TECHNICAL SPECIFICATIONS

(Volume-I)

Meters, Current Transformers, Potential Transformers

Uttarakhand Power Corporation Ltd.

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1. Technical Specifications for Single Phase Electronic Energy Meter of Class 1.0 Accuracy

1.1 Scope

This Specification covers Design, Engineering, Manufacture, Testing, Inspection and Supply of A.C. Single Phase, Two wire Solid State (Static) Fully Electronic Energy meters of accuracy class 1.0 and Current Rating (5-30) A, with backlit LCD Display for 240 Volt systems.

It is not the intent to specify completely herein all the details of the design and construction of meter. However, the meter shall conform in all respects to high standards of engineering, design and workmanship shall be capable of performing commercial operation continuously 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 its judgment is not in accordance therewith. The offered meter shall be complete with all components, accessories necessary for their effective and trouble-free operation of the system for the purpose mentioned above. Such components shall be deemed to be within the scope of bidders supply irrespective of whether those are specifically brought out in this specification and / or the commercial order or not.

The offered meter shall be ISI marked and bidder shall have to furnish valid BIS certificate along with the offer.

The original manufacturers of LT A.C. static energy meters shall only quote against this tender. In case of foreign manufacturers their authorized agent/agents may also participate provided that they are registered vendors and have all the testing facilities in India. They should also produce the documents authorizing them as agents, in India.

1.2 Service Conditions

The meters to be supplied against this specification should be suitable for satisfactory continuous operation under the following tropical conditions. Meters should be capable of maintaining required accuracy under hot, tropical and dusty climatic conditions.

Table 1-1: Service Conditions

S.No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-10
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000

1.3 Standards Applicable

Unless specified elsewhere in this specification, the performance & testing of the meters should conform to the following Indian/International standards, to be read with up to date and latest amendments/revisions thereof as on 90 days prior to floating of tender.

Table 1-2: Standards Applicable

S.No.	Standard No.	Title
1	IS 13779, 1999 read with its latest amendments	Specification of AC Static Watt hour meters class 1.0
2	CBIP Report No.304 read with latest amendments	Specification for AC Static Electrical Energy Meters
3	IS 12346 (1988)	Specification for testing equipment for A.C. Static Electrical Energy Meter (latest amendment).
4	C.E.A. Regulation No. 502 / 70 / CEA / DP&D dt. 17/03/2006	Central Electricity Authority (Installation & Operation of Meters) Regulation, 2006.
5	IS 14434 (1998)	Polycarbonate Molding & Extrusion Materials.

1.4 Specific Technical Requirements

1.4.1 Supply System

Rated voltage (V_{ref})	240 V – Phase to Neutral
Rated Current	Basic current - 5 Amps (Ib), Maximum current - 30 Amps (I max)
Rated Frequency	50 Hz

1.4.2 Accuracy

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

1.4.3 Power Consumption

1.4.3.1 *Voltage Circuit*

The active and apparent power consumption in the voltage circuit including the power supply of meter at reference voltage, reference temperature and reference frequency should not exceed 1.0 Watt and 4 VA respectively.

1.4.3.2 *Current Circuit*

The apparent power taken by each current circuit at basic current, reference frequency and reference temperature should not exceed 1 VA.

1.4.4 Maximum Continuous Current

The maximum continuous current in meters should be the current at which the meter purports to meet the accuracy requirement of the specification. The same is indicated in table in clause 2.4 above.

1.4.5 Functional Specifications

Functional specifications shall be as follows:

Table 1-3: Functional Specifications

S.No.	Function/Feature	Technical Requirements
1	Voltage	Ref Voltage 240 volt (P-N), +20% to -25% V_{ref}, however the meter should withstand the maximum system voltage.
2	Display	a) LCD (Six digits) b) Height 10 mm X 6 mm min. c) Pin Type d) Viewing angle min. 70 degrees

S.No.	Function/Feature	Technical Requirements
3	Power factor range	Zero lag –unity- zero lead
4	Display parameters	a) Display parameters LCD test, kWh, MD in kW, Date & Time, Voltage, Current, and Instantaneous Load. b) Display order shall be as specified in this specification.
5	Power Consumption	Less than 1 Watt & 4 VA in Voltage circuit and 1 VA for Current circuit
6	Starting current	0.2 % of I_b
7	Frequency	50 Hz with + / - 5% variation
8	Test Output Device	Flashing LED visible from the front
9	Billing data	Meter serial number, Date and time, kWh, MD in kW, History of kWh, MD with occurrence detail for last 12 months along with TOD readings & meter shall log monthly ON/ Off hrs as history. All these data shall be accessible for reading, recording and spot billing by downloading through optical port with MRI & Laptop computers at site.
10	MD Registration (kW)	a) Meter shall store MD in every 30 min. period along with date & time. At the end of every 30 min, new MD shall be computed & compared with previous MD and store whichever is higher and the same shall be displayed.
11	Auto Reset of MD	The maximum demand should automatically reset at 24 00 hrs. of the last date of each calendar month and the corresponding value along with date/time stamp shall be transferred to Billing (History) registers. Provision shall be made to change MD reset date through MRI even after installation of meter on site. Default resetting date is 24 00 hrs, on last day of every calendar month.
12	TOD metering	Meter shall be capable doing TOD metering for kWh, and MD in kW with at least 4 time zones (programmable on site through CMRI). All TOD data should be available for current and last month.
13	Security feature	Programmable facility to restrict the access to the information recorded at different security level such as read communication, communication write etc
14	Memory	Non-volatile memory (NVM) should retain data for a period of not less than 10 years under un- powered condition.
15	Software & communication compatibility	Galvanically isolated Optical port compatible with IEC 1107/PACT/ANSI to transfer the data locally through CMRI & remote through PSTN / Optical fiber / GSM / CDMA / RF / any other technology to the main computer. The Supplier shall supply Software required for CMRI & for the connectivity to AMR modules. The supplier shall also provide training for the use of software. The software should be compatible to Microsoft Windows systems. The software should have polling feature with optional selection of parameters to be downloaded for AMR application
16	Climatic conditions	Refer IS 13779 for climatic conditions. The meter should function satisfactorily in India with high end temperature as 50ºC and humidity up to 95%.
17	Battery	In case battery removal or total discharge same should not affect the working & memory of the meter.
18	Calibration	Modification in calibration shall not be possible at site by any means.

1.5 General & Constructional Requirements

Table 1-4: General Conditional Requirements

S.No.	Parameters	Technical Requirements
1	Body of Meter	Top transparent and base translucent material polycarbonate of LEXAN 943AA or equivalent grade having properties of V0 inflammability level and UV stabilized. Front cover & base should be ultrasonically welded. Top cover Open - The meter shall have top cover opening detection mechanism. The top cover opening event shall be indicated display continuously in auto scroll mode with kWh or through additional LED and shall be logged in memory. The detection and logging mechanism shall work even when meter is not energized.
2	Terminal Block	Made of polycarbonate of grade 500 R or equivalent. Barrier of adequate size shall be provided between phase and neutral.
3	Terminal cover & Terminals	Transparent extended terminal block cover with provision of sealing through sealing screw. The terminals and all connecting screws will be of suitable material capable of withstanding a current of 150% of Imax for two hours, continuously.
4	Diagram of Connections	Diagram of external connections to be shown on terminal cover
5	Marking on name plates	Meter should have clearly visible, indelible and distinctly name plate marked in accordance with IS & this specifications. Prior approval of name plate design to be taken before product supply.
6	Meter Sealing	As per IS 13779 and CEA Metering Regulation 2006. Supplier will fix it's own two seals between meter base and cover.
7	Guarantee / Warranty	5 Years from the date of dispatch.
8	Insulation	A meter shall withstand an insulation test and impulse test As per IS 13779.
9	Resistance of heat and fire	The terminal block and Meter case shall have safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them as per the relevant IS 13779.

1.5.1 Construction

Meters should be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. However, the following should be ensured:

a. Personal safety against electric shock.
b. Personal safety against effects of excessive temperature.
c. Protection against spread of fire.
d. Protection against penetration of solid objects, dust & water.

- The meter should be designed with ASIC (application specific integrated circuit) and should be manufactured using surface mounting technology (SMT) components. Power supply and voltage divider circuit may be of Pin Through Hole (PTH) technology.
- The meter should be housed in a safe, high grade, unbreakable, fire resistant, UV stabilized, virgin polycarbonate casing of projection mounting type. The meter cover should be transparent, for easy reading of displayed parameters, and observation of operation indicators. The meter base may not be transparent. The meter casing should not change in shape, colour, size, and dimensions when subjected to 200 hrs on UV test as per ASTMD 53. It should withstand 650 deg. C. glow wire test and heat deflection test as per ISO 75.
- The meter cover should be sealable to the meter base with at least 2(two) nos. seals.
- The meter should be supplied with a transparent Extended Terminal Block Cover (ETBC). The ETBC should not be easily detachable from the base and be secured to the base using a hinge/ without hinge

arrangement. ETBC should be closed at the bottom to prevent access for wires to terminal holes, but should have a slot of size 20mm x 20 mm on extreme right-hand side of the bottom of the terminal cover.

- The terminal block should be made of high grade non-hygroscopic, fire retardant, fire resistant and glass reinforced poly carbonate with terminal holes of minimum dia. 5.5 mm and should be suitable to accommodate the insulation of the conductors, meeting the requirement of IS 13779 / CBIP technical report-304. The minimum centre-to-centre distance between adjacent terminals should be 13 mm.
- Terminal cover should have provision for sealing with at least one seal. The embedded portion of the sealing arrangement, i.e. the arrangement to hold the sealing screw for terminal cover should be such that the same cannot be uprooted in any case without breaking/damaging the terminal block.
- The bidder shall submit relevant documents regarding the procurement of polycarbonate material. The polycarbonate material of only the following manufacturers shall be used:

A	LEXAN	943A or equivalent for meter cover & Terminal cover 503R or equivalent for base
B	BAYER	Grade corresponding to above
C	DOW Chemicals	-Do -
D	MITSUBISHI	-Do-
E	TEJIN	-Do-
F	DUPONT	-Do-

- All insulating material used in the construction of meters should be non-hygroscopic, non-ageing and of tested quality. All parts that are likely to develop corrosion should be effectively protected against corrosion during operating life by providing suitable protective coating.
- The meter should conform to the degree of protection ip 51 for protection against ingress of dust, moisture and vermin.
- The meter should be capable of providing phase to neutral protection up to 433 V for 4 hours.
- The manner of fixing the cables to the terminal block should ensure adequate and durable contact such that there is no risk of loosening or undue heating.
- Meter should have 2 (two) screws in each terminal for effective clamping of cables. The screws shall not have pointed ends at the end of the thread. Screw connections transmitting contact force and screw fixing which may be loosened and tightened several times during the life of the meter should be such that the risk of corrosion resulting from contact with any other metal part is minimized.
- Electrical connections should be so designed that contact pressure is not transmitted through insulating material. All terminals and connecting screws and washers should preferably be of brass or copper material.
- The terminals and all connecting screws will be of suitable material capable of withstanding a current of 150% of Imax for two hours, continuously.
- The meter should be compact in design. The entire construction should be capable of withstanding stresses likely to occur in actual service and rough handling during transportation. The meter should be convenient to transport and immune to shock and vibration during transportation and handling.
- The meter should have fixing holes, at least one at top and two at bottom. The top hole should be such that the holding screw is not accessible after fixing the meters. The lower fixing screws should be provided under the sealable terminal cover.
- The meter should be fitted with current transformers for measuring current in the phase element and shunt in the neutral element.
- The shunts, used must be of high quality having high thermal stability and temperature co-efficient. The shunts should be e-beam / spot welded.

- The meter cover should be permanently fixed to the meter base by using ultra sonic welding or any other technology which is either equally or more efficacious in such a way that the meter cover can't be opened without breaking the same, i.e. the meter should be break-to-open type. In case any attempt is made to separate the meter cover from the base by using any tools / implements / device, there should be visible evidence of tampering or attempt to open. The bidder will have to specify the type of technology used by him and will also indicate the tests / standard required for testing the same along with test certificates.
- Meter should have a permanent indication in its display as well as logging of tamper in case of removal of top cover, even in power off condition and it should not disappear even if cover is re-fitted.

1.5.2 Sealing Arrangement

1. The sealing screws used for the meter cover shall be fixed upside down so that these are tightened from the rear or screw less design for fixing the base and cover but provision for sealing arrangement must be there.
2. A run through screw (Stud) has to be provided from bottom side & sealing is to be done on the top side of the meter. Two independent sealing screws are to be provided at each sides of the meter casing. The sealing screws shall be brass or copper. In addition to the sealing screws provided to the meter cover, the sealing screws of the terminal cover should also be brass or copper.
3. Meters must be supplied with two no manufactures' seal between meter base and cover at both sides.
4. The meter should meet EMI / EMC requirements as specified in the relevant standards described in this specification.

1.5.3 Anti-Tamper Features

The meter should have the following anti-tamper features and should record and register forward energy accurately under the following conditions:

- Input phase and neutral connections are interchanged. Reverse power indication LED should be provided or indication should be in display circuit.
- Incoming mains is connected to outgoing terminals and load is connected to incoming terminals.
- Any combination as permissible in all four connecting points should not affect the accuracy of the meter
- Load return is connected to a local earth and not returned to the meter as well as the phase and neutral at supply side are reversed.
- Occurrence of combination of (ii) and (iv) or (iii) and (iv)
- Shorting of (a) incoming phase and neutral wires and (b) outgoing phase and neutral wires and using energy meter in single wire formation (as indicated in the circuit diagram shown separately).
- A part of the load is returned to a local earth and the other part is returned to the meter. "Earth load indication "should appear in display with logging of tamper, if difference between phase current and neutral current exceeding6%.
- Meter should record total energy i.e. total energy through either phase circuit, neutral circuit or both.

**Circuit diagrams indicating some tamper conditions are attached.*

- Meter should record energy with maximum error of (+) 6% to (-) 4% on Injection of DC (+) ve & DC (-) ve in neutral having magnitude up to 400 V & injection of chopped AC in neutral. Tests in this respect will be conducted by using a device available with us for chopped AC injection (60V to 300V) & steady DC injection. DC voltage will be rectified from a three phase power supply. Single phase Circuit diagram of the device enclosed with the tender documents.
- Meter should record energy with maximum error of +/- 4% even in absence of neutral wire not connected at incoming & outgoing, i.e. single wire operation. In such condition Meter should start recording energy at 1.0 Amps. However, meters, which are immune or maintain better accuracy, will be preferred. Both elements should record energy under single wire mode if same phase is given in both elements and load is driven through earth.
- The meter should be immune to Electro Static Discharge or sparks of 35 kVp. Approx generated from automobile ignition coil. Tests in this respect will be conducted by using commonly available devices and

during spark discharge test, spark will be applied directly at all vulnerable points of the meter for a period of 10 to 20 minutes and meter should record under this condition. After application of spark discharge meter should record correctly within the specified limits of errors. Beyond 35 kVp meter should record as tamper if not immune In any case, meter should record energy accurately, taking the values of Phase current and Neutral current into account, whichever is higher.

- Meters should offer compliance to requirements of CBIP-304 and its amendments for tampering using external magnets. The meter should be immune to tamper using external magnets. The meters should be immune to 0.2T of A.C. magnetic fields and 0.27 T of D.C. magnetic fields, beyond which it should record as tamper if not immune. Meter should record Imax with the application of 0.5T permanent magnet with logging in BCS, if not immune.
- The meter should offer a link less design i.e. there is no isolation link provided between the current and voltage circuits and hence there would not be any possibility of tampering with the same. The meter should be capable of recording the following tamper events in memory with date and time stamp preferably along with snapshots of V, I, PF and kWh.

Low Voltage event shall be logged in memory along with occurrence and restoration event data. Threshold should be below 180 volts.

The logging will be on FIFO basis.

- Current reversal – 20 Times.
- Neutral Disturbance – 20 Times.
- Magnetic Tamper – 20 Times.
- Neutral Missing – 20 Times.
- Earth – 20 Times.
- Cover Open – 20 Times.
- Low Voltage (Below 180 V) – 20 times

1.5.4 Display

- The measured value(s) should be displayed on a liquid crystal display (LCD) register. The height x width of the digit should be minimum 10 x 6 mm. the kWh energy registration should take place with 6 complete digits. The display should have backlit capability for easy reading. When the LCD is placed at a constant temperature of 65 Deg C for a period of 30 minutes in operating condition and 80 Deg C for 30 minutes. Under de-energized / storage condition, display should not get deformed.
- The LCD should be of TN (Twisted Pneumatic) type with display size area of at least 40 x 15 mm. The display should have wide viewing angle of at least 70 deg.
- Dot matrix type LCD will not be acceptable.
- Display should have viewing angle of 35 degree up and down from eye level.
- The data should be stored in non-volatile memory (NVM). The non-volatile memory should retain data for a period of not less than 10 years under un-powered condition. Battery back-up memory will not be considered as NVM.
- The register should be able to record and display starting from zero, for a minimum of 2500 hours, the energy corresponding to rated maximum current at reference voltage and unity power factor. The register should not roll over in between this duration.
- In addition to provide serial number of the meter on the display plate, the meter serial number should also be programmed into meter memory for identification through communication port for CMRI / laptop / meter reading print out.
- It should be possible to read the meter during power off condition. It should also be possible to read the meter with CMRI / laptop in this condition. If battery is used for the same, it should be a separate battery and not the one used for RTC, i.e., the RTC battery and the battery used for display during power off condition should not be the same. The battery should be of high quality lithium / lithium-ion battery, with life of at least 10 years. In case of lithium battery, no. of operations per day are to be restricted to maximum 5(five) operations so that battery life is not hampered during ten years.

- Display sequence: The meter should display the required parameters in two different modes as per the sequence given below
    - **Auto Display Mode:** The following parameters hereinafter referred to as "Billing Parameters" (BP) should be displayed in an auto-cycle mode, in the following sequence:

Table 1-5 Auto Display Mode

S.No.		Display Mode for Single Phase Meter
1.	Auto Display Mode	LCD Test
		Meter Serial Number
		Real Time
		Date
		Previous month Active forwarded Energy –H1kWh (Last Bill)
		Previous Month Power Factor – H1PF (Last Bill)
		Previous month maximum demand H1kW (Last Bill)
		Previous month Apparent Energy – H_1kVAh (last bill)
		Previous month power on Hours (Last Bill)
		Instantaneous Voltage
		Instantaneous Phase Current
		Instantaneous Neutral Current
		Cumulative Active Energy (Forwarded) Reading-CkWh
		Cumulative Apparent Energy Reading-CkVAh

Cumulative Active Energy (Forwarded) Reading-CkWh parameter should be on meter display for 20 seconds and all other parameters should be on meter display for 10 seconds and the time gap between two auto-cycles should be 30 seconds. Display of decimal digit shall be blocked during Auto Display mode.

- **Push Button Mode:** In addition to the auto display mode parameters, the following parameters should be displayed on pressing the push button (All displays of auto mode and the following):

Table 1-6 Push Button Mode

S.no		Display Mode for Single Phase Meter
2	**Push Button Mode** Meter Display for 10 Second and time gap between two auto cycles should be 30 Seconds	Current month maximum demand in kW
		Current month power ON Hours
		Instantaneous Load –kW
		Instantaneous Power Factor
		Billing Period Count
		Total Tamper Count
		Supply frequency
		TOD (a) Current TOD1 kWh Energy register (b) Current TOD2 kWH Energy register (c) Last Bill TOD1 kWH register (d) Last Bill TOD2 kWH register
		High Resolution Display

The meter should also be capable of offering a high-resolution display which should enable conducting of dial testing by the user in the shortest possible time and as a minimum, the meter should be capable of offering a resolution of 6 digits for kWh & Wh display with NO decimal point Any other useful display will be acceptable. Accuracy test for low load will be measured by short dial test as well as pulse count test.

1.5.5 Display Power Up in Absence of Mains Supply

The meter should have the provision of providing the display of billing parameters in absence of main supply. Press of push button should activate the display to facilitate hands free meter reading with auto-off provision. It should be possible to read the meter using CMRI during power-off condition using this facility.

1.5.6 Maximum Demand Registration and Reset

Meter should continuously monitor and calculate the average maximum demand for each demand interval time of 30 minutes and maximum of these in a calendar month should be stored along with date and time when it occurred. The maximum demand should automatically reset at 24:00 hrs. of the last date of each calendar month and the corresponding value along with date/time stamp shall be transferred to billing (history) registers. The integration period should be set as 30 minutes, on real-time basis.

The billing purpose parameters (active forwarded energy, maximum demand in kW) should be recorded and should be available in bill (history) for a minimum period of last 12 months.

1.5.7 Time of Use / Time of Day Monitoring

The meter should offer the capability of time of use monitoring for energy. Minimum 2 registers should be capable of being configured for TOD monitoring for Peak / off peak hours. Time slots T1-23-00 Hrs. to 17-00 Hrs. of next day and T2-17-00 Hrs. to 23-00 Hrs. In case of any change of Time slots in future as per directive of SERC, the same is to be incorporated by the supplier even after completion of the order as per instruction from the appropriate authority.

1.5.8 Self- Diagnostic Feature

The meter should be capable of performing complete self-diagnostic check to monitor integrity of data memory location at all time. The meter should have 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 prints out at BCS end
(d) Non-volatile Memory (NVM) status in meter reading prints out at BCS end.

1.5.9 Communication Ports and Protocol

The meter should have a communication port with appropriate protocol for data communication with Hand Held Equipment, depending upon the choice of technology adopted for meter reading by the utility. Technology option for meter reading / communication shall be provided separately. The Supplier shall provide appropriate meter reading protocol. Vendor to jointly work with Discom IT team to develop PDS / CMRI software for meter downloading and further uploading on computer. The vendor has to give an undertaking in this regard.

1.5.10 Marking of the Meter

The marking on the meter should be in accordance with relevant clauses of IS 13779.

The basic marking on the meter nameplate should be as follows (all other markings as per IS should also be there)

(a) Manufacturer's name & trade mark
(b) Type Designation
(c) No. of phases & wires
(d) Serial number (Size not less than 5mm)
(e) Month & Year of manufacture
(f) Reference Voltage
(g) Rated Current

(h) Operating Frequency
(i) Principal unit(s) of measurement
(j) Meter Constant (imp/kwh)
(k) Class index of meter
(l) "Property of UPCL"
(m) Purchase Order No. & Date
(n) Guarantee (Guaranteed for a period of 60 months from the date of delivery)
(o) BIS marking
(p) Place of manufacture
(q) Bar coded sr. no. of the meter along with manufacturing date.

1.5.11 Connection Diagram & Terminal Markings

The connection diagram of the meter should be clearly shown on terminal cover.

1.5.12 Output Device

The meter should have a test output accessible from the front and capable of being monitored with suitable testing equipment while in operation at site. The test output device should be provided in the form of LED output. There should be adequate clearance of the test output from other outputs so that there is no interference of other outputs while performing accuracy test with standard scanners.

The relation between test output and the indication on display should comply with the marking on the name plate (imp per kWh).

1.5.13 Sealing Arrangement

All meters shall be sealed by the manufacturer at its works with 2 (two) nos. Polycarbonate seals with manufacturer's logo and sequential numbers.

A Tracking and recording software (25 nos. or more as per our requirement) for all new seals shall be provided by the manufacturer of the meter so as to track total movements of the seals starting from manufacturing, procurement, storage, record keeping, installation, series of inspections, removal & disposal.

Seal tracking software should be submitted and installed at PC/Laptop of the purchaser before commencement of supply of meters.

1.6 Tests

1.6.1 Type Test

The offered meters should be type tested at any NABL Accredited laboratory in accordance with IS 13779 with latest amendments and CBIP Report 304. The type test report should not be more than 3 (three) years old. If there is any modification in the design/parameters of the specifications or use of constituent materials in the offered meters submitted with the offer, from the meter which was submitted type tested, which may affect the characteristics as well as parameters of the meter, revised type test certificates as per the design, parameters and constituent material used in the offered meter, shall have to be submitted failing which the offer may be liable to be rejected.

Type test certificate should contain the following information clearly:

1. Class of accuracy
2. Meter Constant

The purchaser reserves the right to select sample from any material offered for inspection /inspected and dispatched, which will be got type tested at any NABL accredited laboratory. The results of this type-tested sample shall be applicable for the entire quantity of the particular lot offered or supplied by the supplier. The Purchaser shall bear the testing charges, if sample passes all the tests and if sample fails in any one of the tests, supplier shall have to bear testing charges, same are recoverable from the supplier's any pending bill, security deposit,

Bank Guarantee or by any suitable means, whichever deem fit by the Purchaser. In case of sample failing in aforesaid type tests, supplier shall have to replace the whole lot materials, which should pass through the type tests, the re-testing charges will have to be paid by supplier. If any quantity against the particular lot is consumed by the Purchaser, the supplier will agree for any penalty/deduction in price as may be mutually agreed.

1.6.2 Acceptance Tests

The acceptance tests to be carried out as stipulated in CBIP Report 304 & IS 13799 (with latest amendments) shall be witnessed by the purchaser's representative(s) at manufacturer's works. Scale of sampling, procedure to be followed for acceptance test and criteria for acceptance shall be as specified in CBIP Report 304 & IS 13799.

1.6.3 Additional Acceptance Tests

Following additional acceptance tests shall be carried out on one sample meter for meeting the criteria as per this specification:

a) Magnetic induction of external origin (AC & DC).
b) Electro Static Spark Discharge of 35KVp
c) Tamper and Fraud protection as per Anti-tamper feature clauses of this specification.
d) Injection of DC pulse (low frequency) in the neutral.
e) Shunt test by applying 100 Amps continuous load for minimum two hours after removing it from the meter for verification and conformation for quality of shunt & its E-beam welding.
f) Physical verification of internal components and functional tests.
g) Dry Heat Test as per IS 13779 / 99, Clause 12.6.1, on the sample meter selected by the representative of purchaser shall be arranged by the supplier at any NABL accredited laboratory, at his cost.

In case of failure of Meters as specified in Annexure – H of IS-13779 (For A above) the entire lot will be treated as rejected. In case of failure of any single meter for the additional acceptance tests the entire lot will be rejected.

1.6.4 Routine Tests

Each and every meter of the offered lot shall undergo the routine tests as well as functional tests as per IS 13779/1999, CBIP Report-304. The manufacturer shall submit the routine test report of all the meters as well as a statement showing seal Sl. Nos. against each meter of offered lot in soft copy (MS WORD or EXCEL format), to the purchaser, along with offer letter for acceptance test.

1.6.5 Test Facilities

The Bidder shall indicate the details of the equipment available with him for carrying out the various tests as per relevant Standards.

The manufacturer shall have the following testing facilities to ensure accurate calibration:

a) AC high voltage test
b) Insulation test
c) Test of no load condition
d) Test of Starting condition
e) Test on Limits of error
f) Power loss in voltage and current circuit
g) Test of Repeatability of error
h) Test of meter constant
i) Test of magnetic influence
j) Fully automatic test bench

1.6.6 Testing Equipment/Meter Calibration

All testing equipment/ meter used shall be calibrated within valid time limit at NABL accredited lab. Seals provided by Calibrating agency on testing equipment/meters shall be in good condition.

1.7 Pre-Delivery Inspection at Manufacturer's Works

1. All acceptance Tests shall be witnessed and certified by purchaser's representative at manufacturer's works. The vendor shall give at least 10 days advance intimation to the purchaser to enable them to depute their representative for witnessing the Tests. The said representative shall have full facilities for unrestricted inspection of supplier's works, raw materials, manufacturing processes and conducting necessary Tests.
2. The said representative shall verify the calibration seals provided by the calibrating agency on testing equipment/ meters.
3. Test reports of routine Tests carried out by the manufacturer shall be submitted to the inspecting authority at the time of inspection for his approval.
4. Acceptance of any quantity of materials shall in no way relieve the supplier of his responsibility for meeting all requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.
5. In case of waiver of inspection, vendor shall carry out all (i) routine and (ii) acceptance Tests and submit test reports for approval of the purchaser, before dispatch of material.
6. The entire cost of testing for acceptance & routine rests and checking of length etc shall be borne by the supplier.
7. The purchaser reserves the right to select sample from any material offered for inspection /inspected and dispatched, which will be got type tested at any NABL accredited laboratory. The results of this type-tested sample shall be applicable for the entire quantity of the particular lot offered or supplied by the supplier. The Purchaser shall bear the testing charges, if sample passes all the Tests and if sample fails in any one of the Tests, supplier shall have to bear testing charges, same are recoverable from the supplier's any pending bill, security deposit, Bank Guarantee or by any suitable means, whichever deem fit by the Purchaser. In case of sample failing in aforesaid type Tests, supplier shall have to replace the whole lot materials, which should pass through the type Tests, the re-testing charges will have to be paid by supplier. If any quantity against the particular lot is consumed by the Purchaser, the supplier will agree for any penalty/deduction in price as may be mutually agreed.

1.8 Random Sample Testing After Delivery

Purchaser shall carry out random sample testing on sample meters collected from different stores of the consignees at purchaser's testing laboratory. Scale of sampling and criteria for acceptance shall be as per CBIP Report 304 & IS 13799. Date of testing of meters will be intimated to the supplier for witnessing testing of the meters. Random sample testing will be completed within one month from the date of receipt of meters at different stores. In case the meters do not meet the acceptance criteria, the lot will be declared defective and, in that event, meters supplied are to be replaced by the manufacturers free of cost including free transportation from the site to their works and back. The replaced meters shall be offered for inspection & testing.

1.8.1 Submission of Sample Meter

The bidder will have to submit his/her sample Meters and Seals in sealed casing / carton along with relevant meter documents, on any working day, within the specified period of submission of tender documents latest by the last date & time of submission of bid to the Office of the purchaser.

No tender will be accepted without submission of samples.

- While submitting the samples and required documents the bidder has to submit two numbers of sealed meters as per the specifications stated herein before, without the welding of the meter base and cover and body screw caps.
- They should also submit one prototype of meter base and cover (with body screw caps) properly welded, fitted inside a Pilfer Proof Meter Box
- The tenderer shall have to submit 10 (ten) Nos. of each type of offered seals.
- Any other accessories required for observing the performance and capabilities of the meters.

- Operating/threshold value at which the meter will record energy as per specified limits of errors and also logic at which meter log tamper at different tamper conditions.
- Sample meter testing will be conducted as per relevant IS.

1.9 Quality Assurance Plan

The design life of the meter shall be minimum 20 years and to prove the design life the firm shall have at least the following quality Assurance Plan.

- The factory should be completely dust proof.
- The testing rooms shall be temperature and humidity controlled as per relevant standards.
- 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.
- Meter frame dimensions tolerances shall be minimum.
- The assembly of parts shall be done with the help of jigs and fixtures so that human errors are eliminated.
- The meters shall be batch tested on automatic, computerized test bench and the results shall be printed directly without any human errors.
- The Bidder shall invariably furnish the following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.
- Statement giving list of important raw materials, names of sub- suppliers for the raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials.
- Information and copies of test certificates in respect of bought out accessories.
- List of manufacturing facilities available.
- Level of automation achieved and lists of areas where manual processing exists.
- List of areas in manufacturing process, where stage inspections are normally carried out of quality control and details of such tests and inspections.
- List of testing equipment available with the bidder 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.
- 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:
    - The routine tests.
    - Acceptance tests shall be furnished with the bid, etc.

1.9.1 Manufacturing Activities

- All the materials, electronics and power 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.
- The manufacturer should use Application Specific Integrated Circuit (ASIC) or Micro controller for metering functions. The electronic components shall be mounted on the printed circuit board using latest Surface Mounted Technology (SMT) 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 and there shall be no drift in the accuracy of the meter at least up to 10 years. Further, the Bidder should own or have assured access (through hire, lease or sub-contract) of the mentioned facilities. The PCB material should be of glass epoxy FR-4 grade conforming to relevant standards.
- All insulating materials used in the construction of meters shall be non-hygroscopic, non-aging and of tested quality. All parts that likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.

1.9.2 Quality Should Be Ensured at the Following Stages

- At PCB manufacturing stage, each board shall be subjected to bare board testing.
- At insertion stage, all components should undergo testing for conforming to design parameters and orientation.
- Complete assembled and soldered PCB should undergo functional testing using test equipment (testing jig).
- Prior to final testing and calibration, all meters shall be subjected to accelerated ageing test to eliminate infant mortality, i.e., meters are to be kept in ovens for 72 hours at 55 deg. Centigrade temperature & atmospheric humid condition. After 72 hours meters should work correctly. Facilities / arrangement for conducting ageing test should be available with the manufacturer.
- The calibration of meters shall be done in-house.

1.10 Documentation

- 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.
- Operating manual should be provided inside each of the Pilfer Proof Meter Boxes.
- One set of routine test certificates shall accompany each dispatch consignment.
- The acceptance test certificates in case pre-dispatch inspection or a routine test certificate in cases where inspection is waived has to be approved by the purchaser.

Executive Engineer (Stores), UPCL will be the final authority for approving the drawings submitted by the tenderer.

1.11 Guarantee

- The manufacturer shall provide a guarantee of 54 months from the date of commissioning or 60 months from the date of dispatch whichever is earlier.
- Bidders shall guarantee to repair or replace the meters and meter boxes (if supplied), which are found to be defective/ inoperative at the time of installation, or become inoperative/ defective during guarantee period. Replacements shall be affected within 1 month from the date of intimation.
- If during the guarantee period, the materials are found defective or sub-standard, the same will have to be repaired/replaced free of cost by the supplier within 30 days of intimation. If the defective materials are not replaced/rectified as per above guarantee clause, the Company shall recover twice the equivalent amount from any of the bills of the supplier or from performance guarantee so deposited by the supplier.
- Life of battery used for the meter should be guaranteed for 10 (ten) years.
- The meter/battery found defective within the above guarantee period shall be replaced by the supplier free of cost within 30 (thirty) days of the receipt of intimation of failure / defect.

1.12 Packing & Forwarding

a) The equipment shall be packed in cartons / 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. Supplier without any extra cost shall supply any material found short inside the packing cases immediately.

b) The packing shall be done as per the standard practice as mentioned in IS 15707 2006. Each package shall clearly indicate the marking details (for e.g., Manufacturer's name, Sl. Nos. of meters in the package, quantity of meter, and other details as per supply order). However, he should ensure the packing is such that, the material should not get damaged during transit by Rail / Road.

1.12.1 Component Specifications

All the material and electronic power components used in the manufacture of the meter shall be of highest quality and reputed makes as per Schedule III, so as to ensure higher reliability, longer life and sustained accuracy.

1.13 Schedules

1.13.1 Schedule – I [Guaranteed Technical Particulars of Ac Single Phase, Cl 1.0, 5-30a, Static Whole Current Energy Meter with LCD Display]

Table 1-7:
GTP of Ac Single Phase, Cl 1.0, 5-30a, Static Whole Current Energy Meter with LCD Display

S.No.	Particular	Min. Requirement as per Specification of UPCL
1	Name of manufacturer	
2	Type of Meter (Model No.)	
3	Rating	
4	Accuracy Class	Class-I
5	Rated Voltage	240V (+ 20%, - 25%)
6	Rated current	Ib-5 Amp. Imax- 30 Amp
7	Rated frequency	50 Hz ± 5%
8	Power factor	0 lag to Unity to 0 lead
9	Minimum saturation current	Bidders to specify
10	Meter Constant (imp. / kWh)	-do-
11	Max. Continuous current rating (Amp.)	30 Amps.
12	Continuous current rating of terminals for two hours	45 Amps
13	Running with no load & (-)70% to 120 % voltage	No creeping
14	Short time over current for 10 milliseconds	30 Imax for one half cycle at rated frequency
15	Starting current at which meter shall run & continue to run	0.2% of Ib at rated voltage and unity power factor
16	Power loss at rated frequency & reference temperature	
	Current circuit at rated current	Less than 1 VA
	Voltage circuit at rated current	Less than 1.0 W / 4VA
17	Type of material used	
	Base	High Impact strength, non-hygroscopic, fire retardant, fire resistant, UV stabilized poly carbonate (Lexan 503R or equivalent)
	Meter cover	High Impact strength, non-hygroscopic, fire retardant, fire resistant, UV stabilized Transparent poly carbonate (Lexan 943A or equivalent)
	Terminal Block	Material High Impact strength not hygroscopic, fire retardant, fire resistant, UV stabilized poly carbonate (Lexan 500R or equivalent) Barrier of adequate size shall be provided between phase and neutral

S.No.	Particular	Min. Requirement as per Specification of UPCL
	Terminal cover	High Impact strength, non-hygroscopic, fire retardant, fire resistant, glass reinforced poly carbonate (Transparent)& non detachable with hinging arrangement (Lexan 943A or equivalent).
	Screw	
	(i) Material	Brass/ Copper
	(ii) Size	Bidders to specify
18	Internal diameter of Terminal Hole	Min. 5.5 mm
19	Centre to Centre clearances between adjacent terminals	13 mm
20	Transducers	
	Input	Current transformer in phase element and E-beam / spot welded Shunts in the neutral.
	Output	LCD
	Shunt resistivity	Bidders to specify
	C.T. – no of turns	-do-
	Type of Register	LCD suitable for operation up to 80^0 C
	No. of Digits	6 (integer only)
	Size of Numerals	10 X 6 mm (minimum)
21	Display	
	On Scroll Mode & Auto display mode	Both required as per sequence mentioned in Technical Specification clause No.14
	Type of push button	Spring loaded push button to be provided on top cover of meter to read parameters
22	Reading on power off condition	Meter shall be able to display reading during power outage through the push button provided on the meter with facility for hands free meter reading with auto-off provisions.
23	a) Battery of Real time clock	(i) It shall be Lithium / Lithium-ion battery having at least 10 years of life
		(ii) The drift in time shall not exceed +/- 3 minutes per year
	b) Battery for Display during power off condition	It shall be Lithium / Lithium-ion battery having at least 10 years of life
24	Fixing/sealing arrangement	
	(i) Fixing of meter	3 fixing holes (one at top & two at bottom under terminal cover). The top fixing screw shall not be accessible after meter is fixed to meter box base.
	(ii) Sealing of meter cover to Base	At least, two sealing provision/screws shall be provided for proper fixing of the meter cover so that access to the working part shall not be possible without breaking the seal. Necessary provision shall be kept for fixing the utility seal also.
		The meter cover shall be permanently fixed to the base by ultrasonic welding or any other technology which is equally or more efficacious so that cover

S.No.	Particular	Min. Requirement as per Specification of UPCL
		cannot be opened without breaking, i.e. the meter should be break to open type.
25	Type of hinged un-detachable terminal cover	Terminal cover shall be hinged.
26	Performance of meter in tamper conditions	
	(i) Phase-neutral interchanged	Should work within specified accuracy
	(ii) Main & load wire are interchanged	----do----
	(iii) Load is not terminated back to meter & current is drawn through local earth fully or partially	---do----
	(iv) Neutral disconnected from both incoming & outgoing and load drawn through local earth	-do- provided threshold current is 1 Amp. & above
27	Suitability of meter to sustain over voltage i.e. phase to phase voltage injected between phased & neutral	Should sustain
28	Electromagnetic compatibility (EMI / EMC severity level)	As per IS 13779 1999
	(i) Effect on accuracy of external electromagnetic interference of electrical discharge, external magnetic field & DC current in AC supply or in neutral	Should work within accuracy as per latest IS & CBIP report -304 with latest amendment.
	(ii) Immune to Electrostatic discharge upto 35kVp	Exceeding 35kVp it should log as tamper
	(iii) Current reversal, Neutral disturbance & Magnetic tamper logging in memory	Meter shall log last 25 events with date and time
29	Effect on accuracy under tamper conditions / influence conditions	Should work within accuracy specified in IS 13779 / 1999, and CBIP tech. Report 304 . Error beyond +/- 4 % will not be acceptable for conditions not specified in IS 13779 / 1999 & CBIP tech. Report 304
30	Drift in accuracy of measurement with time	No Drift in accuracy in measurement with time
31	Name plate details	It should cover all the details as prescribed in Clause-21
32	Approximate weight of meter	To be indicated
33	Type of mounting	Projection type
34	Calibration	Meter shall be software calibrated at factory & there shall not be any mechanical form of calibration, such as, mechanical preset / trim port / potentiometer etc. so that any adjustment in calibration is not possible after freezing the meter constant.
35	Manufacturing activity	
	(i) Mounting of components on PCB shall be SMT type	SMT type and ASIC technology
	(ii) Compliance to assurance	To be complied
36	Testing facility	

S.No.	Particular	Min. Requirement as per Specification of UPCL
	Fully automatic computerized meter test bench with print out facility shall be available	Must be available
	Make and Sl. No. of Test bench	To be indicated
	Accuracy of ESS duly calibrated	---do---
	Whether complete testing facilities are available for carrying out all acceptance and additional acceptance tests are available in house.	
37	Guarantee period of meter	60 months from the date of dispatch. Guarantee period shall be printed on the nameplate.
38	BIS license	
39	BIS license No. & dt. with its validity for ISI certification mark on offered meter.	To be mentioned
40	Details of meter design for which above BIS certification has been obtained -	To be mentioned
	Ratio of Ib to Imax	
	Material of meter body	
	Type of energy registering counter	
	Type of technology (Digital/Analog)	
	Grade of printed circuit Board material	
	Type of assembly of component used (SMT)	
	Meter constant (IMP / kWh)	
	Auxiliary power circuit (with PT or PT less)	
	Current circuit (CT / Shunt combination or only shunt)	
	Accuracy class	
41	ISO accreditation no. & dt. with its validity	
42	Other parameters / features not covered in the above GTP	Conform to specification of IS-13779 / 1999 & CBIP technical report No.304 (with its latest amendment).
43	Past Experience	Copies of order executed in last two years along with GTP of the supplied meters to be enclosed

1.13.2 Schedule – II Technical Deviations proposed by the bidder are as follows.

Table 1-8: Technical Deviations proposed by the bidder are as follows.

S.No.	As per Technical specification	Deviation by the bidder

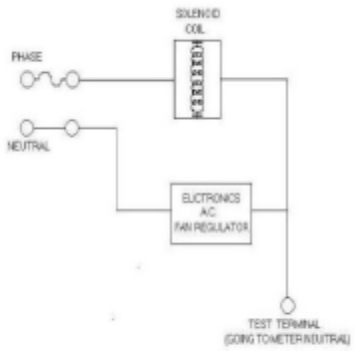
1.13.3 Schedule – III Meter component specifications

Table 1-9 Meter Component Specifications

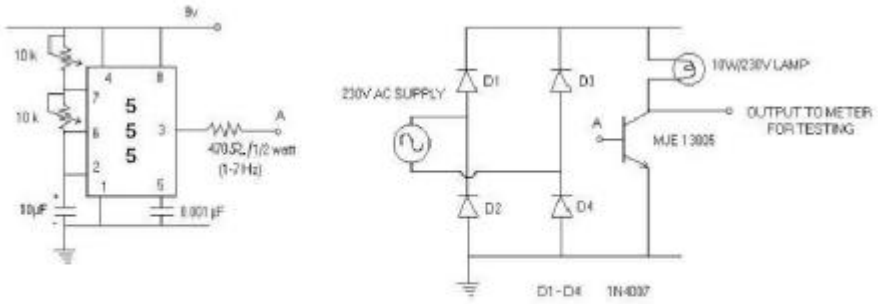
S.No	Component	Requirement	Make / origin
1	Measuring Element	(a)Current transformer shall be provided in the phase element and (b) E-beam/Spot welded Shunt in the neutral.	Any make or origin conforming to IS-2705
2	Measurement /computing chips	The Measurement / computing chips used in the meter should be with the Surface mount type along with the ASICs.	Analog Devices, AMS, Cyrus Logic, Atmel, SAMES, NEC, Texas Instruments, Phillips
3	Memory chips	The memory computing chips should not be affected by the external parameters like sparking, high voltage spikes or electrostatic discharges.	Atmel, National Semiconductors, Microchip, Texas Instruments, Phillips, Hitachi, Teridian
4	Display modules	The display modules should be well protected from the external UV radiations. The display should be clearly visible over an angle of at least a cone of 70o.The construction of the modules should be such that the displayed quantity should not disturbed with the life of display. The display should be TN type industrial grade with extended temperature range.	Haijing, Holtek, Bonafied Technologies, Advantek, Truly Semiconductor, Hitachi, SONY
5	Communication modules	Communication modules should be compatible for the RS 232 ports	National Semiconductors, Hitachi, Texas Instruments, Philips, HP, Agilent
6	Optical port	Optical 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.	National Semiconductors,
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.	As specified.
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.	Philips, Toshiba, Fairchild, Murata, Rohm, Siemens. National Semiconductors, ATMEL, Texas Instruments, Hitachi. Ligitec, OKI, EPCOS

S.No	Component	Requirement	Make / origin
9	Mechanical parts	The internal electrical components should be of electrolytic copper & should be protected from corrosion, rust etc.	
10	Battery	Lithium / Lithium-ion with guaranteed life of 10 years	Renata, Panasonic, Varta, Tedrium, Sanyo, National, Tadiran or Duracell
11	RTC / Micro controller	The accuracy of RTC shall be as per relevant IEC / IS standards	Philips, Dallas, Atmel, Motorola, NEC, Renesas, Hitachi, Xicor, Texas Instruments, NEC or OKI

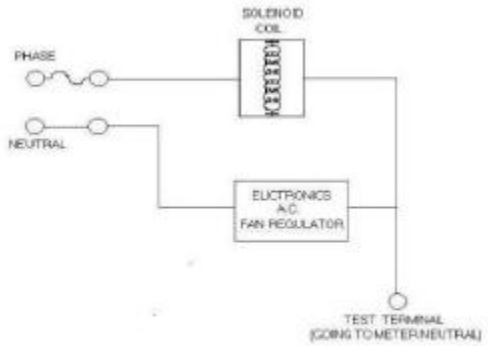
1.13.4 Schedule –IV Circuit Diagrams



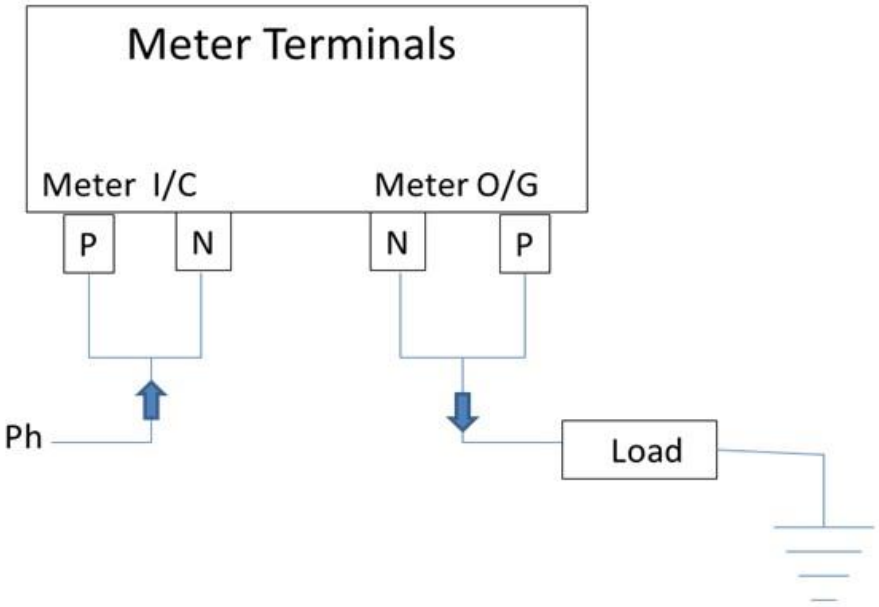
CIRCUIT DIAGRAM FOR TEST JIG TO INTRODUCE CHOPPED A.C. IN NEUTRAL



CIRCUIT DIAGRAM FOR TEST FIGURE TO INTRODUCE PULSATING D.C. IN NUTRAL



CIRCUIT DIAGRAM FOR TEST JIG TO INTRODUCE CHOPPED A.C. IN NEUTRAL



Circuit Diagram for tampering with incoming and outgoing terminals

2. Technical Specification for Three Phase, Four Wire Alternating Whole Current (10-60) Amp Static Energy Meter (Category -C)

2.1 Scope

This specification covers the design, engineering, manufacture, assembly, inspection, testing at manufacturers works before dispatch packing, supply and delivery at different circle and area stores including insurance during transit of class 1.0 accuracy, LT 3-phase, 4-wire, 240 V system static whole Current Electronic meter of current range 10-60A, with backlit LCD display, CMRI & Base Computer software compatible for tariff purposes with TOD features along with tamper proof meter box. The meter should be for balance & unbalance load and capable of recording and display energy in kWh and demand in kVA & kW, power factor range of Zero lag-unity-Zero lead. Meter should have facility / capability of recording tamper information & load survey in active, apparent & reactive energy and phase currents etc.

It is not the intent to specify completely herein all the design and construction of meter however the meter shall confirm in all respect to high standard of engineering, design and workmanship shall be capable of performing in continuous commercial operation in a manner acceptable to purchaser, who will interpret the meanings of drawings and specification shall have the right to reject any work or material which in its judgment is not in accordance herewith. The offered meter shall be complete with all, accessories, hardware, software and components necessary for their effective and trouble free operation of the system for the purpose mentioned above. Such components shall be deemed to be within the scope of bidders supply irrespective of whether those are specifically brought out in this specification and / or the commercial order or not.

The offered meter shall be ISI marked and bidder shall have to furnish valid BIS certificate along with the offer.

The metering system should be flexible enough for changing requirements in future and designed for minimum maintenance. The meters will be supplied with fully wired weatherproof, Polycarbonate pilfer proof Meter Box. Meter box should be capable of housing meter and MODEM. Meter should have approachable provision for extending power supply through plug to MODEM over and above the separate RS 232 port for MODEM installation. The supplier will provide seals on all sealing points of meter. The meter shall consist of measuring element, Registers, operational indicators and test outputs enclosed together in the continuous ultrasonically welded meter block along with tamper proof box.

2.2 Climatic Conditions

The meters to be supplied against this specification should be suitable for satisfactory continuous operation under the following tropical conditions. Meters should be capable of maintaining required under hot, tropical and dusty climatic conditions.

Table 2-1: Climatic Conditions

S.No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39

S.No.	Particulars	Value
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

2.2.1 Tropical Treatment

The meters shall be suitably designed and treated for normal life and satisfactory operation under hot & hazardous tropical climate conditions and shall be dust and vermin proof. All the parts & surface, which are subject 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 injurious effect of excessive humidity.

2.3 Standards Applicable

Unless specified elsewhere in this specification, the performance & testing of the meters should conform to the following Indian / International standards, to be read with up to-date and latest amendments / revisions thereof as on 90 days prior to floating of tender.

Table 2-2: Standards Applicable

S.No.	Standard No.	Title
1	IS13779, 1999 read with its latest amendments.	A.C. Static Watt-hour Meters, Class 1.0 &2.0
2	CBIP Technical Report 88(July 96) & 325	Specification for AC Static Electrical Energy meters of CBIP with its latest amendments.
3	IEC 687/62053/61036	Alternating current static watt-hour meters for active energy (Class 1.0)
4	CBIP Technical Report 111	Specification for Common Meter Reading Instrument
5	IS 13410 – 1992 with latest amendment	Specification for Pilfer Proof Meter box Suitable for 3 – Ph static Energy Meter
6	ETD 13 (6211)/IS15959	Category 'C' for consumer metering

Meters matching with requirements of other national or international standards that ensure equal or better performance than the above-mentioned standards should also be considered. When the equipment offered by the bidder conforms to standards other than those specified above, salient points of difference between standards adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule. A copy of such standards along with their English translation shall invariably be furnished along with the offer.

