered if necessary as per the requirement of the utility.

(a) The qualified firms (whose bids are technically qualified including passing in NABL tests) should have compatibility with ISBM/Scanner of each reputed makes i.e. Lampex & Analogic whose ISBMs are in present use in EPDCL and also any other reputed makes duly compatible to EPDCL tariff regulations. Further the qualified firms have to arrange demonstration of

(i) downloading data from existing and new IrDA port meters on to the ISBM/Scanner directly and to generate consumer spot bill for both IrDA & non IrDA port meters. The meter manufacturers shall give an undertaking to EPDCL that both the meter and ISBM/Scanner are compatible and able to download the readings from all makes of 1Ph meters. The meter manufacturers should submit an undertaking obtained from ISBM manufacturers that the meter data is accurately downloaded from the meter to ISBM by using APEPDCL IrDA protocol given in the specification attached in Annexure-5.

(ii) need to demonstrate on field that the billing is done correctly for the existing tariff and the same is to be certified by EPDCL/Revenue wing and to obtain and submit consent from ISBM manufacturer for incorporating any change in tariff in future.

iii) the adopted IrDA protocol has to be shared with EPDCL and it should be modifiable by the meter manufacturer, as and when required by EPDCL without any additional cost.

Procurement of meters and ISBMs separately

The meter shall have communication capability of **IrDA Physical layer port** with ISBM (procured separately as per the enclosed Technical specification for ISBMs in Annexure -5 for information purpose) as specified by the utility.

Parameters to be downloaded with ISBM/Scanner

The following parameters should be downloaded by ISBM/Scanner.

- Meter Make
- Meter Sr. No.
- Time & Date
- All the parameters specified in scrolling and push button parameters along with tamper indications if any.

- ISBM/Scanner must have facility to download all the data to the base computer.
- Other than above, if manufacturer proposes to record extra parameters, may indicate in their offer.

Current and Voltage elements

a. Current elements

1. The Single phase meter shall be based on E-beam shunt in the phase element and single CT/Hall effect sensor/other sensor in neutral element with proper isolation.
2. It is necessary to ensure accurate recording by the meter during the condition when DC component exists in the load, EM CT/Shunt currents to be compared and higher of the two to be used for measurement. Specific confirmation to be submitted by the bidders that accuracy of measurement will not suffer due to utilization of shunt on account of thermal stability and temperature coefficient, up to an operational temperature of 80° C. shunt shall comply with IS:13779(Cl. 5&9).
3. The CTs shall have proper magnetic shields and shall be mounted with the meter base through proper fixing arrangement so that it should have a firm support and should not move from its position in any case

b. Voltage elements

PT less design is highly preferred i.e., for power supply to PCB, in place of conventional electro magnetic VTs use of potential divider is preferred.

In meter, power supply unit should be micro control type instead of control transformer to avoid magnetic influence.

Display parameters in the meter should not be accessible for reprogramming at site. Complete metering system and measurement shall not be affected by the external electromagnetic interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic field and DC current in AC supply etc. The meter shall meet the requirement of **CBIP TR No.325 (with latest amendments)**

The measurement by meter shall not get influenced by injecting of AC Voltage/chopped signal/DC signal, harmonics and RF interference.

Meter shall be capable of withstanding switching and transient surges of up to 6KV highest level so as to protect the internal meter circuit. A MOV in the circuit of min. 14mm diameter of standard makes such as EPCOS should be provided, such that it avoids the flow of surge in the main circuit thus making PCB unaffected.

The meter accuracy shall not be affected by AC/DC magnetic field on all the sides of meter i.e., front, sides, top and bottom of the meter as per **CBIP-88 / 325 (with latest amendments)** Technical Report. Moreover meter working shall not be affected by permanent magnet of 0.5T of minimum size 70x70x50mm.

5.1.12 Maximum Demand Registration and MD Resets :

Meter shall continuously monitor and calculate the average maximum demand for each demand interval time of 30 minutes and maximum of these in a calendar month shall be stored along 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. The cumulative KWh reading should also be recorded at 24.00 hrs. on the last date of each calendar month for previous **12** months . The Integration period shall be set as 30 minutes on real-time basis.

The billing purpose parameters (active import and export energy, maximum demand in (KW) shall be registered and shall be available for a minimum period of last **12** months.

5.1.12.1. TIME OF USE MONITORING

The meter shall offer the capability of time of use monitoring for energy. Minimum 4 registers shall be capable of being configured for 'TOD monitoring for Peak / Off peak hours.

5.1.12.1.1 LOAD PROFILE RECORDING:

The meter shall be capable of monitoring and recording load profile information for voltage, active import and export energy for every 30 minutes for at least 100 days duration and Cumulative Active energy import reading (kWh) Import & export for each calendar month for **previous 11 months** and Maximum Demand KW with 30 minutes integration and maximum of these in a calendar month for **previous 11 months**.(Import & Export)

5.1.12.1.2 CMRI / BCS / LAPTOP REQUIREMENTS

The Common Meter Reading Instrument (CMRI) should be capable of being loaded with user friendly software for reading / downloading meter data to base computer / Laptop. Windows based Base Computer Software (BCS) shall be provided for receiving data from CMRI and downloading instructions from base computer software to CMRI.

5.1.13 Test output :

The meters shall have a separate pulse emitter or high resolution display for testing purpose as described in **CBIP Report No.88 / 325 (with latest amendments)**

The resolution of the test output shall be sufficient, to enable the conduction of the starting current test in less than 10 minutes and accuracy test at the lowest load shall be completed with desired accuracy within 5 minutes (as per Clause 4.2.2.10 of **CBIP Report No.88 / 325 (with latest amendments)**).

5.1.14 Calibration :

The Meter should be only factory calibrated and no modification of calibration should be possible at site by any means what so ever. This is to ensure that the meter cannot be tampered at site.