2.4 Specific Technical Requirements

a) Class of accuracy: Three phase four wire whole current meter of 1.0 (No drift in tolerance of accuracy with time)
(Meter should record energy at 1% Ib at UPF preferably an error band + 2%)
b) Supply Voltage: 3 X 240+20% to – 40% volts (phase to neutral) and 415 volts phase to phase
c) Frequency: 50 Hz (+/- 5%)
d) Current Range (basic) (I_b): 10A
e) Maximum Current:60 A (600% of I_b)
f) Starting Current: 0.2% of Ib at UPF
g) Power factor range: Zero (lagging) – Unity – Zero (Leading). **In case leading power factor, kVAH should be equivalent to kWH.**
h) Power Loss: 1. Voltage Circuit Less than 1W / 8VA per phase
2. Current Circuit Less than 1VA
i) Resistance to impulse voltage: Minimum 10KV peak

j) Resistance to surge voltage: Minimum 8KV peak of 1.2/50 Micro sec.
k) Test Voltage at 50 Hz for 1min: 4 KV rms – as per IS 13779
l) Clock time accuracy: + 3 min/year – as per CBIP Tech Rep 325

2.5 General Functional Requirements

2.5.1 Maximum Continuous Current

The maximum continuous current in meters should be the current at which the meter purports to meet the accuracy requirement of the specification.

2.5.2 Construction

The Meters should be designed and constructed in such a way as to avoid introducing any danger in use and under normal conditions so as to ensure, specially,

a) Personnel safety against electric shock
b) Personnel safety against effects of excessive temperature as per relevant standards.
c) Protection against penetration of solid objects, dusts and water as per relevant standards
d) Protection against spread of fire as per relevant standards.
e) Detection against fraud or pilferage.

The meter should be compact & reliable in design, easy to transport & immune to vibration & shock involved in the transportation & handling. The construction of the meter should ensure consistence performance under all conditions especially during heavy rains / very hot weathers. The insulating materials used in the meter should be non-hygroscopic, non-ageing & have tested quality.

The meter body should not have any screws, through which meter can be opened or tampered without breaking the seals. The meter should be sealed in such a way that the internal parts of the meter becomes inaccessible and attempts to open the meter shall result in visible damage to the meter cover. This is to be achieved by using continuous Ultrasonic welding on the meter body

The meter should comply latest technology such as Microcircuit or Application Specific Integrated Circuit (ASIC) to ensure reliable performance. The mounting of the components on the PCB should compulsorily be Surface Mounted Technology (SMT) type.

Power supply component may be of PTH type. The electronic components used in the meter should be of high quality and there should be no drift in the accuracy of the meter for at least ten years. The circuitry of the meter should be compatible with 16 Bit (or better) ASIC with compatible processor and meter should be based on Digital measuring and sampling technique. Any better arrangement with justification will be acceptable.

The meter should be housed in a safe, high grade, unbreakable, fire resistant, UV stabilized, virgin Polycarbonate casing of projection mounting type. The meter cover should be transparent, for easy reading of displayed parameters, and observation of operation indicators. The meter base may not be transparent, but it should not be black in colour. The meter casing should not change shape colour, size, dimensions when subjected to 200 hrs on UV test as per ASTMD 53. It should withstand 650 deg. C. glow wire test and heat deflection test as per ISO 75.

The meter shall have an operation indication device such as a blinking LED. The operation indicator shall be visible from the front window and capable of being monitored conveniently with suitable testing equipment.

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. The meter cover should be sealed to the meter base with at least 2 nos. seal by the manufacturer. The bidder shall submit relevant documents regarding the procurement of high-grade polycarbonate material.

2.5.3 CT's/Shunt Arrangement

The meter shall operate on CT or shunt. The CTs provided in the phase element shall have proper magnetic shield and shall be mounted firmly without any movement. The bidders shall submit the details of the shunt and how they are protected against external influences & temperature variations.

2.5.4 Meter Case and Cover

a) Meter case (base and cover) and extended terminal block cover (ETBC) shall be made of unbreakable high-grade flame retardant & injection molded in UV stabilized poly carbonate with minimum thickness of 2.0 mm on all sides. Meter case (base and cover) and ETBC shall be totally transparent but supplier may provide translucent /opaque meter base. The material shall be of good dielectric strength and mechanical strength. The name plate shall be very small in size and shall preferably be transparent. It shall not obstruct the visibility of components.
b) The molded meter case should not change in color, Shape, size, dimensions when subjected to 200 hrs. on UV test as per ASTMD 53. It should withstand 650 deg. C. glow wire test and heat defection test as per ISO 75.
c) The manufacturer shall emboss (or fix a good quality sticker) on the base and cover the name of the material they have used in an abbreviated form e.g. PCFR (to denote what they have used - flame retardant poly carbonate).
d) The meter cover shall be fixed on meter base with the help of 2 nos. internal locks so that after pressing the cover on the base the cover will be fixed and cannot be opened without breaking the internal locks.
e) The meter cover & base shall have provision of fixing a push fit seal in the pre moulded female part on the cover & base of the meter so that after fitting the push fit seal in this, the meter box and cover cannot be opened. This arrangement shall be provided in 2 points, one at left side and one on right side.

Supplier may provide meters with internal locking arrangement through unidirectional screws or endless rivets and provision of two nos. of push fit polycarbonate seals on left side & right side of meter base & cover, however supplier shall ensure that it is not possible to lift the meter cover from the meter base at all without breaking cover. Although meters with original provision shall be preferred.

After this, the meter shall be seamlessly ultrasonically welded. The meter case of the sample meters to be furnished by the bidders after opening of Part-I should be as per above and at the time of sample testing, it shall be opened to ascertain conformity of seamless ultrasonic welding as per specification.

The meter case shall have the following properties of plastic material:

Table 2-3 Properties of plastic material

Sl.No.	Property	Units	Value	Standards
1.	Physical water absorption	%	Max. 0.35	ASTMD 570/ IS:5133(part 2) :1969
2.	Electrical Dielectric strength at 90 deg. C. in oil.	KV/ MM	Min 16	ASTMD 149
3	Thermal HDT	Deg. C.	Min. 125	ASTMD 648/ ISO 75
4.	Flammability a) Rating b) Glow wire test 650 deg. C.		FV 2 Passes	UL94/ IS:11000(part 2-sec-1) IEC-60695-2-1-12 & IS:11000-2-1
5.	Mechanical a) Tensile strength b) Flexural strength c) Modulus of Elasticity d) Izod impact strength notched 23 Deg. C.	 MPa MPa MPa KJ/Sq.M	 Min. 50 Min. 90 Min. 2000 Min. 8	 ISO 527 / any equivalent standard ISO 178 / any equivalent standard ISO 178 / any equivalent standard ISO 180/1A or any equivalent standard

Meter serial No. should also be bar coded along with numeric decimal Sl. No. of minimum size 5 mm x 3 mm on the name plate of meter. There shall be no potential link (internal / external) in the meters.

2.5.5 Meter Box

The meter box shall be made of Transparent Polycarbonate material which complies following properties as given by in table.

Meter box shall be weather proof, capable to withstanding temperatures of boiling water for 5 minutes continuously without distortion or softening. It shall withstand Glow wire test at 650°C as per IS: 11000. HDT of Polycarbonate material shall be minimum 120° C (at 1.8 MPa°C).

i. The meter Box shall have roof tapering down for easy flow of rainwater.
ii. The thickness of the box shall be minimum 2.0 mm from all sides.
iii. The overall dimensions of the box shall be such that a minimum 20 mm clearance from left, right and top side, 10 mm from front and back side & 75 mm from meter terminals shall be maintain in between meter and box surface.
iv. The box cover shall have 4 nos. push fit type arrangement to make it fully tamper evident. Suitable arrangement shall be provided to avoid snap locking during transit. Once push to fit arrangement are locked it should not open without breaking the meter box. **Supplier shall provide 2 nos. external wired push fit double locked polycarbonate seals on both sides of meter box.**
v. The cover shall be made overlapping type having collars on all four sides. The cup-board shall be provided with semicircular / circular gasket of sufficient size to completely fit in the grooves of the base. The gasket should be made of neoprene rubber. The base of the cup board must have a groove to hold the gasket and the overlap of the top cover with the base must be minimum 6 mm (with gasket).
vi. Push button arrangement shall be required on the cover of the box to operate the meter display push button from outside the meter box to read the meter display parameters without opening the meter box cover.
vii. The provision for connecting optical probe for meter communication through meter reading instrument without opening the box seal should be provided. It shall have independent sealing arrangement.
viii. The cover & base of meter box shall be transparent so that connections are visible from outside of the meter box.
ix. Box shall have minimum 4 nos. holes of 6 mm diameter with washer at four corners of meter box for fixing the meter box on wall / wooden board.
x. Suitable provision shall be provided at the bottom side of the meter box for cable inlet & outlet and the same shall be capable of accommodating cable of 25 mm diameter, engineering plastic cable gland shall be provided.
xi. The following information shall be indelibly embossed on the meter box (or on a good quality sticker from inside) - Purchase order No. & date, month and year of manufacture, UPCL and the manufacturer's name.

For every 1000 meters with meter box supplied, 5 spare meter boxes shall be provided free of cost by the supplier for replacement purpose, etc.

2.5.6 Terminal Block and Cover

- The terminal block shall be of high grade non-hygroscopic, fire retardant, low tracking, fire resistant, reinforced poly-carbonate (not Bakelite) or equivalent high-grade engineering plastic which should form an extension of the meter case and have terminal holes and shall be of sufficient size to accommodate the insulation of the conductors, meeting the requirement of IS 13779:1993/CBIP technical report- 88.
- The manner of fixing the conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixing which may be loosened and tightened several times during the life of the meter shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material. The internal diameter of the terminal holes shall be 8.5 mm minimum. The clearance and creepage distance shall conform to relevant clause of IS 13779:1993/CBIP technical report no.-88.
- The screws shall have thread size not less than M4 and head having 4-6mm. Diameters. The screws shall not have pointed ends at the end of threads. All terminals and connecting screws and washers should be of Brass or Copper material. The terminal should withstand glow wire test at 960 +/- 15 ºC and the terminal should withstand at least 135 ºC as per IS.

- The internal diameter of terminal hole should be minimum 9.5 mm and center to center distance is 13 mm. The holes in the insulating material shall be of sufficient size to accommodate the insulation of conductor also.
- Meter should pass in the EMIMC test.
- The CT used in the meter must be metallic shielded
- Ferrite beads should be used for protection for high voltage
- The terminal cover shall be transparent re-enforced Polycarbonate, Engineering Plastic with minimum thickness 2.5 mm and the terminal cover shall be of extended type completely covering the terminal block and fixing holes. The space inside the terminal cover should be sufficient to accommodate adequate length of external cables.

2.5.7 Marking of the Meter

The marking on the meter should be in accordance with relevant clauses of IS 13779.

The Basic Marking on the Meter Name Plate Should Be as Follows (All Other Markings as Per IS Should Also Be There):

(a) Manufacturer's name & trade mark
(b) Type Designation
(c) No. of phases & wires
(d) Serial number (Size not less than 5mm)
(e) Year of manufacture
(f) Reference Voltage
(g) Rated Current
(h) Operating Frequency
(i) Principal unit(s) of measurement
(j) Meter Constant (imp/kwh)
(k) Class index of meter
(l) Property of "UPCL"
(m) Purchase Order No. & Date
(n) Guarantee (Guaranteed for a period of 5 Yrs.)
(o) BIS marking
(p) Place of manufacture
(q) Meter Sl. No. in alpha numerical form, Dt. of manufacture, Rating of the meter and P.O reference should be bar coded.
(r) Any other suitable information

2.5.8 Display of Measured Values

- The meter shall have Alphanumeric display with at least 7 full digits with LCD backlit display, having minimum character height of 10 mm. The data should be stored in non-volatile memory. The non-volatile memory should retain data for a period of not less than 10 years under unpowered condition. Battery back-up memory will not be considered as NVM. It should be possible to easily identify the single or multiple displayed parameters through symbols / legend on the meter display itself or through display annunciator.
- The register shall be able to record and display starting from zero, for a minimum of 2500 hours. The energy corresponding to rated maximum current at reference voltage and unity power factor. The register should not roll over in between this duration. In addition to provide Serial Number of the meter on the display plate, the meter serial should also be programmed into meter memory for identification through communication port for CMRI / laptop / meter reading printout.
- Visibility of display in poor light conditions is an important criterion. STN or TN type of LCD to be used. Proper annunciation legends for the displayed parameters to be provided (programmable).
- The meters should have auto-display mode for pre-selected parameters. Push-Button mode of display should display all parameters and it should have priority over auto mode. The meter should give clear message on

display to indicate that the meter has experienced tampers and the nature of tamper with first occurrence and last restoration date & time.

- The meter shall have a test output (blinking LED) accessible from the front and be capable of being monitored with suitable testing equipment. The operation indicator must be visible from the front. Test output device should be provided in the form of one common LED for active, reactive and apparent energies with the provision of selecting the parameter being tested (separate LED may also be used with proper separation).
- Meters should have calibrating LED pulse output for Energy Vectors. The meter should also record values of Energies at present date & time (Programmable).

2.5.9 Display Sequence

The meter should display the required parameters in two different modes as follows:

- Auto Display Mode
- Push Button Mode

Display sequence for both Auto & Push Button mode must be maintained, any interchange between the display parameters is not accepted. Display Parameters of three phase whole current meter shall be as follows.

Table 2-4: Display Sequence

No.	Auto Display/Billing Parameters	No.	Push Button Display
1	LED/ LCD test	1	Frequency – Hz
2	Meter serial number	2	Instantaneous phase to Neutral Voltage - Vr – N – Vy- N - Vb- N -
3	DATE	3	Instantaneous Line Current - Ir - Iy - Ib -
		4	Instantaneous load – kW
		5	Instantaneous load – kVA
4	TIME	6	Instantaneous Power factor -
5	Previous month – M. D- kW	7	Date & time of previous months – MD – kW
6	Previous month – P. F.	8	Previous month end reading- kWh
7	Current cumulative reading- kWh	9	Previous month - M. D –kVA
		10	Previous month - M. D –kVA
		11	Previous month – Power on Hours
		12	Previous month – Tamper Count
		13	Maximum demand- kW Date & time (since installation)
		14	Current Ckt related present tamper status
		15	Voltage Ckt related present tamper status
		16	Other tamper status -
		17	Last occurrence tamper date & time-
		18	Cumulative Power ON Hours -
		19	Cumulative tamper occurrence -
		21	M. D. Reset count -
		23	Circuit OK

The meter display should be reconfigurable at site under strict security conditions.

2.5.10 Anti-Tamper Features

The meter should have the following anti-tamper features:

- The meter shall be capable of recording energy correctly even if the input and output terminals are interchanged.
- The meter shall work correctly irrespective of phase sequence of supply.
- The meter shall work correctly even in absence of neutral. The Meter should record accurate energy even if load is drawn partially or fully through a local earth.
- The meter shall work correctly if one, two and all three-phase current direction is reversed.
- The meter should work in absence of two phase and record relevant energy on any one phase & Neutral or any one phase & earth.
- The Potential link shall not be accepted.
- Meter should record energy with maximum error of + 4% on injection of DC in neutral, injection of pulsating DC (7-10Hz) in neutral. DC voltage will be rectified from a three phase power supply.
- Meter should meet accuracy under magnetic influence as per CBIP 304 latest amendments . No abnormal behavior like flickering, switching on-off of display, abnormal heating etc should be observed during magnet test. Meter should record energy at Imax with Tamper logged, if it gets affected from magnetic influence.
- Meter should record energy with maximum error of +/- 4% on injection of chopped AC in Neutral. However meters which are immune or maintain better accuracy, will be preferred. Maximum chopping for AC injection will be 25% to 30% at peak end.
- The registration shall not be affected more than +/- 4% if external A.C. or high frequency Voltage is applied to the meter neutral with respect to earth(up to 450 volt,1khz).
- The meter should be immune to Electro Static Discharge or Sparks of 35 kVp (approx) induced by using frequency-generating devices having very high output voltage. Tests in this respect will be conducted by using commonly available devices and during spark discharge test, spark will be applied directly at all vulnerable points of the meter for a period of 10 minutes and meter should record under this condition. After application of spark discharge meter should record correctly within the specified limits of errors. Beyond 35 kVp meter should record as tamper if not immune. correctly within the specified limits of errors. Beyond 35 kVp meter should record as tamper if not immune.
- Circuit diagrams for test jig for chopped A.C. & pulsating D.C injection are enclosed. The meter shall be capable of recording occurrences and restoration with date and time the following tamper conditions:
  i. Missing Potential for all phases.
  ii. Voltage unbalance (If Vmax - Vmin is greater then 30% of Vref)
  iii. Current reversal for all phases.
  iv. CT Open / CT Short / Load or Current imbalance etc
  v. All potential missing or Power failure.
  vi. Magnetic Disturbances (IS 13779 & CBIP 304)
  vii. High voltage (35 KV apply if not immune)
  viii. Neutral Disturbance due to AC / DC abnormal signal (if not immune)
- Snapshot values of phase Voltage, Phase Current & Phase wise Power Factor, Active Energy value during occurrence & restoration to be provided in the above mentioned for all tamper conditions (up to 300 events).
- The duration of tamper before it is logged should be a user programmable through authenticated commands. (But it should not be more than 10 min.) All authenticated commands should be Base Computer Software controlled.
- All transactions with meter should be date & time logged (minimum last 5 transactions)
- Properly designed meter tamper logic should be provided and clearly explained in the bid.

- The tamper logic should be capable of discriminating the system abnormalities from source side and load side and it should not log/record tamper due to source side abnormalities. A minimum of 300 events (one event means either occurrence or restoration) of all types of tamper with date & time stamping should be available in meter memory. The logging will be on FIFO basis.
- Meter should have an indication in its display if top cover is removed / open and must be logged in.

2.5.11 Measurement of Harmonics

The meter should be capable of measuring fundamental energy as well total energy i.e, fundamental plus Harmonics energy. Total energy shall be made available on meter display and the same only shall be used for billing purpose. Provision for measuring of fundamental energy be kept for utilization in future. The total energy & fundamental energy shall be logged in the meter memory and be capable of downloading to the BCS through the CMRI and be available for viewing at the BCS end.

2.5.12 Resetting of Maximum Demand

The meter should be capable of recording the Apparent MD with integration period of 30 minutes (programmable). The meter should also record MD at preset date and time. MD reset should be through all of the three means:

1. Manually
2. Through authenticated MRI or Remote Communication Command,
3. Automatic resetting at 00:00 hrs at first day of the Month.

Facility to invoke any of the above through authenticated MRI command should be provided. By default, the M.D. reset will be through push button on any date of the month. MD reset button should have proper sealing arrangement.

Push button for scrolling display & MD reset should be separate. Push button on the meter case should be such that the push button can be operated without opening the meter box.

2.5.13 Load Survey

The meter should be capable of recording load survey for the following parameters for a Period of minimum 90 days with 30 minutes integration period.

- Demand in kW
- Demand in kVA

The NVM shall not require any additional battery backup to retain the data in case of power failure, for up to 10 years and the data storage shall be independent of battery backup unit. The life of the RTC battery in circuit condition should be minimum 5 years in case of power failure.

It should be possible to transfer this data to base computer software through MRI. The data so obtained should be displayed in both graphical & numeric form in the BCS. The BCS with all details is to be provided by the supplier at no extra cost.

2.5.14 Time of Day (TOD) Tariff

- Meter should be able to record & store apparent & active energies (forward) consumption along with maximum demand in kW & kVA for at least different four time Zones.
- Meter shall be able to record and store apparent and active energies, consumption along with maximum demand in kVA during specific peak hours described as following time Zone of register in accordance with the present tariff is TOD meter shall be able to record of the TOD tariff which is as below:

Table 2-5 TOD Tariff

Season / Time of day	Morning Peak hours	Normal hours	Evening Peak hours	Off-Peak hours
Slot sequence	**4**	**1**	**2**	3
Winters 01.10 to 31.03	0600-0930 hrs	0930-1730hrs	1730-2200 hrs	2200-0600hrs

Season / Time of day	Morning Peak hours	Normal hours	Evening Peak hours	Off-Peak hours
Summer 01.04 to 30.09	-	0700-1800 hrs	1800-2300hrs	2300-0700hrs

Provision of TOD MD (kVA), TOD (kWh) and TOD (kVAH) parameters are to be made available in the meters. **Meter should be able to record & store energy parameters in four separate TOD time slots as per sequence in above table.**

2.5.15 Output Device

The meter shall have a test output accessible from the front and be capable of being monitored with suitable testing equipment. The operation indicator, if fitted, must be visible from the front. Test output device shall be provided in the form of LED output device. The relation between test output and the indication on display shall comply with the marking on the name plate (imp per kWh).

2.5.16 Communication Port

- The meter should be provided with a galvanic ally isolated optical communication port (such as IED-1107, PACT, ANSI port, etc. conforming to respective standards) so that it can be easily connected to a hand-held common meter reading instrument (CMRI) for data transfer or subsequently hooked to remote metering device such as modem etc. The optical communication port should also have a separate sealing provision and should be compatible with SAND's or ANALOGIC make CMRI or Laptop with proper attachment (cords).
- Billing data should be downloaded with fast speed less than a minute and meter data with load survey and tamper parameters should be downloaded in less than 3 minutes approximately.
- The meter shall have optical port in addition to RS232 communication port for remote meter reading through external modem.
- The baud rate of the meter shall be 9600 bps.
- The bidder shall provide application programming interface (API) to read their meters and convert the meter data as per IEEMA MIOS standard. Supply of API with the meter is mandatory.
- Bidders may accept the protocol of their choice but should load the software and the protocol software at the base computer station of UPCL.
- It is the responsibility of the meter manufacturer to provide the software and all facilities required by the purchaser to use DOS based hand held CMRI for reading the meter. The meter data should be downloaded with fast speed, preferably less than a minute.

2.5.17 Special Requirement for Display

- The meter shall have indication for unsatisfactory/non-functioning of the following:
    - Time and calendar
    - Real time clock with battery
    - All display segments
    - Non-volatile memory.
- The meter serial number, consumers name and address, C.T. and P.T. ratio and date with time of taking reading shall invariable be available at base computer software.
- The meter shall be factory programmed for each and every month for minimum 20 years at the time of manufacture and correctness of 20 years calendar. In addition, following parameters should also be factory programmed:
    - CT/PT Ratio
    - Integration period
    - Display sequence

2.5.18 Meter Reading during Power Off

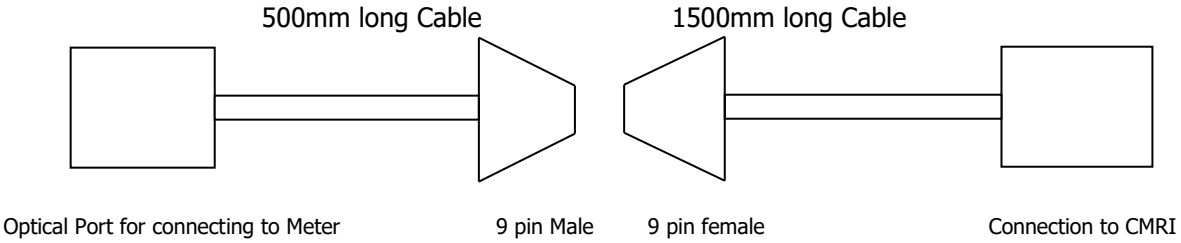
It should be possible to read the meter-display visually and with MRI in absence of input voltages with the help of internal or external battery backup. The interface preferred will be inductive coupling. If otherwise, proper sealing arrangement of coupling port to be provided.

In case of internal battery, the arrangements should be such that hands free operation is possible. Separate battery should be used for this purpose (Not RTC or processor battery).

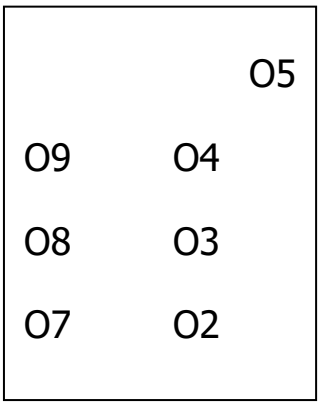
2.5.19 Interface with MS-DOS based CMRI

For Physical interface between meter and Common Meter Reading Instruments shall consist of meters optical sensor terminating into a 9 Pin D type male connector with a cable of 500mm + 10mm length as per electrical circuit as illustrated below, each communication cord to be supplied for each meter free of cost duly fitted with meter box with a provsion of reading the data without opening the meter box . Also, the meter box shall have provision of sealing the 9 pin D type connector.

ILLUSTRATION NO.1

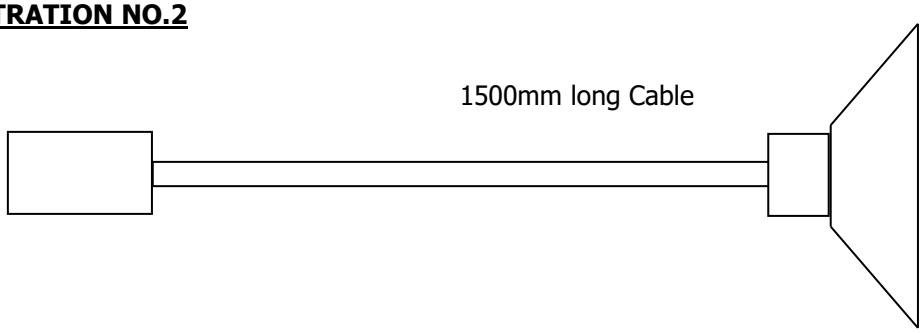


The configuration of 9 Pin D type male connector shall be as given below:



PIN	SIGNAL NAME
01	NC
02	TRANSMIT DATA (TXD)
03	RECEIVE DATA (RXD)
04	NC
05	SIGNAL GROUND (SG)
06	NC
07	NC
08	NC
09	POWER SUPPLY

ILLUSTRATION NO.2



Connection to CMRI 9 Pin Female connector to Base Computer Station (BCS)

- Meter shall invariably be provided with LCD display cycling facility for essential parameters, as envisaged under clause No. 13.1 of the technical specification.
- The Static Trivector Meter shall measure and retain previous 12 months data (month wise) of the kWh and kVAH reading at 2400 Hrs. of the last day of each calendar months, Average Power Factor and maximum demand with date and time of occurrence of that particular month. These parameters shall also be obtainable through common meter reading instrument whenever required of last 12 months.
- The meter shall be provided with an accurate quartz crystal based real time clock. The maximum drift permissible in the real time clock shall be +5 minutes per year for these meters.
- All the registers and other parameters shall be updated every second.

2.5.20 Maximum demand Registration and Resets

- The meter shall continuously monitor and calculate the average maximum demand for each interval of time of 30 minutes and maximum of these shall be stored along with date and time when it occurred.
- The meter shall automatically store the 30 minute average demand. At the end of every 30 minutes, the new calculated demand should be compared with previous maximum demand and stored whichever of them is higher. The maximum demand for every calendar month along with the date and time when it occurred should be registered.
- The maximum demand shall automatically reset at 24.00 Hrs. of the last date of each calendar Month for which minimum 20 calendar years shall be programmed by the manufacturer at his works.
- The meter shall be provided with its own real time clock calendar with built in battery backup and time derived from this clock shall be used for maximum demand intervals. The meter shall display the maximum demand reset count.

2.5.21 Load Survey capability and billing point Requirements

The meter shall be capable of recording & storing kW, kVA, kWh, kVAH, voltage & current of all 3 phases and average power factor for at least last 65 days. The maximum demand in last 12 months with date and time of occurrence and tamper details as per clause no. 23 should be recorded in its Nonvolatile memory and it should be possible to transfer this data through a galvanic ally isolated optical communication port on to the base computer station through a DOS based CMRI. The load survey data should be available in the form of bar charts as well as in spread sheets. The Windows based BCS should provide complete load survey data that can be viewed in the graphic form (daily view, weakly view and months) and also in the numeric form (Spread Sheet) with the help of Microsoft Excel software.

- The meter should have a test output accessible from the front and capable of being monitored with suitable testing equipment. The output device may be either in the form of pulses or in the form of high-resolution display.
- The operational indicator must be visible from the front

2.5.22 Billing Parameters

The predefined date and time for registering the billing parameters of kWH, kVAH , kVA and kW MD as well as Tamper Count and Power-on hours readings shall be 24:00 Hrs of the last day of every month. All billing parameters shall be transferred to billing registers and shall be displayed on auto cyclic display mode referred to as "BILLING PARAMETERS".

The above billing data, TOD register's data, load survey data, tamper information 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.

2.5.23 Self-Diagnostic Features

The meter shall be capable of performing complete self-diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data memory location all the time. If possible, the details of malfunctioning should be recorded in the meter memory. The bidder should furnish the details of self-diagnostic capability feature.

2.5.24 Immunity to Electro Magnetic & Electro static Disturbance

The offered meter shall record accurately in case of DC or spurious signal is injected through neutral. If possible, the meter shall log such condition with date and time.

The threshold value shall be such as:

- The accuracy of the meter should not be affected with the application of abnormal voltage/frequency generating device such as spark discharge of approximately 35 KV **or the meter shall record energy at Imax with recording of the date & time of tamper in its memory.**
- In case DC signal is injected on the neutral terminal of the meter through Diode / resistance / capacitor, it must function accurately.
- The manufacturer can give his details as per their product.

Influence of High Magnetic Field: The meter accuracy or accuracy display under normal conditions shall not be affected by placement of an external magnetic field (0.5 tesla (DC) and 0.2 tesla (AC) permanent magnet, size minimum 70x70x50mm, of 0.5 Tesla ±5% anywhere on the surface of the meter without meter box. The magnetic test shall be conducted on both phase & neutral circuit and if the same is applied beyond 10 sec. meter shall start recording energy at Imax

2.5.25 Technical Support, Manuals & Training

Extensive technical support, detailed technical literature & training is to be provided by the manufacturer.

2.5.26 Influence Quantities

The meter shall work satisfactorily with guaranteed accuracy as per limit as per limit or relevant IS under presence of the following quantities

- Electromagnetic field
- External magnetic field
- Radio frequency interference
- Vibration
- Voltage fluctuation
- 35KV Electrostatic field
- Harmonics distortion as per relevant IS and IEC.

2.5.27 Power Consumption by Meter

Voltage Circuit: The active and apparent power consumption in the voltage circuits (all 3 phases) including the power supply of meter at reference voltage, reference temperature and reference frequency should not exceed 1.5 Watt and 10 VA respectively.

Current Circuit: The apparent power taken by each current circuits (all 3 phases) at basic current, reference frequency and reference temperature should not exceed 4 VA.

2.5.28 Starting Current

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

2.5.29 Running at No Load

When 70% & 120% voltage is applied and no current flows in the current circuit, the test output of the meter should not produce more than one pulse.

2.5.30 Local Communication Mode

The meter shall have a galvanically isolated optical communication port as per IEC 1107 / ANSI / PACT so that it can be easily connected to a hand-held common meter reading instrument (CMRI) for data transfer. The billing data & the tamper data downloading time should be less than 2 minutes. The optical port should be provided with proper sealing arrangement so that the optical cover should not be opened without breaking the seal. The stored data in the meter should be available through CMRI even when the display of the meter is not available.

The above ports suitable for interface of the meter with appropriate protocol to Common Meter Reading Instrument (CMRI) / LAPTOP / PC.

2.5.31 Remote Communication Mode

The meter shall have a separate RS232 port for connection of MODEM to be procured separately. On procurement of GPRS MODEM the meter should be capable for remote communication. Meter should have provision of power supply of modem.

Port shall support communication on DLMS and should be accessible through a DLMS compliant HHU.

It should not be possible to alter date in the meter by-passing commands from the CMRI or Laptop. For alteration of RTC time, change of TOD timing, Billing parameters, etc. it should be possible to perform this function through CMRI but only through authenticated commands sets by BCS after scheduling for particular meter sl. nos. No alteration / change should be possible through authenticated commands sets by the BCS without scheduling the meters. Moreover, no alternation / change should be possible using CMRI only, i.e. the control has to be with the BCS.

The BCS shall have multi-level password for data protection & security.

2.5.32 Tamper Information and Logic

- Minimum two hundred (200) events (occurrence and restoration) of all types of tamper with date and time shall be available in the meter memory on first in, out basis. It shall be possible to retrieve the tamper data along with all related snap shots data through the meter's optical port with the help of CMRI and download the same to the BCS where it shall be available for viewing. All this information shall be available in simple and easily understandable format. Method of detecting and recording tamper fraud features with proper sketches and phasor diagrams should be provided by the supplier.

The tamper event recording should be rollover type for individual compartments. The latest / last tamper event should be logged and earlier should disappear in each compartment. Tamper occurrence and restoration should be counted as separate event.

No. of events for tampers shall be in the following manner:

Event Type	No of Events
METER COVER OPEN	1 Nos.
MISSING POTENTIAL	30 Nos.
CURRENT SHORT (BYPASS) & OPEN	50 Nos.

Event Type	No of Events
CURRENT UNBALANCE	25 Nos.
INFLUENCE OF HIGH MAGNETIC FIELD	25 Nos.
INFLUENCE OF SPURIOUS SIGNAL	39 Nos.
CURRENT POLARITY REVERSAL	30 Nos.

Each event shall have a separate compartment.

In case of any tamper, separate indication should be displayed on the display of meter.

2.5.33 Tamper Logic

Properly designed meter tamper logic should be provided. The tamper logic should be capable of discriminating the system abnormalities from source side and load side and it should not log/record tamper due to source side abnormalities.

There shall be minimum three separate compartments for logging of different types of tampers. Bidder under their offer should explain the logging of various tampers in each compartment.

Once one or more compartments have become full, the last tamper event pertaining to the same compartment will be entered and the earliest (first one) tamper event should disappear. Thus, in this manner each succeeding tamper event will replace the earliest recorded event, compartment wise. Events of one compartment/category should overwrite the events of their own compartment/category only.

Bidders may indicate alternate proposals for the above tamper detection and logging scheme. Tamper count should increase as per occurrence (not restoration) of tamper events. The total number of tamper counts should also be provided on the meter display as well as at the BCS end. **Due to failure or restoration of supply, no false restoration of tamper should occur.**

2.5.34 Tamper Persistence time

The tamper persistence time for logging/registration of an occurrence of a tamper should be 5 minutes +/- 10 seconds. The persistence time for logging of restoration of tamper should be immediate (less than 120 sec).

2.5.35 Sample Meter Submission

Bidders will have to submit six nos. sample meters as per the specifications along with their bid offers at the time of opening of tender for complete testing of meter as per specification. Sample meters should be submitted to Superintending Engineer (Inspection & Quality assurance), V.C.V. Gabar Singh Urja Bhawan, UPCL, Dehradun for arranging the type test from Govt. approved / NABL accredited testing laboratories (CPRI or ERDA only) and other tests at appropriate labs as per provision of technical specification for his final approval of samples. Part-II (price-bid) of those firms shall be opened whose sample meter will clear the testing.

To ensure quality of material, one meter is to be checked from CIPET, Ahemdabad for material identification (terminal block, meter cover, base and meter box).

Vendor shall have to submit pre-defined copies of all the software (meter reading software for CMRI, Base computer software for meter data analysis and technical details).

Testing will also be conducted for all tamper events and BBT.

Bidders shall provide sample meters without any identification of their name inside or outside the meters. The identification should be provided through a removable sticker fixed on the top of the meter case. If any permanent identification provided inside the meter, the sample shall not be accepted.

The necessary testing fees for outside agencies (Testing carried out other than UPCL Lab) will be borne by bidder and bidder shall have to deposit the same as per instructions of SE (I&QA), UPCL. The intimation in this regard

will be conveyed to the bidder, for which the name of the person and the contact number may please be provided along with the offer.

2.5.36 Accuracy

There shall be no drift in accuracy, during the guarantee period. In case any drift is noticed which is beyond the permissible limits, the bidder shall re-calibrate / replace by a new meter without any extra cost.

2.5.37 Hand Held Unit (HHU)

To enable local reading of meter data, a DLMS compliant HHU shall be used. It shall be compatible to the DLMS compliant energy meters that are to be procured / supplied on the basis of this specification. The HHU shall be supplied by the meter manufacturer along with the meters free of cost one for each 100 meters supplied.

2.5.38 Base Computer System & Software Requirements

- The Common Meter Reading Instrument (CMRI/Laptop) should be capable of being loaded with user-friendly software (MS-DOS 5.0 or higher version compatible) for reading / downloading meter data. Windows based Base Computer Software (BCS) should be provided for receiving data from CMRI / Laptop and downloading instructions from base computer software to CMRI / Laptop.
- The BCS should be WIN XP, WIN vista. WIN 7 pro based and copy righted.
- The data stored in the meters memory including defrauded energy should be available on the BCS.
- This BCS should have, amongst other requirements, features and facilities described later in this specification, the facility to convert meter-reading data into user definable ASCII file format so that it may be possible for the user to integrate the same with the user's billing data and process the selected data in desired manner. All the data available in the meter including energy, MD, and history data should be convertible to user defined ASCII file format for integration with third party software. The vendor should supply necessary base computer software for reading / viewing of meter data and converting to user defined ASCII files formats. The user should have the flexibility to select the parameters to be converted into ASCII file. The vendor should also supply the necessary CMRI / Laptop software (during sample testing also).
- The bidder has to supply the Meter Reading protocol (API), free of cost. The protocol should not be complicated & should be easily understandable to introduced compatibility between meters, BCS and CMRI of other makes. The bidder shall indicate the relevant standard to which the protocol complies. The compatibility of transferring data from the meter to CMRI & then to the BCS should be easily established. Any change or up-gradation of CMRI software of CMRI software or BCS in future, required for any reason, has to be done by the supplier at his own cost.
- The software should be capable of preparing CMRI to read the meter information or to reconfigure the meter for change of TOD timings and / or time setting of the meter.
- The exhaustive on-line help should be available with the software so that user can use all the features of the software by just reading the help contents.
- In BCS 12 months back-up data for kWh, kVAH, MD in kW & kVA (Total & TOD wise), Average Load Factor, Average Power Factor must be available with TOD.

2.6 Tests

2.6.1 Type Test

The offered meters should be type tested at any NABL accredited laboratory in accordance with IS 13779 with latest amendments, CBIP Report 304 with latest amendments. The detailed type test report should not be more than 3 (Three) years old. A copy of the Type Test results should be enclosed with the offer. If there is any modification in the design / parameters of the specifications or use of constituent materials in the offered meters submitted with the offer, from the meter which was submitted type tested, which may affect the characteristics as well as parameters of the meter, revised type test certificates as per the design, parameters and constituent material used in the offered meter, shall have to be submitted failing which the offer may be liable to be rejected.

Type Test Certificate from any CPRI or NABL accredited laboratory shall only be considered.

Type test certificate should contain the following information clearly:

- Class of accuracy
- Meter constant

The purchaser reserves the right to select sample from any material offered for inspection /inspected and dispatched, which will be got type tested at any NABL accredited laboratory. The results of this type-tested sample shall be applicable for the entire quantity of the particular lot offered or supplied by the supplier. The Purchaser shall bear the testing charges, if sample passes all the tests and if sample fails in any one of the tests, supplier shall have to bear testing charges, same are recoverable from the supplier's any pending bill, security deposit, Bank Guarantee or by any suitable means, whichever deem fit by the Purchaser. In case of sample failing in aforesaid type tests, supplier shall have to replace the whole lot materials, which should pass through the type tests, the re-testing charges will have to be paid by supplier. If any quantity against the particular lot is consumed by the Purchaser, the supplier will agree for any penalty/deduction in price as may be mutually agreed.

2.6.2 Acceptance Tests

a) The acceptance tests as stipulated in CBIP Report 304/ IS 13779 (with latest amendments) shall be carried out by the supplier in presence of purchaser's representative.
b) Also, the following additional acceptance tests shall be carried out on one meter randomly selected from each lot offered for inspection / acceptance testing.
   - Magnetic induction of external origin (AC & DC)
   - Tamper & Fraud protection, as per this specification.
   - Test of endurance up to 150% of Imax, for two hours, followed by verification of limits of error.
   - Verification of internal components and functional tests.
c) Dry Heat Test as per IS 13779 / 99, Clause 12.6.1, on the sample meter selected by the representative of purchaser shall be arranged by the supplier at any NABL accredited laboratory, at his cost.

In case of failure of Meters as specified in Annexure – H of IS-13779 (For A above) the entire lot will be treated as rejected. In case of failure of any single meter (in the acceptance tests as per B above) the entire lot will be rejected

2.6.3 Routine Tests

Each and every meter of the offered lot shall undergo the routine tests as well as functional tests as per IS 13779/1999, CBIP Report 304 and after sealing the meters, the manufacturers will submit the routine test report of all the meters as well as a statement showing seal Sl. Nos. against each meter Sl. No. of offered lot in soft copy (MS WORD or EXCEL format), to the purchaser, along with offer letter for acceptance test.

2.6.4 Test Facilities

The tests for equipment / instrument shall be carried out as per relevant Standards and test certificates shall be furnished for scrutiny. The Bidder shall indicate the details of the equipment available with him for carrying out the various tests as per relevant Standards.

The standard meters used for conducting tests shall be calibrated periodically at any NABL Accredited Test Laboratories and valid test certificates shall be available at works for verification by purchasers representative.

The manufacturer shall have at least the following testing facilities to ensure complete testing -

a) AC high voltage test
b) Insulation test
c) Test of no-load condition
d) Test of Starting condition
e) Test on Limits of error
f) Power loss in voltage and current circuit
g) Test of Repeatability of error
h) Test of meter constant
i) Test of magnetic influence

j) Fully automatic Test Bench

2.7 Pre-Delivery Inspection at Manufacturer's Works

a) All acceptance Tests shall be witnessed and certified by purchaser's representative at manufacturer's works. The vendor shall give at least 10 days advance intimation to the purchaser to enable them to depute their representative for witnessing the Tests. The said representative shall have full facilities for unrestricted inspection of supplier's works, raw materials, manufacturing processes and conducting necessary Tests.
b) The said representative shall verify the calibration seals provided by the calibrating agency on testing equipment/ meters.
c) Test reports of routine Tests carried out by the manufacturer shall be submitted to the inspecting authority at the time of inspection for his approval.
d) Acceptance of any quantity of materials shall in no way relieve the supplier of his responsibility for meeting all requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.
e) In case of waiver of inspection, vendor shall carry out all (i) routine and (ii) acceptance Tests and submit test reports for approval of the purchaser, before dispatch of material.
f) The entire cost of testing for acceptance & routine rests and checking of length etc shall be borne by the supplier.
g) The purchaser reserves the right to select sample from any material offered for inspection /inspected and dispatched, which will be got type tested at any NABL accredited laboratory. The results of this type-tested sample shall be applicable for the entire quantity of the particular lot offered or supplied by the supplier. The Purchaser shall bear the testing charges, if sample passes all the Tests and if sample fails in any one of the Tests, supplier shall have to bear testing charges, same are recoverable from the supplier's any pending bill, security deposit, Bank Guarantee or by any suitable means, whichever deem fit by the Purchaser. In case of sample failing in aforesaid type Tests, supplier shall have to replace the whole lot materials, which should pass through the type Tests, the re-testing charges will have to be paid by supplier. If any quantity against the particular lot is consumed by the Purchaser, the supplier will agree for any penalty/deduction in price as may be mutually agreed.

2.8 Random Sample Testing After Delivery

Purchaser shall carry out random sample testing on sample meters collected from different stores of the consignees at purchaser's testing laboratory. Scale of sampling and criteria for acceptance shall be as per CBIP Report 304 & IS 13799. Date of testing of meters will be intimated to the supplier for witnessing testing of the meters. Random sample testing will be completed within one month from the date of receipt of meters at different stores. In case the meters do not meet the acceptance criteria, the lot will be declared defective and in that event, meters supplied are to be replaced by the manufacturers free of cost including free transportation from the site to their works and back. The replaced meters shall be offered for inspection & testing.

2.8.1 Submission of Sample Meter

The bidder will submit his two nos. sample Meters in sealed casing / cartoon along with relevant Meter documents. The bidder will be given a receipt, jointly signed by the bidder and UPCL officials, mentioning the samples and papers submitted by the bidder.

While submitting the samples and required documents, the bidder has to submit two numbers of sealed meters as per the specifications stated herein before, without the welding of the meter base and cover and body screw caps.

They should also submit one prototype of meter base and cover (with body screw caps) properly welded.

The sample of the meter submitted against this NIT will be sent to any NABL accredited laboratory for Accuracy, Tamper & Acceptance tests as per the relevant standard and its amendment at supplier's cost.

2.9 Quality Assurance Plan

- The design life of the meter shall be minimum 20 years and to prove the design life the firm shall have at least the following quality Assurance Plan -
- The factory shall be completely dust proof.
- The testing rooms shall be temp. 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.
- Meter can't open / break for testing purpose, ICT facility must be available in Auto Test Bench.
- 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.
- Meter frame dimensions tolerances shall be minimum.
- The assembly of parts shall be done with the help of jigs and fixtures so that human errors are eliminated.
- The meters shall be batch tested on automatic, computerized test bench and the results shall be printed directly without any human errors.
- The Bidder shall invariably furnish the following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material
- Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials.
- Information and copies of test certificates in respect of bought out accessories.
- List of manufacturing facilities available.
- Level of automation achieved and lists of areas where manual processing exists.
- List of areas in manufacturing process, where stage inspections are normally carried out of quality control and details of such tests and inspections.
- List of testing equipment available with the bidder 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.
- The laboratory of manufacturer 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:
    I. The routine tests
    II. Acceptance tests shall be furnished with the bid.

2.10 Manufacturing Activities

- All the materials, electronics and power 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. The manufacturer should use Application Specific Integrated Circuit (ASIC) or Micro controller for metering functions.
- 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 and there shall be no drift in the accuracy of the meter at least up to 10 years. Further, the Bidder should own or have assured access (through hire, lease or sub-contract) of the mentioned facilities. The PCB material should be of glass epoxy FR-4 grade conforming to relevant standards.
- All insulating materials used in the construction of meters shall be non-hygroscopic, non-aging and tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.

2.10.1 Quality ensured

- At PCB manufacturing stage, each Company shall be subjected to bare Company testing. At insertion stage, all components should undergo testing for conforming to design parameters and orientation. Complete assembled and soldered PCB should undergo functional testing using test equipment (testing jig).
- Prior to final testing and calibration, all meters shall be subjected to accelerated ageing test to eliminate infant mortality i.e. meters are to be kept in ovens for 72 hours at 55deg Centigrade temperature & atmospheric humid condition. After 72 hours meters should work correctly. Facilities / arrangement for conducting ageing test should be available with the manufacturer.
- The calibration of meters shall be done in-house.
- The bidder should submit the list of components used in the meter along with the offer.
- 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 bidder shall also give the details of quality assurance procedures followed by him in respect of the bought-out items.
- 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.

2.11 Documentation

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.

Sets of operating manuals shall be supplied to the purchaser as per requirement. Operating manuals with each meter & one set of routine test certificates shall accompany each dispatch consignment. The acceptance test certificates in case pre-dispatch inspection or a routine test certificate in cases where inspection is waived has to be approved by the purchaser.

Executive Engineer (Stores), UPCL will be the final authority for approving the drawings submitted by the tenderer.

2.12 Guarantee

The manufacturer shall provide a guarantee of 54 months from the date of commissioning or 60 months from the date of dispatch whichever is earlier. Bidders shall guarantee to repair or replace the meters and meter boxes (if supplied), which are found to be defective/ inoperative at the time of installation, or become inoperative/ defective during guarantee period. Replacements shall be effected within 1 month from the date of intimation. If during the guarantee period, the materials are found defective or sub-standard, the same will have to be repaired/replaced free of cost by the supplier within 30 days of intimation. If the defective materials are not replaced/rectified as per above guarantee clause, the Company shall recover twice the equivalent amount from any of the bills of the supplier or from performance guarantee so deposited by the supplier.

Life of battery used for the meter should be guaranteed for 10 (ten) years.

2.13 Packing & Forwarding

The equipment shall be packed in cartons / 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. Supplier without any extra cost shall supply any material found short inside the packing cases immediately. The packing shall be done as per the standard practice as mentioned in IS 15707 2006. Each package shall clearly indicate the marking details (for e.g., manufacturer's name, Sr. Nos. of meters in the package, quantity of meter, and other details as per supply

order). However, he should ensure the packing is such that, the material should not get damaged during transit by Rail/ Road.

2.13.1 Component Specifications

The Components used for manufacture of meter should be of high quality and the bidders should confirm component specification as specified in Schedule - III.

2.14 Schedules

2.14.1 Schedule – I [Guaranteed Technical Particulars of Ac Single Phase Two Wire, L.T. Static Whole Current Energy Meter with LCD Display 10-60 A]

Table 2-6:
Guaranteed Technical Particulars of Ac Three Phase Four Wire, L.T. Static Whole Current Energy Meter with LCD Display 10-60 A

S. No.	Particular Min.	Requirement	As offered
1	Name of manufacturer		
2	Type, name & number		
3	Standard Applicable	IS 13779/1999, IS 12346 / 1988, IS 14434 / 1998, CEA regulation no. 502 / 70 / CEA / DT&D dt.17.03.06 and CBIP technical report no.88/304 with its latest amendment as on date.	
4	Type of Meter (Model No.)		
5	Rating		
	Accuracy Class	1.0	
	Rated Voltage	240V Ph to Neutral (+ 20% to - 25%)	
	Rated current	Ib- 10 Amp. Imax- 60 Amp	
	Rated frequency	50 Hz ± 5%	
	Power factor	0 lag to Unity to 0 lead	
	Minimum saturation current	Bidders to specify	
	Meter Constant (imp / kWh)	-do-	
6	Max. Continuous current rating (Amp.)	60 Amps.	
	Continuous current rating of terminals for two hours	90 Amps	
	Running with no load &(-)70% to120 % voltage	No creeping	
7	Short time over current for 10 mili seconds	30 Imax for one half cycle at rated frequency	
8	Starting current at which meter shall run & continue to run	0.2% of Ib at rated voltage and unity power factor	
9	Power loss at rated frequency & reference temperature		
	Current circuit at rated current	Less than 4 VA(Including all phases) as per IS	
	Voltage circuit at rated current	Less than 1.5W / 8VA as per IS	
10	Type of material used		
	Base	High Impact strength, non-hygroscopic, fire retardant, fire resistant, UV stabilised poly Carbonate	

S. No.	Particular Min.	Requirement	As offered
	Meter cover	High Impact strength, non-hygroscopic, fire retardant, fire resistant, UV stabilised Transparent poly carbonate	
	Terminal Block	Material High Impact strength not hygroscopic, fire retardant, fire resistant, UV stabilised poly carbonate Barrier of adequate size shall be provided between phase and neutral	
	Terminal cover	High Impact strength, non-hygroscopic, fire retardant, fire resistant, glass reinforced poly carbonate (Transparent)& non detachable with hinging arrangement	
	Screw		
	(i) Material	Tin / Nickel Plated – Brass	
	(ii) Size	Bidders to specify	
11	Internal diameter of Terminal Hole	Min. 9.5 mm	
12	Centre to Centre clearances between adjacent terminals	13 mm	
13	Transducers		
	Input	C.T provided in phase element and in the neutral. Voltage Potential divider (PT less)	
	Output	LCD	
	C.T. – no of turns	Bidders to specify	
14	Type of Register	LCD suitable for operation up to 80^0 C	
	No. of Digits	7 (integer only)	
	Size of Numerals	10 X 6 mm (minimum)	
15	Display		
	On Scroll Mode & Auto display mode	Both required	
	Type of push button	Spring loaded push button to be provided on top cover of meter to read parameters	
16	Reading on power off condition	Meter shall be able to display reading during power outage through the push button provided on the meter with facility for hands free meter reading with auto-off provisions.	
17	Battery of Real time clock	(i) It shall be Lithium-ion battery having at least 10 years of life	
		(ii) The drift in time shall not exceed +/- 3 minutes per year	
18	Fixing/sealing arrangement		
	(i) Fixing of meter	3 fixing holes (one at top & two at bottom under terminal block). The top fixing screw shall not be accessible after meter is fixed to Pilfer Proof Meter Box base.	
	(ii) Sealing of meter cover to Base	At least, two sealing provision/screws shall be provided for proper fixing of the meter cover so that access to the working part shall not be	

S. No.	Particular Min.	Requirement	As offered
		possible without breaking the seal. The meter cover should be sealed to the meter base with at least 2 nos. seal by the Manufacturer. Necessary provision shall be kept for fixing the utility seal also.	
		The meter cover shall be permanently fixed to the base by ultrasonic welding or any other technology which is equally or more efficacious so that cover cannot be opened without breaking, i.e. the meter should be break to open type. Meter should have an indication in its display if top cover is removed.	
19	Type of hinged undetectable terminal cover	Terminal cover shall be hinged.	
20	Performance of meter in tamper Conditions		
	(i) Input and output Terminals interchanged	Should work within specified Accuracy	
	(ii) Change of phase sequence	----do----	
	(iii) Absence of Neutral	----do----	
	(iv)Phase current reverse	----do----	
	(v) Indication of above tamper condition	LCD / LED indication.	
21	Suitability of meter to sustain over voltage i.e. phase to phase voltage injected between phased & neutral	Should sustain	
22	Electromagnetic compatibility (EMI / EMC severity level)	As per IS 13779 1999	
23	(i) Effect on accuracy of external electromagnetic interference of electrical discharge, external magnetic field	Should work within accuracy as per latest ISS & CBIP report -88/ 304 with latest amendment.	
24	(ii) Current reversal, Neutral disturbance & Magnetic tamper logging in memory	Meter shall log last 150 events with date and time	
25	Effect on accuracy under tamper conditions / influence conditions	Should work within accuracy specified in IS 13779 / 1999, and CBIP tech. Report 88. Error beyond +/- 4 % will not be acceptable for conditions not specified in IS 13779 / 1999 & CBIP tech. Report 88.	
26	Drift in accuracy of measurement with time	No Drift in accuracy in measurement with time	
27	Name plate details	It should cover all the details as prescribed in Clause-10	
28	Approximate weight of meter	To be indicated	
29	Type of mounting	Projection type	
30	Calibration	Meter shall be software calibrated at factory & there shall not be any mechanical form of calibration, such as, mechanical preset / trim port / potentiometer etc. so that any adjustment in	

S. No.	Particular Min.	Requirement	As offered
		calibration is not possible after freezing the meter constant.	
31	Manufacturing activity		
	(i) Mounting of components on PCB shall be SMT type	SMT type and ASIC technology	
	(ii) Compliance to assurance	To be complied	
32	Testing facility		
	Fully automatic computerized meter test bench with print out facility shall be available		
	Make and Sl. No. of Test bench	To be indicated	
	Accuracy of ESS duly calibrated	---do---	
	Whether complete testing facilities are available for carrying out acceptance tests and additional acceptance tests in house.		
33	Guarantee period of meter	5-years from the date of dispatch. Guarantee period shall be printed on the nameplate with year and month of manufacturing details	
34	BIS license		
	BIS license No. & dt. with its validity for ISI certification mark on offered meter.	To be mentioned	
	Details of meter design for which above BIS certification has been obtained -	To be mentioned	
	Ratio of Ib to Imax		
	Material of meter body		
	Type of energy registering counter		
	Type of technology (Digital/Analog)		
	Grade of printed circuit board material		
	Type of assembly of component used (SMT)		
	Meter constant (IMP / kWh)		
	Auxiliary power circuit (with PT or PT less)		
	Current circuit (CT / Shunt combination or only shunt)		
	Accuracy class		
35	ISO accreditation no. & dt. with its validity		

2.12.1 Schedule – II [Technical Deviations proposed by the bidder are as follows]

Table 2-7: Technical Deviations proposed by the bidder are as follows

S.No.	As per Technical specification	Deviation by the bidder

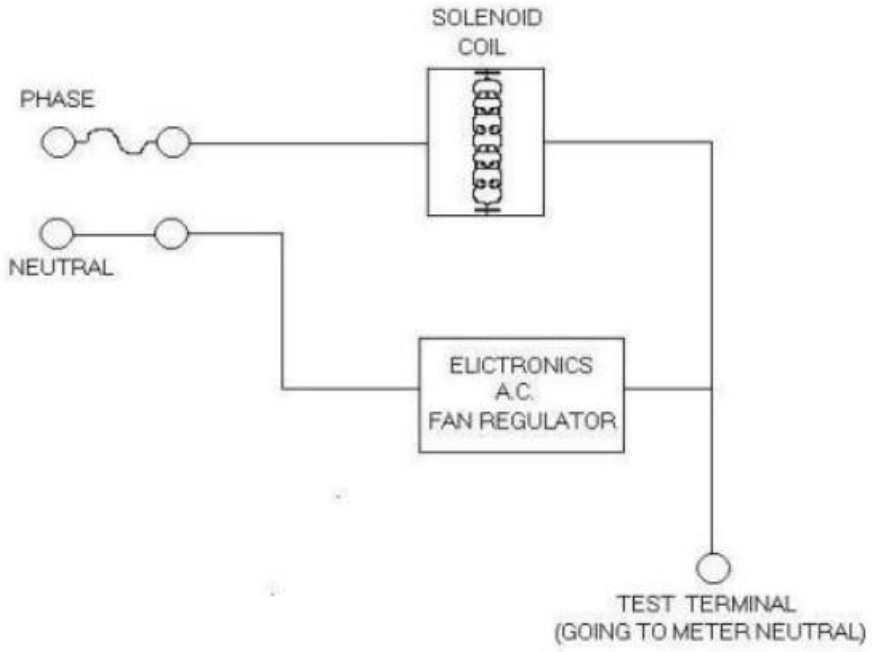
2.14.2 Schedule – III [Meter component specifications]

Table 2-8:
Meter component specifications

S. No.	Component Function / Feature	Requirement	Make / origin
1	Current Element	C.T. shall be provided in the phase element and E-beam /spot welded Shunt in the neutral with proper isolation.	Any make or origin conforming to IS-2705
2	Measurement /computing chips	The Measurement / computing chips used in the meter should be with the Surface mount type along with the ASICs.	Analog Devices, AMS, Cyrus Logic, Atmel, SAMES, EC, Texas Instruments, Phillips, Maxim, Toshiba, Renasas, Siemens, National Semiconductor, ST
3	Measurement / computing chips	The memory computing chips should not be affected by the external parameters like sparking, high voltage spikes or electrostatic discharges.	Atmel, National Semiconductors, Microchip, Texas Instruments, Phillips Hitachi, Teridian, Toshiba, Renasas
4	Display modules	The display modules should be well protected from the external UV radiations. The display should be clearly visible over an angle of at least a cone of 70o.The construction of the modules should be such that the displayed quantity should not disturbed with the life of display. The display should be TN type industrial grade with extended temperature range.	Haijing, Holtek, Bonafied Technologies, Advantek, Truly Semiconductor, Hitachi, Sony, Tianma, Fairchild Semiconductor
5	Communication Modules	Communication modules should be compatible for the RS 232 ports	National Semiconductors, Hitachi, Texas Instruments, Philips, HP, Agilent, Everlight
6	Optical port	Optical 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.	National Semiconductors, Hitachi, Texas Instruments, Siemens, Agilent, Philips, HP, Everlight
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.	As specified.
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.	Philips, Toshiba, Fairchild, Murata, Rohm, Siemens. National Semiconductors, ATMEL, Texas Instruments, Hitachi. Ligitec, OKI, EPCOS, TDK, Epson, Panasonic
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.	
10	Battery	Lithium-ion with guaranteed life of 10 years	Renata, Panasonic, Varta, Tedrium, Sanyo, National, Tadiran, Duracell, Tekcell

S. No.	Component Function / Feature	Requirement	Make / origin
11	RTC / Micro controller	The accuracy of RTC shall be as per relevant IEC / IS standards	Philips, Dallas, Atmel, Motorola, NEC, Renesas, Hitachi, Xicor, Texas Instruments, NEC, OKI, Epson, ST
12	Pilfer Proof Meter Box	Technical specification given in separate sheet	Technical specification given in separate sheet

2.14.3 Schedule-IV [Circuit diagram]



CIRCUIT DIAGRAM FOR TEST JIG TO INTRODUCE CHOPPED A.C. IN NEUTRAL

3. Technical Specification for Single Phase, Two Wire Alternating Whole Current (10-60) Amp Static Energy Meter (Category -C)

3.1 Scope

This specification covers the design, engineering, manufacture, assembly stage-testing, inspection and testing before supply of A.C. single phase two wire solid state (static) whole current electronic energy meters of accuracy class 1.0 and current rating 10-60Amps, with backlit LCD display as per requirement given in this specification. The above meters shall be supplied in a pilfer proof box (cup-board) which shall be weather proof made of poly- carbonate with flame retardant properties as per technical specification. The meter and meter box (cup-board) shall be supplied in suitable packing so as to withstand transit shock.

The meter should be single phase two wire, two elements type capable to record and display energy in kWh and demand in kW for single phase two wire A.C. loads for power factor range of Zero Lag-Unity-Zero lead, as per requirement given in this specification.

The meter shall have facility for downloading data with proper security via an optically isolated communication port. Proper data security should be available with the meters so that no data alteration of meter should be possible through the meter reading instrument.

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 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 necessary for their effective and trouble-free operation of the system for energy measurement. 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.

The offered meter shall have BIS certification i.e. the offered meters shall be ISI marked and bidder shall have to furnish the notarized ISI license as on date of bid opening.

Firm must have NABL accredited lab for acceptance tests of energy meters as per IS. Bidder must have CMMI-DEV maturity level-3 certificate for software development.

3.2 Climatic Conditions

The meters to be supplied against this specification should be suitable for satisfactory continuous operation under the following tropical conditions. Meters should be capable of maintaining required under hot, tropical and dusty climatic conditions.

Table 3-1: Climatic Conditions

S.No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-5
3	Relative humidity range (%)	10 to 100

S.No.	Particulars	Value
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

3.2.1 Tropical Treatment

The meters shall be suitably designed and treated for normal life and satisfactory operation under hot & hazardous tropical climate conditions and shall be dust and vermin proof. All the parts & surface, which are subject 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 injurious effect of excessive humidity.

3.3 Requirement

The requirement of 240V volts, 50 Hz, single phase, whole current static energy meters of accuracy class 1.0 is as under:

RATING 10-60 A

The meter shall bear BIS certification i.e. meter shall be ISI marked. The meter should comply the DLMS Protocol.

NOTE: *If any other meter protocol is defined in the technical specification then it should be considered overwritten as DLMS protocol.*

3.4 Standards Applicable

Unless otherwise specified elsewhere in this specification, the meter shall conform in all respects including performance and testing thereof to the following Indian / International Standards to be read with upto-date and latest amendments / revisions thereof.

Table 3-2Applicable Standards

S. No.	Standard No.	Title
1	IS:13779-1999 (with latest amendments)	Specification for AC static watt hour meters Class 1 & 2
2	IEC 62052–11	Electricity metering equipment (AC) – General requirements & test conditions Part 11. metering equipment
3	IEC 62053-21	Electricity Metering equipment (AC)- particular Requirements – Part – 21 Static meters for active Energy (class 1 & 2)
4	IEC 62053-61	Electricity Metering Equipment (a.c)-Particular requirement- Part- 61 -Power consumption and voltage requirements
5	IEC – 61000-4-5 (2001-04)	Electromagnetic capability, Testing and measurement Techniques, Surge immunity test
6	IEC 61358:1996	Acceptance inspection for direct connected AC static Watt hour meter for active energy (class 1 & 2)

7	IS:14772:2000	Specification for boxes for the enclosure of electrical accessories
8	CBIP, New Delhi technical Report No. 325 (revised July 1996) read with latest edition/ amendments issued till date	Specification for AC static electrical energy meters
9	IS:9000	Basic Environmental testing procedures for Electronic & Electrical items
10	IS 15959	DLMS Protocol

In case of any conflict or discrepancy the order of precedence shall be (i) IS (ii) IEC (iii) CBIP technical report-CBIP 325 (latest amendments). In case of any difference between the provisions of these standards and the provisions of this specification, the provisions contained in this specification shall prevail.

3.5 Service Conditions (Climatic Conditions)

The meters shall be suitably designed and treated for normal life and satisfactory operation under the hot and hazardous tropical climate conditions typically existing in state of Uttarakhand (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:

a) Maximum ambient air temperature : 55 deg.C
b) Maximum ambient air temperature in shade : 45 deg.C
c) Maximum temperature attainable by the meter exposed to sun. : 60 deg. C
d) Minimum ambient temperature : (-) 10 deg.C
e) Average daily ambient air temperature : 40 deg.C
f) Maximum relative humidity : 95 %
g) Number of months of tropical monsoon condition : 4 months
h) Maximum altitude above mean sea level : 3000 meters
i) Average annual rain fall : 1200 mm
j) Maximum wind pressure : 200 kg/sq.m
k) Isoceraunic level (days per year) : 40
l) Seismic level (horizontal accn.) : 0.30 g
m) Permitted noise level : 45 db

3.6 Principal Parameters

The meter shall conform to following parameters:

Table 3-3Principal Parameters

S. No.	Item	Specification
1	Type of installation	Outdoor installation (inside meter box)
2	System Voltage	240 V,-40% to +20% (phase to neutral)
3	System frequency	50 Hz ± 5%
4	No. of phases	Single phase two wire
5	System of earthing	solidly grounded
6	Resistance to surge /impulse Voltage of 1.2/50 Microsecond	10 kV peak
7	Test Voltage at 50 Hz for 1 minute 2 kV rms	
8	Meter should be able to with stand up to 480 V P-N for 15 minutes continuously	

3.7 Technical Requirements

a) **Rated voltage (Vref)** : 240 V phase to neutral (Single phase, two wire system)
b) **Rated current** : Basic current 10 A (Ib) Max. current 60A (Imax)

3.7.1 Supply System & Power Supply Variation

The supply system shall be LT 240 volts, phase to neutral, single phase two wire.

The extreme power supply variation for which an operating meter should withstand without damage and without degradation of its metrological characteristics when it is subsequently operated under its normal operating conditions shall be as follows:

Specified operating range : 0.80 to 1.1Vref

Limit range of operation : 0.60 to 1.2 Vref

The limits of error for voltage variation of + 20% to -40 % of Vref, shall be as under:

	Influence quantities	Value of current	Power factor	Limits of variation in % error
i)	Voltage variation between – 40% to +20%	Ib Ib	1 0.5 lag	0.7 1.0
ii)	10% of 3rd harmonic in current circuit	0.6 Ib 0.6Imax	UPF UPF	0.6 0.6

However, the bidder can offer meters which can withstand higher variations.

Meter shall be functional & able to register energy even if the voltage falls up to 50% of the rated voltage.

3.7.2 Power Factor Range

The meter shall be suitable for full power factor range from zero(lagging) through unity.

3.7.3 Accuracy

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

3.7.4 Power Consumption

a) **Voltage circuit**: The active and apparent power consumption in voltage circuit including the power supply of meter at reference voltage reference frequency and reference temp. shall not exceed 1.0 watt and 8 VA respectively.
b) The apparent power taken, under normal operating condition, by the current circuit at basic current, reference frequency and reference temp shall not exceed 1VA.

3.7.5 Starting Current

Meter should start registering energy at 0.2 % of Ib at UPF in main and neutral circuit.

3.7.6 Running with No – Load

When 70% and 120% of rated voltage is applied with no current flowing in current circuit, the test output of the meter shall not produce more than one pulse / count. The minimum test period for this test shall be as per clause 8.3.2 of IEC 62053-21.

3.7.7 Auxiliary Power

The meter shall draw power for working of electronic circuit from phase and neutral.

3.7.8 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) Each current circuits of 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 normal time constant) carrying 1.25 times the reference voltage, the temperature rise of the respective parts shall not exceed the value given below and above an ambient temperature of 50^0 C.
    a. Winding 50^0 C
    b. External surface of the case 15^0 C

3.8 General and Constructional Requirements

Meter shall be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. The following should be ensured:

a. Personnel safety against electric shock.
b. Personnel safety against effects of excessive temperature.
c. Protection against spread of fire.
d. Protection against penetration of solid objects, dust and water
e. Protection against fraud.
f. Prevention against pilferage.

3.8.1 Meter Case

a) Meter case (base and cover) and extended terminal block cover (ETBC) shall be made of unbreakable high-grade flame retardant & injection moulded in UV stabilized poly carbonate with minimum thickness of 2.0 mm on all sides. Meter case (base and cover) and ETBC shall be totally transparent but supplier may provide translucent /opaque meter base. In case supplier offers meter with single moulded base & cover, translucent /opaque base & cover of meters shall also be accepted. The material shall be of good dielectric strength and mechanical strength. The name plate shall be very small in size and shall preferably be transparent. It shall not obstruct the visibility of components.

b) The moulded meter case should not change in colour, Shape, size, dimensions when subjected to 200 hrs on UV test as per ASTMD 53. It should withstand 650 deg. C. glow wire test and heat defection test as per ISO 75.
c) The manufacturer shall emboss on the base and cover the name of the material they have used in an abbreviated form e.g. PCFR (to denote what they have used - flame retardant poly carbonate).
d) The meter cover shall be fixed on meter base with the help of 2 nos. internal locks so that after pressing the cover on the base the cover will be fixed and cannot be opened without breaking the internal locks.
e) The meter cover & base shall have provision of fixing a push fit seal in the pre moulded female part on the cover & base of the meter so that after fitting the push fit seal in this, the meter box and cover cannot be opened. This arrangement shall be provided in 2 points, one at left side and one on right side.
f) Supplier may provide meters with internal locking arrangement through unidirectional screws or endless rivets and provision of two nos. of push fit polycarbonate seals on left side & right side of meter base & cover, however supplier shall ensure that it is not possible to lift the meter cover from the meter base at all without breaking cover. Although meters with arrangement as mentioned at 'e' shall be preferred.
g) Meter base and cover should be made in a single mould or the meter shall be seamlessly ultrasonically welded. The seamless ultrasonic welding of meter case shall be such that if in case of any attempt to open the meter cover from base, there should be a clearly visible evidence of opening / tampering of meter case.
h) The meter case of the sample meters to be furnished after opening of Part-I by the successful bidders only, should be as per above and at the time of sample testing, it shall be opened to ascertain conformity of seamless ultrasonic welding as per specification.
i) The meter case shall have the following properties of plastic material:

Table 3-4 Properties of Plastic Material

S. No.	Property	Units	Value	Standards
1.	Physical water absorption	%	Max. 0.35	ASTMD 570/ IS:5133(part 2) :1969
2.	Electrical Dielectric strength at 90 deg. C. in oil.	KV/ MM	Min 16	ASTMD 149
3	Thermal HDT	Deg.C	Min. 125	ASTMD 648/ ISO 75
4.	Flammability a) Rating b) Glow wire test 650^0 C		FV 2 Passes	UL94/ IS:11000(part 2-sec-1) IEC-60695-2-1-12 & IS:11000-2-1
5.	Mechanical			
	a) Tensile strength	MPa	Min. 50	ISO 527 / any equivalent standard
	b) Flexural strength	MPa	Min. 90	ISO 178 / any equivalent standard
	c) Modulus of Elasticity	MPa	Min. 2000	ISO 178 / any equivalent standard
	d) Izod impact strength notched 23 ^{0} C	KJ/Sq.M	Min. 8	ISO 180/1A or any equivalent standard

3.8.1.1 *Meter Box:*

a) Meter box shall be made of transparent polycarbonate material. It shall be weather proof, capable of withstanding temperature of boiling water for 5 minutes continuously without distortion or softening. It shall withstand glow wire test at 650^0 C as per IS: 1100. HDT of polycarbonate material shall be 120^0 C at 1.8MPaoC.
b) Minimum thickness of box shall 2.0 mm from all sides.
c) The meter box shall have tapering down roof for easy flow of rain water.

d) Groove shall be provided by the firm in the meter box cover at the place of optical port for taking reading through MRI without opening the meter box cover.
e) Meter box shall be totally transparent (top & bottom) press fit type with non detachable (4 nos.) push fit arrangement which shall be an integral part of meter box and cannot be detached from the base without breakage along with specially designed molded polycarbonate tamper proof transparent seals at two points from the front side with serial no, company logo & purchase name.
f) The size of meter box (length, breadth and height) shall be such that there should be a minimum of 10 mm clearance on all sides from the meter sides except the bottom side which should be minimum 60 mm from the lower edge of terminal block and 10 mm clearance on front and 10mm clearance from back of the meter.
g) The cover shall be made overlapping type having collars on all four sides. The box shall be provided with semicircular / circular gasket of sufficient size to completely fit in the grooves of the base. The gasket should be made of neoprene rubber. The base of the meter box must have a groove to hold the gasket and the overlap of the top cover with the base must be minimum 6 mm (with gasket).
h) It should be possible to access the push button of the meter without opening the main meter box cover and suitable arrangement for access to meter push button shall be provided.
There should be no internal elevation of excess plastic wall of window of meter box as it is hampering the meter reading process.
i) A general arrangement for fixing the meter shall be made inside the box. The design of the meter box will be such as to facilitate easy wiring and terminals should be easily approachable. Soft rubber gasket for protection from ingress of dust and moisture shall be provided on all around cover. The meter box shall have minimum 3 Nos. holes of 6mm dia for fixing the meter box on wall / wooden board.
j) The manufacturer shall emboss or fix a sticker on the base and cover the name of the material they have used in an abbreviated form e.g. PCFR (to denote what they have used - flame retardant poly carbonate).
k) On front side of meter box there should be provision of purchaser's name embossed or printed on a good quality sticker placed on inside of the box.
For every 1000 Nos. meters with meter box, 5 Nos. spare meter boxes shall be provided by the supplier free of cost for replacement purpose, etc.

3.8.1.2 *Test for Meter Case (Base & Cover) & Meter Box*

The following tests complying with IS: 14772:2000 (with latest amendment) are to be conducted on the meter case (base & cover) & meter box at any independent NABL accredited laboratory and test reports shall be submitted to Superintending Engineer (I&QA), UPCL within 15 days from the date of order.

a) Test of material identification
b) Test for mechanical strength
c) Test for water absorption
d) Test for stability at high temperature
e) Test for withstanding temperature boiling water for 5 minutes continuously for non- distortion or softening of material.
f) Glow wire test at 650^0 C as per IS :11000

3.8.2 Terminal Block, Terminal and Extended Terminal Block Cover

a) The terminal block shall be moulded type made of non-hygroscopic, flame-retardant material having good dielectric and mechanical strength, 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 moulded terminal block shall be made from best quality material conforming to IS: 13779-1999 (latest amended) having adequate insulating properties.
   i. The material should be corrosion resistant, inert to chemicals, oxidizing agents, petro-chemical products, acids, salts and ultraviolet radiation.

ii. 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.
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.

The terminal block should satisfy all the conditions specified in IS: 13779 and IEC 62052 - 11. The material of the terminal block should fulfill the requirement of following tests:

1. The flame-retardant rating of V0 as per UL 94 testing.
2. The glow wire test for temperature of 960^0 C as per IS: 11000 (Part-2/Sec.1) or IEC 60695-2-1.
3. Heat deflection temperature (HDT) test of 135^0 C. as per ISO 75 or ASTM D-648
4. Ball pressure test at 125^0 C as per IEC 60335-1.

b) The base of the meter should extend to enclose the three sides (back and two sides) of the terminal block.
c) The current circuit conductors of the meter shall be connected to its current terminals from inside the meter terminal block adopting procedure prescribed in either B-1 or B-2 of the recommended methods under IS:13779. Any other method which meets these requirements in a better manner/way shall also be considered. The bidder should elaborate the arrangement adopted.
d) 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% Imax. Current and made of electroplated (or tinned) brass. Any other provision which meets this in a better manner / way shall also be considered. The bidder should elaborate the provision adopted.
e) 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 shall be provided in each incoming and outgoing terminal 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.
f) The internal diameter of the terminal holes should be minimum 5.5 mm and shall be capable of carrying continuous current up to 150% of Imax. The holes in the insulation 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.
g) The voltage circuit and the 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 circuit.
h) 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.
i) The meter shall be supplied with extended terminal block cover (ETBC). The ETBC shall be extended by minimum 25mm below the terminal block.

To facilitate separate sealing, a raised support arrangement or a slot type arrangement with 2mm hole, which shall constitute an integral part of ETBC cover shall be provided.

The terminal cover of the meter should be fixed to the terminal block in such a way that it should not be possible to open the terminal cover once in locked position after installation without breaking the terminal cover or leaving visible evidence of tampering.

The seal shall be placed in the meter box at specified place (not in loose condition) for providing sealing at site, after installation.

The ETBC shall be designed such that the meter's internal parts are not accessible for tampering without breaking the seal(s). Suitable barriers in moulding shall be provided such that direct access to incoming/outgoing terminals is not possible through gaps left in cable entry holes after insertion of main/load side cables.

The terminal cover shall be engraved/screen printed with logo of manufacturer and purchaser (if possible).

The alignment of incoming cable terminals on meter terminal block should be such that it is not directly in-line with the cable hole/gland on the meter box body, so that there is no chance of inserting any wire/cable from the gland hole directly to the incoming terminal on the TB to avoid probability of theft by making direct connection. If the holes for incoming and outgoing cables are provided on the sides of meter box then the same shall also be acceptable.

The terminal cover shall be provided with one colored polycarbonate tamper proof seal with suitable interlocking arrangement. The seal shall be embossed /indelibly marked or laser etched with serial number & logo of manufacturer with name, UPCL visible from front. Provision for seal should be made at one point from the front side of the meter terminal cover. The meter terminal cover shall be rendered inaccessible after the terminal cover press fit with base & sealed. The seal shall be placed in the meter at specified place (not in loose condition) to ensure sealing at site after meter installation.

3.8.3 Display Parameters and Type Of Display

a) The meter should have bright LCD electronic display with backlit of white/green/purple screen with black digit having minimum description of parameters (e.g. words like kWh, kW, BP Values etc) / character height X width of 8mm X 4mm or higher in auto scroll mode. The meter should have 6 digits display for reading/ measuring parameters apart from liquid display.

   By default the meter shall continuously display only Real time, date, whole digit active cumulative forward energy (kWh) & maximum demand (kW) without decimal point with 30 minutes integration of the current month with date & time. However, in Push button mode, all parameters shall be displayed. The LCD shall be of STN (Super Tested Pneumatics) type, construction suitable for temperature withstand of 80 deg. C (storage) and 65 deg. C (operation). The LCD Display should have a wide viewing angle of 45 deg to 60 deg cone, up to one meter distance.

   Meter data shall not be lost in the event of power failure. The meter shall keep the energy and maximum demands recorded in its non-volatile memory independent of battery backup, so that in the event of power failure / damage of the meter the last reading of such billing quantities should not be lost.

   The display shall not be affected by electrical & Mechanical disturbances. The Non-volatile Memory (NVM) shall have a minimum retention time of 10 years under un-powered condition i.e. the NVM shall have a storage life (without use) of 10 years. The battery back up memory will not be considered as NVM.

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

For clear visibility of the display of the meter reading at a distance, large viewing area with large display icons is preferred.

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

When the meter is placed in oven at a constant temperature of 65 º C for period of 30 minutes, the character of LCD should not deform.

After keeping the meter at a constant temperature of 80 º C for period of 30 minutes and when restored at normal temperature, the LCD should work satisfactorily.

b) The display of various parameters shall be scrolling one after another. The meter shall be capable to measure & display continuously 'Active energy kWh' at all the loads & power factors i.e. Zero lag – Unity – zero lead. The meter should also have provision for Automatic recording of cumulative kWh at 24.00 Hrs on the last day of the month for each calendar month & the same should go to memory.

c) Display Sequence: The meter shall display the required parameters in two different modes as follows:

AUTO SCROLL DISPLAY

Meter shall be capable of displaying the following parameters. The display of various parameters shall be continuously scrolling one after another. The display shall have "ON" time of at least 10 sec. for each measured values for auto display cycling.

i. Meter Serial Number
ii. Date
iii. Real Time
iv. Active cumulative forward energy (kWh) and Apparent Energy (kVAh)
v. Maximum demand (kW) with 30 minutes integration of the current month with date & time.

PUSH BUTTON DISPLAY

The following parameters shall be displayed, one after other, with press of push button each time. The display shall have on time of approx 10 seconds for each measured values.

i. LCD Segment Check
ii. 6 digit Sr. No. of meter (Manufacturer)
iii. Date
iv. Time.
v. Current cumulative Active (forwarded) Energy (kWh)
vi. Maximum demand kW of last month
vii. Cumulative Active Energy (kWh) and apparent energy (kVAh) for each calendar month for previous six months
viii. Instantaneous load in watt
ix. Instantaneous Power Factor
x. Instantaneous Voltage
xi. Instantaneous Current
xii. Instantaneous Frequency
xiii. Cumulative Maximum Demand reading of 24:00 hrs of last day of month.

Note:

i. DOT matrix type LCD shall not be accepted.
ii. The LCD display of the meter should be backlit. The back lit should not glow during power off condition.
iii. The RTC accuracy should be as per CBIP report. Provision to set RTC through HHT/CMRI/communication should be provided.

DISPLAY IN LIGHTNING

Since Uttarakhand is highly prone to lightning, the meter shall be designed & manufactured in such a way that the display & working of the meter shall remain perfect even in case of lightening surges.

d) LCD least count

Even though the display shall be without decimal digit in push button mode and in auto scroll mode, the internal least count of energy recording shall not be more than 0.01kWh. Hence, every 0.01 kWh consumption will be internally stored. Also, there be no loss of energy registration on account of frequent power outages due to high startup time of the meter.

To verify this, meter shall be switched off after pulses equal to 0.01 kWH are generated. This process shall be repeat 100 times; the kWH reading should increase by 1.0. This shall be verified during inspection of meter.

e) Meter reading at power outage

Provision to read the meter in no power condition shall be made. In case of power failure Auto mode shall not function. The same push button shall be used for displaying the Real time, date, whole digit active cumulative forward energy (kWh) & maximum demand (kW) without decimal point with 30 minutes integration of the current month with date & time shall be displayed. In case of power failure data downloading for Historical energy, maximum demand & all the tamper events through CMRI (common meter reading instrument) shall be possible. The battery life shall be 10 years. To verify that the sample meters are not having chargeable capacitor, the samples will be kept in power off conditions for 48 hours and then meters will be checked by pressing the push button and the CMRI shall be done.

In any case, RTC Battery Power shall not be used for display under Power off condition. During power failure, the reading should be taken only after pressing of push button.

f) Maximum Demand registration and MD resets

The automatic MD reset shall be performed at the end of every month i.e. 00.00 hours of first day of the month. It shall be possible to change the automatic MD reset date and time through optical even after installation of meter with special software and password protection.

Last twelve months MD values with date and time stamp shall be stored in the memory. These

data including the last twelve month's cumulative kWH readings, tamper information along with meter serial number shall be possible to read by downloading through optical port on CMRI or laptop computers. Meter should also maintain the history of last 65 days of energy consumption (kWH & MD) at 24:00 hours of each day & this should be downloadable through CMRI.

"The meter shall also provide half hourly load survey for kWh for the last 65 days."

NOTE: 1. The MD should be in kW on display and in kVA and kW in MRI report.

3.8.4 Output Device

The meter shall have a test output device in the form of calibration LED of red colour and minimum intensity 10 mCD (mili-Candela) accessible from the front and shall be capable of being monitored conveniently with suitable testing equipment while in operation at site. The location of calibration LED should be such that the calibration pulses can be sensed easily through the sensor.

The relation between test output and the indication on display shall comply with the marking on the name plate (impulse per kwh).

The bidder shall state the necessary number of pulse count(s) to ensure measurement accuracy of at least 1/10th of class of the meter at the different test points.

The resolution of the test output pulse(s) should be sufficient to enable conduction of the starting current in less than 10 minutes and accuracy test at the lowest load with desired accuracy within 5 minutes.

3.8.5 Communication Capability (Through Optical Port):

The meter shall have provision of optical port on the front side of meter to transfer the data locally through CMRI and shall be capable of being hooked to a remote metering device such as modem, etc. for future to enable Automatic meter reading. Bidder shall prove communication of Modem with their meter in front of samples testing team.

Software required for CMRI and meter reading protocols shall be supplied by the supplier free of cost. The meter reading software provided shall be GUI based, user friendly and menu driven on window-based operating system. Free of cost training for the use of software shall also be provided by the supplier.

The software should have polling feature with optional selection of parameters to be downloaded for AMR application. The software should have programmable facility to restrict the access to the information recorded at different security levels.

The supplier shall provide API (application program interface)/protocol of the meter in CD form for AMR purpose to UPCL along with the supply.

3.8.6 Real Time Clock & Calendar:

The meter should have real time clock (RTC), which can be synchronized remotely with the utility's system clock through configuration software. In case of meter connected to AMR system through GSM/GPRS/PLCC modem, the meter should be able to synchronize its clock with the system time. Battery used for meter display during power off condition shall be separate from the battery used for real time clock. This shall be verified by removing the display battery and verifying that the power down display is inactive and RTC has accurate time after reconnecting the battery after 1minute or more of its removal.

3.8.7 Tamper and Fraud Protection

The meter should have tamper and fraud protection features to prevent / defect common ways of tamper and fraud. Meter shall continue to register active energy accurately under the following conditions.

a) Reversal of line & load terminals: On reversal (interchange) of input (line) and output (load) terminals – the reverse indication in the form of LCD icon.
b) Interchanging of phase & neutral: On reversal (interchange) of phase and neutral at the mains or incoming supply side of meter terminals the meter shall record energy accurately so that consumption of power will be positive. However, when load & supply side of meter is interchanged then computation of power shall be reverse & meter shall display Reverse icon.
c) Drawing of current through local earth: Using earth in place of neutral (i.e. when load is not terminated back to the meter and instead current is drawn partially or fully through a local earth) irrespective of the phase and neutral connections to the meter. The earth indication in the form of LCD icon.
d) Neutral Missing should be available.
e) Influence of high magnetic field: The meter accuracy or accuracy display under normal conditions shall not be affected by placement of an external magnetic field (0.5 tesla (DC) and 0.2 tesla (AC)) permanent magnet i.e. it should comply the standards in CBIP 325 (latest amendments), size minimum 70x70x50mm of 0.5 Tesla ±5% anywhere on the surface of the meter without meter box. The magnetic test shall be conducted on both phase & neutral circuit & the meter shall start recording energy at Imax within 20 sec. of application of such magnetic field. The meter shall comply the standards in CBIP 325 (latest amendments).
f) When the neutral from both incoming & outgoing side are disconnected and the load is taken through earth, the threshold value for recording of energy under tamper condition using earth in place of neutral shall in no case be more than 1A. This is to be provided through battery. The accuracy of the meter shall be tested at

various load points from 2A to 60A (Imax) and accuracy of meter shall be within ±3%. The energy recording shall also be verified at 2A by running the meter for 1kWH and switching the meter ON & OFF to verify that the meter records energy.

g) Influence of DC signal: The meter should record energy as per voltage measured between incoming phase and neutral terminals when DC signal is injected on the neutral terminal of the meter through Diode. The test in this condition will be carried out at Vref. applied to incoming phase & input terminal of diode. The circuit diagram for DC injection test(s) is enclosed.

h) The meter shall be capable to store tampered kWH values under three different condition i.e. load reversal, earthed (full or partial) and neutral loss, in three separate registers apart from being added into the cumulative register.

i) Any combination of the conditions described above under (a), (b) & (c)

j) The threshold values for different tamper features shall be as under:
   a. The starting current of main measuring element (between 1 & 4) shall be 0.2% Ib.
   b. The Starting Current of neutral element (between 2&3) shall not exceed 0.2% of Ib.

k) **NEUTRAL TAMPERING:**

The meter shall record energy proportional to the current and 240 V when any of the temper circuits enclosed as annexure 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 from 70% of rated voltage to rated voltage. The meters shall record in positive variation. The meter should be immune to such neutral disturbances.

The threshold value for this tamper should be less than equal to 210V. In case phase current & neutral current are equal, then this tamper should not occur even if voltage drops below 210 V.

For circuit No. 4: Timer switch circuit should be tested at values Pon=5.0 sec, Poff=1.0 sec. Manufacturer should state Threshold values and occurrence and restoration timing in the tender offer against all the four circuit tampers enclosed.

NOTE:

i. The Tamper should be designed in below mentioned 5 compartments:
   a. Current Tamper minimum 80 Nos.
   b. Voltage Tamper minimum 40 Nos.
   c. Other Tamper minimum 40 Nos.
   d. Cover Open Tamper 1 No.
   e. Power Failure Tamper minimum 40 Nos.

   These five Tamper Compartment should cover all the tamper mentioned in the technical specifications.

ii. OBIS Code for Current reversal should be as per manufacturer specific but the manufacturer should mention the OBIS code in the GTP of the meter.

l) **APPLICATION OF ABNORMAL VOLTAGE / FREQUENCY**:

The accuracy of the meter should not be affected with the application of abnormal voltage/frequency generating device such as spark discharge of approximately 35kV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:
   a. On any of the phases or neutral terminals
   b. On any connecting wires of the meter
   c. Voltage discharge with 0-10 mm spark gap
   d. At any place in load circuit
   e. Spark on meter body

The accuracy of meter shall be checked before and after the application of above device(s) with site conditions. Protection from spark plug / abnormal frequency should be available

m) **Ferrite beads should be used for protection from EMI**.

The bidder should furnish the details as to how their meter is able to detect/protect the above tampers and fraud with sketches and phasor diagrams wherever necessary. If bidder has any better proposal for temper logic, the same may be submitted along with the offer for purchaser's consideration. Additional features if any in their meter may also be clearly indicated.

Sketches for aforesaid tamper conditions are enclosed.

n) In the MRI report of meter the tamper occurrence shall be available with date & time on FIFO basis. FIFO shall apply compartment wise

o) Meter cover open event should be available and in case the top cover of meter is opened by any means then "COVER OPEN"/message/prominent indication should be continuously displayed on the screen & reading can be taken only through MRI/ push button. The date & time of the event should be logged in the memory and the same should be available in the MRI report.

p) Apart from above mentioned tampers, meter shall be immune to the low frequency low voltage device (Jammer).

q) The software shall record minimum 200 Nos. tamper events including magnetic events.

3.8.8 Sealing Arrangement Of The Meter

The meter cover shall be permanently seamlessly ultrasonically welded to the meter base and push fitted. It shall not be possible to open the meter cover without permanently damaging the meter cover or base, easily visible from the front. In order to make the ultrasonically welded meter base with cover fool proof from tampering, option for at least one number of push-fit moulded seals shall be provided on the meter case-cover boundary as below:

The meter shall be sealed with one no. of specially designed and moulded coloured polycarbonate tamper proof seals, to be inserted on one side of meter case, with internal locking arrangement embossed or indelibly marked or laser etched with serial number and UPCL and manufacturer logo visible from the front and matching with the serial number of the meter or firm shall provide seal tracking software. The seals shall become unserviceable and irreplaceable in case of any attempt to tamper the meter.
screws or endless rivets and provision of two nos. of push fit polycarbonate seals on left side & right side of meter base & cover, however supplier shall ensure that it is not possible to lift the meter cover from the meter base at all without breaking cover. Although meters with arrangement as mentioned at 7.1 'e' shall be preferred.
Additionally, at least One sealing hole shall be provided on meter case suitable for inserting sealing wire of min. 2mm dia.

3.8.9 Fixing Arrangement of Meter

The meter shall be fitted to the base of the Meter box through 3 No. screws or meter shall be fitted with one no. mounting screw provided on ETBC.

3.8.10 Marking of Meter

The meter terminal marking and mounting arrangement should be as per Indian installation practices. The marking on every meter shall be in accordance with IS:13779/IEC 62052-11.

Every meter shall have name plate beneath the meter cover window portion such that the name plate cannot be accessed without opening the meter cover. The marking on the name plate shall be indelible, distinct and readable from outside the meter housed inside the box. The name plate marking should not fade or otherwise be adversely affected by UV exposure with lapse of time. The basic markings on the meter name plate shall be as follows:

a) Manufacturer's name or trade mark and place of manufacture
b) Designation of type
c) Number of phases and wires for which the meter is suitable
d) Serial number
e) Month and year of manufacture
f) Reference voltage, frequency
g) Basic current and rated maximum current in Amps
h) Principal unit(s) of measurement
i) Meter constant (imp/ kwh)
j) Class index of meter
k) Property of "UPCL"
l) Purchaser's order Number & date
m) Guarantee period - 5 years
n) Bar Coding of serial number, month & year of manufacture of the meter

o) Sign of insulation
p) Seamless Ultrasonic Welded (not required in single mould of meter base and cover)
q) ISI mark with license number

3.8.11 Connection Diagram and Terminal Markings

The connection diagram of the meter shall be clearly shown on the meter name plate and shall be of permanent nature. Alternatively, connection diagram can be permanently engraved on the inside portion of terminal cover. Further to this, terminal marking i.e. M1, L1 etc. should be clearly embossed on terminal block which is visible from distantly.

3.9 Salient Features

The meter shall have following additional salient features:

a) 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. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.
b) Even if phase to phase voltage i.e. 480 volts is supplied for 15 minutes between phase and neutral of the meter, the meter should not get damaged and continue to record correctly within class 1 accuracy after restoration of normal supply.
c) The meter should not saturate up to 900% Ib and should record energy accurately for P.F. range 0 lag – unity - 0 lead.
d) The meter should not have any form of mechanical adjustments such as trim-pots potentiometer etc. for calibration. The meter shall be tested, calibrated and sealed at manufacturer's works before dispatch. Further, no modification of calibration shall be possible at site by any means what so ever. The meter shall be software calibrated. All-important data such as calibration data, billing parameters and cumulative kWH should be stored in internal NVM to the main processing circuit and it should not be possible to change it through standard serial communication.
e) The short-time over current rating shall be 30 Imax for one half cycle at rated frequency as per clause No. 9.2.3 of IS:13779/ Clause 7.2 of IEC 62053-21
f) The meter shall withstand impulse voltage test at the rated impulse voltage of 10 KV (for meters of protective class-II) as per clause 7.3.2 of IEC 62052-11:2003.
g) Single LED shall be provided for test output pulse (Impulse / kWh-Red). For other conditions such as phase reversal and earth, icon shall be provided on LCD display.
h) The meter shall be provided with CT/Shunt in main circuit as well as in neutral circuit.
i) The location of calibration LED (preferably at the center) should be such that the calibration pulses can be sensed easily through the sensor.
j) READING FACILITY AT POWER SUPPLY FAILURE:
In case of absence of power supply, the meter should be capable to display the measured quantities by pressing push button only or can read through Common meter reading instrument (CMRI) with the help of internal battery. The battery used for RTC shall not be used for this purpose. Life of the battery should be at least 10 years.
k) The meter shall be integrated with two current sensors to measure the load currents. Main current sensor shall be provided between the phase terminals (supply & load) and the neutral sensor shall be provided between the neutral terminals (supply & load) of the meter. The meter should also be capable to correctly record the energy within the accuracy class 1.0 for current flowing through its neutral sensor, for entire range of current and power factors, as applicable and specified in national / international standards. In addition, same rating & type of meter shall be tested for its neutral sensor, for all tests as specified in applicable IS 13779 / IEC 61036 including the starting current test as specified in this specification.
l) Meter should have facility for reading through push button only and complete data can be fetched through optical port from outside the box even in case of power OFF condition. This facility shall be provided by

powering the meter through a separate internal long life (upto 10 years) battery (primary battery) and this battery shall not damage the meter during prolong idle storage of meter.

3.10 General

a) All electrically live screws shall be of brass/ nickel tin plated. All other screws shall be electro plated.
b) The meter shall draw power for its working through phase and neutral.
c) The terminal inserts shall be of heavily tinned brass.
d) The meter shall conform to the degree of protection IP 51 of IS:12063/ IEC 62052-11 clause 5.9 for protection against ingress of dust, moisture and vermin.
e) There should not be any creepage in the meter even at 120% & 70 % of supply voltage.
f) The meter should be free from jumps during sudden switching of heavy loads / or transient voltage spikes.
g) Meter shall display direct reading and without multiplying factor.

3.11 Electromagnetic Compatibility And Interference Requirement

The meter shall meet EMI/EMC requirements as specified in the relevant standards described in clause 2.0 of this specification and shall also be protected against radiated interference from either magnetic or radio frequency sources.

The offered whole current meter shall also withstand DC Immunity test as per relevant standard so as to ensure that the meter current circuits do not saturate on passage of direct current.

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

The disturbance(s)/discharge(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.

3.12 Manufacturing Activities

1. All the materials, electronics and power 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.
2. The manufacturer should use application specific integrated circuit ASIC or Micro controller for metering functions.
3. 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.
4. The electronic components used in the meter shall be of high quality and there shall be no drift in the accuracy of the meter at least upto 10 years. Further, the Bidder should own or have exclusive access (through hire, lease or sub-contract) of the afore-mentioned facilities.
   Adequate documents regarding exclusive hire or exclusive lease shall be made available. In case of sub-contract, it shall be ensured that the sub-contractor is not carrying out sub-contracting for any other bidder in the above tender. The bidder shall indicate with the name and location of such facility alongwith an undertaking and certificate from the utility and any ambiguity on such a confirmation shall result in immediate disqualification of the bidder.

The above shall be verified during works inspection or material inspection also and if any ambiguity is found, it shall be considered as a breach of contract by the successful bidder.
Bidders without in-house design, development and manufacturing facility as above or who are buying populated PCBs will not be considered as meter manufacturers.
The PCB material should be of glass epoxy FR-4 grade conforming to relevant standards.

5. All insulating materials used in the construction of meters shall be non-hygroscopic, non-aging and of tested quality. All parts which are likely to develop correction shall be effectively protected against correction by providing suitable protective coating.
6. Quality should be ensured at the following stages:
    a. At PCB manufacturing stage, each board must 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 zig).
    d. Prior to final testing and calibration, all meters shall be subjected to accelerated ageing test to eliminate infant mortality.
7. The calibration of meters shall be done in-house.
8. A detailed list of bought-out items and list of components which are used in the manufacturing of the meter should be furnished indicating the name of firms which are to be selected from Annexure-II (Make of the components for bidder).
9. 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(s) may also be furnished.

3.13 Type Test

a) The type test certificates for all tests as per IS:13779-1999/relevant IEC standard (latest amendments) will be furnished along with tender. Type test certificates from any one of the standard laboratories such as NPL/ERTL/CPRI/ERDA (NABL accredited for particular equipment/ test) shall only be considered.
b) Type test certificates from educational institute(s) will not be accepted. The type test certificates shall not be more than 24 months (2 years) old from the date of bid opening.
c) Additional Type Test:

In addition to the test mentioned at (a) above, supplier shall have to furnish the following type test reports:

a. DC influence test as per IS: 13779-1999 or IEC 62053-21, in phase circuit.
b. The test of influence of supply voltage shall be carried out as per clause no. 12.7.2.1 of IS:13779/1999, except the interruption time should be variable from 10 mili. Sec. to 5 sec.
c. Test of voltage variation as per this specification.
d. The meter shall withstand impulse voltage test at the rated impulse voltage of 10 KV (for meters of protective class-II) as per clause 7.3.2 of IEC 62052-11:2003.

The type test certificates of the above additional tests shall also be submitted along with the bid.

The following information should be clearly mentioned in the type test reports:

a. Type of Display i.e. whether counter type or LCD display.
b. Details of Shunts / CT used in main and neutral circuit.
c. Accuracy at different loads and PF for both main and neutral circuit separately

3.14 Guaranteed Technical Particulars

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

3.15 Inspection and Testing

a) All Acceptance tests as laid down in the ISS/IEC and this specification shall be carried out.
b) Following tests shall also be carried out as Acceptance tests by adopting methods specified in ISS:13779/ISO:9000/ as per relevant IEC standard / CBIP 325 (latest amendments)

- AC voltage test.
- Test of meter constant
- Tests of limits of error clause. 11.11 of IS:13779 at 400 % Ib, 600% Ib and 800 % Ib at pf 0.5 lag,
- 0.8 lead & unity.
- Vibration Test
- Shock Test
- Vibration & shock test shall be carried out as acceptance test by adopting procedure laid down in ISS: 13010/1990 and its latest amendments.
- Voltage variation test as per this specification.
- Test of no load condition at 70% and 120 % of rated voltage. The minimum test period shall be as per clause 8.3.2 of IEC 62053-21.
- Test of DC components in AC circuits - The limits of variation in percentage error shall be 3.0% for class 1 meter at Imax/root2 and UPF, as per Annexure-D of IS:13779.
- Diode injection test as per clause 7.7 of this specification.
- Accuracy test under following anti tamper conditions:
    (a) Phase neutral interchanged
    (b) Ph-neutral normally connected and load earthed Phase neutral interchanged and load earthed Supply and load side interchanged and load earthed
    (c) Supply and load side interchanged and reversed and load earthed Normal connection with partial earth load
    (d) Neutral Disconnected at both sides
    (e) (The single line connections diagram of different tamper conditions are enclosed with the specification).
- Test of MRCT on both elements in case of tamper features as per cl. 7.7 of this specification.
- Permanent magnet test (as specified in Clause 7.7e of this specification). Separate battery for Display and RTC shall also be verified as per clause 7.6 of this specification
- The 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.
- The accuracy of the meter shall be checked & it should not be affected with the application of abnormal voltage/frequency generating device such as spark discharge of approximately 35 KV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:
    (a) On any of the phases or neutral terminals
    (b) On any connecting wires of the meter
    (c) Voltage discharge with 0-10 mm spark gap
    (d) At any place in load circuit

The accuracy of meter shall be checked before and after the application of above device(s) with site conditions.

- When the meter is placed in oven at a constant temperature of 65º C for period of 120 minutes, the character of LCD should not deform. After keeping the meter at a constant temperature of 80 ºC for period of 120 minutes and when restored at normal temperature, the LCD should work satisfactorily.

- Number of samples for test from each lot shall be selected as per provision of IS. The criteria for selection of No. of samples and for acceptance of lot will be as under:

(a) The sampling plan shall be as per IS: 13779 with maximum lot size of 5,000 Nos. meters for quantity offered for Inspection. The sub-lot size shall be taken accordingly i.e. either 5,000 Nos. or less as applicable on quantity offered for inspection.
32 Samples shall be selected at random from the each sub lot of meters and acceptance test as per relevant standards and additional acceptance tests as per technical specification as listed above shall be carried out on these samples.
If the quantity offered is 5,000 Nos. or less than 5,000 Nos. but in both case 32 samples shall be randomly selected. If the quantity offered is more than 5,000 Nos. then 32 samples shall be randomly selected for each sub lot of meters. For example, if offered quantity is 12000 Nos. then 32 samples shall be selected from each sub lot as mentioned below:

1. From Ist sub lot of 5000 Nos. meters– 32 samples
2. From IInd sub lot of 5000 Nos. meters – 32 samples
3. From sub lot of remaining 2000 Nos. meters – 32 samples

The samples should be selected on random basis and they should be selected in such a way that they represent the entire lot of meters offered for inspection.

(b) Following procedure shall be adopted to clear the tested lot:
A sample of 32 meters selected from sub lot of 5000 Nos. meters shall be tested for tests mentioned above. Any meter failing in any one of these tests shall be considered defective. If the number of defectives found in the sample is less than or equal to 1, the lot shall be considered to be conforming to these tests. If the number of defectives is greater than or equal to 4, the lot shall be considered as not conforming to these tests. If the number of defectives is between 1 and 4 i.e. either 2 or 3, a further sample of 32 meters shall be taken from the offered meters and shall be subjected to these tests. If the number of defectives is two samples combined is less than 4, the lot shall be considered as conforming to these tests, otherwise rejected.