5.2 CONSTRUCTION:

5.2.1 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. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating. The meter shall have proper fixing arrangement for mounting in meter Box.

5.2.2 Meter case:

The meter case including its base shall be made of self-extinguishing type superior grade Polycarbonate. Both meter base and cover shall be transparent and jointed such that it should be 'break to open' (ultrasonically welded/heat stake process/chemical process/Push fit) and they should not be detachable. The casing should be dust and moisture proof to the degree of IP 51 as per IS 12063, vermin proof and sturdy. The material should be highly non-flammable having high rigidity in combination with high heat resistance. Also it should have high impact strength. The meter case should be such that internal connections are clearly visible (i.e. transparent). The meter case shall have a provision with a deep cut for hanging the meter.

5.3. TERMINALS AND TERMINAL BLOCK:

5.3.1 The terminal block shall be of moulded type and shall be fixed to the extended portion of the meter base. The meter base shall cover the terminal block of its back & sides. It should be non hygroscopic, non ignitable and with material of good dielectric and mechanical strength. The terminal block should be vertically mounted / slid on the meter base to prevent any gap being created between the meter base/cover and terminal block (terminal side) such that extended terminal cover shall be provided, to ensure that the internal parts are not accessible for tampering etc., without breaking seals. A firm connection shall be established within the meter to energize the voltage circuit. The distance between the end terminal block and the ending of the extended terminal cover shall be a minimum of 2 inches. Terminal blocks shall be with 20% glass filled polycarbonate material with IS 13779 and IS 11000.

5.3.2. The meter terminal block shall have tin-plated brass terminal inserts. The terminals shall have suitable construction with barriers and cover to provide firm and safe connections of incoming and outgoing leads. The terminal screws shall have flat bottom so as not to pierce in the external conductors. The terminals shall be of suitable rating to carry continuously 150% I_{max} current and made of electroplated (or tinned) brass. Any other provision which meets this in a better manner / way shall also be considered. The bidders should elaborate the provision adopted.

5.3.3. The manner of fixing the external conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. All parts of each terminal shall be such that the risk of corrosion is minimized. Two screws of size M4x 8 shall be provided in each incoming and outgoing terminals for effectively clamping the external leads or thimbles. Each screw shall engage at least 3 threads in the terminal. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material. It should be possible to directly insert the solid or stranded wire into the terminals.

5.3.4 The internal diameter of the terminal holes should be minimum 5.5mm and adequately designed for inserting up to 16mm² Aluminum stranded armoured cable sizes and shall be capable of carrying continuous current upto 150% of I_{max} . The holes in the insulating material of the terminal block, which form an extension of the terminal holes, shall be of sufficient size to accommodate the insulation of the conductors also. The clearance and creepage distances shall not be less than values specified in clause 6.6. of IS:13779:1999. Further, the supporting webs between the two terminals of the terminal block should be sufficiently high to ensure that the two neighboring terminals do not get bridged by dust or a flash over does not take place.

5.3.5. The termination of current circuit wires, if used, inside the meter (i.e. CT primary conductor / shunt) on the terminal block should be through lugs and washers of proper size. The loop length

of the primary current circuit should be kept minimum. Alternatively, the CT primary conductor / shunt may be flattened to form a 'lug' like shape for proper terminating on terminal block without using lug or any other better arrangement may also be provided. All electrically live screws, i.e. screws used for electrical connections shall be of tin plated brass.

5.3.6 The **extended terminal cover shall be of Non Push fit type** and fixed to the meter terminal block by one screw of M4 size. The screws arrangement should not be detachable from the cover .

5.3.7 **Connection diagram:**

Every meter shall be indelibly marked with a connection diagram for which it is intended and shall be attached to the inner side of the extended terminal cover. In case any special precautions need to be taken at the time of testing the meter, the same may be indicated along with the circuit diagram.

5.3.9 **Terminal Arrangement :**

Connecting terminals of current and voltage shall be in the following sequence: Phase(in),Neutral(in) and Neutral(out),Phase(out).

5.3.10 **Non Flammability:**

The terminal block, the terminal cover and the case shall ensure reasonable safety against spread of fire. They shall not be ignited by thermic over load of live parts in contact with them. To comply with this these parts shall fulfill the conditions of the glow wire test as per clause 5.2.4. of **CBIP Technical Report No. 88 / 325 (with latest amendments)**.

5.4 **SEALING OF METER:**

Proper sealing arrangement made up of Polycarbonate with steel wire should be provided on the meter to make it tamper proof and avoid mishandling by unauthorized persons.

The manufacturer shall provide minimum two seals for the meter at the factory after calibration and testing and the seal number should match with meter serial number. The meter cover shall have provision for placing minimum 2Nos. polycarbonate seals to be provided by EPDCL.

The meter should be designed and constructed in such a manner as to make it pilfer proof.

5.5 **Component Specifications:**

Printed Circuit Board: The fully double-layered glass epoxy shall be used. The latest technology such as hybrid microcircuit or Application Specific Integrating Circuit (ASIC) shall be used to ensure reliable performance. The mounting of components on the PCB shall be SMT (Surface Mounted Technology Type).

All the material and electronic power components used in the manufacture of the meter shall be of highest quality and reputed makes like given as under so as to ensure higher reliability, longer

life and sustained accuracy.

Sl. No.	Component Function / Feature	Requirement	Make / Origin
1	Measurement / computing chips	The Measurement computing chips used in the meter should be with the surface mount type along with the ASICs	USA: Analog Devices, AMS, Cyrus Logic, Atmel, Phillips South Africa: SAMES, Japan: NEC. Teridian Semiconductors USA. Texas Instruments
2	Memory chips	The memory chips should not be affected by the external parameters like sparking, high voltage spikes or electrostatic discharges.	USA: Atmel, National, Semiconductors, Microchip, Texas Instruments, Phillips, ST Japan: Hitachi
3	Shunt bimetal	E-beam shunt for phase and single CT/Hall effect sensor/other sensor in neutral element	Reputed make
4	Display modules	a) The display modules should be well protected from the external UV radiations. b) The display should be clearly visible over viewing angle specified in this specification. c) The construction of the modules should be such that the displayed quantity should not disturbed with the life of display. d) The display should be STN type industrial grade with extended temperature range and multi layered.	Japan: Sony, Hitachi Hongkong: Genada Singapore: Bonafied Technologies, Korea: Advantek, Success, Dianguang
5	Communication modules	Communication modules should be compatible for communication with meter reading instruments.	National Semiconductors, Hitaachi, HP, Optonica, Phillips,
6	Infrared communication port	Infrared port should be used to transfer the meter data to meter reading instrument. The mechanical construction of the port should be such to facilitate the data transfer easily. The MRI instrument should have compatibility with the spot	National Semiconductors, Hitaachi, HP, Optonica, Wuhan Aimmax, Phillips, Vishay, Ligitec, Liteon, Fairchild, Sharp or Reputed make

		billing machine of utility so as to generate consumer bill instantaneously.	approved by Discom.
7	Power Supply	The power supply should be with the capabilities as per the relevant standards. The power supply unit of the meter should not be affected in case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections. Power supply should be unaffected by the magnet.	SMPS Type or better
8	Electronic components	The active & passive components should be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	USA: Atmel, National Semiconductors, Texas Instruments, Phillips Japan: Hitachi, Oki, AVZ, Ricon Toshiba, Korea: Samsung Siemens, EPCOS, YAGEO
9	Mechanical parts	The internal electrical components should be of electrolytic copper & should be protected from corrosion, rust etc. The other mechanical components should be protected from rust, corrosion etc. by suitable plating/ painting methods.	As specified
10	RTC(Quartz crystal)	The accuracy of RTC shall be as per relevant IEC / IS standards	USA: Phillips, Dallas, ST Atmel, Motorola, Xicor, Microchip Renesas, Japan: NEC, Oki, Hitachi
11	Battery	Maintenance free Lithium with guaranteed life of 5 years	Renata, Panasonic, Varta, Tedirun, Sanyo, National
12	PCB	Glass epoxy, fire resistance grade FR4 with minimum thickness 1.6mm	-----

5.6 TAMPER & FRAUD PROTECTION:

5.6.1 The single phase meter should have features to prevent/detect any tamper and fraud including:

1. Load Earthing:

The meter shall record correctly when

- a) Earth is used as a return path for load even when phase and neutral connection are reversed.
- b) Phase neutral normally connected & Load earthed.
- c) Phase-neutral interchanged and load earthed
- d) Supply & Load side interchanged & Load earthed.
- e) Supply & Load side interchanged & Reversed & load earthed.
- f) Normal connection with partial earth load of main and/or neutral element.

2 DC Immunity:

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

3 External Magnetic Influence :

The meter shall not get influenced by application of any external magnetic fields as per **CBIP report No.325 (with latest amendments)** and 0.5T permanent magnet for Static Electronic Energy Meters.

4. Meter shall record energy accurately under the effect of signals emitted by mobile phone or any other such devices such as TV Remotes, AC Remotes, Audio System Remotes etc. In conformity of this, the meter shall be checked under such influence (10 minutes) for the following conditions:

10% Ib and UPF, 50% Ib and UPF, Ib and 0.8 PF, 120% Ib and UPF

5. EVENT RECORD

The meter should have features to detect the occurrence and restoration of the magnetic influence more than 0.2 T with date & time stamping & shall be available on demand. Last twenty events shall be available on first in and first out basis.

The meter shall be capable of recording the following tamper events in memory (minimum 5 each) with date and time stamp. (**Considering occurrence and restoration as one event. 5x5 tamper event in each category are to be logged**).

- Magnetic tamper

- Single wire tampering (Neutral missing)

The meter shall also have provision for detection and logging of opening of meter cover.

Note :

1. The measurement by meter shall not get influenced by injection of A.C.Voltages/chopped signal/DC signal, harmonics and RF interference interference (such as TV Remotes, AC Remotes, Audio System Remotes etc.)
2. 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 phasor diagrams if required. Additional features if any in their meter may also be clearly indicated.

3. All the above latest 5 tamper and fraud conditions compartmentally separated (block method) shall be registered in the memory and shall be retrievable through **ISBM/Scanner..**
- 5.6.2 EMC / EMI TEST: The meter shall undergo the EMC / EMI test as per IS with latest amendments.
- 5.6.3 **LED/LCD INDICATIONS:** The following LED/LCD (Icons) indications shall be provided:
- (i) Meter Calibration only LED
 - (ii) Phase available indication
 - (iii) Load earthing : should glow when load is earthed.
 - (iv) Neutral missing/Single wire tampering: When the neutral from both incoming and outgoing side are disconnected and the load is taken through earth, the meter should record energy as per rated voltage, rated frequency and unity power factor, in proportion to the current drawn with accuracy of meter within $\pm 3\%$. Under such condition, the energy recording should start at load current of minimum 1.0 Amp. Or even lower- an additional Neutral Missing indication in the form of LCD Icon or LED shall be switched on. Voltage circuit & Current circuit shall be solidly connected inside the meter box without any link.
- 5.6.4. The meter shall be capable of recording minimum 100 events in memory with date and time stamp. Following events should be logged in different compartments on FIFO basis.
- Power on off
 - Magnetic influence in case meter is affected.
 - Neutral Disturbance in case meter is affected.
 - Front cover open (Non Rollover event).
 - Earth loading (Partial / Full earth)
 - Single Wire metering

5.7 TECHNICAL SPECIFICATION OF NON PUSH FIT TYPE PP METER BOX MADE OF POLYCARBONATE.

5.7.1 TECHNICAL DETAILS :

1. The meter box shall be weather proof, tamper proof and made of transparent polycarbonate. Type test of material is required to be furnished along with the sample.
2. The meter box should be unbreakable un-deformable and should withstand the temperature up to 140 deg.cent. The box shall comply with the provisions of IS14772 with latest amendment.
3. Thickness of the base should be at least 2 mm and cover should be of not less than 0.8 mm.
4. **There should be a minimum of 50mm clearance on left, right and topsides and 75 mm on bottom side and 25mm clearance on the front and 10mm clearance on back of the meter.**
5. Meter shall be fitted with the base of box through screw or by some other better means and the meter shall be removable, and the meter TC shall be of non-push fit type. The meters shall be supplied duly mounted on the base of meter box ..
6. **Suitable circular holes with adjustable cable glands shall be provided on the left side of the meter box for inlet and right side of the meter box for outlet cables.**
7. 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 any tools.