(c) In case of rejection of offered lot as per two above, supplier shall have to re-offer entirely new lot of meters for inspection and testing. Inspection and testing shall be carried out as per procedure and if the lot fails for consecutive second time, order shall be cancelled. The expenditure incurred in re-inspection & testing shall be recovered from the supplier. Further, firm shall be debarred for participation in any tender of same item of any capacity in UPCL for two years from the date of rejection of material along with forfeiture of Security Deposit submitted by the supplier against the order.

(d) 10% quantity from each lot of meters supplied after satisfactory inspection & testing at supplier's works shall be marked and sent by Superintending Engineer (MM) to electronic test lab of UPCL at 18-EC Road, Dehradun for testing and clearance of that lot. Final payment, etc. shall be subject to clearance of above tests.

- For every 50000 nos. meters, Inspection & Quality Assurance wing of UPCL will get samples tested for all or any of the selected tests at UPCL's cost at any Govt. NABL test house at any stage of supply. In case of failure, the payment of bidder shall be withheld. UPCL shall also reserve the right to cancel the balance quantity and to take any suitable action as deemed fit.
- S.E. (I&QA) shall ensure the testing of meters selected from the lot.

3.16 Packing and Forwarding of Energy Meters

Each meter with meter box shall be packed in superior quality three-ply corrugated cardboard carton or thermocol packing box. Such single cartons shall be additionally packed in five (5) ply corrugated cardboard carton accommodating 12-24 meters with meter boxes for easy transportation, storage & handling.

3.17 Samples

Bidders will have to submit Three nos. sample meters as per the specification along with their bid offers at the time of opening of tender for following tests on meter & as per the specification for (i) Creepage (ii) starting current (iii) Dial test (iv) Accuracy (v) Any other test, if required at balanced & unbalanaced loads and at lead, lag & unit Power factor. Sample meters should be submitted to Superintending Engineer (Inspection & Quality Assurance), V.C.V. Gabar Singh Urja Bhawan, UPCL, Dehradun for arranging the above-mentioned tests from UPCL Test Lab and physical verification of meter by I&QA wing of UPCL as per provision of technical specification for his final approval of samples. Part-II (price-bid) of those firms shall be opened whose sample meter will clear the testing.

Vendor shall have to submit predefined copies of all the software (meter reading software for CMRI, Base computer software for meter data analysis and technical details).

Bidders shall provide sample meters, packed in a carton and suitably sealed by bidder, without any identification of their name inside or outside the meters. The identification should be provided through a removable sticker fixed on the top of the meter case. If any permanent identification provided inside the meter, the sample shall not be accepted.

3.18 Performance Guarantee

i. The meter shall be guaranteed for a period of at least five years from the date of receipt of meter at site or UPCL stores. If the meter is found defective within the above guarantee period, supplier will have to replace the same free of cost with a new meter along with box with new serial number.
ii. Meters are to be replaced within 90 days from the date of lifting the same by the supplier, otherwise the cost of meter and 15% supervision charges will be deducted or recovered from pending bills, bank guarantees or by any other means as deemed fit.
iii. Executive Engineer, Electricity Test Division will inform Supplier about meter gone defective within guarantee period with meter serial no. and purchase order no. & date, for lifting the defective meters under intimation to Executive Engineer, Electricity Store Division. Such meters will be lifted by the supplier within 45 days from date of intimation (date of intimation will be deemed as date of information letter by Executive Engineer, Electricity Test Division). If the defective meters are not lifted within 45 days, demurrage charges of Rs. 5/- per meter per day will be charged. Amount of demurrage charges will be informed by Executive Engineer, Test Division to Executive Engineer, Electricity Store Division.
iv. The cumulative damage rate during guarantee period should not exceed:
    1. Upto one year-2%
    2. Upto two years-3%
    3. Upto three years-4%
    4. More than four years-5%

If the supplier fails to adhere to the above requirement, UPCL may take any penal action against the supplier upto and including debarring/blacklisting.

3.19 Quality Assurance Plan

The design life of the meter shall be minimum 20 years and to prove the design life, the firm shall have 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.
iii. The testing and calibrating equipment should be automatic and all test equipment shall have their valid calibration certificates.
iv. 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.
v. During the manufacturing of the meters the following checks shall be carried out.
   a. The assembly of parts shall be done with the help of jigs and fixtures so that human errors are eliminated.
   b. The meters shall be batch tested on automatic, computerized test bench and the results shall be printed directly without any human errors.

   The bidder shall invariably furnish the following information along with his bid, failing which his bid shall be liable for rejection. The information shall be separately given for individual type of material offered.
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 tests normally carried out on raw material in presence of bidder's representative and 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. List of testing equipment available with the bidder for final testing of equipment specified and test-plant limitations, if any, vis-a –vis the 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 provided with the tender.

3.20 Accuracy of Meters

There will be no drift in the accuracy of the meters supplied against this purchase order for a period of 10 year (life time) from the date of supply. In case any drift is noticed / found beyond permissible limits during guarantee period of 5 years, the supplier shall recalibrate such a meter for correct accuracy, and in the event, recalibration is not possible, replace such meter (s) with box with new meter(s) with box without any extra cost.

Note: All extra loose seals should be of polycarbonate double lock with logo of manufacturer with name and with different Serial No./ Series (A, B, C, - - - -) to that of seals on meter body). Total four nos. loose seals are to be provided with each meter (Two for the terminal plate and other two for the meter box).

3.21 Technical Specification for moulded Meter Box Suitable for Single Phase Static Energy Meters

SCOPE:

This specification covers the moulding and supply of moulded cupboard suitable to house the single-phase energy meters. The meter box shall be suitable for wall mounting.

3.22Technical Requirement & Standards

3.22.1 Material and Standards

The meter box i.e. base and cover shall be made of injection moulded, unbreakable, high-grade flame-retardant polycarbonate with minimum thickness of 2.0 mm on all sides having good dielectric and mechanical strength. The top cover of the meter box must be totally transparent without any provision of the separate window arrangement.

The material must be 'UV' stabilized to ensure that the moulded meter box should not change in colour shape, size, dimension when subjected to 200 hrs. on U-V ageing test.

The meter box should have tapered surface / corners to prevent stay of rain water at the top of the meter box.

The meter box should be capable of withstanding the mechanical, electrical and thermal stresses as well as the effects of humidity which are likely to be encountered in service, at the same time ensuring desired degree of safety. The plastic material should be adequately stabilized against detrimental effects of light and weather. The surface appearance of moulded part must be smooth, non-porous and homogenous, free of ripples, defects and marks. No fillers of fibers should be visible at any place. The meter box shall comply in all respect with the requirement of latest amended IS:14772/2000 "General requirements for enclosures for accessories for household and similar fixed electrical installations". Applicable degree of protection shall be IP 42 or better.

3.22.2 Properties of Plastic Material

The plastic material which is to be used by the bidder for these moulded meter boxes must have the following properties:

Table 3-5 Properties of Plastic box- Moulded meter box

S.No.	Property	Units	Value
1.	Physical Water Absorption	%	Max. 0.35
2.	Thermal HDT	Deg. C	Min. 125.
3.	Flammability a) Rating b) Glow wire test @ 650 Deg. C		 FV 2 Passes
4.	Mechanical **a)** Tensile Strength **b)** Flexural strength **c)** Modulus of Elasticity **d)** Izod impact strength notched 23 deg. C.	 MPa Mpa Mpa KJ/Sq.m	 Min. 50 Min. 90 Min. 2000 Min 8

3.22.3 Service Conditions

a)	Maximum ambient air temperature	: 50 deg.C
b)	Maximum ambient air temperature in shade	: 45 deg.C
c)	Maximum temperature attainable by the meter	: 60 deg. C exposed to sun.
d)	Minimum ambient temperature	: (-) 5 deg.C
e)	Average daily ambient air temperature	: 40 deg.C
f)	Maximum relative humidity	: 95 %
g)	Number of months of tropical monsoon condition	: 4 months
h)	Maximum altitude above mean sea level	: 3000 meters
i)	Average annual rain fall	: 10-100 cms
j)	Maximum annual rain fall	: 1450 mm
k)	Maximum wind pressure	: 200 kg /sq.m
l)	Isoceraunic level (days per year)	: 40
m)	Seismic level (horizontal accn.)	: 0.30 g
n)	Permitted noise level	: 45. db

3.22.4 General & Constructional Requirements

3.22.4.1 *Meter Mounting Inside the Meter Box*

The meter base support inside the box is raised by about 5 mm in the box for ease of wiring. Fixing arrangement of meter to the base of meter box should be as per relevant clause of this specification.

3.22.4.2 *Incoming and Outgoing Cable Arrangement*

Suitable circular holes shall be provided at the bottom of the meter box for inlet and outlet cables with glands suitable for 16 sq mm two core aluminum cable, made of brass or engineering plastic for the cable securely fixed to the bottom of the meter box on both side by chuck nuts.

3.22.4.3 *Fixing Arrangement Of Meter Box*

For fixing the meter box to wall or wooden board, 4 nos. holes (two top side holes to be keyholes) of minimum 6 mm dia., shall be provided at the four corners of meter box. The meter is to be installed in the meter box and the box in assembled condition shall have provision to fix it to a pole or on wall. The 4 nos. self-threaded screws and plastic roll plug of min. size of 4mm dia. and 25 mm long shall be provided with each meter box.

3.22.4.4 *Marking / Embossing*

The following information shall be clearly & indelibly embossed (not printed) on the cover and base of the meter box (except Sr. No. of the meter - which may be indelibly printed inside the base of meter box and also on the meter box cover with inkjet printing). The meter box Sr. No. shall be same as of Sr. No. of the meter housed inside that particular meter box:

i. Tender Specification No. CCP-II/18/2012-13
ii. Property of UPCL.
iii. Name/ Brand name of Manufacturer.
iv. Meter Sr. No. (printed on both the base & cover of meter box) through sticker from inside
v. Month and year of manufacture through sticker from inside

3.22.5 **Drawing**

Detailed dimensional drawing & detailed leaflets showing clearly the dimensions & material for meter box and its constructional features should be furnished with the tender offer.

3.22.6 **Sample**

Furnishing of samples shall be as per clause No. 16.0 of technical specifications.

3.22.7 **Packing**

Packing shall be as per clause No. 15.0 of technical specifications.

3.22.8 **Tests**

TYPE TESTS:

The meter box offered shall be fully type tested as per relevant standards and this technical specification (table below). The bidder must furnish one set of type test reports and the dimensional drawing (duly approved by Type Testing agency) along with the tender. The type test report should be from independent recognized testing laboratory / house whose calibration of testing instruments should have traceability to NABL/NPL/ or equivalent. The type tests mentioned below must not have been conducted earlier than two years from the date of opening of bid.

Table 3-6 List of tests to be carried out on moulded box

S. No.	Standard	Clause	Description	Test particulars		
				Type of Tests		
1.	IS:14772	Clause 7	Marking	T		A
2.	As per Bidder's drawing		Dimensions	T		A
3.	IS:14772	Clause 9	Protection against electric shock	T	R	A
4.	IS:14772	Clause 11	Construction	T		

S. No.	Standard	Clause	Description	Test particulars
				Type of Tests
5.	IS 14772	Clause 12	Resistance to ageing, to humid condition, to ingress of solid object and to harmful ingress of water.	T
6.	IS : 14772	Clause 13	Mechanical strength	T
7.	IS :14772	Clause 14	Resistance to heat	T
8.	IS:14772	Clause 16	Resistance to rusting	T
9.	IS:14772	Clause 17	Resistance to tracking	
10.	IS:8620/1996		Test for resistance to heat & fire. Glow wire test at 650 deg. C as per cl. 4 to 10 of IEC 695-2-1	T
11.	IS:13411	Annex-H	Heat deflection temperature (Min. 125 degC.)	T
12	IS : 4249		Self Extinguishing property of spirit burner test.	T
13.	IS:8623/1993	(Part-1) 18.2.2.2	Verification of dielectric properties, insulation test with 500V DC magger	T
14.	CIPET/IR Spectrometry		Material identification.	T
15	IS:13411/1992	Annex. D	Test for water absorption (Max. 0.35)	T

Note: Applicable degree of protection shall be IP 42 or better.

Legend: T = Type Test, R = Routine Test, A = Acceptance Test

ACCEPTANCE TESTS

The acceptance tests as indicated in the above table shall be carried out at the -time of inspection of the offered material.

ROUTINE TESTS

The routine tests as stipulated in the above table shall be carried out and routine test certificates / reports shall be submitted to the purchaser's inspecting officer at the time of inspection of the offered material.

Notes:

1. Where facilities do not exist at supplier's works for carrying out one or more above tests such test(s) may be got carried out at any of the approved laboratories such as CIPET centers / IIT, Delhi / Shriram test house, Delhi.
2. The sampling plan for carrying out the acceptance tests shall be same as in case of energy meters.

3.22.9 Inspection

The inspection may be carried out as per inspection clause mentioned in the tender specification.

3.22.10 Guaranteed Technical Particulars

The bidder shall furnish all the necessary information as desired in the schedule of GTP appended at Annexure. If the bidder desire to furnish any other information in addition to the details as asked for the same may be furnished against the last item for box of this schedule.

MAKE OF THE COMPONENTS FOR BIDDER

All the material & electronic power components used in the manufacture of the meter shall be of highest quality & reputed makes so as to ensure higher reliability, longer life and sustained accuracy.

SI. No.	Item	Requirement	Makes and origin
1	Measurement / Computing Chips	The measurement / computing chips used in the meter shall be with the surface mount type (SMT) along with the ASICs.	USA: Analog Devices, Cyrus LOGIC Atmel, Phillips, Texas Instrument, Renasas, teridian, Motorola, ST microelectronic. South Africa: SAMES Japan: Hitachi, NEC, Oki free scale semiconductors, MMI, Maxim, Siemens
2	Memory Chips	The memory chips shall not be affected by the external parameters like sparking, high voltage spikes or electrostatic discharges.	USA: Atmel, National Semiconductors, Texas Instruments, Phillips, ST micro Electronics, Renasas, ROHM, Onsemi Japan: NEC, Hitachi, Oki Microchip, Siemens, ramtron, numonyx, Micron
3	Display Modules	The display modules shall be well protected from the external UV radiations. The display visibility shall be sufficient to read the meter mounted between height of 0.5m and 2m. The construction of the modules shall be such that the displayed quantity shall not be disturbed through out the life of display. It shall be trans- reflective STN (Super Twisted Nematic) industrial grade type.	Japan: Hitachi, Sony, YEBOO Jiya (Haijing) & Tianma Truly semiconductors
4	Optical Port	The mechanical construction of the port shall be such to facilitate the data transfer easily.	USA: National Semiconductors, Everlight, HP, Agilant, optanik, Siemens Osram Electronics Holland/Korea: Phillips Japan: Hitachi, Sharp Germany: Liteon
5	P.C.B.	Glass Epoxy, fire resistance grade FR4.	Reputed Make

3.23Schedules

3.23.1 Schedule – I [Guaranteed Technical Particulars of Ac Three Phase Four Wire, L.T. Static Whole Current Energy Meter with LCD Display 10-60 A]

Table 3-7: Guaranteed Technical Particulars of Ac Three Phase Four Wire, L.T. Static Whole Current Energy Meter with LCD Display 10-60 A

S. No.	Particular Min.	Requirement	As offered
1	Name of manufacturer		
2	Type, name & number		
3	Standard Applicable	IS 13779/1999, IS 12346 / 1988, IS 14434 / 1998, CEA regulation no. 502 / 70 / CEA / DT&D dt.17.03.06 and CBIP technical report no.88/304 with its latest amendment as on date.	
4	Type of Meter (Model No.)		
5	Rating		
	Accuracy Class	1.0	
	Rated Voltage	240V Ph to Neutral (+ 20% to - 25%)	
	Rated current	Ib- 10 Amp. Imax- 60 Amp	
	Rated frequency	50 Hz ± 5%	
	Power factor	0 lag to Unity to 0 lead	
	Minimum saturation current	Bidders to specify	
	Meter Constant (imp / kWh)	-do-	
6	Max. Continuous current rating (Amp.)	60 Amps.	
	Continuous current rating of terminals for two hours	90 Amps	
	Running with no load &(-)70% to120 % voltage	No creeping	
7	Short time over current for 10 mili seconds	30 Imax for one half cycle at rated frequency	
8	Starting current at which meter shall run & continue to run	0.2% of Ib at rated voltage and unity power factor	
9	Power loss at rated frequency & reference temperature		
	Current circuit at rated current	Less than 4 VA(Including all phases) as per IS	
	Voltage circuit at rated current	Less than 1.5W / 8VA as per IS	
10	Type of material used:		
	Base	High Impact strength, non-hygroscopic, fire retardant, fire resistant, UV stabilised poly Carbonate	
	Meter cover	High Impact strength, non-hygroscopic, fire retardant, fire resistant, UV stabilised Transparent poly carbonate	
	Terminal Block	Material High Impact strength not hygroscopic, fire retardant, fire resistant, UV stabilised poly carbonate Barrier of adequate size shall be provided between phase and neutral	

S. No.	Particular Min.	Requirement	As offered
	Terminal cover	High Impact strength, non-hygroscopic, fire retardant, fire resistant, glass reinforced poly carbonate (Transparent)& non detachable with hinging arrangement	
	Screw		
	(i) Material	Tin / Nickel Plated – Brass	
	(ii) Size	Bidders to specify	
11	Internal diameter of Terminal Hole	Min. 9.5 mm	
12	Centre to Centre clearances between adjacent terminals	13 mm	
13	Transducers		
	Input	C.T provided in phase element and in the neutral. Voltage Potential divider (PT less)	
	Output	LCD	
	C.T. – no of turns	Bidders to specify	
14	Type of Register	LCD suitable for operation up to 80^0 C	
	No. of Digits	7 (integer only)	
	Size of Numerals	10 X 6 mm (minimum)	
15	Display		
	On Scroll Mode & Auto display mode	Both required	
	Type of push button	Spring loaded push button to be provided on top cover of meter to read parameters	
16	Reading on power off condition	Meter shall be able to display reading during power outage through the push button provided on the meter with facility for hands free meter reading with auto-off provisions.	
17	Battery of Real time clock	(i) It shall be Lithium-ion battery having at least 10 years of life	
		(ii) The drift in time shall not exceed +/- 3 minutes per year	
18	Fixing/sealing arrangement		
	(i) Fixing of meter	3 fixing holes (one at top & two at bottom under terminal block). The top fixing screw shall not be accessible after meter is fixed to Pilfer Proof Meter Box base.	
	(ii) Sealing of meter cover to Base	At least, two sealing provision/screws shall be provided for proper fixing of the meter cover so that access to the working part shall not be possible without breaking the seal. The meter cover should be sealed to the meter base with at least 2 nos. seal by the Manufacturer. Necessary provision shall be kept for fixing the utility seal also.	
		The meter cover shall be permanently fixed to the base by ultrasonic welding or any other technology which is equally or more efficacious so that cover	

S. No.	Particular Min.	Requirement	As offered
		cannot be opened without breaking, i.e. the meter should be break to open type. Meter should have an indication in its display if top cover is removed.	
19	Type of hinged undetectable terminal cover	Terminal cover shall be hinged.	
20	Performance of meter in tamper Conditions		
	(i) Input and output Terminals interchanged	Should work within specified Accuracy	
	(ii) Change of phase sequence	----do----	
	(iii) Absence of Neutral	----do----	
	(iv)Phase current reverse	----do----	
	(v) Indication of above tamper condition	LCD / LED indication.	
21	Suitability of meter to sustain over voltage i.e. phase to phase voltage injected between phased & neutral	Should sustain	
22	Electromagnetic compatibility (EMI / EMC severity level)	As per IS 13779 1999	
23	(i) Effect on accuracy of external electromagnetic interference of electrical discharge, external magnetic field	Should work within accuracy as per latest ISS & CBIP report -88/ 304 with latest amendment.	
24	(ii) Current reversal, Neutral disturbance & Magnetic tamper logging in memory	Meter shall log last 150 events with date and time	
25	Effect on accuracy under tamper conditions / influence conditions	Should work within accuracy specified in IS 13779 / 1999, and CBIP tech. Report 88. Error beyond +/- 4 % will not be acceptable for conditions not specified in IS 13779 / 1999 & CBIP tech. Report 88.	
26	Drift in accuracy of measurement with time	No Drift in accuracy in measurement with time	
27	Name plate details	It should cover all the details as prescribed in Clause-10	
28	Approximate weight of meter	To be indicated	
29	Type of mounting	Projection type	
30	Calibration	Meter shall be software calibrated at factory & there shall not be any mechanical form of calibration, such as, mechanical preset / trim port / potentiometer etc. so that any adjustment in calibration is not possible after freezing the meter constant.	
31	Manufacturing activity		
	(i) Mounting of components on PCB shall be SMT type	SMT type and ASIC technology	
	(ii) Compliance to assurance	To be complied	

S. No.	Particular Min.	Requirement	As offered
32	Testing facility		
	Fully automatic computerized meter test bench with print out facility shall be available		
	Make and Sl. No. of Test bench	To be indicated	
	Accuracy of ESS duly calibrated	---do---	
	Whether complete testing facilities are available for carrying out acceptance tests and additional acceptance tests in house.		
33	Guarantee period of meter	5-years from the date of dispatch. Guarantee period shall be printed on the nameplate with year and month of manufacturing details	
34	BIS license		
	BIS license No. & dt. with its validity for ISI certification mark on offered meter.	To be mentioned	
	Details of meter design for which above BIS certification has been obtained -	To be mentioned	
	Ratio of Ib to Imax		
	Material of meter body		
	Type of energy registering counter		
	Type of technology (Digital/Analog)		
	Grade of printed circuit board material		
	Type of assembly of component used (SMT)		
	Meter constant (IMP / kWh)		
	Auxiliary power circuit (with PT or PT less)		
	Current circuit (CT / Shunt combination or only shunt)		
	Accuracy class		
35	ISO accreditation no. & dt. with its validity		

3.23.2 Schedule – II [Technical Deviations proposed by the bidder are as follows]

Table 3-8: Technical Deviations proposed by the bidder are as follows

S.No.	As per Technical specification	Deviation by the bidder

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4. Technical Specifications for Single Phase Pre-Payment meter

4.1 Scope

This specification covers design, manufacture, testing and supply of single phase electronic, accuracy class 1.0 keypad prepayment meters with split unit and provisions for TOD (Time of Day) tariff and R.T.C. (Real Time Clock).

The requirements of the online Vending/Transaction system to be provided for the keypad prepayment metering system are also covered in the scope. The meter shall use keypad technology for the transfer of credit from the vending system to the meter. The meter shall contain the measuring element, main switch, display and keypad and comply with the requirements of the standards. The switch shall be used to disconnect customers depending on their load demand or the state of their account and shall be capable of operating over the life of the meter.

Separate display unit/split unit shall be provided with each meter. The display unit shall have provision to enter the encrypted code in the meter.

4.2 Climatic Conditions

Table 4-1 Climatic Conditions

S.No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

4.2.1 Standard

The meters with accuracy class–1.0 are required for measurement of Active Energy and shall conform to the latest edition of following standards:

IS:13779	:	A.C. Static Watt Hour Meters (Class–1.0 and 2.0)
CBIP Report No. 325	:	Specification for AC static Electrical Energy meters
IS:15884	:	AC Direct Connected Static Prepayment Meters for Active Energy (Class 1 and Class 2)

Meters meeting other authoritative standards which ensure an equal or better quality than the standard mentioned above, will also be acceptable.

4.2.2 Bis Mark

The offered prepayment meter should be approved as per the IS:13779 /15884.

4.2.3 Current & Voltage Rating

Rated Voltage (Vref): 240 V Phase to Neutral

Rated Current: Basic Current 5A (Ib) or higher

Maximum current: 60A (Imax) or higher

4.2.4 Variation in Power Supply

The meters shall be suitable for working satisfactorily with the following power supply system variations:

4.2.4.1 Voltage Supply:

(i)	Specified Operating Range	:	0.7 to 1.3 Vref (-30% to +30%)
(ii)	Operating voltage range for accuracy requirement	:	0.85 to 1.15 Vref i.e. –15% to + 15%

4.2.4.2 Frequency Variation:

The standard reference frequency for performance shall be 50Hz with tolerance $\pm$ 5%.

4.2.5 Voltage Circuit

The active, apparent Power consumption in voltage circuit including the power supply of the meter at reference voltage, reference temperature and reference frequency shall be within limits as specified in IS: 13779 (As per latest amendment.

4.2.6 Current Circuit

The apparent Power taken by each current circuit at basic current, reference frequency and reference temperature shall be within limits as specified in IS: 13779 (As per latest amendment)..

4.2.7 Starting Current

The meter shall start registering the energy at 0.2% of Ib.

4.2.8 Accuracy

Class of accuracy of meter shall be 1.0 and shall confirm to accuracy requirement as per specify IS.

4.2.9 Keypad Pre-payment Meter

The keypad buttons shall have numbers/letters on them, which shall be clearly visible and resistant to wear. The layout of the numbering shall be same as that used on standard telephones for numbers '1' through '9' and buttons such as '*', '0', and '#'. Button '5' shall have some form of physical identification (raised printing or a pip) to aid customers with poor sight.

The keypad IP rating shall be adequate to permit use with moist or wet hands whilst ensuring the safety of the user and preventing ingress of dirt and water to the unit. The keypad buttons shall provide audible feedback when pressed with differing tones to distinguish between valid and invalid entry. The entry of codes for credit or commands associated with programming functions such as tariff change shall be via numeric codes. Code encryption/decryption must be carried out using an internationally recognized standard (i.e. Triple DES/AES).. The meter shall permit a time delay of up to 20 seconds between keystrokes.

The meter has Keypad buttons which enables the user to view various displays available on the meter. The display parameters shall be as follows:

- Days Left (based on consumption of last seven days)
- Value of recent consumption
- The currently active rates, the prices charged for consumption at each rate and the number of units consumed at each rate.
- "Authenticated Billing Code" #
- The total amount vended
- Shows the Refund code
- Displays monthly consumption in Rupees
- Maximum Demand with occurrence of time and date
- Instantaneous load and its cost
- kWH unit
- Date/Time, Serial no.
- Voltage, current etc.
- Key code mode for punching code in to the meter

 # "Authenticated Billing Code":

The meter shall display minimum 20 digit authenticated meter reading code on key 5. The full 20 digit (minimum) token shall contain the following frozen value at midnight (00:00 Hr) of month end

1. *5 digit cumulative kWh energy register.*
2. *Date of frozen data.*
3. *Credit balance, it may be positive or negative.*
4. *The tamper flag, which only indicates whether there is any tamper or not.*

4.3 Tariff

Following are the features required in the meter for Tariff. It shall be possible to change the tariff related parameters through vend code.

4.3.1 Minimum charges

Using the online vending system, it shall be possible to define the minimum charge for the applicable tariff category. If the consumer consumes electricity equivalent of amount less than the minimum charge then at the end of the billing period the meter shall deduct the difference of the minimum amount and the monthly consumption (Amount).

4.3.2 Fixed Charges

Meter shall be able to deduct fixed charges on daily basis such as meter rent, sanctioned load based charges etc. The fixed charges shall be defined using the online vending system.

4.3.3 Time of Day (TOD) Tariff

The meter shall have facility for recording and storing of TOD consumption on minimum Four Tariff Rates, per day basis. It shall be possible to change the time period for TOD recordings through the portable device or through vending system.

4.3.4 Slab Tariff

The meter shall have capability for defining minimum four tariff slabs. It shall be possible to change the slabs through the portable device or through the online vending system.

4.3.5 Tax/Duty

It shall be possible to define the tax percentage through online vending system which has to be levied on the amount of the energy consumed.

4.3.6 Debt Management

It shall be possible to collect the debt from the consumers with the use of the online vending system. The debt percentage shall be defined in the vending system.

4.4 Communication Capability

The meter shall be provided with an optical communication port / RS232 port. It shall be possible to read the meter through the optical port with hand held device.

4.5 General Requirements

Meter shall be designed and constructed in such a way as to avoid introducing any danger in use and under normal conditions so as to ensure specially the following:

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

1. All the material used in the manufacturing of meters shall be of highest quality. The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation.
2. All insulating material used in the construction of meter shall be non-hygroscopic non-ageing and of tested quality and shall conform to tests as specified in relevant Standards.
3. The meter shall be designed on application specific integrated circuit and shall be manufactured using SMT (Surface Mount Technology) components.
4. The terminal block, the terminal cover and the meter case shall ensure reasonable safety against the spread of fire. They should not be ignited by thermal overload of live parts in contact with them.
5. The meter shall conform to the degree of protection IP 51 against ingress of dust, moisture and vermin.
6. All parts which are subject to corrosion under normal working conditions shall be protected effectively. Any protective coating shall not be liable to change by ordinary handling due to exposure to air under normal working conditions.
7. The meters shall be designed such that their working remains unaffected by electromagnetic interference, electrostatic discharges and high voltage transients as specified in standard.

4.6 Constructional Requirements

4.6.1 Meter Case

a) The meter shall have completely insulated body and be of wall mounted projected type. The meter shall have a case made of unbreakable high-grade fire resistant, reinforced polycarbonate or equivalent high-grade engineering plastic which can be sealed in such a way that the internal parts of the meter are accessible only after breaking the meter cover seals. The meter cover shall have at least two sealing screws, each screw having the sealing holes.
b) The meter case shall have at least three mounting holes. Two holes for mounting screws on the terminal block sealed beneath the terminal cover and one for hanging screw on the top.
c) The meter case shall be ultrasonically welded with the meter cover in such a way that it should not be possible to open the meter cover without any visible marks of damage.

4.6.2 LCD Unit

The display unit shall be Pin type built-in liquid crystal display. The measured value(s) shall be displayed on minimum six-digit Liquid Crystal display (LCD) display unit, having minimum character size of 8mm X 4mm. When the meter is not energized, the display need not be visible. Each display shall be retained for a minimum period of 2s.

4.6.3 Window

The meter cover shall be of high grade, fire resistant, reinforced polycarbonate or equivalent high-grade engineering plastic with one window made of UV stabilized, silicon coated polycarbonate or equivalent high-grade engineering plastic for reading the register. The window shall be integral part of the meter cover such that it cannot be removed undamaged without breaking the meter cover. Alternatively, bidder may provide meters with transparent cover made of aforesaid material.

4.6.4 Terminals and Terminals block

a) The terminal block shall be made from best quality non-hygroscopic, fire retardant, reinforced polycarbonate (not Bakelite) or equivalent high-grade engineering plastic which should form an extension of the meter case. If shall have terminal minimum internal diameter 8.5mm
b) The meter shall be provided with terminal to connect the cables. The screws shall not have pointed edge at the end of thread. The clearance and creep age distance of terminal block and tips between the terminal and the surrounding parts of metal enclosure shall be as per relevant IS standard.
c) All parts of each terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized.
d) Electrical connections shall be so designed that contact pressure is not transmitted through insulating material.

4.6.5 Terminal Cover

a) The meter terminal Block shall be provided with an extended terminal cover with independent sealing arrangement in such a way that it shall cover the terminals, the conductor fixing screws, the external conductors and their insulation i.e. no part of meter or cable accessories shall be visible from the front of the meter.
b) When the meter is mounted, no access to the terminals shall be possible without breaking the seal of the meter terminal cover.

4.6.6 Terminal Arrangement

A diagram of connections should be provided inside the cover the terminal block. The terminal cover shall be extended such that when it is placed in position it is not possible to approach the connections or connecting wires.

4.6.7 Name Plate Marking

The name plate shall have following markings which shall be indelible, distinct and readable from outside the meter:

- Manufacturer's name and/or trade mark and the place (with country) of manufacture;
- Designation of type;
- The no. of phases and no. of wires for which the meter is suitable for;
- The manufacturer’s serial number and year of manufacture;
- Reference voltage;
- The basic current and the maximum current;
- The principal unit in which the meter reads;
- Meter constant;
- Class index of the meter;

- Reference Frequency;

4.7 Tamper and Fraud Protection

The meter shall operate normally under the following conditions:

1. **Phase current reversal**: The meter shall record forwarded energy/ No load shall be drawn through meter.
2. **Neutral current reversal**: The meter shall record forwarded energy/ No load shall be drawn through meter
3. **Phase and neutral interchange**: The meter shall record forwarded energy.
4. The meter shall operate normally in case the phase and neutral are swapped with neutral connected to earth.
5. In case the neutral is opened with earth load connected, partial phase by pass or full phase bypass the energy shall be recorded on the wire which has higher current recording. Such tampers shall be logged in the memory of the meter.
6. The metering system shall be provided with adequate magnetic shielding so that any external magnetic field (AC Electro Magnet or DC Magnet) as per the values specified in standard applied on the metering system shall not affect the proper functioning and recording of energy as per error limits prescribed by standard.
7. **Spark Immunity**: The meter shall be immune up to 35 kV spark discharge. The meter shall be tested by feeding spark under the following manner for 10 minutes and accuracy shall be maintained:
    a. On any of the phases or neutral terminals.
    b. On any of the connecting wires of the meter (Voltage discharge with 0-10 mm spark gap)
        i. At any place in load circuit
        ii. At any location of meter body.
8. **Measurement shift:** The meter shall have measuring element for both phase and neutral to avoid tampering with neutral. The energy measurement shall always be done on the element with higher current. The meter shall detect the measurement shifting from phase to neutral circuit and neutral to phase circuit in the memory. This shall be done by finding the imbalance between phase and neutral current and comparing with the pre-defined threshold and the persistence time.
9. **Meter Cover Open detection**: If case of meter cover/base is opened it shall log the tamper in meter memory

4.8 Type Tests

a) Meter shall be fully type tested as per IS 13779/1999 (amended up to date)/ CBIP 325 and IS 15884. The Type Test Reports shall clearly indicate the constructional features of the type tested meters. All the Type Tests shall have been carried out from any NABL accredited Laboratories to prove that the meters meet the requirements of the specification.
b) Meters shall pass all the acceptance and routine tests as laid down in IS: 13779/1999 (amended up to date), IS 15884 and also additional acceptance tests as prescribed in this specification
c) Prepayment functionality shall be tested by UPCL as per IS: 15884 / 2010 (amended up to date)..

4.9 Other Acceptance tests

1. The meter shall withstand continuously for a period of at least 5 minutes at a voltage of 440 V between phase and neutral without damage/problems,
2. Power consumption tests,
3. The meter shall withstand impulse voltage at 10kV.
4. The meters shall be tested at (-) 15% and at (-) 30% of reference voltage as well as (+) 10% and (+) 20% of reference voltage and shall record energy within limits of variation indicated above.

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

i) The meter shall detect the measurement shifting from phase to neutral circuit and neutral to phase circuit in the memory. This shall be done by finding the imbalance between phase and neutral current and comparing with the pre-defined threshold and the persistence time. The condition for measurement shift shall be according to below conditions and the meter shall log the forwarded energy in this condition:

1	Interchanging of phase & neutral terminals.
2	Neutral connected on incoming side but connected to earth via resistor on outgoing side. Load is connected solidly to ground.
3	Phase & neutral interchanged at incoming and load is connected to earth.
4	Shorting is provided on current coil terminals.

ii) Meter shall record accurate energy in case of external magnetic influencing signals as per the IS13779. Meter shall either be immune or shall switch recording to Imax in case of any external magnetic influence. Meter shall again revert to normal reading once the external magnetic influence is removed. Incidence of switching to Imax and reversal on normal recording after removal of magnetic influence shall mandatorily be recorded in the Tamper event with date and time stamp. In case of abnormal magnetic field such as continuous DC magnetic induction of 0.27 Tesla ± 5% and magnetic induction of 10 milli Tesla the meter shall perform the following features:

a) Meter shall log the event in its memory as Magnetic tamper with date and time stamp.
b) Meter shall show "TAMPER" in the display.
c) Meter shall start recording at 100% of Imax (Defrauded metering)

4.10Sample Meter

Three nos. samples of Single Phase Prepayment meters must be submitted within 15 days of opening of Part-I to Superintending Engineer (I&QA), UPCL, Urja Bhawan. Sample meters shall be tested at UPCL's test Lab by group of our technical experts as per specification. Date of testing shall be informed to the bidders. Engineer of the bidder shall come with vending software and token generation system. Other than verification of sample meter as per IS 13779 and IS 15884, below mention tests shall also be done and bidders' representative shall be well equipped to demonstrate desired features:

a) Vending system operation.
b) Test of application of tariff.
c) Token generation.
d) Token punch & checking all display parameters on meter as well as parallel home display unit
e) Balance available in the meter.
f) Test of friendly credit hours start & end time
g) Test of disconnect the output supply once when credit reach to zero.
h) Test of reconnect the output supply on providing credit limit / charging with new token.
i) Test of disconnect the out supply if load / current exceed the preset value in the meter.
j) Test of reconnect the out supply if load / current falls below the preset value in the meter.
k) Test of visible / audible over load warning.
l) Test of visible / audible low credit warning.
m) Authentic Billing Code (ABC) verification.
n) All tampers shall be tested as mentioned in the specification.
o) MRI of meter for verification of tamper information with date & time, load survey and meter readings.

Part-II will be opened for only those bidders whose sample meters will pass in testing.

4.11 Re-Testing

From the lots inspected and received at UPCL stores/ store centers, UPCL shall reserve full right to re-test the material for which the authorized officer(s) of UPCL as nominated by MD, UPCL may pick up samples from the lots supplied at random for quality check only.SE (MM) shall ensure to sent at least 2 selected meters from each lot to SE (I&QA) for testing.

Sample meters from each lot of supply shall be sent by Superintending Engineer (Inspection & Quality Assurance), V.C.V. Gabar Singh Urja Bhawan, UPCL, Dehradun for arranging the type test from Govt. NABL test house (CPRI or ERDA only) for testing. If the meter fails in any of the tests carried out, that very lot of meters will be considered as rejected and the same shall be replaced by the supplier without any extra cost on UPCL's account. If replacement is not possible due to consumption of the meters then in that case for consumed meters, UPCL will deduct 30% (Thirty percent) cost of the consumed meters. Further, the failure would account for in the performance of the bidder irrespective of meters being replaced or not. UPCL shall bear the expenses of this post supply testing but in case the sample fails the recovery against the same including the cost of testing and other expenses, if any shall be made from the contractor.

5. Specification for Three Phase Prepaid Meter

5.1 Scope

This specification covers design, manufacture, testing and supply of single phase electronic, accuracy class 1.0 keypad prepayment meters with split unit and provisions for TOD (Time of Day) tariff and R.T.C. (Real Time Clock).

The requirements of the online Vending/Transaction system to be provided for the keypad prepayment metering system are also covered in the scope. The meter shall use keypad technology for the transfer of credit from the vending system to the meter. The meter shall contain the measuring element, main switch, display and keypad and comply with the requirements of the standards. The switch shall be used to disconnect customers depending on their load demand or the state of their account and shall be capable of operating over the life of the meter.

Separate display unit/split unit shall be provided with each meter. The display unit shall have provision to enter the encrypted code in the meter.

5.2 Climatic Conditions

The meters to be supplied against this specification should be suitable for satisfactory continuous operation under the following tropical conditions. Meters should be capable of maintaining required under hot, tropical and dusty climatic conditions.

Table 5-1: Climatic Conditions

S.No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

5.3 Standard

The meters with accuracy class–1 are required measurement of Active Energy and shall conform to the latest edition of following standards:

IS:13779	:	A.C. Static Watt Hour Meters (Class–1 and 2)
CBIP Report No. 325	:	: Specification for AC static Electrical Energy meters
IS:15884	:	AC Direct Connected Static Prepayment Meters for Active Energy (Class 1 and Class 2)

Meters meeting other authoritative standards which ensure an equal or better quality than the standard mentioned above, shall also be acceptable. All kinds of tests which are required as per mentioned standards shall be carried out.

5.4 Bis Mark

The offered prepayment meter should be approved as per the IS:13779 /15884.

5.5 Current and Voltage Rating

Rated Voltage (Vref) : 3 x 240 V Phase to Neutral and 415 V Phase to Phase

Rated Current : Basic Current 10A (Ib) or higher

Maximum current 60A (Imax) or higher

5.6 Variation In Power Supply

The meters shall be suitable for working satisfactorily with the following power supply system variations:

5.6.1 Voltage Range

(i)	Specified Operating Range	:	0.7 To 1.3 Vref.(-30% to +30%)
(ii)	Operating voltage range for accuracy requirement	:	0.85 to 1.15 Vref i.e. –15% to + 15%

5.6.2 Frequency Variation

The standard reference frequency for performance shall be 50Hz with tolerance $\pm$ 5%.

5.7 Power Consumption

5.7.1 Voltage Circuit

The active, apparent Power consumption in voltage circuit including the power supply of the meter at reference voltage, reference temperature and reference frequency shall be within limits as specified in IS: 13779 (As per latest amendment).

5.7.2 Current Circuit

The apparent Power taken by each current circuit at basic current, reference frequency and reference temperature shall be within limits as specified in IS: 13779 (As per latest amendment).

5.8 Starting Current

The meter should start registering the energy at 0.2% of Ib.

5.9 Accuracy

Class of accuracy of meter shall be 1.0 and shall confirm to accuracy requirement as per specify IS.

5.10 Keypad Prepayment Meter

The keypad buttons shall have numbers/letters on them, which shall be clearly visible and resistant to wear. The layout of the numbering shall be same as that used on standard telephones for numbers '1' through '9' and buttons

such as '*', '0', and '#'. Button '5' shall have some form of physical identification (raised printing or a pip) to aid customers with poor sight.

The keypad IP rating shall be adequate to permit use with moist or wet hands whilst ensuring the safety of the user and preventing ingress of dirt and water to the unit. The keypad buttons shall provide audible feedback when pressed with differing tones to distinguish between valid and invalid entry. The entry of codes for credit or commands associated with programming functions such as tariff change shall be via numeric codes. Code encryption/decryption must be carried out using an internationally recognized standard (i.e. Triple DES/AES). The meter shall permit a time delay of up to 20 seconds between keystrokes.

The meter has Keypad buttons which enables the user to view various displays available on the meter. The displays parameters shall be as follows:

- Days Left (based on consumption of last seven days)
- Value of recent consumption
- The currently active rates, the prices charged for consumption at each rate, and the number of units consumed at each rate.
- "Authenticated Billing Code" #
- The total amount vended
- Shows the Refund code
- Displays monthly consumption in Rupees
- Maximum Demand with occurrence of time
- Instantaneous load and its cost
- kWH unit
- Date/Time, Serial no.
- Voltage, current etc.

 # Authenticated Billing Code:

The meter shall display minimum 20 digit authenticated meter reading code on key 5. The full 20-digit (minimum) token shall contain the following frozen value at midnight (00:00 Hr) of month end

1. *5-digit cumulative kWh energy register.*
2. *Date of frozen data.*
3. *Credit balance, it may be positive or negative.*
4. *The tamper flag, which only indicates whether there is any tamper or not.*

5.11 Tariff:

Following are the features required in meter for Tariff

5.11.1 Minimum charges

Using the vending system, it shall be possible to define the minimum charge for the applicable tariff category. If the consumer consumes electricity equivalent of amount less than the minimum charge then at the end of the billing period the meter shall deduct the difference of the minimum amount and the monthly consumption (Amount).

5.11.2 Fixed Charges

Meter shall be able to deduct fixed charges on daily basis such as meter rent, sanctioned load based charges etc.

5.11.3 Time of Day (TOD) Tariff

The meter shall have facility for recording and storing of TOD consumption on minimum Four Tariff Rates, per day basic. It should be possible to change the time period for TOD recordings through the portable device or through the online vending system.

5.11.4 Slab Tariff

The meter shall have capability for defining minimum four tariff slabs. It shall be possible to change the slabs through the portable device or through the online vending system.

5.11.5 Tax/Duty

It shall be possible to define the tax percentage through online vending system which has to be levied on the amount of the energy consumed.

5.11.6 Debt:

It shall be possible to collect the debt from the consumers with the use of the online vending system. The debt percentage shall be defined in the vending system

5.12 Communication Capability

The meter shall be provided with a optical communication port / RS232 port. It shall be possible to read the meter through the optical port with the help of Hand-Held Unit.

5.13 General Requirements

1. Meter shall be designed and constructed in such a way as to avoid introducing any danger in use and under normal conditions so as to ensure specially the following:
    - Personnel safety against electric shock
    - Personnel safety against effects of excessive temperature.
    - Protection against penetration of solid objects, dust and water.
    - Protection against spread of fire.
2. All the material used in the manufacture of meters shall be of highest quality. The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation.
3. All insulating material used in the construction of meter shall be non-hygroscopic non-ageing and of tested quality and shall conform to tests as specified in relevant Standards.
4. The meter shall be designed on application specific integrated circuit and shall be manufactured using SMT (Surface Mount Technology) components.
5. The terminal block, the terminal cover and the meter case shall ensure reasonable safety against the spread of fire. They should not be ignited by thermal overload of live parts in contact with them.
6. The meter shall conform to the degree of protection IP 51 against ingress of dust, moisture and vermin.
7. All parts which are subject to corrosion under normal working conditions shall be protected effectively. Any protective coating shall not be liable to change by ordinary handling due to exposure to air under normal working conditions.
8. The meters shall be designed such that their working remains unaffected by electromagnetic interference, electrostatic discharges and high voltage transients as per standard.

5.14 Constructional Requirements

1. **Meter Case:**
   The meter shall have completely insulated body and be of wall mounted projected type. The meter shall have a case made of unbreakable high-grade fire resistant, reinforced polycarbonate or equivalent high-grade engineering plastic which can be sealed in such a way that the internal parts of the meter are accessible only after breaking the meter cover seals. The meter cover shall have at least two sealing screws each screw having the sealing holes. The meter case shall have at least three mounting holes. Two holes for mounting screws on the terminal block sealed beneath the terminal cover and one for hanging screw on the top.
2. **LCD Unit:**

The display unit shall be Pin type built-in liquid crystal display. The measured value(s) shall be displayed on minimum six-digit Liquid Crystal display (LCD) display unit, having minimum character size of 8mm X 4mm. When the meter is not energized, the display need not be visible. Each display shall be retained for a minimum period of 2s.

3. **Window:**
   The meter cover shall be of high grade, fire resistant, reinforced polycarbonate or equivalent high-grade engineering plastic with one window made of UV stabilized, silicon coated polycarbonate or equivalent high-grade engineering plastic for reading the register. The window shall be of transparent material ultrasonically welded with the meter cover such that it cannot be removed undamaged without breaking the meter cover. Alternatively, bidder may provide meters with transparent cover made of aforesaid material.

5.15 Terminals and Terminals Block

a. The terminal block shall be made from best quality non-hygroscopic, fire retardant, reinforced polycarbonate (not Bakelite) or equivalent high-grade engineering plastic which should form an extension of the meter case. If shall have terminal minimum internal diameter 8.5mm

b. The meter shall be provided with terminals to connect the cables. The screws shall not have pointed edge at the end of thread. The clearance and creep age distance of terminal block and tips between the terminal and the surrounding parts of metal enclosure shall be as per IS.

c. All parts of each terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized.

d. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material.

5.16 Terminal Cover:

a. The meter terminal Block shall be provided with an extended terminal cover with independent sealing arrangement in such a way that it shall cover the terminals, the conductor fixing screws, the external conductors and their insulation i.e. no part of meter or cable accessories shall be visible from the front of the meter.

b. When the meter is mounted, no access to the terminals shall be possible without breaking the seal of the meter terminal cover.

5.17 Terminal Arrangement:

A diagram of connections should be provided inside the cover of the terminal block. The terminal cover shall be extended such that when it is placed in position it is not possible to approach the connections or connecting wires.

5.18 Name Plate Marking:

The name plate shall have following markings which shall be indelible, distinct and readable from outside the meter:

- Manufacturer's name and/or trade mark and the place of manufacture;
- Designation of type;
- The no. of phases and no. of wires for which the meter is suitable for;
- The manufacturer’s serial number and year of manufacture;

- Reference voltage;
- The basic current and the maximum current;
- The principal unit in which the meter reads;
- Meter constant;
- Class index of the meter;
- Reference Frequency;

5.19 Tamper and Fraud Protection

5.19.1 Phase Sequence Reversal:

The meter should work accurately irrespective of phase sequence of the supply.

5.19.2 C.T. Shorting / By Passing:

The meter shall have capability to record bypassing/shorting and opening of current coil (s) of one or any two phases with date, time. Meter shall not disconnect the supply under CT bypass or open.

5.19.3 Missing Potential:

The meter shall be capable of detecting and recording occurrences and restorations of missing potential (1 phase or 2 phases) which can happen due to intentional/ accidental disconnection of potential leads with date and time along with total no. of such occurrences for all phases during the above period. This tamper recording shall not be done when meter is without any load i.e. current in all phases is zero.

5.19.4 External Magnetic Influence:

The metering system shall be provided with adequate magnetic shielding so that any external magnetic field (AC Electro Magnet or DC Magnet) as per the values specified in standard applied on the metering system shall not affect the proper functioning and recording of energy as per error limits prescribed in standard.

5.19.5 Meter Cover Open detection

If case of meter cover/base is opened it shall log the tamper in meter memory.

5.19.6 Spark Immunity

The meter shall be immune up to 35 kV spark discharge. The meter shall be tested by feeding spark under the following manner for 10 minutes and accuracy shall be maintained:

a. On any of the phases or neutral terminals.
b. On any of the connecting wires of the meter (Voltage discharge with 0-10 mm spark gap)
c. At any place in load circuit
d. At any location of meter body.

5.20 Tests

5.20.1 Type Tests

Meter shall be fully type tested as per IS 13779/1999 (amended up to date)/ CBIP 325 and IS 15884. The Type Test Reports shall clearly indicate the constructional features of the type tested meters. All the Type Tests shall have been carried out from Laboratories which are accredited by the National Board of Testing and Calibration Laboratories (NABL) of Govt. of India to prove that the meters meet the requirements of the specification.

i. Prepayment functionality shall be tested by UPCL as per IS: 15884 / 2010 (amended up to date).

ii. Meters shall pass all the acceptance and routine tests as laid down in IS: 13779/1999 (amended up to date), IS 15884 and also additional acceptance tests as prescribed in this specification

5.21 Other Acceptance tests

1. The meter shall withstand continuously for a period of at least 5 minutes at a voltage of 440 V between phase and neutral without damage/problems,
2. Power consumption tests,
3. The meter shall withstand impulse voltage at 10kV.
4. The meters shall be tested at (-) 15% and at (-) 30% of reference voltage as well as (+) 10% and (+) 20% of reference voltage and shall record energy within limits of variation indicated above.
5. For other influence quantities like frequency variation the limits of variation in percentage error will be as per IS: 13779/1999 (amended up to date).
6. Meter shall record accurate energy in case of external magnetic influencing signals as per the IS13779. Meter shall either be immune or shall switch recording to Imax in case of any external magnetic influence. Meter shall again revert to normal reading once the external magnetic influence is removed. Incidence of switching to Imax and reversal on normal recording after removal of magnetic influence shall mandatorily be recorded in the Tamper event with date and time stamp. In case of abnormal magnetic field such as continuous DC magnetic induction of 0.27 Tesla ± 5% and magnetic induction of 10 milli Tesla the meter shall perform the following features:
    a. Meter shall log the event in its memory as Magnetic tamper with date and time stamp.
    b. Meter shall show "TAMPER" in the display.
    c. Meter shall start recording at 100% of Imax (Defrauded metering)

5.22 Re-Testing

From the lots inspected and received at UPCL stores/ store centers, UPCL shall reserve full right to re-test the material for which the authorized officer(s) of UPCL as nominated by MD, UPCL may pick up samples from the lots supplied at random for quality check only.

SE (MM) shall ensure to send atleast 2 selected meters from each lot to SE (I&QA) for testing.Sample meters from each lot of supply shall be sent by Superintending Engineer (Inspection & Quality Assurance), V.C.V. Gabar Singh Urja Bhawan, UPCL, Dehradun for arranging the type test from Govt. NABL test house (CPRI or ERDA only) for testing.