8. The box should have proper mounting arrangement so that it could be mounted on the wall or the pole, as the case may be.
9. 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.
10. 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.
11. The individual meter manufactures shall submit the specific drawing and sample accordingly to accommodate their make meter only.
12. The APEPDCL PO no. with date shall be engraved / embossed on the top cover of the box. The name of the manufacture shall be engraved on the bottom half of the box. The nameplate shall have “ guaranteed up to : _____ “ (Five years after delivery schedule as per purchase order.)

: 5.8 GUARANTEED TECHNICAL PARTICULARS

The guaranteed technical particulars as detailed in the specification Annexures-3(b), 3(C) shall be guaranteed and a statement of guaranteed technical particulars shall be furnished in the format along with the bid without which the Bid will be treated as Non-Responsive.

6.0 TESTS:

6.1 Type tests :

6.1.1 METERS:

The equipment offered shall be fully type tested at an NABL Accredited Laboratory either as per IS 13779 standard **or CBIP TR No. 88 / 325 (with latest amendments)**. The type test reports can pertain to similar type of materials with similar or higher capacity current rating (Base current remaining the same). Two copies of type test reports shall be furnished with the Bid. **The date of type tests shall be not be later than 5 years prior to the date of opening of the tender.** The type testing should be on three samples if type test reports are as per IS:13779/99 or on one or more samples if the type test reports submitted are as per **CBIP TR No. 88 / 325 (with latest amendments)**. The Bids received without type test reports will be treated as Non-responsive.

6.1.2 TESTS FOR BOXES:

The following tests are to be conducted on the box at any independent accredited laboratory and test reports are to be furnished within 4 weeks from the date of contract. Manufacturing shall be started after approval of test reports and drawings.

- i) Test of material identification.
- ii) Test for mechanical strength as per IS 5133.
- iii) Test for water absorption as per IS 5133.
- iv) Test for stability at high temperature as per IS 5133.
- v) Test for withstanding temperature boiling water for 5 minutes continuously for non-distortion or softening of material as per IS 5133.
- vi) Glow wire test as per clause 5.2.4 of **CBIP Technical Report No. 88 / 325 (with latest amendments)**.

6.2 ACCEPTANCE AND ROUTINE TESTS:

6.2.1 Meters

6.2.1.1 Acceptance Tests: Samples picked up by the inspecting officer for acceptance tests shall be first subjected to 'soaking' at 70 +/- 2 Deg. C for four hours. After normalizing the acceptance tests as stipulated in IS 13779/99 with latest amendments and shall be carried out by the supplier in presence of purchaser's representative. Also the following additional tests are carried out on mutually agreed quantity of meters from each lot offered for inspection.

- i) Shock Test.
- ii) Vibration Test.
- iii) Magnetic induction of external origin (AC&DC).
- iv) Tamper & Fraud protection as per Cl. 5.5.
- v) Repeated Switch ON / OFF test.

For sampling plan for pre-dispatch inspection, maximum lot size of 10,000 meters shall be considered for acceptance test as per IS:13779/99. The testing charges should be borne by the supplier.

6.2.1.2 Routine Tests :

All the routine tests as stipulated in IS:13779/1999 and in addition tamper and fraud protection tests as per clause 5.5. shall be carried out and test certificates shall be furnished for approval of the purchaser.

6.2.2 Boxes

6.2.2.1 Acceptance Tests

- i) Physical verification of dimensions of the box.
- ii) Compatibility of the box for housing the Meter, and ensuring ease of connecting and reading the meter.
- iii) Test for mechanical strength.

6.2.1.2 Routine Tests :

The routine test certificates for the following shall be furnished for approval of the purchaser.

- i) Physical verification of dimension of the box.
- ii) Compatibility of the box for housing the meter ensuring good quality of hinges and ease of connecting and reading the meter.

6.3 TEST REPORTS / TEST CERTIFICATES:

6.3.1 Record of routine test reports shall be maintained by the Bidder at his works for periodic inspection by the purchaser's representative.

6.3.2 Test certificates of tests conducted during manufacture shall be maintained by the Bidder. These shall be produced for verification as and when desired by the purchaser.

6.4 TEST FACILITIES :

The tests shall be carried out as per relevant Standards and test certificates shall be furnished for approval. The Bidder 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.

NOTE: The Meters used for conducting tests shall be calibrated periodically at reputed Government Accredited Test Laboratories and test certificates shall be available at works for verification by purchasers representative.

7.0 INSPECTION:

- 7.1 The purchaser may carry out the inspection at any stage of manufacture. The 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 relieve 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.
- 7.2 All acceptance tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the Bidder and purchaser at the time of purchase. The Bidder shall afford the inspector representing the purchaser all reasonable facilities without charge, to satisfy him that the equipment is being furnished in accordance with this specification.
- 7.3 The supplier shall keep the purchaser informed in advance, about the manufacturing programme so that arrangement can be made for inspection.
- 7.4 The purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The supplier shall give 15 days for local supply/30 days in case of foreign supply advance intimation to enable the purchaser to depute his representative for witnessing the acceptance and routine tests.
- 7.5 The purchaser reserves the right to get type test any meter, or Box from any of the lots offered for inspection received at any Destination Stores at supplier's expenses.
- 7.6 **Training:** Training for two of purchaser's engineers shall be imparted by the bidder. All expenses towards training of purchaser's engineers shall be borne by the bidder. The expenditure towards travel and incidentals including accommodation is to purchasers account.