If the meter fails in any of the tests carried out, that very lot of meters will be considered as rejected and the same shall be replaced by the supplier without any extra cost on UPCL's account. If replacement is not possible due to consumption of the meters then in that case for consumed meters, UPCL will deduct 30% (Thirty percent) cost of the consumed meters. Further ,the failure would account for in the performance of the bidder irrespective of meters being replaced or not. UPCL shall bear the expenses of this post supply testing but in case the sample fails the recovery against the same including the cost of testing and other expenses, if any shall be made from the contractor.

5.23 Sample Meter

Three nos. samples of Three Phase Prepayment meters must be submitted within 15 days of opening of Part-I to Superintending Engineer (I&QA), UPCL, Urja Bhawan. Sample meters shall be tested at UPCL's test Lab by group of our technical experts as per specification. Date of testing shall be informed to the bidders. Engineer of the bidder shall come with vending software and token generation system. Other than verification of sample meter as per IS 13779 and IS 15884, below mention tests shall also be done and bidders' representative shall be well equipped to demonstrate desired features:

a) Vending system operation.

b) Test of application of tariff.
c) Token generation.
d) Token punch & checking all display parameters on meter as well as parallel home display unit
e) Balance available in the meter.
f) Test of friendly credit hours start & end time
g) Test of disconnect the output supply once when credit reach to zero.
h) Test of reconnect the output supply on providing credit limit / charging with new token.
i) Test of disconnect the out supply if load / current exceed the preset value in the meter.
j) Test of reconnect the out supply if load / current falls below the preset value in the meter.
k) Test of visible / audible over load warning.
l) Test of visible / audible low credit warning.
m) Authentic Billing Code (ABC) verification.
n) All tampers shall be tested as mentioned in the specification.
o) MRI of meter for verification of tamper information with date & time, load survey and meter readings.

Part-II will be opened for only those bidders whose sample meters will pass in testing.

5.24 Consumer Interface Unit (CIU)

- The meter shall be supplied with a separate In-home display unit /CIU.
- The display unit shall be powered up from the meter
- The display unit shall have a LCD display similar to that of the meter.
- The display unit shall have a key pad to enter the code. The keypad should be similar to the keypad available on the meter.
- The display unit shall have an RJ11 connection port to connect to the meter.
- Maximum distance between the display unit and the prepayment meter shall be 100 meters.
- The display unit and energy meter shall be connected using a 4-wire connection cable (Similar to telephone cable).
- The display unit shall have a buzzer to generate alarm signal in case of low credit and overload.
- CIU / IHD shall be supplied with Bluetooth compatibility for exchange of data
- Pairing facility shall be available on CIU to connect with mobile app (OS Android / iOS provided by the meter manufacturer)
- For security reason an initial parity shall be provided between Bluetooth module and app to avoid unnecessary intervention of other devices using same frequency band
- It should support Blue tooth 4.0 (BLE) or above to connect to mobile app.
- Pairing facility shall be available on CIU to connect with mobile app.
- It should work on ISM band from 2.4 to 2.485 GHz,
- Distance should be as per Blue tooth specification class 2 (within 10 meters of Line of Sight)
- It should support reading from mobile app OS Android / iOS.

5.25 Meter Reading

It shall be possible to read the prepayment meters and minimum following information shall be available in meter reading data.

- The transaction history data with date and time.
- All the events history with time based and category-based information.
- Tariff details including the TOD tables, slab tables and information about the current active rate price.
- Monthly history and consumption data of the energy consumed for last twelve months.
- All the account related information like meter credit, emergency credit details, minimum charge and fixed charges value.
- All the limiting parameters shall also be available in meter reading.

5.26 Vending System Requirements

a) WEB BASED VENDING SOFTWARE SYSTEM:

The vending system shall be "web based vending system" for easy operation and token generation by any client machine (PC) at UPCL Division/Sub-Division/ collection centre or by online recharge. The online system shall be integrated with website of UPCL & payment gateway. This will enable the consumer to generate recharge token by making payment either at collection center of UPCL or online through credit card or net banking. There shall not be any limitation of client machine (PC). The unlimited user licenses for vending application shall be provided during the course of tenure of contract (i. e. guarantee & AMC period). Necessary modification & upgradability of the software is sole responsibility of the vendor & it shall be free of cost during guarantee period.

b) This section specifies the requirements of the vending system for currency-based prepayment metering solution.

The meter shall work on the latest currency transfer keypad technology supported by an online vending system. Since the keypad technology is future proof, cost effective and in this communication age, enables consumers to buy electricity through Utility billing centers and Utility website which enables 24x7 anywhere anytime vending faculties, hence the system provided by the bidder shall have such capabilities to integrate with utility / any third party service providers based upon mutual agreement with utility.

The vending system shall use Triple Data Encryption Standard (Triple DES/AES), i.e. it provides three levels of encryption for the vend code. The code shall be meter specific and can't be used in any other meter. Triple DES/AES is widely used in banking systems worldwide due to the high level of security provided by the algorithm.

The necessary licensed Software for each Vending PC at Utility billing centre shall be provided by bidder.

The vending PC shall be placed at the billing stations of Utility for which necessary office space, electricity etc. and furniture for this system shall be provided by Utility. Cash shall be collected by Utility staff; upon the advice of the designated staff the vend terminal / personal computer shall generate a token to transfer the credit to the energy meter. The token shall be printed using the printer attached to the personal computer. Also, the VPN connectivity for access between the vending station placed at Utility premises & the bidder's server shall be provided by Utility. Adequate back up power in the form of suitable UPS with standard back up shall be provided at each Vending Station.

The vending system shall be the online vending system from where the vend codes shall be issued. A client system shall be provided in the project monitoring center to produce the MIS reports and defining the customers in the database as mentioned in this specification.

In order to have vending system interoperable provision to integrate the prepaid system with the utility's website & payment gateway through web services technology should be made available.

5.27 Vending Process

The vending codes shall be issued from the online prepaid metering, Billing & Collection system. It shall be possible to provide various vending options like web-based vending and utility center-based vending. This system will produce the MIS report and help to define the customers in the database as mentioned in this specification. The steps of vending shall be as under:

a) On receipt of the vend request the system shall have a provision to ascertain the identity of the consumer. The keys to identify the consumer shall be the meter serial number or consumer number.
b) The vend terminal shall send the request to a central database that shall authenticate the transaction and generate an encrypted code.
c) In order to provide maximum security to the system the encryption shall not be done on the vend terminal.
d) On receipt of each request the vend terminal shall connect to the central database and get the code generated.

e) The code hence generated shall be printed on paper using the attached printer.
f) The vending system shall be used to transfer current values (Rupees) to the meter.
g) The consumer shall pay the money at the vend terminal, this information when fed to the vend terminal shall be send to the central database that shall encrypt the token using Triple DES / AES encryption algorithm.

5.28 Prepaid Metering, Billing & Collection Software

The prepaid Metering, Billing & Collection software shall be supplied by the successful vender for implementing prepaid metering solution in UPCL. The solution shall be web based and shall have capability to interface with the central database and produce the management reports which shall be decided mutually with the successful bidder. It shall manage all administrative data, including setting of system accounts, tariff, and consumer data. It shall also provide reporting system for system analysis. The Enterprise software solution shall be provided to UPCL with unlimited user licenses. Also, the software license shall support unlimited consumer & data management. Various tasks that shall be performed from the prepaid Metering, Billing & Collection software are outlined below.

1.1.1 Consumer Database Management
- Entry of new consumers and their details
- Existing consumer database-Integration with existing consumer database for updating the required information

1.1.2 Meter Database Management
- Uploading of meter database (entering prepaid meter details)

1.1.3 Tariff Management
- Tariff structure definition
- Rate Price definition
- Tariff category
- Tax percentage
- Fixed Charge value
- Minimum charge value
- Slab reset period
- Tariff change administration

1.1.4 Limit Parameters management
- Define Load Limit
- Current Limit value
- Emergency Credit
- Calendar management: National holidays, Sundays, etc.

1.1.5 Debt (previous charges) Management

1.1.6 Transaction management:
- Cash vend transaction
- Retained credit transaction
- Refund Money Transaction
- Previous Charge Transaction
- Integration with payment gateway

1.1.7 Reports
- Debt collection and outstanding report
- Tax and duties accounts report
- Customer's Vend Report

1.1.8 Import of data by the vending station from the master station / Export of data by the main station to the vending stations:
- Import of data from Comma separated values(CSV) format files
- Export of data in CSV format.

1.1.9 Message Management
- Entry of System Message
- Entry of Customer Specific Messages
- Entry of Predefined Messages

1.1.10 User Security Management
- Group rights definition
- Entry of system users and allocation of group rights

5.29 Security Aspect

1. The vending system shall be a sophisticated system with reliable security features.

a) The token created for particular meter with the defined tariff shall not be used for any other meter.
b) The meter shall accept the valid token only once. The token generated shall be meter specific and shall be used only on the particular meter for which it is intended.
c) The token in not be reusable.
d) The token shall be re-issued in case of losing the same.
e) Whenever a tariff change takes place the token should not accept new vends without entering the new tariff.
f) The token generated shall be authenticated as well as encrypted so that no decoding is possible.
g) The Vending system must be certified to ISO/IEC 27001 which is the only auditable international standard which defines the requirements for an Information Security Management System (ISMS). The standard is designed to ensure the selection of adequate and proportionate security controls.

2. All the hardware mentioned in the below table, Internet connectivity for VPN, RJ11 communication cable and the space to setup vending stations shall be the responsibility of Utility. If possible, the existing billing collection counters may also be used to set up vending stations.

5.30 Vending Charges

The DISCOM shall make the payment per vending transaction done with the manufacturer-maintained servers and the payment shall be made on monthly basis after getting the invoice from the supplier. The manufacturer shall ensure to provide the uninterruptible services like generating vend token, tariff management, report generation etc. to UPCL. The delay in getting vends token responses or server breakdown may impose the penalty on the supplier that too shall be manufacturer shall discuss mutually at time of bidding.

5.31 Tests for Boxes

The following tests are to be conducted on the box at any independent NABL accredited laboratory and test reports shall be carried out as per relevant Indian Standard.

- Test of HDT minimum 85° C
- Test for mechanical strength
- Glow wire test at 650°C as per IS: 11000

5.32 Acceptance Test

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.

6. Technical Specifications of Availability Based Tariff Type Meter

6.1 Scope

The specification covers the design, engineering, manufacture, assembly, and testing of Static/ Electronic ABT (Availability Based Tariff) compliant Trivector Type, Four Quadrant, Bi-Directional Energy Meter, suitable for 3-phase 4-wire connections, solidly earthed system with balanced and un-balanced loads for a power factor range from zero to unity (lagging and leading), with initial and sustained accuracy of class 0.2S. The meter shall be installed for EHV/ HV circuit, as a self-contained device for measurement of active energy transmittals in each successive 15-minutes block etc. meeting the ABT requirements and certain other functions, as described in the following paragraphs/ sections of this document. The meter shall be suitable for being connected to voltage transformers (VTs) having a rated secondary line-to-line voltage of 110 V, and to current transformers (CTs) having a rated secondary current of 1A/5A. Any further transformers/ transducers required for their functioning shall be inbuilt in the meter. Necessary isolation and/ or suppression shall also be built-in for protecting the meter from surges, voltage spikes, fault-currents, EMI etc. that occur in the VT and CT circuits of extra high voltage switchyards. The reference frequency shall be 50 Hz. The energy meter shall be rack/ panel/ metal box mounted with individual/ common/ both types of displays.

Firm must have NABL accredited lab for acceptance tests of energy meters as per IS. Bidder must have CMMI-DEV maturity level-3 certificate for software development.

6.2 Climatic Conditions:

The meters to be supplied against this specification should be suitable for satisfactory continuous operation under the following tropical conditions. Meters should be capable of maintaining required under hot, tropical and dusty climatic conditions.

Table 6-1: Climatic Conditions

S.No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

6.3 Standards:

While drafting this specification, reference has been made to Uttarakhand State Grid Code, National and International standard specifications with latest amendments. In case, if certain details are not covered in this specification, the relevant State Grid Code/ Indian/ International standard shall be applicable:

IS-14697: AC static Watt Hour Meter for Active energy (Class-0.2S) with latest amendments IEC-60687: Static Watt hour meter for class 0.2s with the latest amendments

CBIP Tech. Report No.(Revised with Latest amendment), with latest amendments CBIP Tech. Report 111 for common Meter Recording instrument and optical Ports in use, with latest amendments IS-9000 Basic Environmental Testing Procedures for Electronic and Electrical Items. (Uttarakhand State Grid Code)

The meter shall be ISI marked and shall fully comply with all stipulations in applicable standards with latest amendments/ the relevant provisions of Uttarakhand State Grid Code, except those specifically modified by this specification.

6.4 ABT Specific Requirements:

6.4.1 Net Active Energy:

The Active Energy (kWh) measurement shall be carried out on 3-phase 4-wire principle with accuracy as per Class 0.2s. The energy shall be computed directly in CT and VT secondary quantities. The meter shall compute the Net Active Energy (kWh) sent out from the substation bus-bars during each successive 15-minutes block, and store it in its memory along with plus/ minus sign i.e. the positive sign if there is a net energy export, and a minus sign if there is a net energy import. Net Active Energy sent out up till that moment in the current block as well as net active energy sent out for the immediate previous block shall be displayed while scrolling.

6.4.2 Reactive Energy:

The meter shall also compute the Reactive Power (kVar) on 3-phase 4-wire principle, with an accuracy as specified and integrate the Reactive Energy (kVarh) algebraically into two separate registers, one for the period for which the average of RMS voltages of all 3-Phases is 103.0% or higher, and the other for the period for which the average of RMS voltages of all 3-Phases is below 97.0%. The Current Reactive Power (kVAr), with a plus or minus sign, and Cumulative Reactive Energy (kVarh) readings of the two registers shall be displayed while scrolling. The readings of the two registers at each midnight shall also be stored in the meter's memory. The Reactive Power and Reactive Energy transmittals shall be computed in kVar/kVarh & directly calculated in CT and VT secondary quantities. When lagging reactive power is being sent out from substations busbars, kVar display shall have a positive sign and kVarh register shall move forward. When reactive power flow is in the reverse direction, kVar display shall have a negative sign and kVarh registers shall move backwards.

6.4.3 Average Frequency:

For the purpose of Average Frequency of 15 minutes block for ABT purpose the meter shall count the number of cycles in VT output during each successive 15-minutes block, and divide the same by 900 to arrive at the average frequency. This shall be stored in the meter's memory as a 2-digit code which shall be arrived at by subtracting 49 from the average frequency, multiplying by 50 and neglecting all decimals. For example, 49.89 Hz shall be recorded as 44. In case the average frequency is less than 49.0 Hz, it shall be recorded as 00. In case it is 51.0 Hz or higher, it shall be recorded as 99. As Average Frequency parameter is also specified to be measured and stored in absolute terms with 2 decimal places, coded Avg Frequency storage on 15-min basis be treated as optional depending upon meter memory space.

6.5 Other Power Quantity Measurements Requirements:

1. Average Frequency (Hz): The Average Frequency of 15 minutes block shall be displayed directly in Hz with two decimal places and shall also be stored in its memory as such. The average frequency shall be recorded with a resolution of 0.01 Hz for the minimum frequency range from 47.50 to 52.50 Hz. The average frequency of current block upto that instant as well as immediate previous 15 minutes block shall be displayed while scrolling in Hz.

2. Active Energy Import & Export: The meter shall also compute Active Energy Import & Export separately during each successive 15 minutes block, store in its memory and display while scrolling, for current block as well as immediate previous 15 minutes block.
3. Net Cumulative Active Energy: Further, the meter shall continuously integrate and display while scrolling the Net Cumulative Active Energy sent out from the substation busbars upto that time. The cumulative kWh reading at each midnight shall be stored in the meter's memory. The register shall move backwards when active power flows back to substation busbars.
4. Average Voltages: The meter shall continuously compute the instantaneous average of the RMS values of the three line-to-neutral VT secondary voltages as a percentage of 63.51 V and display while scrolling. The accuracy of the voltage measurement/ computation shall be at least 0.5%, a better accuracy such as 0.2% in the 95-105% range being desirable.
5. Various Other Power Quantities: Various other power quantity measurements in addition to those specified in other sections/ elsewhere in this specification, shall be as listed below:

6.5.1 Instantaneous Power Quantities:

(Y=Yes Required, N= Not Required)

Sr.	Parameter	Scrolling/Cyclic Display		Remote Reading	Storage at the end of the block	ABT Billing related
		Current Block	Immediate Previous Block			
1	Current – I_r, I_y,I_b	Y	N	Y	N	N
2	Voltage-	Y	N	Y	N	N
3	Average of RMS Voltage as	Y	N	Y	N	N
4	Power Factor	Y	N	Y	N	N
5	Frequency– (Hz)	Y	N	Y	N	N
6	Apparent Power	Y	N	Y	N	N
7	Active Power	Y	N	Y	N	N
8	Reactive Power	Y	N	Y	N	N
9	Real-Time Clock (Date &	Y	N	Y	N	N

15-Minute Block Level Power Quantities (For 90-days) (Load Survey Data):

Sr.	Parameter	Scrolling/Display Cyclic		Remote Reading (Current Block Instantaneous as well as immediate Previous Block)	Storage at the end of the block	ABT Billing Related
		Current Block	Immediate Previous Block			
1	Active Energy Import	Y	Y	Y	Y	N
2	Active Energy Export	Y	Y	Y	Y	N
3	Frequency (Hz)– Average	Y	Y	Y	Y	Y
4	Reactive Energy Lag	Y	Y	Y	Y	N
5	Reactive Energy Lead Import	Y	Y	Y	Y	N
6	Reactive Energy Lag	Y	Y	Y	Y	N
7	Reactive Energy Lead Export	Y	Y	Y	Y	N
8	Net Active Energy	Y	Y	Y	Y	Y
9	Frequency (Coded00-99	Y	Y	Y	Y*	Y
	For 49.00 - 51.00 Hz)					
10	Apparent Energy Import	Y	Y	Y	Y*	N
11	Apparent Energy Export	Y	Y	Y	Y*	N
12	Total Energy (Fundamental + Harmonics)	Y	Y	Y	Y*	N
13	Phase wise Voltages (Vrn, Vyn, Vbn)	Y	Y	Y	Y	Y
14	Phase wise Currents (Ir,Iy,Ib)	Y	Y	Y	Y	Y
15	Demand in kW	Y	Y	Y	Y	Y

Sr.	Parameter	Scrolling/Display Cyclic		Remote Reading (Current Block Instantaneous as well as immediate Previous Block)	Storage at the end of the block	ABT Billing Related
		Current Block	Immediate Previous Block			
16	Demand in kVA	Y	Y	Y	Y	Y

*(Optional depending upon availability of Storage)

Day Level Power Quantities (For90 days):

Sr.	Parameter	Scrolling/ Cyclic Display		Remote Reading (Current Day Instantaneous as well as Immediate Previous Day)	Storage at the end of the day	ABT Billing Related
		Current Day	Previous Day			
1	Day's Active Energy Import	Y	Y	Y	Y	N
2	Day's Active Energy Export	Y	Y	Y	Y	N
3	Net Cumulative Active Energy	Y	Y	Y	Y	N
4	Day's Reactive Energy High	Y	N	Y	Y	Y
5	Day's Reactive Energy Low	Y	N	Y	Y	Y
6	Count and Max/ Min Duration of power off of feeder.	Y	N	Y	Y	N
7	Total Duration of Power off hours of the feeder.	Y	N	Y	Y	N
8	Apparent Energy Import	Y	Y	Y	Y	N
9	Apparent Energy Export	Y	Y	Y	Y	N

Perpetual Type Power Quantities:

Sr.	Parameter	Scrolling/ Cyclic Display		Remote Reading (Instantaneous)	Storage	ABT Billing Related
		Current Block	Previous Block			
1	Cumulative Active Energy perpetual counter in kWh (Separate for import & export as in conventional bidirectional energy meter)	Y	Y	Y	Y	N

Note: Signs may be used to represent Export/ Import/ Lag/ Lead in concurrence with the general scheme as specified in "ABT Specific Requirements" section.

6.6 Time of Day (ToD) Tariff:

1. The energy meter should be capable of registering time of day energy consumption and maximum demand in kVA for 4 different time zones.
2. The meter should be capable to record and store active energy consumption and maximum demand in kVA during specific hours described as following time zones of register:

Season / Time of Day	Morning Peak Hours	Normal Hours	Evening Peak Hours	Off-Peak Hours
Slot Sequence	4	1	2	3
Winters 01.10 to 31.03	0600-0930	0930-1730 hrs.	1730-2200 hrs.	2200-0600 hrs.
Summer 01.04 to 30.09	-	0700-1800 hrs.	1800-2300 hrs.	2300-0700 hrs.

Provision of TOD MD (kVA), TOD (kWH) and TOD (kVAh) parameters are to be made available in the meters. The Meter should be able to record and store energy parameters in four separate TOD time slots as per sequence in above table.

3. The meter should have facility for recording and storing the TOD consumption and Maximum demand data on min. four tariff rates, per day basis. Meter shall record and display TOD parameters in the sequence as per table above.
4. The change of the time period for TOD zones should be possible through the portable device (CMRI) with proper security through the help of BCS with authenticated password so that only authorized person can change TOD timings zones. The main control of this change along with proper security code should be available on the computer located at the purchaser metering office.
5. In MRI report the data related to TOD slots should be indicated as "Morning Peak Hours, Normal Hours, Evening Peak Hours & Off-Peak Hours" preferably or in slot sequence.

6.7 Meter Display:

Each of the rack/panel/metal-box shall have alphanumeric common/ individual/ both type of legible/ easily readable and visible (even during the night) display for indication of the meter parameters one by one of all the Instantaneous Parameters, the current as well as immediate previous 15 minutes block, Day Level parameters &

Perpetual type parameters as specified. These parameters shall be auto-displayed through scrolling/ cyclic display etc. with scroll lock facility. Auto scrolling/ cyclic display etc. shall be visible when any one of the specified power supplies is available.

Besides the quantities specified in the section "Other Power Quantity Measurements Requirements", the following measured/ calculated values/ quantities shall also scroll/ cycle continuously:

i. Meter's identification code and model as specified as well as unique meter serial number.
ii. Date (DD/MM/YYYY), Time (HH24:MM) & Current Block No
iii. Last recorded anomaly/ fraud/ incident log etc. as specified in this specification.

The display shall automatically come back to scrolling mode if push button is not pressed for say 3 minutes. The display shall meet with the condition of minimum roll over period stipulated in clause 6.10 of IS: 14697:1999. The display shall have a good readability & visibility, with back lighting if required.

The size of Displayed digits shall be minimum 10mm height. Display size should be such, so as to display complete/ multiple values as per the type of the contents. While displaying the values, the identification of each value shall be possible preferably through full quantity name or through easily understandable mnemonics/ abbreviations etc. Display must be electronic. LCD/ LED display must have a life at least equal to the life of the meter. The minimum guaranteed life in years of LCD/ LED should be clearly brought out by the manufacturer.

6.8 Data Storage Requirements/ Meter Storage Capacity:

Each meter shall have a Non-Volatile Memory (NVM) in which various parameters as specified shall be stored. Meter shall have storage capacity (Non-volatile) for the specified meter data in its memory for at least a period of 90 days. All the data shall be stored in the form of arrays. The older data shall not get erased unless replaced by fresh data. NVM, which does not require any battery backup shall have minimum retention period of 10 years. Battery backed up memory will not be considered Non-Volatile.

6.9 Monitoring of Voltages:

The three line-to-neutral voltages shall be continuously monitored and in case any or all of these falls below about 70% the condition shall be suitably indicated and recorded in the logs. The indication details shall be given on the front of the meter. The time blocks in which such a voltage failure occurs/ persists shall also be marked, for example with star (*), while storing in the meter's memory. The indication shall automatically become normal when VT secondary voltages are healthy again. The two specified kVArh registers shall remain stay-put while VT supply is unhealthy.

6.10 Special Power Quantity Measurement/ Display/ Storage/ Protection requirements:

a) The meter will do calculations, display & store the various values in CT/ PT secondary power quantities.
b) Meter data in secondary quantities for display and storage shall have minimum 8 digits including one decimal digit for cumulative values and 2 decimal digits for other power quantities.
c) No rounding off to the next higher last decimal shall be done for voltage and frequency. All 15-minutes kWh figures shall however be rounded off to the nearest last decimal.
d) The meter shall safely withstand the usual fluctuations arising during faults etc. The various limits shall be as per the relevant standards with latest amendments. These fluctuations shall not cause any damage to or mal-operation of the meter and shall retain the data under any adverse system conditions. The meter should start registering energy at 0.1% of basic current (Ib) at UPF or lower. Rated maximum current shall be 1.2 times of Ib

e) The meter shall continue to function for the remaining healthy phase(s), in case one or two phases of VT supply fails. In case of a complete VT supply failure, the computation of average frequency shall be done only for the period during which the VT supply was available in the 15-minutes block.
f) Any time block contraction or elongation for clock correction shall also be duly accounted for and logged.
g) Errors in the energy measurement for all power factor angles from 0º to 360º shall be as per the standards specified in this specification.
h) The harmonics shall be filtered out while measuring kWh, kVAr and kVArh and only fundamental frequency quantities shall be measured, computed, displayed & stored. Meter shall also measure, compute & display the Total Energy in kWh consisting of fundamental & harmonic energy for each 15-minute block separately.
i) The Electrical Requirements (Power Consumption, Influence of Supply Voltage, Influence of Self Heating, Influence of Heating, Insulation, Immunity to Earth/ Phase faults etc.), Electromagnetic Compatibility, Accuracy Requirements, Meter Constructional Requirements, Marking of Meter, Test & Test Conditions etc. shall be as per the relevant standards unless specifically modified in these specifications.
j) The meter shall have the provision of recording/display Maximum Demand, MD resetting and MD Count also.
k) The meters shall be supplied with display of energy in kWh , kVArh and kVAh.
l) The provision of Maximum Demand automatically reset at 24.00 hours of the last date of each calendar month and the same should be added in Cumulative Maximum Demand.
m) The meter should not have any physical button for MD Reset although MD can be reset through the CMRI.

6.11 A.C. Supply System:

The supply shall be through CT & PT connection of the respective EHV/ HV feeder as follows.

a) Rated secondary voltage Vref. : 110V Phase to Phase (1 10/¥3V P.N.)
b) Rated secondary current of CTs Ib : 1Amp
c) Voltage variation : V reference + 20% to -30%
d) Frequency : 50HZ +/- 5%
e) Power Factor : Zero to unity (lagging or leading) in all the four quadrants
f) System : 3-phase 4-wire

6.12 Test Output:

Each meter shall have a test output device (visual) for checking the accuracy of active energy (kWh) measurement as per the relevant standards. Test output device may be in the form of a pulse indicator accessible from the front and capable of being monitored by suitable testing equipment as per the relevant standards.

6.13 Self-Diagnostic Feature:

The meter shall be capable of performing complete self-diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data memory location all the time. The meter shall have indications for unsatisfactory, nonfunctioning & malfunctioning of the following at least:

a) Internal Clock/ Date and Time with respect to the DCD/ CMRI/ GPS etc.
b) All display segments as per the requirement under G 19 of IS 14697.

The details of any type of malfunctioning should be logged with time and date in the meter. The details of self-diagnostic capability feature should be furnished by the meter manufacturer.

6.14 Meter Power Supply Arrangement:

The meter must be capable to operate with the power drawn from the PT/CVT secondary circuits. The total burden imposed on CTs & PTs by the meter for measurement and operation shall be as per the relevant standards. While

operating with supply from PT/C VT, the meter shall not require any separate auxiliary supply for their normal operation.

Further, the meter shall be capable to display & data downloading of the stored quantities through either an internal in-built or external power pack battery. The batteries provided for Display/ Optical Port downloading etc shall have life of not less than 10 years. The batteries shall not get damaged or damage the meter even during idle storage of the meter for two years. Adequate protection must be in built to safeguard against damage to meter on account of application of high or wrong type of voltage at external battery terminals etc.

6.15 Clock Battery:

The clock operation in the meter shall not be disturbed in any event. In case of failure of power supply, the meter shall be capable of continued operation of the meter's calendar-clock with the help of internal clock battery. The batteries provided for RTC shall have life of not less than 10 years. The battery shall not get damaged or damage the meter even during idle storage of the meter for two years.

6.16 Real Time Clock

Each meter shall have a built-in calendar and clock, having an accuracy of ±2 minutes per year or better. The calendar and clock shall be correctly set at the manufacturer's works to the Indian standard time. The date (dd/mm/yyyy) and time (HH24: MM) shall be displayed on the meter front while data scrolling. Feature for keeping the time of clocks synchronized with GPS device time should be available via communication port. Meter Software shall have provision for recording reading on 29th Feb. of leap year without manually intervention/ setting etc.

Limited clock adjustment shall also be possible at site, in case of GPS device/ system is not provided, by using the DCD/ CMRI. When an advance or retard command is given through DCD/ CMRI, six subsequent time blocks shall be contracted or elongated by ten seconds each. The meter shall not accept another clock correction command for seven days. All clock corrections shall be logged in the meter's memory and suitably shown on print out of collected data.

Further if the meter clock has drifted so much that it is not possible to correct the meter clock as specified in this specification then it must also be indicated/ logged in the log files. All attempts to synchronize/ actual synchronizing of the meter clock through DCD/ CMRI may also be indicated/ logged in the log files.

6.17 Programmable Parameters:

The meter may have following Programmable (P)/ Non-Programmable (NP) parameters:

Sr.	Information	Type	Password	From		Remote/BCS / Master
				Meter	DCD/ CMRI	
1	Real Time Clock	P	Y	N	Y (Limited as specified)	Y
2	Demand Integration Period	P	Y	N	Y	Y
3	Meter ID/	P	Y	N	Y	Y
4	Relevant settings in respect of ports for communication	P	Y	N	Y	Y

The change in programmable parameters must be logged. The supplier shall furnish details of all the programmable parameters/ facilities under following categories (i) Factory Programmable (ii) User Programmable.

6.18 Communication Capabilities:

Each of the meter/ meter rack shall be provided with an accessible & sealable galvanically isolated Optical port (i.e. IEC 1107 etc.) & a communication port (i.e. RS-485 port etc.) with DLMS IS15959/PACT/ANSI protocol. Both the ports shall be of universal type conforming to relevant standard so that these can be easily connected to a DCD/ CMRI/ MODEM (e.g. GSM/ GPRS/ CDMA/ PLCC/ Microwave/ Radio/ VSAT/ Leased Line/ PSTN/ VPN/ Ethernet etc.)/ Laptop/ PC/ GPS Time device for data communication/ time synchronization etc. The ports shall be integral part of body and sealable. Collected data in meter shall not be reprogrammable/ modifiable through any of the externally provided or internally provided (if any) ports for maintaining data integrity.

6.18.1 Optical Port:

The overall **intention of the optical port** for each meter (or a common optical port for a meter rack) on its front is to tap the data stored in the non-volatile memory/ time correction/ limited configuration changes thorough Portable or hand-held data collection device (DCD/ CMRI). The DCD/ CMRI shall serve as the interface between the meter specified above and the personal computer (PC). It shall also be possible to obtain a print out (hard copy) of all data collected from the meter, using the local PC. Time required for downloading the complete stored data/ logs etc must be reasonable & practicable and mentioned by the manufacturer.

6.18.2 Communication port:

The overall **intention of communication port** is for **online data communication** of all the instantaneous/ current averages/ cumulative values and **offline data retrieval**/ tapping of stored values through open standard protocols through suitable communication device/ media from personal computer/ data collection center/ Base Computer systems/ AMR systems etc. The Host/ Base station & the meter shall follow Master-Slave relationship with meter as slave.

For the purpose of **Online data communication,** Instantaneous/ present averages/ cumulative values mean the actual values at the latest instance of time. These values will be continuously updated by the meter hardware as per internal sampling and computation time. The value read is always the last updated and shall be date and time stamped. The measurement and computation of each of these parameters shall be based on accepted methods. At any instant a snap shot of all/ any selected out of the instantaneous/ current averages/ cumulative values shall be readable by the host. Further during online response, the meter may indicate to the master about its emergent status (such as log overflow, storage capacity overflow etc, anomaly, attempted fraud etc, if any) so that master may take appropriate action in advance.

The purpose of **Offline data communication** is to get stored values/ logs/ Name plate details/ current configuration details etc as well as remote programming of defined programmable parameters/ time synchronization commands etc from master to the meter. Offline data will normally be downloaded once a day (after midnight) but it must be possible to download it any time for any period (out of available data in meter storage) as the master/ host system may desire.

Offline data be downloadable in suitable chunks so that Host/ master may prioritize online & offline communication simultaneously, and also that offline data communication once started may not hang/ clog data communication path keeping in view its bulk.

Online/ Offline Data communication operation shall not erase the data from the meter's memory, or effect the meter operation in any way. No hardware and software changes except configuration changes may be required for online/ offline communication through comm. port whenever the port may be used with suitable communication as and when desired or decided.

Further the meter manufacturer must supply the details, settings & requirements of the open protocol which will be necessary for interfacing the meter with the personal computer/ data collection center/ Base Computer systems/ AMR systems etc. for online and offline data communications

a. It shall be also possible to retrieve this data through communication port and MRI.
b. The meter shall be provided with the following ports:

1. RS 485 port for specific data transfer to Sub-station data logger/computer. RS 485 communication port shall be suitable for interfacing multiple Energy Meters. It shall be possible to download stored meter data on polling basis with the aid of a software schedule by addressing meter/(s) at a time and downloading the stored data into the Sub-station data logger / computer / Data Acquisition Server.
2. Network port (TCP/IP) for periodic transfer through communication mediums like OFC, MPLS etc, to the Data Acquisition Server at remote station.
3. Galvanically isolated optical communication port in front of the meter for data transfer to or from a hand-held data collection device (Common Meter Reading Instrument 'CMRI') – conforming to DLMS IS15959/PACT/ANSI.
   The following ports are desired as back up means of meter data acquisition:
4. RS-232 port for periodic transfer through communication mediums like GSM/GPRS/CDMA etc.

c. Each meter shall have an optical galvanically isolated communication port compatible to RS 232 on its front for tapping all data stored in its memory. The communication protocol should be as per DLMS IS15959/PACT/ANSI. Common Meter Reading Instrument (CMRI) shall also be provided separately for this purpose as per requirement to serve as interface between the meters specified above and the local PC. The overall intention is to tap the data stored in the meter memory on line using the modem and a remote central computer through GPRS/GSM/OFC system and the CMRI/USB as a back up in cases of break-down of the communication system from separate RS232 based communication port.

d. The metering system shall also be provided with an inbuilt Ethernet communication port for data transfer to a central location. This port shall be capable of data transfer on DLMS protocol to a main computer using suitable communication network and compatible communication hardware (interfacing equipment/switches/routers/communication cables etc.) as required. The Ethernet port of meter shall support static IP address along-with subnet mask and gateway address so that it can be integrated into the UPCL LAN in future. The IP address allocated to each meter shall be retained even after power off-on event.

e. Port numbers should be such meeting above criteria.

6.19 DCD/ CMRI & PC Software (Basic Utilities):

The meter supplier/ manufacturer shall provide the necessary licensed software which would enable an IBM-Compatible PC to:

a) Accept the data from the DCD/ CMRI (especially from DCD/ CMRI already available within UPCL procured from M/s Signals & Systems (India) Pvt. Ltd., Chennai bearing model No. CMRI – 1010) and/ or from an interface device connected to the Optical Port and store it in a tamper proof file in binary/ encrypted/ password protected etc read only format for tapping all data stored in a meter's memory and faithfully transferring it to the IBM Compatible PC. The intention is to ensure absolutely no tampering (except total erasure) of the collected data file while handling that file with PC.
b) For reading that binary/ encrypted/ password protected etc. read-only data file, the meter supplier must give a utility program/ software to convert that data to MS Excel format/ text file etc. Also there should be utility to verify the converted file against original tamper proof file as and when desired. Use of both the utilities must be user friendly/ understandable by a computer savvy person/ easy to use with requisite help/ documentation. The above two utilities must also be available free of cost as an ActiveX/ COM/ DCOM etc component (with complete documentation with examples source code snippets in VBA/ VB/ C etc) so as to be useable as an embedded software component with third party Billing/ Base station software.
c) Name of the data file should be such that meter should be identifiable preferably data period shall also be identifiable. For example the Name of the data file for Meter with Sr No xxxxxxxx and with data for the period 01/02/2009 to 28/02/2009 could be xxxxxxxx 20090201 20090228.dat etc.
d) Data collected above through DCD/ CMRI must show all the values of stored quantities as specified as well as the set values of all the programmable parameters, Meter Name Plate Details as well as logs of Parameter Changes/ Clock Correction/ Abnormal Conditions / Tamper/ Fraud Conditions etc.

e) The software for PCs & DCD/ CMRIs shall be supplied in suitable and compatible form/ media to enable its easy loading into the IBM-Compatible as well as existing DCD/ CMRIs in UPCL along with backup copies on CD.
f) Data tapping operation shall not erase the data from the meter's memory, or effect the meter operation in any way.
g) The software in DCD/ CMRI shall be simple to operate & foolproof. For example the data tapping from the coupled meter's memory shall start on pressing of a key, another key to start data transfer to the PC, and an indication, which would indicate completion of data collection, keep indicating while the data is held in the device and would stop indicating when all data has been transferred to the PC etc.
h) DCD/ CMRI software shall also have the necessary feature for time synchronization/ setting of the real time clock of the SEMs while downloading of the data as specified. The DCD/ CMRI software should have features to manually set/ auto synchronizes with BCS, the time in itself beforehand. Further if the meter clock has drifted so much that it is not possible to correct the meter clock as specified then it must also be indicated in the log file being transferred to the DCD/ CMRI from the meter. Also attempts to synchronize/ actual synchronizing of the meter clock through DCD/ CMRI be also indicated in the log files.
i) In case of any discrepancy in tapping of meter data by DCD/ CMRI (i.e. DCD/ CMRI already available within UPCL procured from M/s Signals & Systems (India) Pvt. Ltd., Chennai bearing model No. CMRI – 1010), ABT meter supplier shall install the required software in DCD/CMRI for making it compatible with the ABT meter software. However, if due to some reasons the existing DCD/ CMRI are not suitable, then the meter manufacturer must also supply the DCD/ CMRI.
j) Collected data shall be stored on the base computer in original tamper proof binary/ encrypted format file as well as MS Excel/ Text file.
k) It should be possible to display & print the collected data on PC's screen in MS-Excel / Text format.
l) It should be possible to store the original collected data in binary format, on a floppy disc/ CD/ DVD/ Pen drive.
m) The DCD/ CMRI software should be suitable for reading, down loading of multiple meter data, Time Setting in DCD/ CMRI, Time correction for Meter as specified, and other relevant configurations/programmable parameters in the meter. All such changes/ configurations should be password protected and logged in the meter with date & time.
n) The necessary training if required as well as detailed & easily understandable manuals/ documentation for this purpose shall also be provided.

6.20 Sealing of Meter:

Proper sealing arrangements shall be provided on the meter to make it tamper-proof. Provision of at least two seals on the meter body, one seal on the terminals block and one separate seal on optical port should be available. Sealing arrangement of communication port must also be provided.

6.21 Meter Construction:

The meter shall be made of high quality materials/ components to ensure high reliability and long life. The meter shall be supplied housed in compact and sturdy, metallic or moulded cases of non-rusting construction and finish. The cases shall be designed for mounting on a plane, vertical surface such as a control & relay panel front/ inside a metal box etc. All terminals for CT and PT connections shall be arranged in a row and shall have easy accessibility when terminal cover is open and no accessibility when terminal cover is closed. Terminals shall have a suitable construction with barriers and cover, to provide a secure and safe connection of CT and PT leads through stranded copper conductors of 4 sq. mm. sizes. Minimum Clearance & Creepage Distance shall be as per the relevant standards.

The meter shall also withstand without any damage or mal-operation reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity etc as per relevant standards. They shall have an IP-51 of ISI2063 category dust tight construction, and shall be capable of satisfactory operation in an indoor, non-air-

conditioned installation. It shall be immune to vibration and shocks during transportation and handling. It should also be immune to external magnetic & electric fields as per CBIP-325-latest edition.

All the materials and electronic power components used in the manufacture of the meter shall be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.

The meter shall be designed with application of specific integrated circuits. The electronic components shall be mounted on the printed circuit board. All insulating materials used in the construction of meter 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. Any protective coating shall not be liable to damage by ordinary handling nor damage due to exposure to air under normal working conditions.

The meter shall have operation indication device such as a blinking LEDs and/ or LCD indication, alphanumeric display, sealing arrangements, mounting arrangements etc as specified in this specification. The terminal cover design shall be pilfer proof.

Meter shall be designed and constructed in such a way so as to avoid causing any danger during normal use. However, the following should be ensured:

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 normal working condition.
v. Protection against fraud/ prevention against pilferage.

The meter construction should conform to CBIP reports with latest amendments.

6.22 Connection Diagram & Terminal Marking:

The general scheme of Connection Diagram & Terminal Marking shall be as per the relevant standards. The connection diagram of the metering module shall be clearly shown appropriately on the meter. The meter terminals shall also be marked and this marking should appear in the above diagram. In case any special precautions need to be taken at the time of testing/ installation of the meter the same may be indicated along with the circuit diagram. Phase sequence shall be marked on the diagram of connections.

6.23 Quality Assurance:

The meter manufacturer must have a quality control/ assurance (QA) procedure/ plan for manufacturing of the specified equipment generally based on the established and proven practices of the manufacturer.

6.24 Type/ Routine Tests

Meter must have been fully type tested only from Govt. approved /NABL accredited testing laboratories as per relevant ISS and/ or any other specified international standards, during last 2 years period to be reckoned from the date of opening of tender. The Routine tests shall be carried out strictly as described in the relevant sections of IS 14697/ CBIP technical report -325 publications and with latest amendments thereafter.

6.25 Acceptance Testing

6.25.1 Meter:

Meter shall be duly tested & certified that it is suitable for the purpose as per the relevant standards & CBIP-325 report (Latest Amendment). In addition, each and every meter shall be subjected to the following acceptance tests:

a) Functional checks for display and memory.
b) Accuracy of the calendar and clock. (Method should be given by the manufacturer)
c) Accuracy of kWh, kVarh, voltage, frequency measurement etc. shall be checked at the steps of 0.5 Hz over the full frequency range.
d) Testing of internal/ external power pack battery arrangement as well as meter Burden/ Wattage
e) Testing for all tampers, frauds and anomaly may be carried out for compliance as specified.
f) Working, suitability, functions etc of Optical Port as well as communication port as specified.

6.25.2 Acceptance Testing of DCD/ CMRI software and PC software:

DCD/ CMRIs software and PC software (utilities) supplied by the meter supplier must be installable on the specified DCD/ CMRIs & PCs to verify that they are suitable/ user friendly for the specified purpose. Both software after installation as specified shall be subjected to the following acceptance test:

a) Method of installation on DCD/ CMRI as specified
b) Functional checks as specified
c) Downloading Meter Data from the Meter through optical port
d) Downloading data/ file to PC as specified
e) Tamper proof nature of the data/ file downloaded to the PC.
f) Conversion of the data file to MS Excel/ Txt format as specified and verification of such converted files against original data files from meter.
g) Functioning of auto time synchronization/ setting of the real time clock of the meter while downloading of the data or otherwise as specified.
h) The DCD/ CMRI software should have features to set/ synchronize the time in itself beforehand.
i) Proper functioning of advance and retard time commands.
j) Per meter downloading time verification
k) Capacity of DCD/ CMRI software for data storage

6.26 Manuals:

The meter must have detailed user-friendly manual having operational details, configuration change procedures and maintenance procedures of meter/ DCD/ CMRI software/ PC software and also shall provide the Memory mapping detail of the Meter for online & offline monitoring. A user-friendly manual covering remedial measures to be taken by the users in day to day operation of Meter/ DCD/ CMRI is required to be provided by the manufacturer.

6.27 Guarantee:

i. The meter shall be guaranteed for a period of at least five years from the date of receipt of meter at site or UPCL stores. If the meter is found defective within the above guarantee period, supplier will have to replace the same free of cost with a new meter along with box with new serial number.
ii. Meters are to be replaced within 90 days from the date of lifting the same by the supplier, otherwise the cost of meter and 15% supervision charges will be deducted or recovered from pending bills, bank guarantees or by any other means as deemed fit.
iii. Executive Engineer, Electricity Test Division will inform Supplier about meter gone defective within guarantee period with meter serial no. and purchase order no. & date, for lifting the defective meters

under intimation to Executive Engineer, Electricity Store Division. Such meters will be lifted by the supplier within 45 days from date of intimation (date of intimation will be deemed as date of information letter by Executive Engineer, Electricity Test Division). If the defective meters are not lifted within 45 days, demurrage charges of Rs. 5/- per meter per day will be charged. Amount of demurrage charges will be informed by Executive Engineer, Test Division to Executive Engineer, Electricity Store Division.

iv. The cumulative damage rate during guarantee period should not exceed:
   1. Upto one year- 2%
   2. Upto two years- 3%
   3. Upto three years- 4%
   4. More than four years- 5%

If the supplier fails to adhere to the above requirement, UPCL may take any penal action against the supplier up to and including debarring/blacklisting.

6.28 Packing:

The meter shall be properly packed in suitable packing to avoid damage or disturbance during transit or handling, to ensure their safe arrival at destination and long-term storage. Each meter may be suitably packed in the first instance to prevent ingress of moisture and dust and placed in a cushioned carton of a suitable material to prevent damage due to shakes in transit. The lid of the carton may be suitable sealed. A suitable number of sealed cartons may be packed in a case of adequate strength with extra cushioning, if considered necessary. The cases may be than properly sealed against accidental opening in transit. The packing cases may be marked to indicate the fragile nature of the contents.

6.29 Tamper, Fraud, Anomaly Detection/ Logging of Incidents:

The meter shall have the following special features to prevent/ detect common ways of tamper and fraud and record/ log the same with date & time of occurrence, duration, count etc. However, detection mechanism should ignore momentary/ transient occurrences of these, which are below appropriate thresholds and specify the same clearly in the meter manual/ literature.

a) **Phase sequence Reversal:** The meter shall keep working accurately irrespective of the phase sequence of supply.
b) **Missing Potential:** The meter shall record/ log occurrence and restoration of missing of one/ two potential as per the relevant standards.
c) **CT Reversal:** The meter shall record/log occurrence and restoration of CT reversal of one/two phases as per standards and mentions clearly the phase with time and date stampings.
d) Meter shall work accurately during the tamper conditions of neutral disturbance i.e. when DC voltage/ High Frequency is fed to neutral.
e) The meter should be provided with magnetic shielding so that any external magnetic field (AC/DC Electromagnetic or Standalone Magnet) as per the value specified in CBIP reports no. 325 with latest amendments) should not affect the proper functioning of the meter.
f) Accuracy of the meter should not be affected with the application of the abnormal radiations/ voltages/ frequencies generating devices anywhere on the phase/ neutral circuits etc. The accuracy of the meter should be checked before, & after these applications, and the accuracy of the meter during tamper shall be as per latest CBIP reports
g) Meter shall record the energy accurately under the effect of radiation emitted by mobile phone or such other devices. The test shall be carried out by bringing a mobile phone in the close proximity of the meter for 10 minutes when there is an incoming call and shall be checked under the following conditions:
   i) 10% I_b at UPF
   ii) 50% I_b at UPF
   iii) 100% I_b at UPF

iv) 120% I_b at UPF

g) The offered meter shall also be capable to withstand and shall not get damaged if phase to phase voltage is applied between phase and neutral.
h) The meter should register energy correctly even when the load is not terminated back to the meter and instead the current is drawn through a local earth.
i) Tamper information and readings/ stored data should not be modifiable through CMRI or P.C. / Ports.
j) In case more than one tampers exist simultaneously/ then meter shall record all the tempers with date and time of occurrence/ duration.
k) Power Supply failure: The meter shall log the cases of failure of Self Power i.e. PT/CVT and its restoration with date and time.
l) Tampering data/ events should be recorded/ logged with date and time, firstly as per the recommendations of CBIP-325 Report (Latest Amendments), secondly as per the Relevant Standards or lastly as specified in the Specification in the relevant sections, in that order. And if not covered/ specified in any of the above then the recording should be to log the first occurrence and of last restoration along with total number and total duration of all such occurrences during the above period. It shall also record instantaneous data (for each phase) i.e. voltage, current, P.F. etc. Tampers shall be recorded if it persists for 1 minute continuously and once a tamper is detected by crossing the 1-minute threshold, any momentary normalizations/ restoration for less than 5 minutes thereafter be taken as single continuous temper. However, if some tamper is repeatedly/ excessively occurring for duration even less than 1-minute threshold, it shall also be logged.
m) The meter shall have an appropriate display system by which any attempt of tampering the meter is promptly displayed with date and time tagging.
n) In case of any anomaly/ fraud/ tamper/ battery failure (preferably in advance)/ clock failure/ configuration change etc the meter should have a provision for alarm/ indication. However, details of that particular exception should be stored & available through display. Latest one exception (with date/ time) should also scroll in the display along with the instantaneous values as specified. At least 350 Nos. tampering/ exception events (count, occurrence, restoration and duration) shall be logged with date and time.
o) Other possible tampers/ anomalies which can be detected/ logged be brought out by the vendor.

6.30 Meter Identification/ Name Plate Details/ Marking of Meter:

Each Meter shall bear the information as per the relevant standards. Each meter shall have a unique serial number given by manufacturer, which shall be marked permanently on its front, as well as in its memory. Besides unique meter serial number the meter shall have the provision for programming Meter ID/ Identification code/ string (at least 20 Characters) through DCD/ CMRI, Other markings on the meter shall be as per the relevant standards.

Further, Name Plate details as given below should also be available to be downloadable with DCD/ CMRI operation as well as through remote via comm. port.

Name Plate Details:

S. No.	Information
1	Meter Serial Number
2	Meter Constant (impulse/kWh)
3	Accuracy
4	Make
5	Model/ Designation of Type
6	Month/ Year of Manufacture
7	Configuration/ Settings
8	Firmware version
9	Rated secondary current of CT (1A or 5 A).

S. No.	Information
10	Reference Voltage, Frequency
11	Principal unit(s) of measurement
12	Guarantee Period etc

6.31 Disclosure requirements:

Besides as stated in the relevant sections of the Specification, the meter manufacturer must also give the principle of operation of the meter, outlining the method and stages of computation of various parameters starting from input voltage and current signals including the sampling rate if applicable should be furnished by the supplier. The manufacturer should indicate the method adopted to transform the voltage and current to the desired low values with explanation on devices used such as CT, PT or Potential divider as to how they can be considered superior in maintaining ratio and phase angle for variation of influence quantities and during its service period. Details of memory used in the meter should be furnished by the manufacturer. This is in confirmation with the CBIP-325 reports.