NOTE FOR FOREIGN BIDDERS: The Bidder shall indicate the name (s) of reputed inspection agencies and the inspection charges clearly for each lot. The inspection charges will be borne by the supplier. However the purchaser reserves the right to appoint at supplier's cost any inspection agency to carry out the inspection.

8.0. TESTING

After six months of installations of the meters of the successful bidders, meters in premises of consumers, will be released and taken out for testing in NABL accredited Govt laboratories at the cost of APEPDCL. The bidder's representative can also be present at the time of release and testing of meters. If the meters are found to be defective such supplies will be closed, B.G invoked and EMD forfeited. The firm will not be eligible for participating for any tender in APEPDCL for the next three years.

9.0 QUALITY ASSURANCE PLAN:

- 9.1 The Bidder shall invariably furnish the following information along with his bid, failing which his bid will be rejected. Information shall be separately given for individual type of material offered.
- i) The structure of organization.
 - ii) The duties and responsibilities assigned to staff ensuring quality of work.
 - iii) The system for purchasing, taking delivery and verification of materials.
 - iv) The system for ensuring quality of workmanship.
 - v) The quality assurance arrangement shall conform to relevant requirements of ISO 9001 or 9002 as applicable.
 - vi) Statement giving list of important raw materials names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested. List of test normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.
 - vii) Information and copies of test certificates as in (i) above in respect of bought out accessories.
 - viii) List of manufacturing facilities available.
 - ix) Level of automation achieved and list of areas where manual processing exists.
 - x) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
 - xi) Lists of testing equipment available with the bidder for final testing of equipment specified and test plant limitation. If any, vis-a-vis the type, special acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in schedule of deviations from specified test requirements.
- 9.2 The contractor shall within 30 days of placement of order submit following information to the purchaser.
- i. List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with offers.
 - ii. Type test certificates of the raw materials and bought out accessories if required by the purchaser.
 - iii. Quality Assurance Plan (QAP) with hold points for purchaser's inspection. The quality assurance plan and purchasers hold points and notification points shall be discussed between the purchaser and Bidder before the QAP is finalized.
- 9.3 The contractor shall operate systems, which implement the following:
- (i) **Hold Point:** A stage in the material procurement or workmanship process beyond which work shall not proceed without the documental approval of designated individuals or organizations. The purchaser's written approval is required to authorize work to progress beyond the hold points indicated in approved quality plans.
 - (ii) **Notification Point:** A stage in material procurement or workmanship process for which advance notice of the activity is required to facilitate witness. If the purchaser does not attend after receiving documented notification in accordance with the agreed procedures and with the correct period of notice then work may proceed.
- 9.4. The contractor shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing if required by the purchaser and

ensure that the Quality Assurance requirements of this specification are followed by the sub-contractors.

The quality assurance programme of the contractor shall consist of the quality system and quality plans with the following details:

(i) Quality System:

- The structure of the organization
- The duties and responsibilities assigned to staff ensuring quality of work.
- The system for purchasing, taking delivery and verification of materials.
- The system for ensuring quality workmanship.
- The system for control of documentation.
- The system for the retention of records.
- The arrangement for the contractor's internal auditing.
- A list of the administration and work procedures required to achieve and verify contract's quality requirements. These procedures shall be made readily available to the Project Manager for inspection on request.

(ii) Quality Plans:

- An outline of the proposed work and programme sequence.
- The structure of the contractor's organization for the contract.
- The duties and responsibilities assigned to staff ensuring quality of work.
- Hold and Notification points.
- Submission of engineering documents required by the specification
- The inspection of materials and components on receipt.
- Reference to the Contractor's Work Procedures appropriate to each activity.
- Inspection during fabrication / construction.
- Final Inspection and test.

9.5 Replacement of defective meters

The meters declared defective by the consignees (including meter battery failures) and/or by meter testing lab shall be replaced by the supplier up to the full satisfaction of the purchaser at the cost of supplier within one month of intimation by purchaser/stores officer.

10.0 DOCUMENTATION:

10.1 All drawings shall conform to International Standards Organisation (ISO) 'A' series of drawings 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.

10.2 List of drawings and documents :

The bidder shall furnish the following along with bid

- i. Two sets of drawings showing clearly the general arrangements, fitting details, electrical connections etc.
- ii. Technical leaflets (users manual) giving operating instructions.
- iii. Three copies of dimensional drawings of the box for each quoted item.

10.3 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 work in connection with the equipment prior to the approval of the drawing shall be

at the supplier's risk.

10.4 Approval of drawings/work by purchaser shall not relieve 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 respects 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 any work or materials which, in his judgment is not in full accordance therewith.

10.5 The successful Bidder shall, within 2 weeks of notification of award of contract, submit three sets of final versions of all the drawings as stipulated in the purchase order 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 their approval. The supplier shall within two weeks, submit 30 prints and two good quality report copies of the approved drawings for purchaser's use.

10.6 Eight sets of operating manuals/technical leaflets shall be supplied to each consignee for the first instance of supply.

10.6.1 One set of routine test certificates shall accompany each dispatch consignment.

10.6.2. The acceptance test certificates in case pre-dispatch inspection or routine test certificates in cases where inspection is waived shall be got approved by the purchaser.

11.0 PACKING & FORWARDING :

11.1 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.

- 11.2 Each consignment shall be accompanied with a detailed packing 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 instructions.
 - f. Bill of Material indicating contents of each package.
- 11.3 The supplier shall ensure that the packing list and bill of material are approved by the purchaser before dispatch.
- 11.4. 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.
- 11.5. The marking on each package shall be as per the relevant Standards and shall also contain "APEPDCL".

12.0 QUANTITY AND DELIVERY REQUIREMENTS:

The quantity and delivery requirements are indicated in Annexure - 2.

13.0 SUPERVISION SERVICES: Nil.

The Purchaser will arrange for unloading of the consignments at the destination stores.

14.0 MANDATORY SPARES & TOOLS :

The bidder shall give the list for item and shall keep a reasonable stock of the same, during the warranty period.

15.0 SAMPLE:

2 Nos. sample meters shall be submitted along with the bid. The sample meter shall be provided 1 No. company seal to meter cover. Tenders received without samples will be rejected. The sample shall comply with the specification.

At the time of submission of bid only sample meters are sufficient.

16.0 TECHNICAL DEVIATIONS :

Any deviation in Technical Specification as indicated in Annexure 6 shall be specifically and clearly indicated in the schedule of deviation format –Schedule – ‘A’.

17.0 GUARANTEE:

The material should be guaranteed for satisfactory operation for a period of 5 years from the date of receipt of material at destination stores by the consignee in good condition. During the guarantee period if the meter while in its normal operation is found defective, it shall be replaced by the supplier with a new meter free of cost within 15 days. If the meter is not replaced within 30 days of intimation the supplier should note that the guarantee period would be extended to that extent by the number of days delayed beyond 30 days. If the

tenderer does not replace within 180 days the cost of the meter(s) will be recovered from the existing bills/ future bills/ Bank Guarantees available with AP DISCOMS.

17.1 Penalty for delay in replacement of WGP meters –

In addition to the clause No.17.0 of tender document for SLA for lifting and replacement of defective metres, in case of delay in replacement of WGP meters whatever be the reasons, APEPDCL without prejudice to its other remedies under the Contract, deduct from the Contract Price, as liquidated damages, an amount equivalent to ½% of value of the WGP meters not replaced/ rectified within the prescribed time limit for every week of delay or part thereof subject to a maximum of 5% of the total value of the contract.

For penalty, the No. of days of delay would be rounded off to the nearest week and penalty calculated accordingly. The penalty specified above will be levied and would be adjusted against subsequent pending bills.

Performance security clause:

Within 15 days from the date of award of contract, the successful bidder shall furnish 10% of contract value towards performance security which includes 5% delivery performance. In case there are delivery delays, from the available amount up to 5% shall be recovered for not adhering to the scheduled deliveries as per the purchase order obligations and the supplier should recoup the amount so deducted by DD or BG again up to extent of 10% till warranty period is applicable as part of performance guarantee.

18.0 GENERAL:

- a) 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.
- b) The bidder 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 influence quantities during its service period.
- c) The bidder shall furnish details of memory used in the meter.
- d) Details of testing facilities:

The manufacturer 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 a statement. Bids without these details will be treated as non-responsive.

e) Eligibility of the manufacturers for participating in bidding process as decided by the committee:

- a. *Minimum manufacturing capability facilities*
- b. Manufacturers annual turnover.
- c. Minimum testing facilities at manufacturer premises.
- d. Manufacturer shall have ISO certification.

ACRONYMS

Reference Abbreviations	Name and Address
IEC	International Electro Technical Commission Bureau Central de la Commission Electro Technique International, Rue de verembe Geneva, Switzerland.
ISO	International Organization for Standardization, Danish Board of Standardization Aurehoegyvej – 12, DK – 2900, Heel prup, DENMARK.
ISS	Indian Standard Bureau of Indian Standards Nanak Bhavan, 9, Bhadur Shah Zafar Marg, NEW DELHI – 110002, INDIA.
CBIP	Central Board of Irrigation and Power, Malcha Marg, Chankyapuri, NEW DELHI – 110021, INDIA.
CT	Current Transformer
PT	Potential Transformer
Deg. C	Degrees centigrade
Max	Maximum
Accn.	Acceleration
db	Decibels
MD	Maximum Demand
TOD	Time off day
Min.	Minimum
CMRI	Common Meter Reading Instrument
SMC	Sheet moulding compound

The meter shall have communication facility of metered data through IrDA physical layer standard and the communication protocol shall be noted below:

COMMUNICATION PROTOCOL FOR NET METERS

(For Consumer Meters)

Master : Meter Accessing Instrument with IrDA physical layer standard
(CMRI).

Slave : Energy Meter (Considered in this document)

Consumer (Meter) to grid Export parameters

Grid to Consumer (meter) Import parameters

“IR Transceiver : Should be complaint to the latest IrDA Physical layer standard”

i.e., the details is as follows:

General :

Peak wavelength : 850-900 nM
Half Angle : 15° Minimum cone
Link Distance : 1.5 m from the top of meter cover
Speed : 2.4 kbit/s – 115.2 kbit/s(SIR)
Modulation : Baseband, no carrier
Window : Infrared window

Emitter:

Intensity in angular range : 40- 500 mW /Sr
Rise and Fall time : 600n Sec Maximum

Receiver:

Irradiance : 4-5x10⁵ μ W/ Cm²
Latency : 10 m Sec

Communication protocol:

Baud Rate - 9.6 kbps
Physical layer, SIR, 1/16 at 9.6 kbps

Sync Word	Meter IP	Payload	Command	CMRI IP	Data	Checksum
16 bit 95h 95h	24 bit = ffffffh	8 bit	8 bit	24 Bit	Max 244 Bytes	8 bit

I.Steps for getting reading through Meter to CMRI

The following procedure adopted for getting reading through CMRI for already installed single phase IR PORT meters supplied by different firms.

Format – Little Endian

all values in HEX

Check Sum calculation = if data, then Check Sum = $\sum \sim \text{Data}$, else Check Sum = 0

1. Command 1 – from CMRI to Meter

Transmitting Sync packet (11 bytes, Data Nil, with two starting sync bytes) to all meters

this data is received by all meters found in range.