Annexure-A

MAKE OF THE COMPONENTS FOR BIDDER

SI. No.	Item	Requirement	Makes and origin
1	Measurement / Computing Chips	The measurement / computing chips used in the meter shall be with the surface mount type (SMT) along with the ASICs.	**USA:** Analog Devices, Cyrus LOGIC Atmel, Phillips, Texas Instrument, Renasas, teridian, Motorola, ST micro electronic. **South Africa**: SAMES **Japan:** Hitachi, NEC, Oki free scale semi conductors, MMI, Maxim, Siemens
2	Memory Chips	The memory chips shall not be affected by the external parameters like sparking, high voltage spikes or electrostatic discharges.	**USA:** Atmel, National Semiconductors, Texas Instruments, Phillips, ST micro Electronics, Renasas. **Japan:** NEC, Hitachi, Oki Microchip, Siemens, ramtron,numonyx, Micron
3	Display Modules	The display modules shall be well protected from the external UV radiations. The display visibility shall be sufficient to read the meter mounted between height of 0.5m and 2m. The construction of the modules shall be such that the displayed quantity shall not be disturbed through out the life of display. It shall be trans-reflective STN (Super Twisted Nematic) industrial grade type.	**Japan:** Hitachi, Sony, YEBOO Jiya (Haijing) & Tianma
4	Optical Port	The mechanical construction of the port shall be such to facilitate the data transfer easily.	**USA:** National Semiconductors, Everlight, HP, Agilant, optanik, Siemens, Osram Electronics **Holland/Korea:** Phillips **Japan:** Hitachi, Sharp **Germany:** LITEON Fairchild
5	P.C.B.	Glass Epoxy, fire resistance grade FR4.	**Reputed Make**
6	Electronic Components	The active & passive components shall be of the surface mount type and are to be handled and soldered by the state of art assembly processes.	**USA:** National Semiconductors, Atmel, Phillips, Texas Instruments, ST, onsemi. **Japan:** Hitachi, Okai, AVX, Ricoh **Korea:** Samsung, EPCOS Toshiba & Siemens
7	Battery	Lithium with guaranteed life of 10 years.	Varta, Teridian, Sanyo, national renota, Panasonic, ST, Epson, Maxell, intersil, Mitsubishi, Teckcell, Saft
8	RTC / Micro Controller	The accuracy of RTCD shall be as per relevant IEC / IS standards.	**USA:** Phillips, Dallas, Atmel, Motorola, Microchip, Texas instruments, ST, Epson, intersil, renasas **Japan:** NEC or Okai Teridian

7.Technical Specifications for LT CT Operated AC Static Tri-vector Meter, Class 0.5s (Category - C)

7.1 Scope

This specification covers the design, engineering, manufacture, assembly, inspection, testing at manufacturers works before dispatch, packing supply and delivery at designated stores of UPCL, insurance of DLMS compliant AMR compatible with GPRS MODEM compatibility features LT CT operated 240 volt 3phase 4 wire static energy meter of class 0.5S accuracy, housed in tamper proof box capable of accommodating GPRS MODEM along with CT's of accuracy class 0.5S housed in CT box and hardware and software as per requirement given in this specification.

The meter should be 3 phase 4 wire type with 4 CT's suitable for energy measurement of solidly earthed balanced/unbalanced 3-Phase system with a power factor range of zero lagging through unity to zero leading.

The meter shall consist of measuring element, registers, operational indicators and test outputs enclosed together in the meter case.

7.2 Climatic Conditions

The meters to be supplied against this specification should be suitable for satisfactory continuous operation under the following tropical conditions. Meters should be capable of maintaining required under hot, tropical and dusty climatic conditions.

Table 7-1: Climatic Conditions

S. No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

7.2.1 Tropical Treatment

The meters shall be suitably designed and treated for normal life and satisfactory operation under hot & hazardous tropical climate conditions and shall be dust and vermin proof. All the parts & surface, which are subject 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 injurious effect of excessive humidity.

7.3 Standards Applicable

Unless otherwise specified elsewhere in this specification, the performance & testing of the meters shall conform to the following Indian/International standards with updated and latest amendments /revisions thereof.

Table 7-2: Standards Applicable

1	IEC 62053-22	AC Static Watt-hour Meters for Active Energy, Class 0.5S
2	IS 14697-1999	AC Static Transformer Operated Watt-hour and VAR-Hour Meters, class 0.5S.
3	CBIP-88 Technical Report No. 88	Specification for AC Static Electrical Energy Meters
4	CBIP Technical report no. 111	Specification for common Meter Reading Instrument
5	IS 9000	Basic Environmental Testing Procedures for Electronic & Electrical Items.
6	Standard Technical specification	Standard technical speciciation , Indian Companion Specification.
7	IS-15707	Specification for testing,evaluation etc.
8	ETD 13 (6211)/IS15959	Category 'C' for consumer metering

Technical specifications to be followed should basically conform to latest guideline documents / Indian Companion standards ICS – BIS - ETD 13 – 6211 – April 2010 as far as practicable.

7.4 Specific Technical Requirements

7.4.1 Supply System

(a) Type of Installation : Indoor
(b) System :3-p-hase 4-wire
(c) System Voltage (Vref) :3x415 volt ph-ph
3x240 volt ph-n
(d) System frequency :50 Hz
(e) No. of Phases :3

The meters shall be suitable for use on L T 3x240V, 3ϕ, 4-Wire system with 4 nos. of CT's each of secondary current rating of 5A. The meter shall be suitable for balance as well as unbalance loads at all power factors. The rated basic current for the Meter shall be 5 Amps.

7.4.2 Power Factor Range

The meter shall be suitable for full power factor range from Zero (lag) to Unity to Zero (lead).

7.4.3 Power Supply Variation

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

- Voltage : 75% to 120 % of Vref
- Frequency : +/- 5% of 50 Hz

The manufacturer can also offer meters, which can withstand higher variations.

7.4.4 Accuracy

The class of accuracy of the meter shall be 0.5S. The class of accuracy of CT shall be 0.5. The class of accuracy should not drift with time.

7.4.5 Power Consumption

The Active and apparent power consumption on each voltage circuit including power supply of the meter at ref. Voltage, temperature and frequency shall not exceed 1.5 watts/phase and 8VA/phase. (Table 9 of IS 13779 1999)

The apparent power drawn by each current circuit of the meter shall not exceed 1VA/phase at basic current, reference frequency and reference temperature. (Table 10 of IS 13779 1999)

7.4.6 Starting Current

The meter shall start registering energy at 0.1% of basic current at unity power factor and shall be fully functional within five seconds after the rated voltage is applied.

When the voltage is applied with no current flowing in the current circuit, the meter shall not register any energy and the test output of the meter shall not be more than 1 pulse per count on no load.

7.4.7 Maximum Continuous Current

The maximum continuous current in meters shall be 200% of rated basic current (Ib) at which the meter purports to meet the accuracy requirements as per the relevant standards.

7.4.8 ISI Marking

The meter shall be ISI marked and bidder shall have to furnish valid BIS certification along with the offer.

7.5 General Functional & Constructional Requirements

7.5.1 General Functional Requirements

Meter Shall Be Designed and Constructed In Such A Way So As To Avoid Causing Any Danger During Use And Under Normal Conditions. However, the Following Should Be Ensured -

a) Personal safety against electric shock
b) Personal safety against effects of excessive temperature.
c) Protection against spread of fire
d) Protection against penetration of solid objects, dust & water
e) Protection against fraudulence
f) Protection against pilferage
g) Protection against fiddling with internal components
h) Size of the Meter along with tamper proof meter box should preferably be comparable to existing installed meter/conventional EMT Meter.
i) Protection against meter jamming by spurious signal injection/high magnetic field application

The meter shall be designed with application specific integrated circuit and shall be manufactured using SMT (surface mount technology) components. Power supply and voltage divider circuits may be of PTH technology. the meter should be housed in a safe, high grade engineering plastic/polycarbonate tamper proof continuous (preferably seamless) ultrasonically welded casing and which is of projection mounting type and is dust/moisture proof, conforming to IP-51 of BIS 12063 I IEC 529.

1. Holographic seals to be provided at front and side joints. Polycarbonate seals have to be provided two numbers at the meter body, two numbers at terminal cover, two numbers at meter box, one number at optical port, one number at RS232 port and one number at MD reset point, two nos. at CT box for all category of meters.
2. All insulating material used in the construction of meters shall be non- hygroscopic, non-ageing and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion throughout during operating life by providing suitable protective coating.

3. The Meter Shall Be Supplied With A Non-Detachable, Transparent Extended Terminal Block Cover (ETBC). The Combined Meter Block and ETBC Shall Be Made Of Unbreakable, High Grade, Fire Resistant, Non-Flammable, Reinforced, Polycarbonate (Not Bakelite) or Equivalent High Grade & Good Quality Engineering Plastic.
4. The Non-Detachable Extended Terminal Block Cover Attached With The Meter Block Should Be Separately Sealable At Two Places And Will Be At The Bottom Of The Meter. The ETBC Once Sealed Should Prevent Unauthorized Tampering By Physical Means.
5. The terminal block should have sufficient insulating properties, mechanical strength and should house plated solid brass terminals with two fixing screws per terminal. The terminals should be designed to withstand high continuous overload.
6. The meter should not get damaged/influenced by the electromagnetic disturbances and electrostatic discharge, harmonics, voltage dips and short interruptions, transients, DC and AC magnetic field, (as per IS 14697 with latest amendments) remote jamming through spurious signals injection etc. and meter should record accurately even when Neutral is opened and should indicate for application of phase voltage on neutral.
7. The meter shall have an operation indication device such as a blinking LCD/LED. The operation indicator shall be visible from the front window and capable of being monitored conveniently with suitable testing equipment.
8. The meter shall conform to the degree of protection IP 51 as per IS 12063/IEC 529 for protection against ingress of dust, moisture, vermin's etc.
9. The combined meter block, ETBC and the tamper proof meter box shall be made of transparent, unbreakable, high grade, fire resistant, reinforced, non- flammable polycarbonate or equivalent high grade & good quality engineering plastic.
10. The meter block shall be of scratch less, transparent, high grade engineering plastic for easy reading of all the displayed values/parameters, nameplate details and observation of operation indicator. The transparency of the box shall remain un-influenced with the environmental conditions. The meter block shall be ultrasonically welded such that it cannot be removed undamaged without breaking the meter block.
11. The combined meter block, ETBC and the tamper proof meter box shall ensure safety against the spread of fire. They should not be ignited by thermic overload of live parts in contact with them.
12. The meter shall have tin plated brass terminals. The terminals shall have suitable construction with barriers and cover to provide firm and safe connection of current and voltage leads of stranded copper conductors or copper reducer type terminal ends (thimbles).
13. The manner of fixing the Conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixing which may be loosened and tightened several times during the life of the meter shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material. The internal diameter of the terminal holes shall be 5.5 mm minimum. The clearance and creep age distance shall conform to relevant clause of IS 13779 1999/CBIP technical report No. 88.
14. The meter shall be compact in design. The entire construction shall be capable of withstanding stresses likely to occur in actual service arid rough handling during transportation. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.
15. The meter shall have a design life of 10 years against manufacturing and design defects. The Supplier shall stand 5 years Guarantee on the meter against any kind of failure/defects/mal-operation within above period. Meter shall be replaced by supplier free of cost within one month of intimation by UPCL. Supplier shall have to repair for another 5 years after the guarantee period is over, on chargeable basis. Supplier shall establish a Customer Support Office at Patna to facilitate quick replacement/providing services for above purpose.
16. The meter shall be provided with an inbuilt accurate quartz crystal based real time clock and calendar, the maximum permissible drift in the real time clock shall be 1 minute per year. The clock reading shall be

adjustable through CMRI/BCS with proper password protected security. The Meter time synchronization through CMRI/BCS should be provided with proper security system so that unauthorized time change is not accepted by the meter. Battery back up should be provided to maintain the time in absence of mains supply.

17. The battery life should be at least 3 year when meter is not powered up and 10 years when meter is powered up.
18. The integration period shall be set as 30 minutes and should be programmable for setting any integration period desired by UPCL subsequently, on real-time basis.
19. Meter shall be pre-programmed for direct display of meter reading without the help of any multiplying factor for the CT ratio used.
20. Vendor will give predefined copies (Qty. indicated in Bid Proposal Sheets) of all the software's (meter reading software for CMRI/BCS, Base computer software for meter data analysis and technical details).
21. It should be possible to check the healthiness of phase voltages by displaying all the voltages on the meter display.
22. The meter shall have provision to be read in the absence of power, through LCD/LED auto-display. A capacitor may be included in the circuit as one of the means, which may provide energy for reading the meter display in absence of power supply. The bidder may adopt and explain other tamper proof means for the above purpose.
23. The meter should work accurately irrespective of phase sequence and shall indicate for wrong phase association.
24. The meter should remain powered up and functional as per prevailing electrical conditions within same accuracy class, even when either any two phases or anyone phase with neutral is available to the meter.
25. The meter should continue to record accurately as per prevailing electrical conditions even if the neutral of potential supply gets disconnected.
26. The meter shall indicate as tamper if one or more CTs are reversed/shorted or missing of one or two potential. However, the meter shall continue to record as per prevailing electrical conditions.
27. Data Security the Meter shall have multilevel password for data protection and security. The meter data retrieval shall be possible directly to authenticate BCS/ through authenticated CMRI prepared by base computer software. The meter shall support the event of change of TOD register timings/no. of TOD registers, demand integration. period and/or setting the meter time through authenticated transaction and shall be logged as an event. The transaction events shall be available for viewing at BCS end. Bidder shall mention minimum no. of events available at BCS end as FIFO basis.
28. The meter data shall be retrievable directly/through to BCS/CMRI and downloadable by CMRI to base computer software for viewing. The meter data downloaded at BCS end should be in user-friendly formats. The supplier shall supply the required software for base computer system. The base computer software shall have the facility to convert the required data (For billing, Energy Audit, tamper analysis purposes) in to ASCII format as per utility requirement for further analysis & billing purpose. This data should be possible to be used as input data for any other software to generate desired reports as per the utility requirement.
29. The meter shall have radio interference suppression such that it should not generate noise, which could interfere with the other equipment.
30. The meter shall have 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 to the consumer after fixing the meters. The lower fixing screws shall be provided under the sealed terminal cover. The requisite fixing screws shall be supplied with each meter.
31. The meter shall work satisfactorily with guaranteed accuracy under presence of various influencing conditions like External Magnetic Field, Electromagnetic Field, Radio Frequency Interference, vibrations, harmonic Distortion, Voltage/Frequency, electromagnetic High Frequency Fields etc. the meter shall be capable of recording even in case of application by fraudulent means any of the tampering methods.
32. It should be possible to check the healthiness of phase voltages by displaying all the voltages on the meter display.

33. The meter shall have provision to be read in the absence of power, through LCD/LED auto-display. A capacitor may be included in the circuit as one of the means, which may provide energy for reading the meter display in absence of power supply. The bidder may adopt and explain other tamper proof means for the above purpose.
34. The meter should work accurately irrespective of phase sequence of the mains supply. There should be provision in CMRI software to display the phasor diagram at site so that meter could be checked at site while installation.
35. The meter should remain powered up and functional even when either two phases or one phase along with neutral is available to meter.
36. The meter should continue to record accurately even if the neutral of the potential supply gets disconnected and shall indicate when any phase voltage is applied on the neutral.

7.5.2 Sealing of Meter

Reliable sealing arrangement should be provided to make the meter tamper evidence and avoid fiddling or tampering by unauthorized persons by way of providing adequate no. of seals on meter terminal cover, communication ports & wherever necessary. All the seals shall be provided in front side only. Rear side sealing arrangement will not be acceptable. Please refer specification for sealing system.

7.5.3 Name-Plate Marking of the Meter

The marking on every meter shall be in accordance with relevant clauses of IS 14697/1999. Every meter shall have name plate beneath the meter cover such that the name plate cannot be accessed without opening the meter cover and without breaking the seals of the meter cover and the name plate shall be marked distinctly and indelibly. The basic marking on the meter nameplate shall be as follows

- Manufacturer's name & trade mark
- Type Designation
- No. of phases & wires
- Serial number
- Month and Year of manufacture
- Reference Voltage
- Rated secondary Current of CT (/5A)
- Reference Standard IS 14697
- Principal unit(s) of measurement
- Meter Constant (imp/kwh, kVARh, kVAh)
- Class index of meter
- "Property of UPCL"
- Purchase Order No. & Date
- Guarantee period

7.5.4 Connection Diagram & Terminal Markings

The terminals shall be marked properly on terminal block for giving external connections. A diagram of connections should be provided inside the cover of terminal block. The terminal cover shall be extended such that when it is placed in position it is not possible to approach the connections or connecting wires. The terminals and the screws shall be suitable to carry up to 150% of Imax safely. The terminals shall have suitable construction with barrier and covers to provide secure and safe connections.

7.5.5 Readout Facility through CMRI, Other Remote Communication Means

1. The meter shall be provided with Galvanically isolated optical communication ports as per IEC 1107, PACT, ANSI with removable cover and with hardware Locking arrangement so that it can be easily connected to a CMRI (Common Meter Reading Instrument) /BCS for data transfer or transfer of data through remote metering device such as modem/multiplexer etc. The optical communication port shall have proper sealing provision.
2. Port shall support communication on DLMS and should be accessible through a DLMS compliant HHU.
3. The meter shall also have the facility of readability and data downloading through remote application.

In view of installation of the meter inside a permanently locked fully transparent polycarbonate tamper proof box, suitable & convenient tamper proof arrangement to be provided by the bidder to facilitate downloading of meter data by CMRI/BCS through optical port are possible in secured manner without breaking the tamper proof meter box. Bidder shall submit necessary drawing showing the above arrangements along with the bid.

7.5.6 Hand Held Unit (HHU)

To enable local reading of meter data, a DLMS compliant HHU shall be used. It shall be compatible to the DLMS compliant energy meters that are to be procured / supplied on the basis of this specification. The HHU shall be supplied by the meter manufacturer along with the meters free of cost one for each XXX meters supplied.

7.5.7 BCS & CMRI Software

1. Sufficient no. of licensed copies of the latest relevant software shall be made available by the supplier for each common meter reading instrument (CMRI) and Base computer software (BCS).
2. Common Meter Reading Instrument (CMRI) & BCS will have be loaded with user-friendly software of latest higher version, compatible for reading, downloading meter data and Time of Day (TOD) programming etc in the meter.
3. Windows based user interactive Base Computer Software (BCS) for receiving data from Meter, BCS/CMRI and downloading instructions from base computer software to Meter, CMRI shall also be provided by the meter supplier. This BCS should have, amongst other requirements, features, and facilities described later in this specification, the facility to convert meter reading data into user definable DBF(Access) and 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, the variable data to export, the field width selection of each variable so that it may be possible for the user to integrate the same with the user's billing data and process the selected data in desired manner.
4. The software's shall have the flexibility to generate the following sets of reports.
    a. Billing reports
    b. Load survey reports
    c. Tamper reports
5. Necessary software for loading application program into meter via CMRI/BCS serial port. Purchaser may ask for some other reports also while placing PO. Accordingly, modification in program shall be the responsibility of the bidder.
6. Base computer station software for accepting data from handheld unit/ CMRl/ Processing, generating reports' and downloading instructions from the BCS to CMRI for onward transmission to meters.
7. Dial-up software for accepting data from the meter through P & T line to the BCS, processing, generating reports.
8. Billing reports to include customer ID, name & address, type of service/ connection (domestic/commercial/high tension/low tension/agriculture etc. total 20 types), connected load, meter status, previous meter reading date and time, current meter reading date and time, maximum demand, date and time of maximum demand occurrence.
9. Load survey report for a pre-determined time to include the following - customer ID, meter number, consumer connectivity references i.e. identity & location of pole / distribution transformer reference, feeder reference, sub- division reference, division reference, circle reference, time, date, maximum demand (kW) , kWh, power factor, kVAh, md reset count, power ON hours, outage duration, number of outages, voltages

max R, Y ,B date time and duration, voltages minimum R, Y ,B date time and duration, load factor as (energy consumed/(maximum demand x power on hours)), average load as (energy consumed / power on hours), THD max date time and duration.

10. The load survey data should be available in the form continuous, bar charts as well as in spreadsheets. The BCs shall have the facility to give complete load survey data both in numeric and graphic form.
11. Tamper reports to include for a pre-determined duration or month wise, tamper count, tamper duration and tamper history for each of the meters.
12. Vendor will provide soft copy of all the software in cd form along with the meters supplied to install & demonstrate compatibility of meter software with the different CMRI's/BCs program.
13. However, billing report, load survey, tamper parameters can be modified by the purchaser as per tariff requirement at the time of placement of order to the successful bidder.

7.5.8 Calibration and Test Output

1. The meter should have test output accessible from the front and be capable of being monitored with suitable testing equipment. The operation indicator must be visible from the front. Test output device shall be provided in the form of one common LCD/LED for kWh, kVARh and kVAh with provision of selecting the parameter being tested. The test output device should have constant pulse rate in terms of pulse/unit energy.
2. The meter shall be tested, calibrated and sealed at works before dispatch. Further, no modification of calibration shall be possible at site by any means.
3. The resolution of the test output shall be sufficient to enable the static current test in less than 10 minutes.
4. The relation between test output & the indication on display shall comply with, the marking on the name plate (imp/kWh).

7.5.9 Display

1. The meter shall be provided with an in-built accurate quartz crystal based real time clock and calendar. The clock reading shall be adjustable through CMRI/BCS with proper password protected security. The meter time synchronization through CMRI/BCS should be provided with proper security system so that unauthorized time change is not accepted by the meter. Battery backup should be provided to maintain the time in absence of mains supply.
2. The battery life should be at least 3 year when meter is not powered up and 10 years when meter is powered up.
3. The meter shall have a minimum 7-digit, 7 segment display of liquid crystal display (LCD) or light emission diode display (LED) with another digit for legend. The minimum character height shall be 10 mm. Principle unit of measured values shall be kilo Watt hour (kWh). The decimal units shall not be displayed.
4. The meter should have facility of auto display mode where all parameters automatically scroll within the specified time and a manual mode where the parameters can be read by push button operation. In auto display mode each parameter shall on display for 10 seconds. The display "off" period between two cycles shall not exceed 120 seconds. The register should not roll over in between this duration.
5. The meter should have non-volatile memory, so that the registered parameters will not be affected by loss of power. A provision shall be made to read the meter parameters such as MD and consumption, etc., through the meter cover without actually opening the meter box cover. The non-volatile memory should have a minimum retention time of 10 years under un-powered condition.
6. It should be possible to easily identify the display parameters through symbol/legend to be made available on the display itself.
7. In case of multiple values presented by a single display, it shall be possible to identify each displayed value/parameter through symbols/legend on the meter display itself.
8. The register shall be able to record & display starting from zero, for a minimum of 1600 hours (one thousand six hundred hours), the energy corresponding to the maximum current at reference voltage and unity power factor. The register should not roll over in between this duration.

9. In addition to providing serial number of the meter on the display plate, the meter serial number shall also be programmed into meter memory for identification through communication port for BCS/CMRI meter reading print out.
10. There shall be a tamper proof provision of reading of the parameters through LCD/LED display in
11. Case of "Power Off" condition or "long power cut scenario". The bidder shall explain the security aspect of the means adopted.

7.5.10 Display Sequence

The meter shall display the required parameters in two different modes as follows, However, Purchaser may ask for modification in the display sequence & display parameters at the time of placing P.O , if required -

Table 7-3 Display Parameters

S.No.	Auto Display/Billing Parameters	S.No.	Push Button Display
1	LED/ LCD test	1	Frequency – Hz
2	Meter serial number	2	Instantaneous phase to Neutral Voltage - Vr – N – Vy- N - Vb- N -
3	DATE	3	Instantaneous Line Current - Ir - Iy - Ib -
4	TIME	4	Instantaneous Power factor -
5	Previous month end reading- kWh	5	Date of previous months – MD – kW - MD – kVA
6	Previous month end reading- kVAH	6	Time of previous month – MD – kW - MD – kVA
7	Previous month - M. D –K.W.	7	CUMULATIVE MD - kW - MD – kVA
8	Previous month – M. D- kVA	8	Rising demand with elapsed time -
9	Previous month – P. F.	9	Current Ckt related present tamper status
10	Previous month – Power on Hours	10	Voltage Ckt related present tamper status
11	Previous month – Tamper Count	11	Other tamper status -
12	Current cumulative reading- kWh	12	Last occurrence tamper date -
13	Current cumulative reading- kVAH	13	Last occurrence tamper time -
14	Instantaneous load – kW	14	Last tamper restoration date -
15	Instantaneous load – kVA	15	Last tamper restoration time -
16	M. D. Reset count -	16	Cumulative Power ON Hours -
17	Circuit OK.	17	Cumulative tamper occurrence -
		18	Previous three months (at least) cumulative kWh, kVAH and maximum demand in kW & kVA at 24 00 Hrs the last date of the month. Display should be with respect to three TOD Zone.

7.5.11 Read Out Parameters with CMRI/BCS

All above including following:

- Energy registers
- Billing registers
- TOD Registers
- Load survey data
- Tamper and fraud (all event details with date and time)
- Self-diagnostic details
- Real time calendar clock fail
- Battery bad flag
- History of Monthly readings of Energy, Maximum Demand,
- Average Power Factor for the last 12 months

Displayed/recorded parameters may be altered at the time of placing order.

7.5.12 Maximum Demand Registration

The maximum demand is to be monitored during each demand interval set with 30 minutes integration and the maximum of these in a month shall be stored. Whenever MD is reset, the maximum demand value so registered shall be stored along with date and time. Under the current integration period, the rising demand should be displayed continuously along with the elapsed time. The registered demand and the number of times the MD is reset shall also be displayed and the information stored.

7.5.13 Maximum Demand Reset

Facility for auto reset of MD at 00.00 hrs of first of every month and storage thereof shall be provided for which minimum 30 years calendar shall be programmed by the manufacturer. The meter shall display the maximum demand reset count.

7.5.14 Self-Diagnostic Feature

The meter shall be capable of performing complete self-diagnostic check to monitor the circuits for any manufacturing defect to ensure integrity of data memory location at all time. The meter shall have indication for unsatisfactory/ non-functioning /malfunctioning of the following -

- Time and date
- All display segments on meter display
- Real Time Clock (RTC) status in meter reading prints out at BCS end.
- Nonvolatile memory (NVM) failure indication at BCS
- Low battery indication at BCS

While installing the meter, it should be possible to check the correctness of phase sequence, phase association, Current Transformer, Voltage connections to the meter and their polarity from the functioning of the meter for different voltage injections with the help of vector/phasor diagrams. For this purpose suitable software for field diagnosis of meter connections with the help of Meter Reading Instrument/BCS should be supplied.

7.5.15 Load Survey Capability

Load survey shall be available for at least 90 days with 30 minutes load survey integration period. Vendor shall provide necessary facility to transfer data to BCS and through CMRl. Load Survey shall be run time configurable and shall be able to choose any of the below mentioned parameters. The survey shall be factory programmable and parameter will be informed to the supplier at the time of ordering.

Load survey for LTCT consumer meter

The meters should log following parameters in 30 minutes integration period for 45 days:

(i) kWh (ii) RkVAh (iii) kVAh (iv) kVA MD (v) Current per phase & (vi) Voltage per phase

It shall be possible to select either demand or energy view at the BCS end. The above load survey data should be available in the form of bar charts as well as in spreadsheets. The BCS shall have the facility to give complete load survey data both in numeric and graphic form.

The load survey data, abnormality event information and instantaneous parameters data shall all be retrievable through the meter's communication port directly by BCS/through radio communication from a common meter reading instrument (CMRI)/Hand Held Unit and shall be transferred (downloaded) to a PC with user friendly 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.

The meter shall have sufficient non-volatile memory for recording history of energy parameters for last twelve billing cycles (Bill date shall be 00 hrs of the 1st date of the calendar month by default -programmable) and information should be made available at the BCS end

7.5.16 Time-Of-Day (ToD) Tariff/Demand

The meter should have provision of registering the time-of-day energy and maximum demand. It shall be possible to define TOD register for active forwarded, apparent forwarded energy type.

The meter should have in-built capacity to define up to eight (8) time zones through operation of CMRI .The change, of the TOD time-period(s) or changing number of TOD zones 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.

7.5.17 Harmonics Measurement

Up to 29th Harmonic shall be measurable that is a sampling rate of 3000/sec. The meter should be capable of measuring fundamental energy as well as total energy. Fundamental energy shall be made available on meter-display and the same only shall be used for billing purpose.

The total energy shall be logged in the meter memory and be capable of down loading to the BCS through CMRI /directly and be available for analysis at the BCS end.

7.5.18 Tamper & Fraud Protection

The meter shall function properly under following common abnormal conditions

Table 7-4: Tamper & Fraud Protection

1. Phase sequence reversal	The meter shall keep working accurately irrespective of the phase sequence of the supply.
2. Missing Neutral	The meter shall continue to record accurately according to electrical connections even if the Neutral of potential supply is accidentally or incidentally disconnected.
3. Current reversal/CT polarity reversal	The meter shall log energy in forward direction even if the current is flowing in reverse direction in one or more phases.
4. External magnetic influence (as per IS 14697 with latest amendment)	The metering system shall be provided with adequate magnetic shielding so that any external magnetic field (AC Electro Magnet or DC Magnet) applied on the metering system shall not affect the accuracy of recording of energy consumption.
5. High Voltage High frequency, jamming injections, AC DC chopping applications	Metering system should be measuring accurately and should indicate the phenomena as tampering.

Beside this the meter should have features to detect the occurrence and restoration of, at least, the following common abnormal events

- **Missing Potential & potential imbalance**

The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of Potential failure which could happen due to disconnection of potential leads (one or two), failure of phase line fuse from the Transformer primary side. Meter shall also detect and log cases of voltage unbalance (from 5 % for more than 5 minutes or more- programmable) of voltages.

- **Current imbalance**
  The meter shall be capable of detecting and recording occurrence and restoration with date and time of Current unbalance (30% or more for more than 15 minutes- programmable).
- **Current Circuit Short**
  The meter shall be capable of detecting and recording occurrences and restoration of shorting of any one or two phases of current circuit to identify events like CT saturation, CT lead shorting, CT inter turns short etc.
- **Current Circuit Open**
  The meter shall be capable of detecting and recording occurrences and restoration of opening of any one or two phases of current circuit which can happen due to intentional / accidental disconnection of current circuits. The meter shall be able to log abnormality conditions in current open event like CT leads burns, loose connection, CT winding open etc in the meter memory. No load condition should not be recorded in meter memory as a Current circuit open event.
- **Power ON/OFF**
  The meter shall be capable to record power on/off events in the meter memory. All potential failure should be recorded as power off event.
- The meter shall be capable of recording the cases of phase association error as tamper.
- The meter should record accurately even when the neutral is opened and shall indicate when phase voltage is fed to the neutral
- The meter shall record the total duration of the above abnormalities, time and date of their occurrences & restorations with a snap shot of electrical conditions viz. Voltage, Current, PF etc.

The meter shall keep records for the minimum last 250 events (occurrence + restoration) for above of abnormal conditions. It shall be possible to retrieve the abnormal event data along-with all related snap- shots' data through the meter's optical port or through radio with the help of a hand-held unit (HHU) and download the same to the BCS where it shall be available for viewing. All this information shall be made available in simple and easily understandable format.

The meter shall also be capable to withstand and shall not get damaged if phase to phase voltage is applied between phase to neutral.

7.5.19 Tamper Logic

a) Properly designed meter event logic should be provided. There shall be separate compartments for logging of potential related event, current related event and power on/off event. The bidder should explain the events details in each compartment under their offer.
b) The logging of various events in each compartment should be as under
c) Once one or more compartments have become full, the last event pertaining to the same compartment will be entered and, the earliest (first one)-event should disappear. Thus, in this manner each succeeding event will replace the earliest recorded event, compartment wise. Events of one compartment/category should overwrite the events of their own compartment/category only.
d) A properly defined meter tamper logic should be provided. The tamper logic should be capable of discriminating the system abnormalities from source side and load side and it should not log/record tamper due to source side abnormalities.
e) There shall be three separate compartments for logging of different types of tampers as follows

Compartment No. 1

50% of the tamper memory space shall be allocated for the following current related tampers

-CT polarity reversal

-CT open circuit

-CT short (bypass)

Compartment No. 2.

25% of the tamper memory space shall be allocated for missing potential tampers.

Compartment No. 3

25% of the tamper memory space shall be allocated for current unbalance tampers.

Once one or more compartments have become full, the last tamper event pertaining to the same compartment will be entered and the earliest (first one) tamper event should disappear. Thus, in this manner each succeeding tamper event will replace the earlier recorded event compartment wise. Events of one compartment/category should overwrite the events of their own component/ category only.

Bidder shall mention any new development in the field of above.

7.6 Tests

Unless specifically waived off all acceptance tests shall be witnessed by the purchaser.

7.6.1 Type Test

The material/ equipment offered shall be fully type tested in NABL accredited test laboratories as per standards and certificate is to be furnished by the bidder. Type test shall not be more than three years old.

7.6.2 Acceptance Test

Acceptance test shall be carried out as specified in table, 20 of CBIP technical report no. 304 & as per other relevant IS.

7.6.3 Routine Test

All routine tests as specified in table 2018 of CBIP technical report no. 304 & other relevant codes shall be carried out on each individual meter.

7.6.4 Fixing Of Meters

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

7.6.5 Specification, For Resin Cast Ring Type Current Transformers

A set of 4 nos**.** of Resin cast current transformers (CT,) of accuracy class 0.5 with solid galvanized/electrolytic copper bus bar for low tension energy metering shall be supplied with each meter. These CT's are proposed to be mounted as per suitability.

7.6.6 General Technical Requirement

- Rated Voltage :240 Volts(Phase to Neutral), 400V (ph-Ph)
- Rated Current (I Basic) :5 Amps balanced & unbalanced load
- Rated Frequency :50 Hz
- Accuracy class :0.5S
- Power Factor :Unity to Zero (all power factor lag/or lead).
- Temperature :The standard reference temperature for Performance shall be 27 °C.
- Supply system variation :Voltage Vref + 20% to -25%
- Frequency :50 Hz $\pm$ 5%
- Highest system voltage :660 V
- Current Transformer Ratio :200/5A, 100/5A

7.6.7 Construction

1) Core Material Basis for Material/Insulation etc. shall be guided by Reference Standards.
   - Material Low Loss, CRGO M4 OR Better Grade (Core Losses Should Not Exceed 0.8 Watts/Kg. At 1.5 Tesla)
   - Thickness Less Than OR Equal To 0.27mm.
2) Copper Wire
   - Material Enamelled Wire As Per IS 1800 Part IX / IEC 317
   - Test Certificate to be submitted
3) Insulation
   - Coil should be insulated with Electrical grade polyester tape.
   - Outer insulation should be with vacuum mixed, homogenous Resin casting
   - Minimum 2 mm thickness of resin above the coil of the CT to be ensured
4) Secondary Terminal
   - A three core (2.5mm) PVC insulated flexible multi strand copper wire leads shall come out directly from the CT as secondary terminal. Two wires shall be used for CT incoming & outgoing & one wire for PT. Proper color coding/identification shall used to identify the CT & PT leads. Secondary lead must be secured during casting against loosening while connection.
   - Bidder may propose some other arrangement also and shall explain the same in the offer.
5) Mounting Clamp
   - M.S. (1.6 mm thick) uniformly hot dip galvanized
   - It must be properly tightened to secure CT against vibration.
   - It must have suitable insulation distance from primary.

   Or the bidder shall make any other arrangement which should be properly explained in the offer.
6) Rating Plate

   Self-adhesive, laminated, printed label must be having following details

   - Manufacturer's name
   - Manufacturing month and year.
   - Batch No
   - Property of UPCL
   - Ratio, Burden & Accuracy Class
   - Applicable Standard
   - I.L.
   - STC Rating
   - Continuous thermal current
   - Caution against open secondary
   - Guarantee Period.

7.6.8 Drawing Approval

Party must get final drawing approval before commencement of commercial production/supply.

7.6.9 Test and Test Conditions

Type Test

The CT offered shall be fully type tested at any of the NABL accredited test laboratories as per relevant standards.

a) Schedule of type test for CT (AS per Reference Standard) to be conducted and certified by NABL Certified Lab I test house
   - Verification of terminal marking and polarity.
   - High voltage power frequency test.
   - Over voltage inter-turn test.
   - Determination of error according to the requirement of appropriate accuracy class at 5%, 20%, 100% and 120% with Full and Quarter Burden.
   - Short time current test and Peak dynamic current test.

- Temperature rise test etc.

b) Schedule of routine & acceptance test for CT
   - Verification of terminal marking and polarity.
   - Determination of error according to the requirement of appropriate accuracy class at 20% and 120% with Full and Quarter Burden.
   - Any other test as per reference standard.

7.7 Technical Specification for Pilfer Proof Box to House the Meter and CT Separately

7.7.1 Technical Details

a) The box shall be fully transparent scratch less, robust, & weather proof made out of poly phenylene oxide/high grade, good quality engineering plastic with flame retardant properties.

b) It shall be capable of withstanding temperatures of boiling water for 5 minutes continuously without distortion or softening. The thickness of the box shall not be less than 3 mm on the load bearing side (i.e. back side of the box) and other sides, door and roof shall not be less than 2.5 mm. The box shall have its roof tapering down to both sides for easy flow of water.

c) The box shall have two separate compartments, the upper chamber to house the meter and the lower chamber to house four numbers ring type resin cast CTs The lower, both sides of chamber shall be provided with suitable nos. blank holes of suitable diameter with cable glands with PVC chuck nuts on either side & bottom side of box for incoming and outgoing cables. The blanks should be removable for cable entry & exit as per site conditions. The base supports of the meter, CTs shall be raised suitably for ease of wiring.

d) Both the chambers should have provision for sealing independently with minimum of two seals each.

e) The boxes shall comply the provision of IS 5133 and IEC 695. The boxes shall be suitable for outdoor/indoor application with IP 55 protection. The box shall have its roof designed for easy flow of rainwater without any stagnation on the box

f) In view of installation of the meter inside a permanently locked fully transparent tamper proof box, suitable & convenient, tamper proof arrangement to be provided by the bidder to facilitate downloading of meter data by CMRI/BCS through optical port in secured manner without breaking the tamper proof meter box. Bidder shall submit necessary drawing showing the above arrangements along with the bid.

g) The overall dimensions of the box shall be such that adequate clearance is maintained between meter surface and box from all sides.

h) There should be adequate protection against any entry of dust, moisture, water, vermin etc.

i) Color Meter box shall be transparent.

j) The pilfer proof box shall be as follows
   - Material Scratch and break resistant, transparent, clear, polycarbonate/high grade & good quality engineering material. The transparency should remain un-influenced with the environmental conditions. The minimum thickness shall be 2 mm. There should not be any ingress of moisture into the box.
   - Internal hinges
     A minimum of 2 nos. internal hinges of each compartment, well protected against corrosion shall be provided. The hinges of the door should be concealed and they shall be fixed to the flanges provided to the base and cover of the box in such a manner that the door opens by a minimum of 120 degrees.
   - Handle
     Suitable handle or knob shall be provided for opening of the box door/s.
   - Fixing arrangement
     While fixing the meter, screws should not protrude outside. For fixing the box to the wall, 8 nos. keyholes of minimum 6 mm diameter shall be provided at all the four corners of each compartment of the box. The meter and CTs are to be installed in the box.
   - Latch
     The doors shall be provided with a GI latch or a 'U' clamp to make it safe with the base of the box.

- Sealing arrangement
  Both the compartment shall have provision for adequate number of sealing on each to make it fully tamper resistant.
- Printing Metallic/engraved label containing the letters ----------UPCL and the P.O. no. and date shall be engraved/embossed on the top cover of the box. The name of manufacturer shall be engraved/embossed on the bottom half of the box. A blank sticker shall also be pasted on the meter box for use of field staff to indicate service no. etc.
- The fixing arrangements shall not be complex and it shall be easily approachable for connections when the door is open and is completely tamper resistant once it is sealed.
- The dimensional drawing giving details of the meter box shall be enclosed with the bid.
- There should be push button operating arrangement on the meter box so that the push button on meter body may be operated without opening the meter box.

The bidder may offer same other suitable tamper proof arrangement also which should be explained in detail.

7.7.2 Pilfer Proof Box Tests

The following tests are to be conducted on the box at an NABL accredited laboratory and certificate to be furnished by the bidder.

- Test of material identification
- Test for mechanical strength as per IS 5133
- Test for water absorption as per IS 5133
- Test for stability at high temperature as per IS 5133
- Test for withstanding temperature of boiling water for 5 minutes continuously for non-distortion or softening of material.
- Glow wire test at 650oC as per clause 5.2.4 of CBIP Technical Report No. 88 Read with amendments.

7.7.3 Acceptance and Routine Tests

The following shall constitute acceptance test for box.

- Physical verification of dimensions of the box.
- Compatibility of the box for housing the meter for ensuring ease of connections and reading the meter.
- Tamper proof feature of the box.
- Test certificates as per relevant standards shall be furnished for approval.
- Life of battery used for the meter should be guaranteed for 10 (ten) years.

The supplier will extend immediate warranty replacement support.

7.8 Pre-Delivery Inspection at Manufacturer's Works

a) All acceptance Tests shall be witnessed and certified by purchaser's representative at manufacturer's works. The vendor shall give at least 10 days advance intimation to the purchaser to enable them to depute their representative for witnessing the Tests. The said representative shall have full facilities for unrestricted inspection of supplier's works, raw materials, manufacturing processes and conducting necessary Tests.
b) The said representative shall verify the calibration seals provided by the calibrating agency on testing equipments/ meters.
c) Test reports of routine Tests carried out by the manufacturer shall be submitted to the inspecting authority at the time of inspection for his approval.
d) Acceptance of any quantity of materials shall in no way relieve the supplier of his responsibility for meeting all requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.
e) In case of waiver of inspection, vendor shall carry out all (i) routine and (ii) acceptance Tests and submit test reports for approval of the purchaser, before dispatch of material.

f) The entire cost of testing for acceptance & routine rests and checking of length etc shall be borne by the supplier.

g) The purchaser reserves the right to select sample from any material offered for inspection /inspected and dispatched, which will be got type tested at any NABL accredited laboratory. The results of this type-tested sample shall be applicable for the entire quantity of the particular lot offered or supplied by the supplier. The Purchaser shall bear the testing charges, if sample passes all the Tests and if sample fails in any one of the Tests, supplier shall have to bear testing charges, same are recoverable from the supplier's any pending bill, security deposit, Bank Guarantee or by any suitable means, whichever deem fit by the Purchaser. In case of sample failing in aforesaid type Tests, supplier shall have to replace the whole lot materials, which should pass through the type Tests, the re-testing charges will have to be paid by supplier. If any quantity against the particular lot is consumed by the Purchaser, the supplier will agree for any penalty/deduction in price as may be mutually agreed.

7.9 Quality Assurance Plan

The vendor shall furnish the following information along with this bid; failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.

1. The structure of Organization
2. The duties and responsibilities assigned to staff ensuring Quality of work.
3. The system of purchasing, taking delivery and verification of materials
4. The system for ensuring quality of workmanship
5. The quality assurance arrangements shall conform to the relevant requirement of ISO 9001 or ISO 9002 as applicable.
6. Statement giving list of important raw materials names of sub-suppliers for the raw materials, list 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 vendor's representative, copies of test certificates.
7. Information and copies of test certificates in respect of bought out accessories.
8. List of manufacturing facilities available.
9. Level of automation achieved and list of areas where manual procession exists.
10. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
11. Lists of testing equipment available with the bidder for final testing of equipment specified and test plant limitation. If any, vis-à-vis the type, special acceptance and routine tests specified in the relevant standards.
12. These limitations shall be very clearly brought out in schedule of deviations from specified test requirements.

7.9.1 The Vendor Shall Also Submit Following Information

1. List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with offers.
2. Type test certificates of the raw materials and bought out accessories if required by the utility.
3. Quality Assurance Plan (QAP) withhold points for purchaser's inspection. The quality assurance plan and purchasers hold points shall be discussed between the purchaser and vendor before the QAP is finalized.

7.10 Guarantee

The manufacturer shall provide a guarantee of 54 months from the date of commissioning or 60 months from the date of dispatch whichever is earlier. Bidders shall guarantee to repair or replace the meters and meter boxes (if supplied), which are found to be defective/ inoperative at the time of installation, or become inoperative/ defective during guarantee period. Replacements shall be affected within 1 month from the date of intimation. If during the guarantee period, the materials are found defective or sub-standard, the same will have to be repaired/replaced

free of cost by the supplier within 30 days of intimation. If the defective materials are not replaced/rectified as per above guarantee clause, the Company shall recover twice the equivalent amount from any of the bills of the supplier or from performance guarantee so deposited by the supplier.

7.11 Services

Manufacturer shall also extend services to repair the meters & boxes on chargeable basis, up to a period of 60 months from the date when the guarantee period is over i.e. after 60 months of installation & successful operation of the instant meter. These defective/inoperative meters shall be repaired within a month time at reasonable charges for which Supplier shall maintain 1% stock as reserve.

7.12 Schedules

7.12.1 Schedule – I [Guaranteed Technical Particulars Item CT Operated Meters - 100/5 A & 200/5 A]

Table 7-5: Guaranteed Technical Particulars Item CT Operated Meters - 100/5 A & 200/5 A

S. No.	Description	Offered
1	Maker's name and country	
2	Type of meter/model	
3	Standards Applicable	
4	Accuracy/Interface class	
5	Parameters displayed	
6	P.F. Range	
7	Current Rating (100/5A, 200/5 A)	
8	Maximum Current (Imax)	
9	Minimum starting current	
10	Rated Voltage	
11	Meter constant	
12	Variation of voltage at which meter functions Normally	
13	Rated Frequency	
14	Power Loss in Voltage circuit (VA & watt) & Current circuits (VA)	
16	MD reset Provisions	
17	Display	
	a) Type of Register	
	b) No. of digits of display and height of character	
	c) Auto display mode & scroll mode	
	d) Type of push button for scroll mode	
18	Nonvolatile memory	
19	Details of provision for taking reading during power off condition	
20	Principle of operation	
21	MD Integration period	
22	Weight of meter	
23	Dimensions	

S. No.	Description	Offered
25	Outline drawings & Leaflets	
26	a) Remote meter-readout facility	
	b) Communication protocol used.	
	c) Sealing provision for meter & optical port.	
	d) Baud rate of data transmission	
	e) Required software to be resident in HHU and BCS.	
	f) Ultrasonic welding of body	
	g) Manufacturers Seal provided	
27	Base Computer Software	
28	Type Test Certificates	
29	Time of Day Zones (Selectable)	
30	Whether meter measures both fundamental & Harmonic Energy	
31	Real Time Clock Accuracy	
32	Battery for Real Time Clock	
33	Anti Tamper Features	
34	Effect of accuracy under tamper conditions	
35	Drift in accuracy of measurement with time	
36	Name plate details	
37	Type of calibration	
38	Type of mounting	
39	Testing facility	
40	Data retention by NVM without battery back up and un-powered condition	
41	Type of material used	
42	Base	
43	Cover	
44	Terminal Block	
45	Terminal cover	
46	Screw	
	i) Material	
	ii) Size	
47	Internal diameter of Terminal Hole	
48	Centre to Centre clearances between adjacent terminals	
49	Security Profiles	
	a) Basic Security	
	b) Advance Security	

7.12.2 Schedule – II [Technical Deviations proposed by the bidder]

Table 7-6: Technical Deviations proposed by the bidder

S.No.	As per Technical specification	Deviation by the bidder

8. Technical Specifications for Three phase Four Wire CT PT Operated, AC Static Tri-vector Meter, Class 0.5s Accuracy (Category - C)

8.1 Scope

This specification covers the design, engineering, manufacture, assembly, inspection, testing at manufacturers works before dispatch, packing supply and delivery at designated stores of UPCL, insurance of DLMS compliant AMR compatible with GPRS MODEM compatibility features CT PT operated 3 phase static energy meter of class 0.5S accuracy, housed in tamper proof box capable of accommodating GPRS MODEM and hardware and software as per requirement given in this specification.

The purchaser shall provide the details other than Meter No. & Seal Nos. for each consumer before installation of meter.

The meter should be 3 phase 4 wire suitable for energy measurement of solidly earthed balanced/unbalanced 3-Phase system with a power factor range of zero lagging through unity to zero leading.

The meter shall consist of measuring element, registers, operational indicators and test outputs enclosed together in the meter case.

8.2 Climatic Conditions

The meters to be supplied against this specification should be suitable for satisfactory continuous operation under the following tropical conditions. Meters should be capable of maintaining required under hot, tropical and dusty climatic conditions.

Table 8-1: Climatic Conditions

S. No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

8.2.1 Tropical Treatment

The meters shall be suitably designed and treated for normal life and satisfactory operation under hot & hazardous tropical climate conditions and shall be dust and vermin proof. All the parts & surface, which are subject 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 injurious effect of excessive humidity.

8.3 Standards Applicable

Unless otherwise specified elsewhere in this specification, the performance & testing of the meters shall conform to the following Indian/International standards with updated and latest amendments/revisions there of -

The energy meter shall be of accuracy Class 0.5S for active/ reactive / apparent energy and conform to relevant clauses of following standards or report –

Table 8-2: Standards Applicable

S.No.	Standard	Title
1	IEC 62053-22	AC Static Watt-hour Meters for Active Energy, Class 0.5S
2	IS 14697-1999	AC Static Transformer Operated Watt-hour and VAR-Hour Meters, class 0.5S.
3	CBIP-88 Technical Report No. 88	Specification for AC Static Electrical Energy Meters
4	CBIP Technical report no. 111	Specification for common Meter Reading Instrument
5	IS 9000	Basic Environmental Testing Procedures for Electronic & Electrical Items.
6	Standard Technical specification	Standard technical specification , Indian Companion Specification.
7	IS-15707	Specification for testing,evaluation etc.
8	ETD 13 (6211)/IS15959	Category 'C' for consumer metering

Priority Technical specifications to be followed should basically conform to latest guideline documents/ Indian Companion standards ICS – BIS-ETD 13 – 6211 – April 2010 as far as practicable.

8.4 Specific Technical Requirements

8.4.1 Supply System

- Type of Installation :Indoor
- System :3-phase 4-wire
- PT Secondary Voltage (Vref) :3x110 volt ph-ph
  :3x63.5 volt ph-n
- Secondary Current of CT :5 Amp or 1 Amp
- System frequency :50 Hz
- No. of Phases :3

The meter shall be suitable for balance as well as unbalance loads at all power factors.

Meter shall be programmed for (i)PT Ratio 11kV/√3 / 110 √3 & (ii) CT ratio of 5/5 Amp or 1/1 Amp. Rated basic current for the meter shall be either 5 Amp or 1 Amp as per the need, however the exact rating i.e. 5 Amp or 1 Amp will be informed at the time of purchase order.

8.4.2 Power Factor Range

The meter shall be suitable for full power factor range from Zero (lag) to Unity to Zero (lead).

8.4.3 Power Supply Variation

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

- Voltage 75% to 120 % of Vref
- Frequency +/- 5% of 50 Hz

The manufacturer can also offer meters, which can withstand higher variations.

8.4.4 Accuracy

The class of accuracy of the meter shall be 0.5S. The class of accuracy should not drift with time.

8.4.5 Power Consumption

The Active and Apparent Power Consumption On Each Voltage Circuit Including Power Supply Of The Meter At Ref. Voltage, Temperature And Frequency Shall Not Exceed 1.5 Watts/Phase And 8VA/Phase.

The Apparent Power Drawn By Each Current Circuit Of The Meter Shall Not Exceed 1VA/Phase At Basic Current, Reference Frequency And Reference Temperature. (Table 10 Of IS 13779 1999)

8.4.2 Starting Current

The meter shall start registering energy at 0.1% of basic current at unity power factor and shall be fully functional within five seconds after the rated voltage is applied.

When the voltage is applied with no current flowing in the current circuit, the meter shall not register any energy and the test output of the meter shall not be more than 1 pulse per count on no load.

8.4.6 Maximum Continuous Current

The maximum continuous current in meters shall be 200% of rated basic current (Ib) at which the meter purports to meet the accuracy requirements as per the relevant standards.

The Meter Shall Be ISI Marked And Bidder Shall Have To Furnish Valid BIS Certification Along With The Offer.