Sync Word	Meter IP	Payload	Command	CMRI IP	Data	Checksum
16 bit 95h 95h	24 bit = ffffffh	8 bit	8 bit	24 Bit	Max 244 Bytes	8 bit

Example for Transmitting sync packet

95 95 ff ff ff 0b 96 31 11 05 00

Sync Word = 95h 95h

Meter IP = All meters in range = fffffffh

Payload = 0bh = 11d

Command = 96h = 150d

CMRI IP = 05113h = CMRI Serial number 332081d

Check Sum = 0 (because there is no data)

2. Meters use wireless Collision Avoidance

i.e. all meters which receive the Command 1 respond in random time slots of 62.5 ms each up to maximum of 0.5s.

Response 1 from meter

Sync Word	CMR IP	Payload	Response	Meter IP	Data	Checksum
16 bit 95h 95h	24 bit = ffffffh	8 bit	8 bit	24 Bit	Max 244 Bytes	8 bit

Sequence = 95 95 31 11 05 14 96 a8 4a 0f 01 a8 4a 0f 51 18 00 80 1e ee

CMRI IP = 332081 = 051131h

Payload = 14h = 20d

Instruction = Return Command = 96h = 150d

Meter Serial Number 0f4aA8h = 1002152d

Data (explained as under):

01h = No of Packets to follow

Meter Serial Number 0f4aA8h = 1002152 (repeated for confirmation)

Supplier Customer Relationship Code = 18h (Normal meters)
= 19h (Net Meters)

Tender Number = 00h

Current Tamper Status = 80h (meter healthy check)

MD Integration Period = 1eh = 30 minutes

Check Sum = eeh = (~01h + ~a8h + ~4ah + ~0fh + ~51h + ~18h + ~00h + ~80h + ~1eh)

3. Command 2 from CMRI for first packet directed to individual meter

The CMRI reads all the responses (with or without collision). Correct responses are Sequenced in cache memory. Then it commands meters with individual IPs and collects all possible packets.

Sync Word	Meter IP	Payload	Command	CMRI IP	Data	Checksum
16 bit 95h 95h	24 bit = ffffffh	8 bit	8 bit	24 Bit	Max 244 Bytes	8 bit

CMRI Command set for packet 1 = 95 95 a8 4a 0f 0b 00 31 11 05 00

Meter Serial Number = Meter IP = 0f4aA8h = 1002152d

Payload = 0Bh = 11d

Command = 00 (Command for first packet, in this case only packet)

CMRI IP = 332081 = 051131h

Check Sum = 00

4. Response 2 from meter – this is the first packet. (Import Parameters)

Sync Word	CMR IP	Payload	Response	Meter IP	Data	Checksum
16 bit 95h 95h	24 bit = ffffffh	8 bit	8 bit	24 Bit	Max 244 Bytes	8 bit

Meter Response =

95 95 31 11 05 d7 00 a8 4a 0f 6b af 2c 15 00 00

2c ac 20 4e 00 00 00 00 00 00 00 00 00 00 00

```

e0 96 00 00 42 97 00 00 46 0a 00 00 20 08 25 10
e0 96 00 00 a0 01 40 9e 01 30 d8 0b 20 00 00 10
00 00 c0 00 00 b0 00 00 a0 42 97 00 00 a2 01 40
9f 01 30 df 0b 20 00 00 10 00 00 c0 00 00 b0 00
00 a0 46 0a 00 00 21 00 40 1e 00 30 c8 00 20 00
00 10 00 00 c0 00 00 b0 00 00 a0 07 0d 16 99 05
c2 f8 00 1e 8e 58 01 2f 7e 00 00 2f 3e 03 00 2f
fc 02 00 2f be 02 00 02 00 04 20 8c 10 20 de 14
20 de 10 20 08 15 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 9a

```

Please again note above the interchange change in Meter Serial Number and CMRI IP location.

Meter Data = Byte 11 to Second Last Byte. It is decompressed and decrypted by BCS

Payload = d7h = 215d

Command Response = 00

Meter Serial Number = Meter IP = 0f4aA8h = 1002152d

Check Sum = last byte = 9ah

Byte 33 –36 = 0096e0h = Cumulative kWh (Two Decimal, least count 0.01) = 386.24

Byte 124 – 127 = 0599160Dh = Current Month Maximum demand with date

3. Command 3 from CMRI for 2nd packet directed to individual meter

The CMRI reads all the responses (with or without collision). Correct responses are Sequenced in cache memory. Then it commands meters with individual IPs and collects all possible packets.

Sync Word	Meter IP	Payload	Command	CMRI IP	Data	Checksum
16 bit 95h 95h	24 bit = ffffffh	8 bit	8 bit	24 Bit	Max 244 Bytes	8 bit

CMRI Command set for packet 1 = 95 95 a8 4a 0f 0b 01 31 11 05 00

Meter Serial Number = Meter IP = 0f4aA8h = 1002152d

Payload = 0Bh = 11d

Command = 01 (Command for second packet, in this case two packet)

CMRI IP = 332081 = 051131h

Check Sum = 00

Response 3 from meter – this is the second packet(Export Parameters)

Sync Word	CMR IP	Payload	Response	Meter IP	Data	Checksum
16 bit 95h 95h	24 bit = ffffffh	8 bit	8 bit	24 Bit	Max 244 Bytes	8 bit

Meter Response =

```

95 95 31 11 05 d7 00 a8 4a 0f 6b af 2c 15 00 00
2c ac 20 4e 00 00 00 00 00 00 00 00 00 00 00
e0 96 00 00 42 97 00 00 46 0a 00 00 20 08 25 10
e0 96 00 00 a0 01 40 9e 01 30 d8 0b 20 00 00 10
00 00 c0 00 00 b0 00 00 a0 42 97 00 00 a2 01 40
9f 01 30 df 0b 20 00 00 10 00 00 c0 00 00 b0 00
00 a0 46 0a 00 00 21 00 40 1e 00 30 c8 00 20 00
00 10 00 00 c0 00 00 b0 00 00 a0 07 0d 16 99 05
c2 f8 00 1e 8e 58 01 2f 7e 00 00 2f 3e 03 00 2f
fc 02 00 2f be 02 00 02 00 04 20 8c 10 20 de 14
20 de 10 20 08 15 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00

```

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

00 00 00 00 00 00 00 00 00 9a

Please again note above the interchange change in Meter Serial Number and CMRI IP location.

Meter Data = Byte 11 to Second Last Byte. It is decompressed and decrypted by BCS

Payload = d7h = 215d

Command Response = 00

Meter Serial Number = Meter IP = 0f4aA8h = 1002152d

Check Sum = last byte = 9ah

Byte 33 –36 = 0096e0h = Cumulative kWh (Two Decimal, least count 0.01) = 386.24

Byte 124 – 127 = 0599160Dh = Current Month Maximum demand with date

5.Command 4 from CMRI (closing command)

no further commands responded by meter as it is one way communication).

Sync Word	Meter IP	Payload	Command	CMRI IP	Data	Checksum
16 bit 95h 95h	24 bit = ffffffh	8 bit	8 bit	24 Bit	Max 244 Bytes	8 bit

CMRI Command set for Closing command = 95 95 a8 4a 0f 0b 9e 31 11 05 00

Command = 9eh = 158d

Data is then downloaded for each valid meter in sequence.

The CMRI restarts the process 3 times till no meter response is found.

After receiving closing command from ISBM/Scanner to meters, the meter will not respond for further broadcast command till 15 minutes. Display of the meter will be highlighted with “ DONE”

II.Steps for getting reading through CMRI to SBM (all values in HEX)

Format – Little Endian

Check Sum calculation = if data, then Check Sum = $\sum \sim \text{Data}$, else Check Sum = 0

1. As soon as reading from meter is downloaded by the CMRI,

2. it tabulates a sequence as under:

Three Sync Bytes F3h F7h 11h

Meter Serial Number = 3 bytes

Kwh = 4 bytes (2 decimal)

Kw Md Value = 2 Bytes (2 decimal)

Kw MD Month = 1 Byte

Kw MD Date = 1 Byte

Kw MD Hour = 1 Byte

Kw MD Minute = 1 Byte

Check Sum = 1 Byte

Example = F3 F7 11 a8 4a 0f e0 96 00 00 66 01 04 0B 06 1E E4

Byte 4-6 = Meter Serial Number = Meter IP = 0f4aA8h = 1002152d

Byte 7–10 = 0096e0h = Cumulative kWh (Two Decimal, least count 0.01) = 386.24

Byte 11– 12= MD (2 decimal) = 0166h = 3.58

Byte 13 = 4 = Month = April

Byte 14 = Day = 11

Byte 15 = 6 = Hour

Byte 16 = 1eh = Time = 30

Byte 17 = E4h = Check Sum ($\sim F3 + \sim F7 + \sim 11 + \sim a8 + \sim 4a + \sim 0f + \sim e0 + \sim 96 + \sim 00 + \sim 00 + \sim 66 + \sim 01 + \sim 04 + \sim 0B + \sim 06 + \sim 1E$)

2. The CMRI replies by sending back the check sum to close the communication.

NOTE

The participating bidders shall give demonstration of their meters for data downloading and generation of spot bills through ISBMs within one month from the date of opening of the technical bid.

GUARANTEED TECHNICAL PARTICULARS FOR METERS

Sl. No.	Characteristics	
1.	Marker's name and country	
2.	Type of meter/model a) Basic Current (A) b) Maximum Current (A)	
3.	Accuracy class	
4.	Power consumption per Phase (a) Voltage Circuit (ii) Current circuit	
5	Minimum starting current of the meter(% Ib)	
6	Display Parameters	
7	Display (No. of digits and height of character)	
8.	P.F. Range	
9.	Variation of voltage at which meter functions normally	
10.	Particulars of readout a) Continuous display b) Manually on display	
11.	Details of Meter Base & Cover (i) Type of Material (a) Meter base & cover (b) Terminal block © Terminal cover (d) Terminals (ii) Dimensions & Weight	
12.	Non volatile memory retention time in absence of power	
13.	Memory capacity (kB)	
14	MD Interval	
15.	Details of capability for Tamper and Fraud provisions on Display (manually)	
16	Guarantee for satisfactory operation of Meter	

II

1.	Standards to which the meter conforms	
2.	Overload capacity	
3.	Dynamic Range	
4.	a) Meter terminal block having sealable extended terminal cover. b) Connection diagram inside the terminal cover. c) Maximum safe current the terminals and screws shall carry.	
5.	Change in errors (accuracy) due to variation in voltage, frequency & temperature to be furnished a) Voltage variation i) + 20% to +10% ii) + 10% to - 10% iii) - 10% to - 20% iv) - 20% to - 30% v) -30% to -40% b) Frequency variation i) 50±5% Hz c) Temperature	
6.	Detailed explanation how the tamper detection made is furnished or not?	
7.	Sealing of the meter (Nos. of seals) a) Meter cover b) Terminal block cover c) Others, if any	
8.	Whether the meter carries any certification mark	
9.	Self diagnostics features (Provide details)	
10.	Principle of operation (Provide details)	
11.	Any additional measuring parameters	

GUARANTEED TECHNICAL PARTICULARS OF BOX

Sl. No.	Characteristics
1.	Manufacturer' name
2.	Material used for box body
3.	Material withstanding temperature
4.	Dimensions of box (L x W x H)
5.	Thickness (mm)
6.	Color
7.	Viewing window Material Dimensions Whether shade arrangement to window provided or not
8.	No. of Hinges
9.	Handle provisions
10.	Earthing provision
11.	Sealing Arrangements
12.	Inlet & Outlets
13.	Gasket Whether gasket is provided for (each) door and window Material of the gasket
14.	Suitable for outdoor installation