8.5 General Functional & Constructional Requirements

8.5.1 General Functional Requirements

1. Meters shall be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. However, the following should be ensured -
   a) Personal safety against electric shock
   b) Personal safety against effects of excessive temperature.
   c) Protection against spread of fire
   d) Protection against penetration of solid objects, dust & water
   e) Protection against fraudulence
   f) Protection against pilferage
   g) Protection against fiddling with internal components
   h) Size of the Meter along with tamper proof meter box should preferably be comparable to existing installed meter/conventional Meter.
   i) Protection against meter jamming by spurious signal injection/high magnetic field application
2. The meter shall be designed with application specific integrated circuit and shall be manufactured using SMT (surface mount technology) components. Power supply and voltage divider circuits may be of PTH technology. the meter should be housed in a safe, high grade engineering plastic/polycarbonate tamper proof continuous (preferably seamless) ultrasonically welded casing and which is of projection mounting type and is dust/moisture proof, conforming to IP-51 of BIS 12063, IEC 529. The meter PCB should be wireless to avoid improper and loose connections/ contacts.
3. Holographic seals to be provided at front and side joints. Polycarbonate seals have to be provided two numbers at the meter body, two numbers at terminal cover, two numbers at meter box, one number at optical port, one number at RS232 port and one number at MD reset point.
4. All insulating material used in the construction of meters shall be non- hygroscopic, non-ageing and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion throughout during operating life by providing suitable protective coating.
5. The meter shall be supplied with a non-detachable, transparent extended terminal block cover (ETBC). The combined meter block and ETBC shall be made of unbreakable, high grade, fire resistant, non-flammable, reinforced, polycarbonate (not bakelite) or equivalent high grade & good quality engineering plastic.

6. The non-detachable extended terminal block cover attached with the meter block should be separately sealable at two places and will be at the bottom of the meter. The ETBC once sealed should prevent unauthorized tampering by physical means.
7. The terminal block should have sufficient insulating properties, mechanical strength and should house plated solid brass terminals with two fixing screws per terminal. The terminals should be designed to withstand high continuous overload.
8. The meter should not get damaged/influenced by the electromagnetic disturbances and electrostatic discharge, harmonics, voltage dips and short interruptions, transients, dc and ac magnetic field, (as per is 14697 with latest amendments) remote jamming through spurious signals injection etc. and meter should record accurately even when neutral is opened and should indicate for application of phase voltage on neutral.
9. The meter shall have an operation indication device such as a blinking LCD/LED. The operation indicator shall be visible from the front window and capable of being monitored conveniently with suitable testing equipment.
10. The meter shall conform to the degree of protection IP 51 as per is 12063 / IEC 529 for protection against ingress of dust, moisture, vermin's etc.
11. The combined meter block, ETBC and the tamper proof meter box shall be made of transparent, unbreakable, high grade, fire resistant, reinforced, non- flammable polycarbonate or equivalent high grade & good quality engineering plastic.
12. The meter block shall be of scratch less, transparent, high grade engineering plastic for easy reading of all the displayed values/parameters, nameplate details and observation of operation indicator. The transparency of the box shall remain un-influenced with the environmental conditions. The meter block shall be ultrasonically welded such that it cannot be removed undamaged without breaking the meter block.
13. The combined meter block, ETBC and the tamper proof meter box shall ensure safety against the spread of fire. They should not be ignited by thermic overload of live parts in contact with them.
14. The meter shall have tin plated brass terminals. The terminals shall have suitable construction with barriers and cover to provide firm and safe connection of current and voltage leads of stranded copper conductors or copper reducer type terminal ends (thimbles).
15. The manner of fixing the conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixing which may be loosened and tightened several times during the life of the meter shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material. The internal diameter of the terminal holes shall be 5.5 mm minimum. The clearance and creepage distance shall conform to relevant clause of IS 13779 1999 / CBIP technical report no. 88.
16. The meter shall be compact in design. The entire construction shall be capable of withstanding stresses likely to occur in actual service arid rough handling during transportation. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling. The meter shall have a design life of 10 years against manufacturing and design defects. The supplier shall stand guarantee for 60 months on the meter against any kind of failure/defects/mal-operation within above period. Meter shall be replaced by supplier free of cost within one month of intimation by UPCL. Supplier shall have to repair for another 5 years after the guarantee period is over, on chargeable basis. Supplier shall establish a customer support office at Patna to facilitate quick replacement/providing services for above purpose.
17. The meter shall be provided with an inbuilt accurate quartz crystal based real time clock and calendar, the maximum permissible drift in the real time clock shall be 1 minute per year. The clock reading shall be adjustable through CMRI/BCS with proper password protected security. The meter time synchronization through CMRL/BCS should be provided with proper security system so that unauthorized time change is not accepted by the meter. Battery backup should be provided to maintain the time in absence of mains supply.
18. The battery life should be at least 3 year when meter is not powered up and 10 years when meter is powered up. Demand integration period shall be set as 30 minutes and should be programmable for setting any integration period desired by UPCL subsequently, on real-time basis. It should be possible to reset MD by the following options:
    a. Communication driven reset

b. Local push button
c. Auto reset at 24.00 Hrs at the end of each billing cycle

19. Vendor will give predefined copies (qty. indicated in bid proposal sheets) of all the software's (meter reading software for CMRI/BCS, base computer software for meter data analysis and technical details).
20. It should be possible to check the healthiness of phase voltages by displaying all the voltages on the meter display.
21. The meter shall have provision to be read in the absence of power, through LCD/LED auto-display. A capacitor may be included in the circuit as one of the means, which may provide energy for reading the meter display in absence of power supply.
22. The bidder may adopt and explain other tamper proof means for the above purpose.
23. The meter shall detect and correctly register energy (active plus reactive) only in forward direction under any tamper condition.
24. The meter should work accurately irrespective of phase sequence and shall indicate for wrong phase association.
25. The meter should remain powered up and functional as per prevailing electrical conditions within same accuracy class, even when either any two phases or anyone phase with neutral is available to the meter.
26. The meter should continue to record accurately as per prevailing electrical conditions even if the neutral of potential supply gets disconnected.
27. The meter shall indicate as tamper if one or more CTS are reversed/shorted or missing of one or two potential. However the meter shall continue to record as per prevailing electrical conditions.
28. It should be possible to check the healthiness of phase voltages by displaying all the voltages on the meter display.
29. The meter shall have provision to be read in the absence of power, through LCD/LED auto-display. A capacitor may be included in the circuit as one of the means, which may provide energy for reading the meter display in absence of power supply. The bidder may adopt and explain other tamper proof means for the above purpose.
30. The meter should work accurately irrespective of phase sequence of the mains supply. There should be provision in CMRI software to display the phasor diagram at site so that meter could be checked at site while installation.
31. The meter should remain powered up and functional even when either two phases or one phase along with neutral is available to meter.
32. The meter should continue to record accurately even if the neutral of the potential supply gets disconnected and shall indicate when any phase voltage is applied on the neutral.
33. Every meter should have three fixing holes, one at top & two at bottom. The top hole shall be provided with a special clip at the back of the meter so that the holding strew is not accessible after the fixing of meters. The lower fixing screw shall be provided under the sealed terminal cover. The requisite screws shall be supplied with each meter.

8.5.2 Data Security

1. The Meter shall have multilevel password for data protection and security. The meter data retrieval shall be possible directly to authenticate BCS/ through authenticated CMRI prepared by base computer software. The meter shall support the event of change of TOD register timings/no. of TOD registers, demand integration .period and/or setting the meter time through authenticated transaction and shall be logged as an event. The transaction events shall be available for viewing at BCS end. Bidder shall mention minimum no. of events available at BCS end as FIFO basis.
2. The meter data shall be retrievable directly/through to BCS/CMRI and downloadable by CMRI to base computer software for viewing. The meter data downloaded at BCS end should be in user-friendly formats. The supplier shall supply the required software for base computer system. The base computer software shall have the facility to convert the required data (For billing, Energy Audit, tamper analysis purposes) in to ASCII format as per utility requirement for further analysis & billing purpose. This data should be possible to be used as input data for any other software to generate desired reports as per the utility requirement.

3. The meter shall have radio interference suppression such that it should not generate noise, which could interfere with the other equipment.
4. The meter shall have three fixing holes, one at the top and two at the bottom.
5. The top hole shall be provided with a special clip at the back of the meter so that holding screw is not accessible to the consumer after fixing the meters. The lower fixing screws shall be provided under the sealed terminal cover. The requisite fixing screws shall be supplied with each meter.

8.5.3 Sealing of Meter

1. Reliable sealing arrangement should be provided to make the meter tamper evidence and avoid fiddling or tampering by unauthorized persons by way of providing adequate no. of seals on meter terminal cover, communication ports & wherever necessary.
2. All the seals shall be provided in front side only. Rear side sealing arrangement will not be acceptable. Please refer specification for sealing system.

8.5.4 Name-Plate

1. The marking on every meter shall be in accordance with relevant clauses of IS 14697/1999.
2. Every meter shall have name plate beneath the meter cover such that the name plate cannot be accessed without opening the meter cover and without breaking the seals of the meter cover and the name plate shall be marked distinctly and indelibly. The basic marking on the meter nameplate shall be as follows:
    a. Manufacturer's name & trade mark
    b. Type Designation
    c. No. of phases & wires
    d. Serial number
    e. Month and Year of manufacture
    f. Reference Voltage
    g. Rated secondary Current of CT (-/5A) or (-/1 A)
    h. Reference Standard IS 14697
    i. Principal unit(s) of measurement
    j. Meter Constant (imp/kWh, kVArh, kVAh)
    k. Class index of meter
    l. "Property of UPCL
    m. Purchase Order No. & Date
    n. Guarantee period

8.5.5 Connection Diagram & Terminal Markings

1. The terminals shall be marked properly on terminal block for giving external connections. A diagram of connections should be provided inside the cover of terminal block.
2. The terminal cover shall be extended such that when it is placed in position it is not possible to approach the connections or connecting wires.
3. The terminals and the screws shall be suitable to carry up to 150% of Imax safely.
4. The terminals shall have suitable construction with barrier and covers to provide secure and safe connections.

8.5.6 Communication Capability

1. The meter shall be provided with two ports for communication of the measured/collected data as per guideline document i.e. a hardware port compatible with RS 232 or RS 485 specifications which shall be used for remote access through suitable Modem (GPRS/GSM/EDGE/CDMA/PSTN/LPR) and an Optical port complying with hardware specifications detailed in IEC-62056-21. This shall be used for local data downloading through a DLMS compliant HHU.
2. The RS 485 port shall be used at Substations suitable for multi-drop connections of the meter for exporting data to sub-station data logger/DCU/Computer and the remote end server.

3. The RS 232 port shall be used at boundary points meters and Distribution Transformer meters capable to transfer and export data to the remote end server through suitable communication mediums (GPRS/GSM/EDGE/CDMA/ PSTN/LPR).
4. Both ports shall support the default and minimum baud rate of 9600 bps.
5. Port shall support communication on DLMS and should be accessible through a DLMS compliant HHU.
6. In view of installation of the meter inside a permanently locked fully transparent polycarbonate tamper proof box, suitable & convenient tamper proof arrangement to be provided by the bidder to facilitate downloading of meter data by CMRI/BCS through optical port are possible in secured manner without breaking the tamper proof meter box. Bidder shall submit necessary drawing showing the above arrangements along with the bid.

8.5.7 Hand Held Unit (HHU)

To enable local reading of meter data, a DLMS compliant HHU shall be used. It shall be compatible to the DLMS compliant energy meters that are to be procured / supplied on the basis of this specification. The HHU shall be supplied by the meter manufacturer along with the meters. Number of HHU's to be provided shall be decided by the purchaser.

8.5.8 Software

1. Sufficient no. of licensed copies of the latest relevant software shall be made available by the supplier for each common meter reading instrument (CMRI) and Base computer software (BCS).
2. Common Meter Reading Instrument (CMRI) & BCS will have be loaded with user-friendly software of latest higher version, compatible for reading, downloading meter data and Time of Day (TOD) programming etc in the meter.
3. Windows based user interactive Base Computer Software (BCS) for receiving data from Meter, BCS/CMRI and downloading instructions from base computer software to Meter, CMRI shall also be provided by the meter supplier. This BCS should have, amongst other requirements, features, and facilities described later in this specification, the facility to convert meter reading data into user definable DBF(Access) and 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, the variable data to export, the field width selection of each variable so that it may be possible for the user to integrate the same with the user's billing data and process the selected data in desired manner.
4. The software's shall have the flexibility to generate the following sets of reports.
   a. Billing reports
   b. Load survey reports
   c. Tamper reports
5. Necessary software for loading application program into meter via CMRI/BCS serial port. Purchaser may ask for some other reports also while placing PO. Accordingly modification in program shall be the responsibility of the bidder.
6. Base computer station software for accepting data from handheld unit/ CMRI/ Processing, generating reports' and downloading instructions from the BCS to CMRI for onward transmission to meters.
7. Dial-up software for accepting data from the meter through P & T line to the BCS, processing, generating reports.
8. Billing reports to include customer ID, Name & Address, Type of service/ connection (domestic/commercial/high tension/low tension/agriculture etc. TOTAL 20 types), connected Load, meter status, previous meter reading date and time, current meter reading date and time, Maximum Demand, date and time of Maximum Demand occurrence.
9. Load survey report for a pre-determined time to include the following – Customer 1D, meter number, Consumer Connectivity references i.e. identity & location reference, feeder reference, time, date, maximum demand (kVA) , kWh, power factor, kVAh, MD reset count, power on hours, outage duration, number of outages, Voltages max R, Y ,B date time and duration, Voltages minimum R, Y ,B date time and duration, load factor as (energy consumed/(maximum demand x power on hours)), average load as (energy consumed / power on hours), THD max date time and duration.

10. The load survey data should be available in the form continuous, bar charts as well as in spreadsheets. The BCS shall have the facility to give complete load survey data both in numeric and graphic form.
11. Tamper reports to include for a predetermined duration or month wise, tamper count, tamper duration and tamper history for each of the meters.
12. Vendor will provide soft copy of all the software in CD form along with the meters supplied to install & demonstrate compatibility of meter software with the different CMRI's/BCS program.

However, Billing report, Load Survey, Tamper parameters can be modified by the purchaser as per tariff requirement at the time of placement of order to the successful bidder.

8.5.9 Calibration and Test Output

1. The meter should have test output accessible from the front and be capable of being monitored with suitable testing equipment. The operation indicator must be visible from the front. Test output device shall be provided in the form of one common LCD/LED for kWh, kVARh and kVAh with provision of selecting the parameter being tested. The test output device should have constant pulse rate in terms of pulse/unit energy.
2. The meter shall be tested, calibrated and sealed at works before dispatch. Further, no modification of calibration shall be possible at site by any means.
3. The resolution of the test output shall be sufficient to enable the static current test in less than 10 minutes.
4. The relation between test output & the indication on display shall comply with, the marking on the name plate (imp/kWh).

8.5.10 Display

1. The meter shall be provided with an in built accurate quartz crystal based real time clock and calendar. The clock reading shall be adjustable through CMRI/BCS with proper password protected security. The meter time synchronization through CMRI/BCS should be provided with proper security system so that unauthorized time change is not accepted by the meter. Battery backup should be provided to maintain the time in absence of mains supply.
2. The battery life should be at least 3 year when meter is not powered up and 10 years when meter is powered up.
3. The meter shall have a minimum 7 digit, 7 segment display of liquid crystal display (LCD) or light emission diode display (LED) with another digit for legend. The size of the digit shall be 10x6 mm. Principle unit of measured values shall be kilo Watt hour (kWh) for 11 kV consumers. The decimal units shall not be displayed.
4. The meter should have facility of auto display mode where all parameters automatically scroll within the specified time and a manual mode where the parameters can be read by push button operation. In auto display mode each parameter shall on display for 10 seconds. The display "off" period between two cycles shall not exceed 120 seconds. The register should not roll over in between this duration.
5. The meter should have non-volatile memory, so that the registered parameters will not be affected by loss of power. A provision shall be made to read the meter parameters such as MD and consumption, etc., through the meter cover without actually opening the meter box cover. The non-volatile memory should have a minimum retention time of 10 years under un-powered condition.
6. It should be possible to easily identify the display parameters through symbol/legend to be made available on the display itself.
7. In case of multiple values presented by a single display, it shall be possible to identify each displayed value/parameter through symbols/legend on the meter display itself.
8. The register shall be able to record & display starting from zero, for a minimum of 1600 hours (one thousand six hundred hours), the energy corresponding to the maximum current at reference voltage and unity power factor. The register should not roll over in between this duration.
9. In addition to providing serial number of the meter on the display plate, the meter serial number shall also be programmed into meter memory for identification through communication port for BCS/CMRI meter reading print out.

10. There shall be a tamper proof provision of reading of the parameters through LCD/LED display in case of "Power Off" condition or "long power cut scenario". The bidder shall explain the security aspect of the means adopted.

8.5.11 Display Sequence

The meter shall display the required parameters in two different modes as follows, However, Purchaser may ask for modification in the display sequence & display parameters at the time of placing P.O , if required -

Auto Display Mode

The following parameters hereinafter referred to as "Billing Parameters" (B.P) shall be displayed in an auto –cycle mode in the following sequence –

S.No.	Name of Parameter
1	LCD Test
2	Date
3	Time
4	Cumulative Active energy import (forwarded) reading (kWh) for the previous calendar month for billing purpose (BP kWh)
5	Cumulative Reactive energy import (forwarded) reading (kVARh) for the previous calendar month for billing purpose (BP kVARh).
6	Cumulative Apparent energy import (forwarded) reading (kVAh) for the previous calendar month for billing purpose (BP kVAh).
7	Maximum Demand (kVA) (during the previous month) for billing purpose (BP kVA), kW and kVA.
8	Average Power Factor for the last month for billing purpose (BP PF)
9	Present status of Tamper.
10	Cumulative tamper count reading of the last two consumption months.
11	Cumulative "Power On" hours reading of the last two months (BP POH).
12	Cumulative Active Energy import (forwarded) reading (kWh) on bill date i.e. Cumulative kWh on instantaneous basis.
13	Cumulative Reactive Energy import (forwarded) reading (kVARh) on bill date i.e. Cumulative kVARh on instantaneous basis.
14	Cumulative Apparent Energy import (forwarded) reading (kVAh) on bill date i.e. Cumulative kVAh on instantaneous basis.
15	Instantaneous Load (kVA), kW and kVA.
16	Maximum Demand (kVA) (during current month) (kVA), kW and kVA both.
17	Rising demand with elapsed time (kVA).
18	MD reset count.

Each of the above parameter shall come & remain on meter display for 10 sec & the time between 2 auto cycle shall be 120 sec.

Push Button Mode

All above & the following:

1	Display Test (LCD/LED Segment Check)
2	Real time & date
3	Instantaneous frequency
4	Phase Voltage R,Y,B.
5	Phase current R,Y,B
6	Cumulative MD kVA forwarded.
7	Tamper and fraud details
8	Present CT status
9	Present PT Status
10	Last occurrence tamper ID
11	Date & Time of last tamper occurrence.
12	Last restoration tamper ID
13	Date & Time of last tamper Restoration
14	Cumulative tamper count
15	TOD register(Active forwarded energy(8nos))
16	TOD register(Apparent forwarded energy(8nos))
17	TOD register(Apparent forwarded MD(8nos))
18	Cumulative power on hours

8.5.12 Read Out Parameters with CMRI/BCS

All the above including following:

1	**Energy registers**
2	Billing Registers
3	TOD Registers
4	Load survey data
5	Tamper and fraud(all event details with date and time)
6	Self-diagnostic details
7	Real time calendar clock fail
8	Battery bad flag
9	History of Monthly reading of Energy, Maximum Demand, Average Power Factor for 12 months (including current month)

Displayed/recorded parameters may be altered at the time of placing order.

8.5.13 Maximum Demand Registration

The maximum demand is to be monitored during each demand interval set with 30 minutes integration and the maximum of these in a month shall be stored. Whenever MD is reset, the maximum demand value so registered shall be stored along with date and time. Under the current integration period, the rising demand should be displayed continuously along with the elapsed time. The registered demand and the number of times the MD is reset shall also be displayed and the information stored.

8.5.14 Maximum Demand Reset

Facility for auto reset of MD at 00:00 hrs of first of every month and storage thereof shall be provided for which minimum 30 years calendar shall be programmed by the manufacturer. The meter shall display the maximum demand reset count.

8.5.15 Self-Diagnostic Feature

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

- Time and date
- All display segments on meter display
- Real Time Clock (RTC) status in meter reading prints out at BCS end.
- Nonvolatile memory (NVM) failure indication at BCS
- Low battery indication at BCS

While installing the meter, it should be possible to check the correctness of phase sequence, phase association, Current Transformer, Voltage connections to the meter and their polarity from the functioning of the meter for different voltage injections with the help of vector/phasor diagrams. For this purpose suitable software for field diagnosis of meter connections with the help of Meter Reading Instrument/BCS should be supplied.

8.5.16 Load Survey Capability

1. Load survey shall be available for at least 90 days with 30 minutes load survey integration period. Vendor shall provide necessary facility to transfer data to BCS and through CMRI.
2. Load Survey shall be run time configurable and shall be able to choose any of the below mentioned parameters.
3. The survey shall be factory programmable and parameter will be informed to the supplier at the time of ordering.

The meters should log following parameters for 45 days

(i) kWh (ii) RkVAh (iii) kVAh (iv) kVA MD (v) Current per phase (vi) Voltage per phase

1. It shall be possible to select either demand or energy view at the BCS end. The above load survey data should be available in the form of bar charts as well as in spreadsheets. The BCS shall have the facility to give complete load survey data both in numeric and graphic form.
2. The load survey data, abnormality event information and instantaneous parameters data shall all be retrievable through the meter's communication port directly by BCS/through radio communication from a common meter reading instrument (CMRI)/Hand Held Unit and shall be transferred (downloaded) to a PC with user friendly 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.
3. The meter shall have sufficient non-volatile memory for recording history of energy parameters for last twelve billing cycles (Bill date shall be 00 hrs of the 1st date of the calendar month by default - programmable) and information should be made available at the BCS end.

8.5.18 Time-Of-Day (Tod) Tariff/Demand

1. The meter should have provision of registering the time-of-day energy and maximum demand. It shall be possible to define TOD register for active forwarded, apparent forwarded energy type.
2. The meter should have in-built capacity to define up to eight (8) time zones through operation of CMRI. The change, of the TOD time-period(s) or changing number of TOD zones should be possible through CMRI with special authenticated command from the BCS so that only authorized person(s) can make such changes.
3. 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.

8.5.19 Harmonics Measurement

Up to 29th Harmonic shall be measurable that is a sampling rate of 3000/sec. The meter should be capable of measuring fundamental energy as well as total energy. Fundamental energy shall be made available on meter-display and the same only shall be used for billing purpose.

The total energy shall be logged in the meter memory and be capable of down loading to the BCS through CMRI/directly and be available for analysis at the BCS end.

8.5.20 Tamper & Fraud Protection

The meter shall function properly under following common abnormal conditions

Table 8-3: Tamper & Fraud Protection

1. Phase sequence reversal	**The meter shall keep working accurately irrespective of the phase sequence of the supply.**
2. Missing Neutral	The meter shall continue to record accurately according to electrical connections even if the Neutral of potential supply is accidentally or incidentally disconnected.
3. Current reversal/CT polarity reversal	The meter shall log energy in forward direction even if the current is flowing in reverse direction in one or more phases.
4. External magnetic influence (as per IS 14697 with latest amendment) and CBIP Publication no. 304.	The metering system shall be provided with adequate magnetic shielding so that any external magnetic field (AC Electro Magnet or DC Magnet) applied on the metering system shall not affect the accuracy of recording of energy consumption.
5. High Voltage High frequency, jamming injections, AC DC chopping applications	Metering system should be measuring accurately and should indicate the phenomena as tampering.

Beside this the meter should have features to detect the occurrence and recording of, at least, the following common abnormal events

a) **Missing Potential & potential imbalance**
The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of Potential failure which could happen due to disconnection of potential leads (one or two), failure of phase line fuse from the Transformer primary side. Meter shall also detect and log cases of voltage unbalance (from 5 % for more than 5 minutes or more- programmable) of voltages.

b) **Current imbalance**
The meter shall be capable of detecting and recording occurrence and restoration with date and time of Current unbalance (30% or more for more than 15 minutes- programmable).

c) **Current Circuit Short**
The meter shall be capable of detecting and recording occurrences and restoration of shorting of any one or two phases of current circuit to identify events like CT saturation, CT lead shorting, CT inter turns short etc.

d) **Current Circuit Open**
The meter shall be capable of detecting and recording occurrences and restoration of opening of any one or two phases of current circuit which can happen due to intentional / accidental disconnection of current circuits. The meter shall be able to log abnormality conditions in current open event like CT leads burns, loose connection, CT winding open etc in the meter memory. No load condition should not be recorded in meter memory as a Current circuit open event.

e) **Power ON/OFF**
The meter shall be capable to record power on/off events in the meter memory. All potential failure should be recorded as power off event.

f) The meter shall be capable of recording the cases of phase association error as tamper.

g) The meter should record accurately even when the neutral is opened and shall indicate when phase voltage is fed to the neutral

The meter shall record the total duration of the above abnormalities, time and date of their occurrences & restorations with a snap shot of electrical conditions viz. Voltage, Current, PF etc.

The meter shall keep records for the minimum last 250 events (occurrence + restoration) for above of abnormal conditions. It shall be possible to retrieve the abnormal event data along-with all related snap- shots' data through the meter's optical port or through radio with the help of a hand held unit (HHU) and download the same to the BCS where it shall be available for viewing. All this information shall be made available in simple and easily understandable format.

The meter shall also be capable to withstand and shall not get damaged if phase to phase voltage is applied between phase to neutral.

8.5.21 Tamper Logic

Properly designed meter event logic should be provided. There shall be separate compartments for logging of potential related event, current related event and power on/off event. The bidder should explain the events details in each compartment under their offer.

The logging of various events in each compartment should be as under

Once one or more compartments have become full, the last event pertaining to the same compartment will be entered and, the earliest (first one)-event should disappear. Thus, in this manner each succeeding event will replace the earliest recorded event, compartment wise. Events of one compartment/category should overwrite the events of their own compartment/category only.

A properly defined meter tamper logic should be provided. The tamper logic should be capable of discriminating the system abnormalities from source side and load side and it should not log/record tamper due to source side abnormalities.

There shall be three separate compartment for logging of different types of tampers as follows

Compartment No. 1

50% of the tamper memory space shall be allocated for the following current related tampers

- CT polarity reversal
- CT open circuit
- CT short (bypass)

Compartment No. 2.

25% of the tamper memory space shall be allocated for missing potential tampers.

Compartment No. 3

25% of the tamper memory space shall be allocated for current unbalance tampers.

Once one or more compartments have become full, the last tamper event pertaining to the same compartment will be entered and the earliest (first one) tamper event should disappear. Thus, in this manner each succeeding tamper event will replace the earlier recorded event compartment wise. Events of one compartment/category should overwrite the events of their own component/ category only.

Bidder shall mention any new development in the field of above.

8.6 Tests

8.6.1 Type Test

1. The meter offered should have successfully passed all type tests described in the IS 14697 and the meter Data Transfer and Communication capability tests from any NABL accredited lab.
2. Type test certificate shall be submitted along with the offer and the same shall not be more than 36 months old at the time of bid submission.
3. Make & type of major components used in the type-tested meter shall be indicated in the QAP.
4. The purchaser reserves the right to select sample from any material offered for inspection /inspected and dispatched, which will be got type tested at any NABL accredited laboratory.
5. The results of this type-tested sample shall be applicable for the entire quantity of the particular lot offered or supplied by the supplier.
6. The Purchaser shall bear the testing charges, if sample passes all the Tests and if sample fails in any one of the Tests, supplier shall have to bear testing charges, same are recoverable from the supplier's any pending bill, security deposit, Bank Guarantee or by any suitable means, whichever deem fit by the Purchaser. In case of sample failing in aforesaid type Tests, supplier shall have to replace the whole lot materials, which should pass through the type Tests, the re-testing charges will have to be paid by supplier. If any quantity against the particular lot is consumed by the Purchaser, the supplier will agree for any penalty/deduction in price as may be mutually agreed.

8.6.2 Acceptance & Routine Tests

1. Criteria for selection for such tests and performance requirements shall be as per IS 14697-1999 (reaffirmed 2004) and CBIP publication NO. 304.
2. Additional acceptance shall include Surge withstand (SWC) for 6 kVp as per IEC 62052-11, Lightning impulse test and HF disturbance test as per IS 14697. One sample meter per order from one of the offered lot shall be subjected to these specific tests. Meters subjected to these tests shall not be used after tests.
3. Accuracy tests shall be performed at the beginning and at the end of the acceptance tests specified.
4. Further Purchaser shall reserve the right to pick up energy meters at random from the lots offered and get the meter tested at third party lab i.e. CPRI / / NPL / CQAL/ ERTL / ERDA at the sole discretion of the Purchaser for Acceptance Testing criteria as per Appendix-C of Latest – standardization of AC static electrical energy meters – CBIP publication NO. 304.
5. The supplier has no right to contest the test results of the third party lab or for additional test and has to replace/take corrective action at the cost of the supplier.
6. It shall be the responsibility of the supplier to arrange such tests and Purchaser shall be informed of the date and time of conduction of tests well in advance to enable him to witness such tests. Test charges of the testing authority, for such successful repeat type tests, shall be reimbursed at actual by the Purchaser.

8.7 Pre-Delivery Inspection at Manufacturer's Works

1. All acceptance Tests shall be witnessed and certified by purchaser's representative at manufacturer's works. The vendor shall give at least 10 days advance intimation to the purchaser to enable them to depute their representative for witnessing the Tests. The said representative shall have full facilities for unrestricted inspection of supplier's works, raw materials, manufacturing processes and conducting necessary Tests.
2. The said representative shall verify the calibration seals provided by the calibrating agency on testing equipments/ meters.
3. Test reports of routine Tests carried out by the manufacturer shall be submitted to the inspecting authority at the time of inspection for his approval.

4. Acceptance of any quantity of materials shall in no way relieve the supplier of his responsibility for meeting all requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.
5. In case of waiver of inspection, vendor shall carry out all (i) routine and (ii) acceptance Tests and submit test reports for approval of the purchaser, before dispatch of material.
6. The entire cost of testing for acceptance & routine rests and checking of length etc shall be borne by the supplier.

8.8 Technical Specification For Pilfer Proof Box To House The Meter

8.8.1 Technical Details

1. The box shall be fully transparent scratch less, robust, & weather proof made out of poly phenylene oxide/high grade, good quality engineering plastic with flame retardant properties.
2. It shall be capable of withstanding temperatures of boiling water for 5 minutes continuously without distortion or softening. The thickness of the box shall not be less than 3 mm on the load bearing side (i.e. back side of the box) and other sides, door and roof shall not be less than 2.5 mm. The box shall have its roof tapering down to both sides for easy flow of water.
3. The box shall be capable of accommodating Meter and GPRS Modem. The box shall be provided with suitable nos. blank holes of suitable diameter with cable glands with PVC chuck nuts on either side & bottom side of box for incoming and outgoing cables. The blanks should be removable for cable entry & exit as per site conditions. The base supports of the meter shall be raised suitably for ease of wiring.
4. Box should have provision for sealing with minimum of two seals each.
5. The boxes shall comply the provision of IS 5133 and IEC 695. The boxes shall be suitable for outdoor/indoor application with IP 55 protection. The box shall have its roof designed for easy flow of rainwater without any stagnation on the box
6. In view of installation of the meter inside a permanently locked fully transparent tamper proof box, suitable & convenient, tamper proof arrangement to be provided by the bidder to facilitate downloading of meter data by CMRI/BCS through optical port in secured manner without breaking the tamper proof meter box. Bidder shall submit necessary drawing showing the above arrangements along with the bid.
7. The overall dimensions of the box shall be such that adequate clearance is maintained between meter surface and box from all sides.
8. There should be adequate protection against any entry of dust, moisture, water, vermin etc.
9. Colour Meter box shall be transparent.
10. The pilfer proof box shall be as follows:
    i. Material Scratch and break resistant, transparent, clear, polycarbonate/high grade & good quality engineering material. The transparency should remain un-influenced with the environmental conditions. The minimum thickness shall be 2 mm. There should not be any ingress of moisture into the box.
    ii. Internal hinges A minimum of 2 nos. internal hinges of each compartment, well protected against corrosion shall be provided. The hinges of the door should be concealed and they shall be fixed to the flanges provided to the base and cover of the box in such a manner that the door opens by a minimum of 120 degrees.
    iii. Handle Suitable handle or knob shall be provided for opening of the box door/s.
    iv. Fixing arrangement While fixing the meter, screws should not protrude outside. For fixing the box to the wall, 8 nos. keyholes of minimum 6 mm diameter shall be provided at all the four corners of each compartment of the box. The meter and CTs are to be installed in the box.
    v. Latch The doors shall be provided with a GI latch or a 'U' clamp to make it safe with the base of the box.

vi. Sealing arrangement Both the compartment shall have provision for adequate number of sealing on each to make it fully tamper resistant.

- Printing Metallic/engraved label containing the letters ----------UPCL and the P.O. no. and date shall be engraved/embossed on the top cover of the box. The name of manufacturer shall be engraved/embossed on the bottom half of the box. A blank sticker shall also be pasted on the meter box for use of field staff to indicate service no. etc.
- The fixing arrangements shall not be complex and it shall be easily approachable for connections when the door is open and is completely tamper resistant once it is sealed.
- The dimensional drawing giving details of the meter box shall be enclosed with the bid.
- There should be push button operating arrangement on the meter box so that the push button on meter body may be operated without opening the meter box.

The bidder may offer same other suitable tamper proof arrangement also which should be explained in detail.

8.8.2 Pilfer Proof Box Tests

The following tests are to be conducted on the box at an NABL accredited laboratory and certificate to be furnished by the bidder.

a. Test of material identification
b. Test for mechanical strength as per IS 5133
c. Test for water absorption as per IS 5133
d. Test for stability at high temperature as per IS 5133
e. Test for withstanding temperature of boiling water for 5 minutes continuously for non-distortion or softening of material.
f. Glow wire test at 650°C as per clause 5.2.4 of CBIP Technical Report No. 88 Read with amendments.

8.8.3 Acceptance and Routine Tests

The following shall constitute acceptance test for box.

a. Physical verification of dimensions of the box.
b. Compatibility of the box for housing the meter for ensuring ease of
c. Connections and reading the meter.
d. Tamper proof feature of the box.

Test certificates as per relevant standards shall be furnished for approval.

8.9 Quality Assurance Plan

The vendor shall furnish the following information along with his bid; failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.

a) The structure of Organization
b) The duties and responsibilities assigned to staff ensuring Quality of work.
c) The system of purchasing, taking delivery and verification of materials
d) The system for ensuring quality of workmanship
e) The quality assurance arrangements shall conform to the relevant requirement of ISO 9001 or ISO 9002 as applicable.
f) Statement giving list of important raw materials names of sub-suppliers for the raw materials, list 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 vendor's representative, copies of test certificates.
g) Information and copies of test certificates in respect of bought out accessories.
h) List of manufacturing facilities available.
i) Level of automation achieved and list of areas where manual procession exists.
j) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

k) Lists of testing equipment available with the bidder for final testing of equipment specified and test plant limitation. If any, vis-à-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.

8.9.1 The Vendor Shall Also Submit Following Information

a) List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with offers.
b) Type test certificates of the raw materials and bought out accessories if required by the utility.
c) Quality Assurance Plan (QAP) withhold points for purchaser's inspection. The quality assurance plan and purchasers hold points shall be discussed between the purchaser and vendor before the QAP is finalized.

8.10Guarantee

The manufacturer shall provide a guarantee of 54 months from the date of commissioning or 60 months from the date of dispatch whichever is earlier. Bidders shall guarantee to repair or replace the meters and meter boxes (if supplied), which are found to be defective/ inoperative at the time of installation, or become inoperative/ defective during guarantee period. Replacements shall be effected within 1 month from the date of intimation. If during the guarantee period, the materials are found defective or sub-standard, the same will have to be repaired/replaced free of cost by the supplier within 30 days of intimation. If the defective materials are not replaced/rectified as per above guarantee clause, the Company shall recover twice the equivalent amount from any of the bills of the supplier or from performance guarantee so deposited by the supplier.

The supplier will extend immediate warranty replacement support

8.11 Services

Manufacturer shall also extend services to repair the meters & boxes on chargeable basis, up to a period of 60 months from the date when the guarantee period is over i.e. after 60 months of installation & successful operation of the instant meter. These defective/inoperative meters shall be repaired within a month time at reasonable charges for which Supplier shall maintain 1% stock as reserve.

8.12 Schedule

8.12.1 Schedule - I [Guaranteed Technical Particulars: Item HT CT PT Operated Tri-Vector Meter]

Table 8-4: Guaranteed Technical Particulars: Item HT CT PT Operated Tri-Vector Meter

S.No.	Description	Offered
1	Manufacturer's name and country	
2	Type of meter/model	
3	Standards Applicable	
4	Accuracy/Interface class	
5	Parameters displayed	
6	P.F. Range	
7	Current Rating	
8	Maximum Current (Imax)	
9	Minimum starting current	
10	Rated Voltage	
11	Meter constant	
12	Variation of voltage at which meter functions Normally	
13	Rated Frequency	
14	Power Loss in Voltage circuit (VA & watt) & Current circuits (VA)	
15	MD reset Provisions	
16	Display	
	a) Type of Register	
	b) No. of digits of display and height of character	
	c) Auto display mode & scroll mode	
	d) Type of push button for scroll mode	
17	Non volatile memory	
18	Details of provision for taking reading during power off condition	
19	Principle of operation	
20	MD Integration period	
21	Weight of meter	
22	Dimensions	
23	Warranty	
24	Outline drawings & Leaflets	
25	a) Remote meter-readout facility	
	b) Communication protocol used.	
	c) Sealing provision for meter & optical port.	
	d) Baud rate of data transmission	
	e) Required software to be resident in HHU and BCS.	
	f) Ultrasonic welding of body	
	g) Manufacturers Seal provided	
26	Base Computer Software	

S.No.	Description	Offered
27	Type Test Certificates	
28	Time of Day Zones (Selectable)	
29	Whether meter measures both fundamental & Harmonic Energy	
30	Real Time Clock Accuracy	
31	Battery for Real Time Clock	
32	Anti Tamper Features	
33	Effect of accuracy under tamper conditions	
34	Drift in accuracy of measurement with time	
35	Name plate details	
36	Type of calibration	
37	Type of mounting	
38	Testing facility	
39	Data retention by NVM without battery backup and un-powered condition	
40	Type of material used	
41	Base	
42	Cover	
43	Terminal Block	
44	Terminal cover	
45	Screw	
	i) Material	
	ii) Size	
46	Internal diameter of Terminal Hole	
47	Centre to Centre clearances between adjacent terminals	
48	Security Profiles	
	a) Basic Security	
	b) Advance Security	

8.12.2 Schedule – II [Technical Deviations proposed by the bidder]

Table 8-5: Technical Deviations proposed by the bidder

S.No.	As per Technical specification	Deviation by the bidder

9. Technical Specification of LT AC Single Phase 5-30 Amps Static Net Energy Meter

9.1 Scope

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

9.2 Applicable Standards

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

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

The specification given in this document supersedes the relevant clauses of IS: 13779 / 1999 (amended up to date) wherever applicable.

The equipment meeting with the requirements of other authoritative standards, which ensures equal or better quality than the standard mentioned above, also shall be considered. For conflict related with other parts of the specification, the order of priority shall be – (i) this technical specification, (ii) IS: 13779 / 1999 (amended up to date).

9.3 Service Conditions

The meters to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions:

S. No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

Table 9-1 Service Conditions

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

9.4 General Technical Particulars

Quality Standard

Meter shall bear ISI mark.

Class of Accuracy

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

Current & Voltage Rating

1) The current rating shall be 5 - 30 Amps.
2) Rated basic current (Ib) for LT Energy Meters shall be 5 Amps.
3) The maximum continuous current (Imax) shall be 600% of rated basic current, i.e. 30 Amps. Moreover the 5 - 30 Amps meters shall work accurately upto 150% of Imax, i.e. 45 Amps.
4) The Voltage Rating shall be 240 volts. The voltage range shall be (-) 25% to (+) 20% of rated voltage,
5) Temperature:

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

Power Factor

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

Power Consumption

Voltage Circuit:

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

Current Circuit:

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

Starting Current

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

Frequency

The rated frequency shall be 50 Hz with a tolerance of ± 5%.

9.5 Construction

9.5.1 Construction Features

1. The meter shall be projection type and dust and moisture proof. The meter base & cover shall be made out of unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities. The meter body shall be type tested for IP 51 degree of protection as per IS: 12063 against ingress of dust, moisture & vermin.
2. Moulded terminal block for current and voltage connections conforming to IS: 13779 / 1999 (amended up to date) to meet the requirement of terminal connection arrangement shall be provided. The termination arrangement shall be provided with an extended transparent / translucent / opaque terminal cover as per clause number 6.5.2 of IS: 13779 and shall be sealable independently to prevent unauthorized tampering. Proper size of grooves shall be provided at bottom of this terminal cover for incoming and outgoing service wires.

3. The terminal block, the terminal cover and the meter case shall ensure reasonable safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them.
4. All insulating materials used in the construction of the meter shall be substantially non-hygroscopic, non-ageing and of tested quality.
5. All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results.
6. Sealing provision shall be made against opening of the terminal cover and front cover. It is necessary to provide screws with two holes for sealing purpose. The meter shall be pilfer-proof & tamper-proof. The provision shall be made on the Meter for at least two seals to be put by utility user.
7. The transparent / translucent base and transparent cover shall be ultra-sonically welded / laser welded (continuous welding) so that once the meter is manufactured and tested at factory, it shall not be possible to open the cover at site except the terminal cover. The Manufacturer shall put at least one seal on meter body before dispatch. The thickness of material for meter body shall be 2 mm minimum.
8. The meter shall be completely factory sealed except the terminal block cover.
9. A sticker label containing warning notice in Hindi / English language which is to be stick up on meters front cover or printed on meter name plate with easily readable font size not less than 10 in red color.

9.5.2 Real Time Internal Clock (RTC)

1. The real time quartz clock shall be used in the meter for maintaining time (IST) and calendar. The RTC shall be non - rechargeable and shall be pre-programmed for 30 Years Day / date without any necessity for correction.
2. The time accuracy shall be as per provisions of CBIP Tech Report 88. Facility for adjustment of real time shall be provided through CMRI with proper security.
3. The clock day / date setting and synchronization shall only be possible through password / Key code command from CMRI or Meter testing work bench and this shall need password enabling for meter.
4. The RTC shall have long life (10 Years) Non rechargeable battery. The RTC battery & the battery for display in case of power failure shall be separate.

9.5.3 Markings and Sticker Labels

1. A push button shall be provided for scrolling the parameters in Alternate Display (On Demand) mode. The provision shall be made on the Meter for at least two seals to be put by utility user.
2. The energy meter shall clearly indicate the Export and Import connection marking on the terminal block and terminal cover.
3. The "→" indicates that Import terminal / forward and "←" indicates that Export terminal / reverse energy measurement.

9.5.4 Output Device

1. The meter shall be provided with flashing LED to represent the pulse output for testing the meter accuracy by suitable testing equipment.
2. The operation indicators must be visible from front. The test output devices shall be provided in the form of blinking LED or other similar devices like blinking LCD.
3. The pulse rates of output devices which is Pulse / kWh (meter constant) shall be indelibly provided on the nameplate. It shall be possible to check the accuracy of active energy measurement of the meter on site by means of LED output. Resolution of the test shall be sufficient to enable the starting current test in less than 10 minutes and accuracy test at the lowest load shall be completed with desired accuracy within 5 minutes.
4. There shall be one CT in Neutral circuit and one shunt / CT in phase circuit. The current whichever is measured as higher either by CT or shunt shall be used for processing / computing energy. The shunt shall be magnetic based and e-beam welded for the construction purpose. The meter shall have CTs with magnetic shielding and same shall be tested separately prior to assembly.
5. PCB used in meter shall be made by Surface Mounting Technology. The meter shall be capable to withstand phase to phase voltage (440 V) if applied between phase to neutral for minimum 5 min.

6. Non specified display parameters in the meter shall be blocked. Display parameters in the meter shall not be accessible for reprogramming at site through any kind of communication.
7. Complete metering system & measurement shall not be affected by the external electromagnetic interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic fields and DC current in AC supply etc. The Meter shall meet the requirement of CBIP Tech. report 88 (amended up to date) except 0.2 Tesla AC magnet test.
8. Complete metering system & measurement shall not be affected by the external electromagnetic interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic fields and DC current in AC supply etc.
9. The Meter shall meet the requirement of CBIP Tech. report 88 (amended up to date) except 0.2 Tesla AC magnet test.
10. For any higher signals than the present standards for Electromagnetic HF/RF field and UPCL technical specifications indicated above, the energy meters shall be immune & the accuracy of meter shall not get affected.
11. The communication of energy meters shall not be affected considering the above feature stated in clause 5.8.1.9 and 5.8.1.10
12. The accuracy of the meter and the measurement by meter shall not get influenced by injection of high frequency AC Voltage / chopped signal / DC signal and harmonics on the terminals of the meter.
13. The watch dog provided shall invariably protect the hanging of microprocessor during such type of tampering devices.
14. The meter accuracy shall not be affected by magnetic field from all sides of the meter i.e. front, sides, top and bottom of the meter.
15. The meter shall record and display Fundamental energy excluding Harmonic energy. The energy meter shall record & display harmonic energy separately.

9.5.5 Self-Diagnostic Features

1. The meter shall display unsatisfactory functioning or nonfunctioning of Real Time Clock battery.
2. All display segments: "LCD Test" display shall be provided for this purpose.

9.5.6 Wireless / Cable less Design

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

9.5.7 Communication Capability

Meter shall have minimum two communication ports.

a) One serial port shall be a standard optical port complying with hardware specifications detailed in IEC – 62056 - 21 which shall be used for meter read out using CMRI/PC or for any configuration by authorized personals.
b) The second serial port shall be used for remote communications. Preference will be given for communication technologies that demonstrate minimum recurring charges and total cost of owner ship. The communication technologies envisaged are RS-232.

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

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

   Meter end, starting 1 to 8 from Left to Right

   Pin no 8 => RX (+)

   Pin no 7 => RX (-)

   Pin no 3 => TX(+)

   Pin no 6 => TX(-)

ii. The interface shall meet all the requirements of RS-232 specifications in terms of Physical media, Network topologies, maximum devices, maximum distance, mode of operation, etc.

iii. Screw type connectors or RJ45 type connectors have to be provided to easily terminate the twisted pair.

iv. The meter shall be supplied with battery backup feature for displaying the parameters during power OFF condition. Battery life shall be minimum ten years. Separate push button shall be provided for activation of battery during power OFF condition. Alternatively, push button provided for displaying alternate mode (On Demand Mode) parameters shall also be acceptable for activation of battery during power OFF condition.

v. After activating the battery during power OFF condition, the meter shall display all Default Display (Auto Scrolling Mode) parameters only once, after which the battery shall switch OFF automatically. The battery shall be locked after 3 operations during one power OFF cycle. The accuracy of the meter shall not be affected with the application of abnormal voltage / frequency generating device such as spark discharge of approximately 35 KV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

   a) On any of the phases or neutral terminals.
   b) On any connecting wires of the meter (Voltage discharge with 0-10 mm spark gap).
   c) At any place in load circuit.
   d) Anywhere on meter body.

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

vii. The data stored in the meters shall not be lost in the event of power failure. The meter shall have Non Volatile Memory (NVM), which does not need any battery backup. Reverse reading lock of main kWh reading is to be incorporated with necessary software modification if required additionally.

9.6 TOD Timing

There shall be provision for at least 6 (Six) Time of Day (TOD) time zones for energy and demand.

The number and timings of these Time of Day time Zones shall be programmable. At present the time zones shall be programmed as per UPCL existing time zones. These may be subject to change as per notification from UPCL.

9.7 Maximum Demand Integration Period

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

9.8 Maximum Demand Reset

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

a. Communication driven reset through hand held terminal (CMRI).
b. Auto reset at 24:00 hrs at the end of each billing cycle: Automatic reset at the end of certain predefined period (say, end of the month). This option shall be blocked by default and made programmable through hand held terminal (CMRI) for the actual date required. No push button shall be provided for MD reset.

9.9 Anti-Tamper Features

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

1. Load through local Earth.
2. The meter shall work accurately without earth.
3. Where neutral is disconnected from the load or from the supply side or both the load and supply side, the meter shall record the energy proportionate to the current drawn through the meter (min 20 % Ib for 5-

30 A) at reference voltage and unity Power Factor. ± 5% error in recording is admissible. All the above tampers shall be verified at basic current at reference voltage.
The potential link shall not be provided on terminal block outside the main meter cover. Visual indication shall be provided to show tamper conditions stated above.

4. The meter shall be immune to the magnetic field (AC / DC / Permanent) up to 0.2 Tesla (except 0.2 Tesla AC). Under influence of any magnetic field (AC / DC / Permanent) more than 0.2 Tesla, if the accuracy of the meter gets affected, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering maximum value current (I_{max}) at reference voltage & unity power factor. In case of magnetic tamper during export / reverse mode, the energy meter shall record & add the same energy considering I_{max} in import / forward mode.
5. In the event the meter body cover (lid) is forcibly opened, even by 2 to 4 mm variation of the meter cover, same shall be recorded as tamper event with date & time stamping and the meter shall continuously display that the cover has been tampered. It is suggested that the manufacturer shall develop their software such that there shall be some time delay for activation of this tamper feature and during that period only the meter cover shall be fitted. After the meter cover is fitted, it shall get activated immediately without any delay. The delay in activation of software shall be for one instance only.
6. The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date. For any higher signals than the present standards and UPCL technical specifications indicated above, the energy meters shall be immune & the accuracy of meter shall not get affected.
The energy meter shall capable to record & display all tamper with indication of "Import / Export" tamper separately with date and time stamping.

9.10 Display of Measured Values

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

9.10.1 Minimum Character Size

1. The energy display shall be minimum 5 digits. The height of the display characters for the principal parameters values shall not be less than 5 mm. The size of digit shall be minimum 9x5 mm.
2. The principal unit for the measured values shall be the kilowatt hour (kWh) and the maximum demand in kW (kWMD) along with the time.
3. The decimal units shall not be displayed for cumulative kWh in auto scroll mode. However it shall be displayed in push button mode for high resolution display for testing.
4. The meter shall be pre-programmed for following details.
   a) Voltage: 240 V
   b) Integration period for kWMD shall be of 30 minutes real time based.
   c) The meter shall auto reset kW maximum demand (kWMD) at 2400 Hrs. of last day of each calendar month and this value shall be stored in the memory along with the cumulative kWh reading.
   d) No reset push button will be provided.

9.10.2 Display Measuring Parameters

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

9.10.2.1 *Default Display*

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

Table 9-2 Display Parameters

S. No.	Parameter
1.00	LCD check
2.00	Real Time and Date
3.00	Instantaneous Active Load in Kilowatt
4.00	Active Energy (kWh) Export Mode
5.00	Maximum demand (kWMD) with date and time. (Expert Mode)
6.00	Active Energy (kWh) (Import Mode)
7.00	Maximum demand (kWMD) with Date and time(Import Mode)
8.00	Harmonic Energy (HkWh) (Export)
9.00	Harmonic Energy (HkWh) (Import)
10.00	Tamper event of Meter Cover Open with Date & Time

Note:

1. Active cumulative energy shall be displayed for minimum 20 seconds. All other parameters shall be displayed for minimum 6 seconds including LCD check.
2. The meter shall display the tamper event of Meter Cover Open with Date & Time in auto scroll mode along with other parameters.
3. The meter shall display the tamper meter cover open with date & time in auto scroll mode along with other parameters.
4. The Default Display (Auto scrolling mode) shall switch to Alternate Display (On Demand Display Mode) after pressing the push button continuously for 5 seconds.
5. The Alternate Display shall switch over to Default Display if the push button is not operated for 15 seconds.

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

a) Cumulative Active Energy (kWh) for each calendar month for previous six months with display of month. (Export mode).
b) Maximum demand (kWMD) in a calendar month for previous six months with date & time. (Export mode).
c) Cumulative Active Energy (kWh) for each calendar month for previous six months with display of month. (Import mode).
d) Maximum demand (kWMD) in a calendar month for previous six months with date and time. (Import Mode)
e) Magnetic tamper event with date / time: This shall be displayed as per the requirement of clause no.

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

9.11 Demonstration

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

9.12 Billing History and Load Survey

9.12.1 **Billing History**

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

Table 9-3 Legends for Billing History

Months	Import		Export	
	MD	Energy	MD	Energy
March(Current month)	MD	kWh	MD	kWh
Feb	MD1	K5Wh1	MD1	K5Wh1
Jan	MD2	kWh2	MD2	kWh2
Dec	MD3	kWh3	MD3	kWh3
Nov	MD4	kWh4	MD4	kWh4
Oct	MD5	kWh5	MD5	kWh5
Sept	MD6	kWh6	MD6	kWh6
Aug	MD7	kWh7	MD7	kWh7
July	MD8	kWh8	MD8	kWh8
June	MD9	kWh9	MD9	kWh9
May	MD10	kWh10	MD10	kWh10
April	MD11	kWh11	MD11	kWh11
March	MD12	kWh12	MD12	kWh12

Details of Legend shall be self-explanatory with legends like:

Export: →

Import: ←

9.12.2 Load Survey parameters

The load survey parameters shall be selectable, however standard energy parameters like kWh (Import & Export), kWMD (Import & Export)), Voltage, Current, Voltage THD (Import & Export), Current THD (Import &Export) & PF (Import & Export) shall be mandatory to be available for selection.

The logging interval for load survey shall be 30 minutes. Load survey data shall be logged for last 45 days on non-time based basis, i.e. if there is no power for more than 24 hours, the day shall not be recorded. Whenever meter is taken out and brought to laboratory, the load survey data shall be retained for the period of actual use of meter. This load survey data can be retrieved as and when desired and load profiles shall be viewed graphically / analytically with the help of meter application software. The meter application software shall be capable of exporting / transmitting these data for analysis to other user software in spreadsheet format.

9.13 Computer Software

1. For efficient and speedy recovery of data downloaded through CMRI on base computer, licensed copies of base computer software shall be supplied free of cost. This BCS software shall be password protected.

2. The computer software shall be "Windows" based of latest version & user friendly & shall support all versions of "Windows". Also, whenever there is new upgrade version operating system is released, the computer software compatible to that version should be provided within 3 months free of cost.
3. The data transfer from meter to CMRI & from CMRI to laptop computer or PC shall be highly reliable and fraud proof. (No editing shall be possible on base computer as well as on CMRI by any means).
4. This software shall be used at number of places up to Division / Sub Division level. Hence as many copies of base computer software as required up to Division / Sub Division level shall be provided by supplier.
5. BCS software shall have the facility to import consumer master data from UPCL billing system to BCS. Format is as follows:
    - BU.
    - PC.
    - MR.
    - Route.
    - Sequence.
    - Consumer Number.
    - Consumer Name.
    - Consumer Address.
    - Meter Serial Number.
    - Meter Make Code
    - DTC code.
6. Import export shall happen on any USB port & RS – 232 port of PC / Laptop.
7. Every report shall have the facility to print/export as text/export as pdf.
8. Exporting of meter number from BCS to CMRI shall be selective on meter number or group of meters of particular MR-Route-Sequence or DTC code. The software shall have capability to convert all the data into ASCII format as per UPCL requirement.
9. Billing Data:
    - Active Energy (kWh) Import
    - Active Energy (kWh) Export
    - Harmonic Energy (HkWh) Import
    - Harmonic Energy (HkWh) Export
10. Load Survey: As per clause no. 5.18.2
11. Tamper Data:

Table 9-4Tamper Data

S.No	Name of Tamper Event as per Clause no. 5.18	Occurrence Date and Time	Restoration Date and Time
1.	Load through local Earth		
2.	Neutral Disconnected		
3.	Magnetic Tamper		
4.	Meter cover open with date and time	Only Occurrence	

12. BCS shall maintain the audit log for connection and disconnection of CMRI to BCS. The BCS shall have the option of downloading the audit log.
13. BCS shall maintain the download billing history.
14. BCS shall store the data to database in encrypted format. Encryption used shall be provided free of cost to UPCL.

15. BCS shall generate Exceptional report of new meters (Meters not available in CMRI initially) reading. Meter manufacturer shall provide API / Exe file with documentation for downloading the data from the meter along with the sample meter.
16. Checksum logic shall also be provided for the downloaded data along with the sample meter.
17. Checksum checking Exe / API shall also be given for validating downloaded meter data as well as generated XML file with sample meter.
18.
19. The total time taken for downloading Billing, Tamper and Load Survey Data for 45 days shall be 8 minutes. Downloading time of only Billing data, i.e. kWh shall be less than 5 secs inclusive of handshaking.
20. The display parameters shall be preprogrammed at factory as per cl. no. 5.19.1.5.
21. Tamper data shall be stored in memory and retrieved by CMRI with necessary software.
22. It shall be possible to upload the CMRI data to any PC having CMRI software. A consumer based data uploading facility is required so that CMRI shall upload data only in that PC which has the concerned consumers' data. The consumer number + meter number + make code shall be the key for creating consumers' files or overwriting consumers' files in PC.
23. The BCS software shall create one single file for the uploaded data, e.g. if CMRI contains the meter readings of 2,000 consumer meters and the said data is uploaded to BCS, then the BCS shall create a single file containing separate records for each consumer meter reading.
24. Also there shall be a provision to give filenames while creating the file. As and when the meter manufacturer releases new or latest or advanced versions of meter hardware / firmware / software, the same shall be made available to purchaser immediately on the release date free of cost.
25. The latest version shall support all existing hardware / meters in the field.
26. Two separate fields shall be provided for consumer name and address – one name field of one line, and other Address field of two lines.
27. The meter samples with CMRI shall be tested by our IT Department for the time required for downloading the data as confirmed by the bidder.
28. API which will be residing on CMRI will be given free of cost with all its documentation and training. Without API, meter samples shall not be approved.
29. BCS shall support all current operating system versions and shall provide new version of BCS wherever the new version of operating system released.
30. As and when the meter manufacturer releases new or latest or advanced versions of meter hardware / firmware / software, the same shall be made available to purchaser immediately on the release date free of cost. The latest version shall support all existing hardware / meters in the field.

9.14 Common Meter Reading Instrument (CMRI)

1. After starting the CMRI, by default it shall be in Meter Reading mode.
2. Memory of CMRI shall be 8 MB min.
3. The CMRI shall possess a specific serial No. which cannot be changed. Every CMRI shall be properly labeled with serial number/tender number/program name/program version.
4. There shall be test option for just checking the connectivity between CMRI and meter.
5. The CMRI shall be supplied including user manual, AA size batteries and a set of direct communication cords for data downloading to the Laptop or PC for each CMRI.
6. There shall be a provision for AUTO POWER SAVE, which shall force the instrument in the power saving mode in case of no-activity within 5 minutes. The data shall not be lost in the event the batteries are drained or removed from the CMRI.
7. The CMRI shall be capable to download following data individually after respective command to CMRI.
   - Only Billing Data,
   - Only Billing History,
   - Only Tamper Data,
   - Only Load Survey Data,

- All Data.

8. CMRI shall be capable of downloading billing data of at least 2,000 (Two thousand) meters at a time. The CMRI supplied shall be capable for downloading data of multiple designs and make of meters as well as for meters added in next 5 years for the common communication protocol attached herewith.
9. The meter specific MRI programs shall have the ability to use CMRI real time clock to tag all time related events.
10. A real time clock shall be provided in the CMRI. The clock shall have a minimum of 15 days battery backup with 30 year calendar. The time drift of the real time clock, considering all influencing quantities shall not exceed + / - 300 seconds per year.
11. After successful downloading of meter data to CMRI, an indication on both, CMRI and meter for confirmation of successful data transfer shall be provided for each set of data, viz. billing, load survey & tamper data. During this period, the energy recording in meter shall not be affected. Repeated downloading from the same meter shall be disabled for a minimum period of 15 minutes for each set of data, viz. billing, load survey & tamper data. For example, if only the Billing Data is downloaded, then further downloading of Billing Data shall be disabled for further 15 minutes.
12. CMRI shall not accept any external file other than BCS.
13. CMRI shall have the audit trail log of connection and disconnection of CMRI with BCS.
14. After downloading the data from meters, it shall be possible to create a single file for all records. The contents of this file shall not be editable.
15. Further, there shall be facility in CMRI to provide the transfer of meter data to base computer through RS 232 port as well as USB port.
16. The interface for communication between CMRI & Base computer shall be supplied free of cost. Two nos. of chords of minimum length of 1 meter shall be provided with each CMRI for downloading the data from CMRI to base computer.
17. The manufacturer / supplier shall modify the compatibility of CMRI with the meter and the base computer system due to any change in language or any other reasons at their own cost within guarantee period.
18. The CMRI shall have facility for re-entering the meter serial numbers directly from base computer system so that once these meters are read and the data is uploaded on base computer system, the serial numbers of existing meters could be deleted from the CMRI and the meter serial numbers of other meters can be entered in the CMRI.

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

It shall show listed (meter serial number available in CMRI) and not listed meters whose data has been downloaded. While exporting the fresh (new) meter data from BCS to CMRI, there shall have the option for downloading or deleting the old data present in CMRI. Before deleting the data from CMRI ask (prompt) (Yes/No) twice the user for confirmation to delete the data.

CMRI shall show the following statistic of meters:

(a) Total listed meters for reading in CMRI.

(b) Total meter reading downloaded in CMRI (excluding the new meters).

(c) New meters reading downloaded in CMRI.

(d) Meter Readings not downloaded in CMRI.

19. CMRI shall have the option to check the reading status (Downloaded or Not Downloaded) for any particular meter.
20. The CMRI shall indicate the status of total consumers / meters, number of consumers / meters read and balance consumers / meters. The search facility for the balance meters shall be provided on the CMRI.
21. The CMRI shall be type tested for (a) Tests of Mechanical requirement such as Free fall test, Shock Test, Vibration test, (b) Tests of Climatic influences such as Tests of Protection against Penetration of Dust and Water (IP 6X), Dry Heat test, Cold Test, Damp Heat Cyclic Test, (c) Tests for Electromagnetic Compatibility (EMC), (d) Test of Immunity to Electromagnetic HF Fields and (e) Radio Interference Measurement.

22. The equipment's offered shall be fully type tested at approved laboratory by National Accreditation Board for Testing and Calibration Laboratories (NABL) as per relevant standards within last 5 years from the date of opening of tender & the type test reports shall be enclosed with the offer.

9.15 Connection Diagram and Terminal Markings

The connection diagram of the meter shall be clearly shown on inside portion of the terminal cover and shall be of permanent nature. Meter terminals shall also be marked and this marking shall appear in the above diagram. **Stickers of any kind shall not be accepted**.

9.16 Name plate and Markings

Meter shall have a name plate clearly visible, effectively secured against removal and indelibly and distinctly marked with all essential particulars as per relevant standards. The manufacturer's meter constant shall be marked on the Name Plate.

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

a) Purchase Order No.
b) Month and Year of manufacture
c) Name of purchaser:
d) Guarantee Five Years
e) ISI mark
f) Communication Capability: LPRF

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

9.17 Tests

9.17.1 Type Tests

Meter shall be fully type tested as per IS: 13779 / 1999 (amended up to date) and external AC (except 0.2 T AC magnet) / DC magnetic influence tests as per CBIP Tech-Report 88 with latest amendments.

1. The Type Test Reports shall clearly indicate the constructional features of the type tested meters. Separate Type Test Reports for each offered type of meters shall be submitted.
2. All the Type Tests shall have been carried out from Laboratories which are accredited by the National Board of Testing and Calibration Laboratories (NABL) of Govt. of India such as CPRI, Bangalore / Bhopal, ERDA Vadodara, ETDC, ERTL to prove that the meters meet the requirements of the specification.
3. Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.
4. Type test reports shall be submitted along with offer. The type test report of meter having identical constructional and other features carried out during last three years shall be valid.
5. The purchaser reserves the right to demand repetition of some or all the type tests in presence of purchaser's representative at purchaser's cost. Meters shall pass the entire acceptance and routine tests as laid down in IS: 13779 / 1999 (amended up to date) and also additional acceptance tests as prescribed in this specification. (3 to 8 meters from a lot more than 1,000 shall be sealed randomly in the factory and shall be tested for tamper events).

9.17.2 Additional Routine tests

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

1. Transportation Test: At least 50% of the samples of the meters be tested for error at Imax, Ib and 5% Ib at unity power factor and 50% Imax and 10% Ib at 0.5 lagging Power Factor besides checking them for starting current. The meter shall be tested with meter cover duly tightened and sealed properly. After recording these errors, the meters be put in their normal packing and transported for at least 50 km in any transport vehicle such as pick up van, Jeep, etc. on uneven rural roads and then re-tested at all these loads after the transportation. The variation in errors recorded before and after transportation shall not exceed 1% at higher loads and 1.5% at low loads.
2. Other Acceptance Tests:
   i. The meter shall withstand continuously for a period of at least 5 minutes at a voltage of 440 V between phase and neutral without damage / problems.
   ii. Tamper Conditions as stated in this specification
   iii. Glow Wire testing for polycarbonate material
   iv. Power Consumption Tests
   v. Verification of data transfer / downloading via RF port as per technical specifications.
   vi. The meter shall comply all the tests for external AC / DC (except 0.2 Tesla AC magnet test) magnetic field as per CBIP Tech Report 88 with latest amendments.
   vii. Moreover, the magnetic influence test for permanent magnet of 0.5 Tesla for a minimum period of 15 minutes shall be carried out by putting the magnet on the meter body.
   viii. If the accuracy of the meter gets affected during the test, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering maximum value current (Imax) and reference voltage at unity power factor.
   ix. After removal of magnet, meter shall be subjected to accuracy test as per IS 13779 / 1999 (amended up to date).
   x. No deviation in error is allowed in the class index as per IS: 13779/ 1999 (amended up to date) & this specification.
   xi. The meter shall withstand impulse voltage at 10 kV.
   xii. The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date. For any higher signals than the present standards and UPCL technical specifications indicated above, the energy meters shall be immune & the accuracy of meter shall not get affected.

Jammer Test shall be carried out at UPCL testing division lab.

The test 5.23.2.2 (i) to (v) shall be carried out at factory for each inspected lot at the time of pre-dispatch inspection.

The tests 5.23.2.2 (vi), (vii) & (viii) shall be carried out on one sample from first lot as per procedure laid down in IS: 13779 / 1999 (amended up to date) and CBIP Tech. Report 88 in NABL LAB.

The test report shall get approved from Executive Engineer, Store and Purchase, UPCL, Dehradun before commencement of supply.

9.17.3 Limits of error

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

Sr. No.	Influence Quantities	Current Value	Power factor	Limits of variation in % error for class 1 meters
a)	Voltage variation	Ib	1	0.7
	– 15% to +10%	Ib	0.5 lag	1.0

Sr. No.	Influence Quantities	Current Value	Power factor	Limits of variation in % error for class 1 meters
b)	Voltage variation	Ib	1	1.1
	– 40% & + 20%	Ib	0.5 lag	1.5

The meters shall be tested at (-) 15% and at (-) 40% of reference voltage as well as (+) 10% and (+) 20% of reference voltage and shall record energy within limits of variation indicated above.

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

9.18 Guaranteed technical Parameters

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

9.19 Pre Dispatch Inspections

All Acceptance Tests and Inspection shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall offer to the inspector representing the purchaser, all the reasonable facilities, free of charge, for inspection and testing, to satisfy him that the material is being supplied in accordance with this specification. The Company's representative / Engineer attending the above testing shall carry out testing on suitable number of meters as per sampling procedure laid down in IS: 13779 / 1999 (amended up to date) and additional acceptance test as per this specification and issue test certificate approval to the manufacturer and give clearance for dispatch. All the meters offered for inspection shall be in sealed condition. The seals of sample meters taken for testing & inspection shall be break open & resealed after inspection. The first lot of meter may be jointly inspected by the Executive Engineer, Testing Division and the Executive Engineer, Inspection Wing.

9.20 Inspection after Receipt at Stores (Random Sample Testing)

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

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

9.21 Guarantee

The meter & CMRI shall be guaranteed for the period of five years from the date of commissioning or five and half year from the date of dispatch whichever is earlier. The meter / CMRI found defective within above guarantee

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

9.22 Packing

The meters shall be suitably packed in order to avoid damage during transit or handling. Each meter may be suitably packed in the first instance to prevent ingress of moisture and dust and then placed in a cushioned carton of a suitable material to prevent damage due to shocks during transit. The lid of the carton may be suitably sealed. A suitable number of sealed cartons may be packed in a case of adequate strength with extra cushioning. The cases may then be properly sealed against accidental opening in transit. The packing cases may be marked to indicate the fragile nature of the contents.

The following information shall be furnished with the consignment:

a. Name of the consignee.

b. Details of consignment.

c. Destination.

d. Total weight of the consignment.

e. Sign showing upper / lower side of the crate.

f. Sign showing fragility of the material.

g. Handling and unpacking instructions.

h. Bill of Material indicating contents of each package and spare material.

9.23 Tender Samples

Tenderer are required to submit 15 (Fifteen) nos. of sample meters and 1 (One) no. of sample CMRI of offered type and 2 (Two) Nos. of meter enclosures as per technical specifications along with the API software, BCS, checksum logic & documentation to Executive Engineer (Store/Purchase) in the office of the Executive Engineer, Store and Purchase, UPCL, Kaulagarh, Dehradun on or before the time & date stipulated for submission of offer for testing the sample meters in third party NABL Lab like ERDA, CPRI, CIPET, ERTL, ETDC and testing the offered API with BCS software, checksum logic & documentation by our IT Department as per technical specifications for testing TOD tariff protocol & interoperability, etc. The offer of those eligible bidders shall only be considered if the sample passes the tests at NABL Lab as well as necessary certification from our IT Department for the offered API, TOD tariff protocol & interoperability, etc. The results of NABL Lab and the certification from IT Department shall not be disputed and shall be binding on the bidder. The required information such as Manufacturer's Name or Trade Name, Sr. No. ISI Certification No. API specification no., etc. shall be on stickers to be affixed on outer portion of sample meters being submitted along with the offer. Such information shall not be embossed or printed on any part of the sample meter. Out of these, two samples shall be without ultrasonic / laser welding to confirm constructional features.

9.24 Quality Control

The purchaser has a right to send a team of experienced engineers for assessing the capability of the firm for manufacturing and testing of meters as per this specification. The team shall be given all assistance and co-operation for inspection and testing at the bidder's works.

The meters supplied shall give service for a long period without drifting from the original calibration & performance must be near to zero percent failure.

9.25Minimum Testing Facilities

Manufacturer shall possess fully computerized Meter Test Bench System for carrying out routine and acceptance Tests as per IS: 13779/1999 (amended up to date). Test Reports for each and every meter shall be generated. The list of testing equipments shall be enclosed. The manufacturer shall have the necessary minimum testing facilities for carrying out the following tests:

a. Insulation resistance measurement,
b. No load condition,
c. Starting current,
d. Accuracy requirement,
e. Power consumption,
f. Repeatability of error,
g. Transportation test,
h. Tamper conditions,
i. LPRF communication connectivity.
j. The manufacturer shall have duly calibrated RSS meter of class 0.1 or better accuracy.
k. The manufacturer shall have Glow Wire Testing facility.
l. The bidder shall have fully automatic Test Bench having in-built constant voltage, current and frequency source with facility to select various loads automatically and print the errors directly.

9.26 Manufacturing Activities

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

Meter shall be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and reflow solder process. The loops/wired joints must be avoided on PCB. Further, the Bidder shall own or have assured access (through hire, lease or sub-contract, documentary proof shall be attached with the offer) of above facilities.

Quality shall be ensured at the following stages:

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

The calibration of meters shall be done in-house on a computerized testing bench having stabilized power supply. The bidders shall submit the list of all (imported as well as indigenous) components to be used in meter, separately along with the offer. List of makes of components is attached herewith as a guide line (Schedule -III).

Bought out items:

A detailed list of bought out items which are used in the manufacturing of the meter shall be furnished indicating the name of firms from whom these items are procured. The bidder shall also give the details of quality assurance procedures followed by him in respect of the bought out items.

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

Table 9-5 List of Plant and Machinery

Sr. No	List of Plant and Machinery used for production of energy meters	
1.	Fully automatic testing Bench with ICT for testing link less meters	Routine Testing and Calibration of Meters
2.	Semi-automatic testing Bench with MSTV	Routine Testing and Calibration of Meters
3.	IR Tester	Insulation testing
4.	HV Tester	Insulation testing
5.	Error calculators	Error testing
6.	Long duration Running test set ups	Reliability testing
7.	Reference Meters class 0.1 accuracy	Error Calculation
8.	Ultrasonic Welding Machines	Welding of meters
9.	Automatic Pick and Place Machines	Automatic placing of SMT components
10.	Solder Paste Printing Machine	SMT Soldering
11.	Solder Furnace IR reflow	SMT Soldering
12.	PCB Scanner	For testing of PCBs
13.	ATE functional tester	For testing of components
14.	Programmers and Program Loaders	Chip Programming tools
15.	CAD PCB designing setups	PCB designing
16.	Furnace IR type for Hybrid Micro Circuits	Resistance network and HMC manufacturing
17.	Laser Trimming Machines	Trimming of resistances for higher accuracy measurement
18.	Wave Soldering Machines	Wave soldering of PCBs
19.	Humidity Chamber	Accelerated testing for life cycle
20.	Dry Heat Test Chamber	Accelerated testing for life cycle
21.	Thermal Shock Chamber	Accelerated testing for life cycle
22.	Pro-e Mechanical Design stations	Mechanical CAD station
23.	Spark erosion tools fabricating machine	Tool fabrication and die manufacturing
24.	CNC wire cut tool fabrication machine	Tool fabrication and die manufacturing
25.	Injection Moulding Machine	Moulding of plastic materials
26.	CNC milling machine for composite tool fabrication	Tool fabrication and Die manufacturing
27.	Vibration testing machine	Vibration testing of meters
28.	Glow wire test machine	Testing of Plastic material
29.	Fast transient burst testing setup	Type testing of Meters

Sr. No	List of Plant and Machinery used for production of energy meters	
30.	Short term over current testing setup	Type testing of Meters
31.	Magnetic and other testing setup	Tamper Testing
32.	Impulse Voltage Testing Setup	Type testing of Meters
33.	Composite Enviornmental testing chambers	Type testing of Meters

9.27 Quality Assurance Plan

The tenderer shall invariably furnish QAP as specified below along with his offer, the QAP adopted by him in the process of manufacturing.

The bidder shall invariably furnish the following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.

a. Statement giving list of important raw materials, names of sub - suppliers for the raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.

b. Information and copies of test certificates as in (i) above in respect of bought out accessories,

c. List of manufacturing facilities available,

d. Level of automation achieved and list of areas where manual processing exists,

e. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

f. List of testing equipments available with the bidder for final testing of equipment specified and test plan limitation, if any, vis-à-vis, the type, special acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly bought out in schedule of deviation from specified test requirements.

The successful bidder shall within 30 days of placement of order, submit following information to the purchaser.

a. List of raw materials as well as bought out accessories and the names of sub - suppliers selected from those furnished along with offers.

b. Type test certificates of the raw materials and bought out accessories if required by the purchaser.

c. Quality assurance plan (QAP) withhold points for purchaser's inspection. The quality assurance plant and purchasers hold points shall be discussed between the purchaser and bidder before the QAP is finalized.

The contractor shall operate systems which implement the following.

a. **Hold point**: A stage in the material procurement or workmanship process beyond which work shall not proceed without the documental approval of designated individuals organizations. The purchaser's written approval is required to authorize work to progress beyond the hold points indicated in quality assurance plans.
b. **Notification point**: A stage in the material procurement or workmanship process for which advance notice of the activity is required to facilitate witness. If the purchaser does not attend after receiving documented notification in accordance with the agreed procedures and with the correct period of notice, then the work may proceed.

The successful bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing if required by the purchaser and ensure that Quality Assurance program of the contractor shall consist of the quality systems and quality plans with the following details.

The structure of the organization.

- The duties and responsibilities assigned to staff ensuring quality of work.
- The system for purchasing taking delivery and verification of material.
- The system for ensuring quality workmanship.
- The system for retention of records.
- The arrangement for contractor's internal auditing.
- A list of administration and work procedures required to achieve and verify contractor's quality requirements.
- These procedures shall be made readily available to the project manager for inspection on request.

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

9.28 Component Selection

As per Schedule – III enclosed.

9.29 Schedules

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

9.29.1 Schedule – I Guaranteed Technical particulars

As per GTP parameters uploaded on e- tendering site

9.29.2 Schedule – II Tenderer's experience

TENDERER'S EXPERIENCE

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

Sr. No. Name of client Order No. & date Qty. ordered Qty. supplied

NAME OF FIRM _____

NAME & SIGNATURE _____

DESIGNATION _____

DATE _____

9.29.3 Schedule - III Component Selection

Table 9-6 Schedule III Component Selection

Sr. No	Component Function	Requirement	Makes
1.	Measurement or computing chips	The measurement or computing chips used in the Meter shall be with the Surface mount type.	**USA:** Analog Devices, Cyrus Logic, Atmel, Philips, Teridian. Dallas, ST, Texas Instruments, Motorola, Maxim, National Semiconductors, Freescale, Onsemiconductors **Germany:** Siemens. **South Africa**: SAMES. **Japan**: NEC, Toshiba, Renasas, Hitachi. **Austria**: AMS **Holland**: Philips (N X P)
2.	Memory Chips	The memory chips shall not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. Meter shall have non-volatile memory (NVM). No other type of memory shall be used for data recording and programming. (The life of the NVM is highest) There shall be security isolation between metering circuit, communication circuit, and power circuit	**USA**: Atmel, Teridian, National Semiconductors, Philips, Texas Instruments, ST, Microchip, Spanson (Fujitsu), Ramtron **Japan**: Hitachi, Renasas **Germany**: Siemens
3.	Display Modules	a. The display modules shall be well protected from external UV radiations. b. The display visibility shall be sufficient to read the Meter mounted at height of 0.5 meter as well as at the height of 2 meters (refer 3.2 d for viewing angle. c. The construction of the modules shall be such that the displayed quantity shall not disturbed with the life of display (PIN Type). d. It shall be trans- reflective HTN or STN type industrial grade with extended temperature range. HTN – Hyper Twisted Nematic (120°)	**Singapore**: E-smart, Bonafied Technologies, Display Tech. **Korea**: Advantek, Jebon, Union Display Inc., **Japan**: Hitachi, Sony, L&G. **Malaysia**: Crystal Clear Technology

Sr. No	Component Function	Requirement	Makes
		STN – Super Twisted Nematic (160°)	
4.	Electronic Components	The active & passive components shall be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	**USA**: National Semiconductors, Atmel, Philips, Texas Instruments, BC Component Analog devices, ST, Maxim, Kemet Onsemiconductors, Freescale, Intersil, Raltron, Fairchild, Muruta, Agilent, AVX, Abracon, Sipex, Diode Inc., Honeywell, Power Integration, Fox, Roham. **Japan**: Hitachi, Oki, AVZ or Rcon, Toshiba, Epson, Kemet, Alps, Muruta, TDK, Sanyo, Samsung, Panasonic **India:** Keltron, Incap, VEPL, PEC, RMC, Gujarat Polyavx, Prismatic, MFR Electronic components Pvt. Ltd., Cermet **Korea:** Samsung **Germany:** Vishay, Epcos, Diotech, Kemet
5.	Battery	Only non-rechargeable battery shall be used for RTC as well as display in absence of Power since the life & reliability of these are better than the rechargeable batteries.	**USA:** Maxell, Renata **Japan:** Panasonic, Sony, Mitsubishi, Sanyo **Germany:** Varta **France:** Saft **Korea:** Tekcell, Vitzrocell Israel: Tadiran.

10. Technical Specification of LT AC Three Phase 10-60 Amps AMR Compatible Static Tod Tri Vector Net Energy Meter As Per Category C of IS: 15959 / 2011

10.1 Scope

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

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

10.2 Applicable Standards

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

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

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

The specification given in this document supersedes the relevant clauses of IS: 13779 / 1999 (amended up to date) wherever applicable.

The equipment meeting with the requirements of other authoritative standards, which ensures equal or better quality than the standard mentioned above, also shall be considered. For conflict related with other parts of the specification, the order of priority shall be – (i) this technical specification, (ii) IS: 13779 / 1999 (amended up to date).

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

i. ISO 9000
ii. ISO 14000

10.3 Service Conditions

As per IS: 13779 / 1999 (amended upto date), the meter to perform satisfactorily under Non - Air Conditioned environment (within stipulations of IS). Meter body shall conform to IP 51 degree of protection.

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

S. No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

The meters to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions:

Table 10-1Service Conditions

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

10.4General Technical Particulars

Table 10-2 Technical Parameters

S. No.	Parameter	
1.	Type	ISI marked LT AC, Three Phase, four wire, 10 - 40 Amps fully Static AMR compatible TOD, Tri – vector Energy Meters with Net Metering Arrangement as per Category C of IS: 15959 / 2011 for measurement of different electrical parameters including Active Energy (kWh), Reactive Energy (kVArh), Apparent Energy, (kVAh) in Import & Export mode etc. in three phase, four wire balanced / unbalanced loads of LT consumers.
2.	Accuracy Class	1.0
3.	Current Rating	10-60 Amps
4.	Rated Basic Current (I_b)	10 Amps per phase
5.	Maximum Continuous Current	Four times (400 %) of I_b.
6.	Starting Current	0.2% of I_b
7.	Short time Current	As per IS 13779/ 1999
8.	Rated Voltage	3 X 240 Volts Ph- N

S. No.	Parameter	
9.	Voltage Range	+20% to -25% of rated voltage
10.	Temperature	The standard reference temperature for performance shall be 27^0 C The mean temperature coefficient shall not exceed 0.07%
11.	Frequency	50 Hz ±5%.
12.	Power Factor	0.0 Lag – Unity - 0.0 Lead. For leading Power factor, the value of kVAh shall be equal to kWh for the purpose of calculation of average power factor (on the basis of kWh/ kVAh) i.e. the value of kVAh shall be based on lagging value of kVArh & kWh.
13.	Power consumption	i. The active and apparent power consumption in each voltage circuit at reference voltage, reference temperature and reference frequency shall not exceed 1.0 W and 4 VA ii. The apparent power taken by each current circuit, at basic current I_b, reference frequency and reference temperature shall not exceed 2 VA.
14.	Design	Meter shall be designed with application specific integrated circuit (ASIC) or microcontroller; shall have no moving part; electronic components shall be assembelled on printed circuit board using surface mounting technology; factory calibration using high accuracy (0.1 class) software based test bench.
15.	Power Supply	SMPS
16.	ISI mark	The meter so supplied must bear the ISI /BIS mark

10.5 Constructional Requirement / Meter Cover & Sealing Arrangement

10.5.1 Construction Features

1. The meter shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially:
   i. Personal safety against electric shock.
   ii. Personal safety against effects of excessive temperature;
   iii. Protection against spread of fire;
   iv. Protection against penetration of solid objects, dust & water in meter.
2. All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results
3. Any protective coating shall not be liable to damage by ordinary handling nor damage due to exposure to air, under normal working conditions.
4. The electrical connections shall be such as to prevent any opening of the circuit under normal conditions of use as specified in this standard.
5. The construction or the meter shall be such as to minimize the risks of short-circuiting of the insulation between live parts and accessible conducting parts due to accidental loosening or unscrewing of the wiring, screws, etc. The meter shall not produce appreciable noise in use.

10.5.2 Material Used

1. The meter base & cover shall be made out of transparent, unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities. The meter case shall also have high impact strength.

2. The entire design and construction shall be capable of withstanding likely to occur in components is preferred for this purpose. Components used shall be of high quality and comply with International Industrial Standard practices.
3. Construction of the meter shall be such as to permit sealing of meter cover, terminal cover, etc. independently to ensure that the internal parts are not accessible for tampering without breaking the seals and ultrasonic welding of meter body.

10.5.3 Meter Body and Sealing Arrangement

1. The poly carbonate body of the meter shall conform to IS: 11731 (FV-2 category) besides meeting the test requirement of heat deflection test as per ISO 75, glow wire test as per the IS: 11000 (part 2/SEC-1) 1984 or IEC-60695-2-12, Ball pressure test as per IEC-60695-10-2 and Flammability Test as per UL 94 or as per IS: 11731 (Part-2) 1986. The type test certificate shall be submitted along with the offer.
2. The meter shall be projection type and shall be dust and moisture proof. The meter cover shall be secured to base by means of sealable unidirectional captive screws. The provision shall be made on the Meter for at least two seals to be put by utility user.
3. The meter body shall be type tested for IP51 degree of protection as per IS 12063 against ingress of dust, moisture & vermin. The type test certificate shall be submitted along with the offer.
4. The transparent polycarbonate base and cover of meter shall be ultra-sonically welded (continuous welding) so that once the meter is manufactured and tested at factory; it shall not be possible to open the cover at site except the terminal cover. The thickness of material for meter cover and base shall be 2 mm (minimum).
5. Independent sealing provision shall be made against opening of the terminal cover and front cover. It is necessary to provide unidirectional screws with two holes for sealing purpose. The meter shall be pilfer-proof & tamper-proof.

10.5.4 Markings and Sticker Labels

1. The energy meter shall clearly indicate the Export and Import connection marking on the terminal block and terminal cover.
2. The "→" indicates that Import terminal / forward and "←" indicates that Export terminal / reverse energy measurement.
3. A sticker label containing warning notice in Hindi / English language which is to be stick up on meters front cover or printed on meter name plate with easily readable font size not less than 10 in red colour.

10.5.5 Terminals and Terminal Blocks

1. The terminals shall be of suitable rating and shall be capable of carrying 150% Imax and made of electro-plated (or tinned) brass and shall be of replaceable type.
2. The terminal block for current and voltage connections conforming to IS: 13779 / 1999 (amended up to date) to meet the requirement of terminal connection arrangement shall be made from high quality non-hygroscopic, fire retardant, reinforced, moulded polycarbonate (non-Bakelite) which shall form an extension of the meter body.
3. The material of which the terminal block is made shall be capable of passing the tests given in IS: 1336O (Part 6/Sec 17) for a temperature of 135^0 C and a pressure of 1.8 MPa (Method A).
4. The holes in the insulating material, which form an extension of the terminal holes, shall be of sufficient size to also accommodate the insulation of the conductors.
5. The conductors where terminated to the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixings, which may be loosened and tightened several times during the life of the meter, shall screw into a metal nut or shall be welded. All parts of each terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized.
6. The manufacturer shall ensure that the supporting webs between two terminals of the terminal block shall be sufficiently high to ensure that two neighboring terminals do not get bridged by dust and there shall not be any possibility of flash over between adjacent terminals of the terminal block.

7. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material.
8. Two screws shall be provided in each current terminal for effectively clamping the external leads or thimbles. Each clamping screw shall engage a minimum of five threads in the terminal. The ends of screws shall be such as not to pierce and cut the conductors used.
9. The minimum internal diameter of terminal hole shall be as per IS.
10. The terminals, the conductor fixing screws or the external or internal conductors shall not be liable to come into contact with terminal covers.
11. The meter shall be completely factory sealed except the terminal block cover. The provision shall be made on the meter for at least two seals to be put by utility user.

10.5.6 Terminal Cover

1. The terminal cover shall be made out of unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities. The terminal cover shall be transparent.
2. The termination arrangement shall be provided with an extended type transparent terminal cover as per clause number 6.5.2 of IS 13779 / 1999 amended upto date and shall be sealable independently to prevent unauthorized tampering.
3. The extended terminal cover shall be fixed to the meter terminal block by means of screws and with one side hinge. The screws shall not be detachable from the cover and shall have provision for sealing. Proper size of grooves shall be provided at bottom of this terminal cover for incoming and outgoing service wires.
4. The terminal cover of a meter shall be sealable independently of the meter cover to prevent unauthorized tampering. The terminal cover shall enclose the actual terminals, the conductor fixing screws and unless otherwise specified, a suitable length of external conductors and their insulation.
5. The fixing screws used on the terminal cover for fixing and sealing in terminal cover shall be held captive in the terminal cover.
6. When the meter is mounted, no access to the terminals shall be possible without breaking seals(s) of the terminal cover.

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

10.5.7 Resistance to Heat and Fire

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

10.5.8 Output Device

Energy Meter shall have test output, accessible from the front, and be capable of being monitored with suitable testing equipment while in operation at site. The operation indicator must be visible from the front. The test output device shall be provided in the form of blinking LED or other similar devices like blinking LCD. Resolution of the test output device shall be sufficient to enable the starting current test in less than 10 minutes and accuracy test at the lowest load shall be completed with desired accuracy within 5 minutes. The pulse rate of output device which Pulse / kWh or pulse / kVArh (meter constant) shall be indelibly provided on the nameplate. It shall be possible to check the accuracy of active energy measurement of the meter on site by means of LED output.

10.5.9 Meter Accuracy

The meter accuracy shall not be affected by magnetic field (AC / DC / Permanent) upto 0.2 Tesla on all the sides of meter, i.e. front, sides, top and bottom of the meter as per CBIP Technical Report 88 with latest amendments.

Under influence of any magnetic field (AC / DC /Permanent) above 0.2 Tesla, if the accuracy of the meter gets affected, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering Imax and reference voltage at unity power factor.

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

Power supply unit shall be micro control type instead of providing conventional transformer and then conversion to avoid magnetic influence.

10.5.10 Real Time Internal Clock (RTC)

1. The real time quartz clock shall be used in the meter for maintaining time (IST) and calendar. The RTC shall be non - rechargeable and shall be pre-programmed for 30 Years Day / date without any necessity for correction. The maximum drift shall not exceed +/- 300 Seconds per year. Facility for adjustment of real time shall be provided with proper security. The calendar and the clock shall be correctly set to Indian Standard Time.
2. The clock day / date setting and synchronization shall only be possible through password / Key code command from one of the following:
    i. Meter testing work bench and this shall need password enabling for meter or a DLMS compliant CMRI.
    ii. From remote server through suitable communication network or Sub-station data logger 'PC'.
3. The RTC shall have long life (10 Years) Non rechargeable battery. The RTC battery & the battery for display in case of power failure shall be separate.

10.5.11 Electromagnetic & Communication Interference

1. Non-specified display parameters in the meter shall be blocked and same shall not be accessible for reprogramming at site through any kind of communication.
2. Complete metering system shall not be affected by the external electromagnetic interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic fields and DC current in AC supply etc. The Meter shall meet the requirement of CBIP Tech-report 88 (amended up to date).
3. A push button shall be provided for high-resolution reading of display with two decimal digits as brought out elsewhere in this specification (optional). Likewise, a push button shall be provided for scrolling the parameters in Alternate Display (On Demand) mode.
4. The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date.
5. For any higher signals than the present standards and UPCL technical specifications indicated above, the accuracy of meter shall not get affected, i.e. the energy meter shall remain immune.
6. The communication of energy meters shall not be affected considering the above feature state in the clause 6.6.14.3 & 6.6.14.4.

10.5.12 Self-Diagnostic Features

1. The meter shall keep log in its memory for unsatisfactory / non - functioning of Real Time Clock battery and can be downloaded for reading through RS – 232 port to read in base computer.
2. The meter shall be capable of performing complete self-diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data memory location all the time.
3. LED / LCD Test display shall be provided for checking of all display Segments.

10.5.13 Battery Backup

1. The meter shall have facility to read the default display parameters during Power supply failure. For this purpose, an internal or external battery may be provided.
2. The internal battery shall be Ni-mh or Li-ion or NI CD maintenance free battery of long life of 10 years.
3. A suitable Push Button arrangement for activation of this battery shall be provided. Alternatively, push button provided for displaying alternate mode (On Demand Mode) parameters shall also be acceptable for activation of battery during power OFF condition.
4. After activating the battery during power OFF condition, the meter shall display all Default Display (Auto Scrolling Mode) parameters only once, after which the battery shall switch OFF automatically. The battery

shall be locked after 3 operations during one power OFF cycle. As soon as the supply is resumed to meter, the battery shall automatically come to normal.

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

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

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

10.5.14 Communication Capability

a) The meter shall be provided with two ports for communication of the measured / collected data as per the IS: 15959 / 2011 amended upto date, i.e. a hardware port compatible with RS 232 specifications (RJ - 11 / RJ - 45 type is also acceptable) which shall be used for remote access through suitable Modem (GPRS / GSM / EDGE / CDMA / PSTN / LPR) and an Optical port complying with hardware specifications detailed in IEC
b) This shall be used for local data downloading through a DLMS compliant CMRI. RS 232 port or TCP / IP port as required on terminal block is also acceptable.
c) Sealing arrangement for Optical & RS 232 port or TCP / IP port as required shall be provided.
d) Both ports shall support the default and minimum baud rate of 9600 bps.
e) Necessary chord for Optical Port of minimum length of 1 metre in the ratio 50:1 shall be provided free of cost.

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

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

   Meter end, starting 1 to 8 from Left to Right.

   Pin no 8 => RX (+)

   Pin no 7 => RX (-)

   Pin no 3 => TX(+)

   Pin no 6 => TX(-)

ii. The interface shall meet all the requirements of RS-232 specifications in terms of Physical media, Network topologies, maximum devices, maximum distance, mode of operation, etc.

iii. Screw type connectors or RJ45 type connectors have to be provided to easily terminate the twisted pair.

Reverse reading lock of main kWh reading is to be incorporated with necessary software modification if required additionally. The meter shall be capable to withstand and shall not get damaged if phase to phase voltage is applied between phase to neutral for 5 minutes.

The accuracy of the meter and the measurement by meter shall not get influenced by injection of high frequency AC Voltage / chopped signal / DC signal and harmonics on the terminals of the meter. The meter accuracy shall not be affected by magnetic field from all sides of the meter i.e. front, sides, top and bottom of the meter.

The meter shall withstand any type of High Voltage and High Frequency surges, which are similar to the surges produced by induction coil type instruments without affecting the accuracy of the meter. The accuracy of the meter shall not be affected with the application of abnormal voltage / frequency generating device such as spark discharge of approximately 35 kV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

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

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

10.5.15 Retention Time of the Non Volatile Memory

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

10.5.16 Wire / Cable less Design

1. The meter PCB shall be wireless to avoid improper soldering & loose connection / contact.
2. The measurement by meter shall not get influenced by injection of High frequency AC Voltage / chopped signal / DC signal and harmonics on the terminals of the meter.
3. Meter shall be tamper proof. No tampering shall be possible through Optical port or RS 232 port.
4. The meter shall record and display Fundamental energy excluding Harmonic energy. The energy meter shall record & display harmonic energy separately.

10.6 TOD Timing

There shall be provision for at least 6 (Six) Time of Day (TOD) time zones for energy and demand.

The number and timings of these Time of Day time Zones shall be programmable. At present the time zones shall be programmed as per UPCL existing time zones. These may be subject to change as per notification from UPCL.

10.7 Maximum Demand Integration Period

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

10.8 Maximum Demand Reset

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

a. Communication driven reset through hand held terminal (CMRI).
b. Auto reset at 24:00 hrs at the end of each billing cycle: Automatic reset at the end of certain predefined period (say, end of the month). This option shall be blocked by default and made programmable through hand held terminal (CMRI) for the actual date required. No push button shall be provided for MD reset.

10.9 Tamper and Fraud Monitoring Features

10.9.1 Anti-Tamper Features

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

i. Change of phase sequence: The meter accuracy shall not be affected by change of phase sequence. It shall maintain the desired accuracy in case of reversal of phase sequence.
ii. Drawing of current through local Earth: the meter shall register accurate energy even if load is drawn partially or fully through a local earth.
iii. The three-phase meter shall continue to work even without neutral.
iv. The three-phase meter shall work in absence of any two phases, i.e. it shall work on any one phase wire and neutral, to record relevant energy.
v. The meter shall work without earth.
vi. The potential link shall not be provided.
vii. Visual indication shall be provided to safeguard against wrong connections to the meter terminals.
viii. The meter shall be immune to the external magnetic field (AC / DC / Permanent) upto 0.2 Tesla. If the accuracy of the meter gets affected under the influence of magnetic field more than 0.2 Tesla, then the

same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering the maximum value current (Imax) at ref. voltage and unity PF in all the three phases. In case of magnetic tamper during export / reverse mode, the energy meter shall record & add the same energy considering I_{max} in import / forward mode.

ix. The meter shall be immune to abnormal voltage / frequency generating devices.

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

10.9.2 Tamper Events

The meter shall work satisfactorily under presence of various influencing conditions like External Magnetic Field, Electromagnetic Field, Radio Frequency Interference, Harmonic Distortion, Voltage / Frequency Fluctuations and Electromagnetic High Frequency Fields, etc. as per relevant IS

- The meter shall record the occurrence and restoration of tamper events of current, voltages, kWh, power factor, event code, date & time etc. listed in Table 32 to 37 of IS: 15959 / 2011.
- In the event the meter is forcibly opened, even by 2 to 4 mm variation of the meter cover, same shall be recorded as tamper event with date & time stamping as per table 37 of IS: 15959 / 2011 and the meter shall continuously display that the cover has been tampered.
- The detection of the tamper event shall be registered in the tamper event register for retrieval by authorized personnel through Optical port via CMRI and through DLMS compliant CMRI & Remote access through suitable communication network.
- The no. of times the tampering has been done shall also be registered in the meter.
- Minimum 200 numbers of events (occurrences & restoration with date & time) shall be available in the meter memory. The recording of abnormal events shall be on FIFO basis.

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

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

a) **Missing potential and potential imbalance:**
The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of potential failure and low potential, which could happen due to disconnection of potential leads (one or two). Meter shall also detect and log cases of voltage unbalance (10% or more for 5 Minutes.) Higher of the 3 phase voltages shall be considered as reference for this purpose.

b) Current Unbalance:
The meter shall be capable of detecting and recording occurrence and restoration with date and time of current unbalance (30% or more for 15 minutes).
Higher of the 3 phase currents shall be considered as reference for this purpose.

c) Current Reversal
The meter shall be capable of detecting and recording occurrences and restoration for reverse current of any one or two phases with date & time of occurrence and restoration.

d) High Neutral Current (CT bypass).

The meter shall be capable of recording incidences of excess neutral current (if it is in excess 10% of I_b for more than 5 minutes). The meter shall record the total duration of the above abnormalities, time and date of their occurrences and restorations with snapshot of instantaneous electrical conditions viz. System Voltages, Phase Currents & System PF.

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

f) Meter Cover Open

In the event the meter is forcibly opened, even by 2 to 4 mm variation of the meter cover, same shall be recorded as tamper event with date & time stamping and the meter shall continuously display that the cover has been tampered. It is suggested that the manufacturer shall develop their software such that there will be some time delay for activation of this tamper feature and during that period only the meter cover shall be fitted. The delay in activation of software shall be for one instance only. After the meter cover is fitted, it shall get activated immediately without any delay.

S. No.	Description	Occurrence (with Occ. Time 5 min.)	Restoration (with rest. Time 5 min.)
1.	PT Link Missing (Missing Potential)	< 50% of Vref.	> 50% of Vref
2.	Over Voltage in any phase	> 115% of Vref	< 115% of Vref
3.	Low Voltage in any phase	< 70% of Vref	> 70% of Vref
4.	Voltage Unbalance (Diff. of phase voltages)	> 10% Vref	< 10 % Vef
5.	CT open	Zero Amps in one or two phases and current in at least 1 phase is > 5% I_b for 15 minutes	> 3 % I_b for 15 min in the tampered phase for 15 min
6.	Current Unbalance (Diff of phase currents)	> 30 % I_b for 15 min	< 30 % I_b for 15 min
7.	Current Bypass	Bypass Current > 10 % I_b for 15 min	Bypass Current < 10 % I_b for 15 min
8.	Current Reversal	Immediate in case of reverse of any of two phases	Direction of all currents are same.
9.	Over Current in any Phase	> 120 % I_{max}	< 120 % I_{max}
10.	Influence of permanent magnet or AC/ DC electromagnet/ permanent magnet	Immediate	1 Minute after removal
11.	Neutral disturbance	-	-
12.	Power failure	Immediate	
13.	Very low PF	-	-
14.	Meter Cover Opening	2 to 4 mm	-

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

For above abnormal conditions, the recording of events shall be on FIFO basis. It shall be possible to retrieve the abnormal event data along with all related snap shots data through RS-232 port with the help of DLMS compliant CMRI & downloaded the same to the base computer.

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

10.10 Display Indicators

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

i. Supply indication
ii. Calibration (pulse indication)

10.11 Display of Measured Values

The display shall be permanently backlit LCD, with wide viewing angle and shall be visible from the front of the meter.

Liquid Crystal Display (LCD) shall be suitable for temperature withstand of 700 C. Adequate back up arrangement for storing of energy registered at the time of power interruption shall be provided.

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

10.11.1 Minimum Character Size

- The meter shall have 5 digits with parameter identifier.
- The height of the display characters for the principal parameters values shall not be less than 5 mm. The size of digit shall be minimum 10x5 mm.
- The decimal units shall not be displayed in auto scroll mode. However it shall be displayed in push button mode for high resolution display for testing. In case of multiple values presented by single display, it shall be possible to display the contents of all relevant memories. When displaying the memory, the identification of each parameter applied shall be possible. The principle unit for measured values shall be the kilowatt-hour (kWh) for active energy, kVArh for reactive energy & kVAh for apparent energy.
- Auto display cycling push button is required with persistence time of 10 Seconds.
- The meter shall be pre-programmed for following details.
    a. Voltage rating: 240 V Phase to Neutral.
    b. MD Integration Period: 30 Minutes.
    c. The meter shall Auto reset kVAMD at 24.00 Hrs. of last day of the month and this value shall be stored in the memory along with the cumulative kWh reading. No reset push button shall be provided.
    d. Average power factor with 2 decimal digits shall be displayed.
    e. The array of data to be retained inside the meter memory shall be for the last 45 days for a capture period of 30 minutes. The load survey data shall be first in first out basis (FIFO).
    f. The meter display shall return to Default Display Mode if the "On Demand" Push Button is not operated for 15 sec.

10.11.2 Minimum Display Capability (Measuring Parameters)

- The sequence of display of various electrical parameters in auto scroll & On Demand mode shall be as per table 27 & 29 (except 8 & 9) of Annex E of IS: 15959 / 2011.
- Display other than specified below shall be blocked.
- The scroll period for auto scroll shall be 10 sec.
- Default Display Mode (Auto Scrolling) (Scrolling Time 10 secs)

All the following parameters will be available in Default Display (Auto Scrolling Mode):

Table 10-3 Display Parameters

S. No.	Parameter
1.	LCD check
2.	Real Time Clock – Date and Time
3.	Cumulative Energy kwh (Import)
4.	Cumulative Energy kWh TOD Zone A(Import)
5.	Cumulative Energy kWh TOD Zone B(Import)

S. No.	Parameter
6.	Cumulative Energy kWh TOD Zone C(Import)
7.	Cumulative Energy kWh TOD Zone D(Import)
8.	Cumulative Energy kWh TOD Zone E(Import)
9.	Cumulative Energy kWh TOD Zone F(Import)
10.	MD – kVA (Import)
11.	MD kVA TOD Zone A(Import)
12.	MD kVA TOD Zone B(Import)
13.	MD kVA TOD Zone C(Import)
14.	MD kVA TOD Zone D(Import)
15.	MD kVA TOD Zone E(Import)
16.	MD kVA TOD Zone F(Import)
17.	Cumulative Energy kwh (Export)
18.	Cumulative Energy kWh TOD Zone A(Export)
19.	Cumulative Energy kWh TOD Zone B(Export)
20.	Cumulative Energy kWh TOD Zone C(Export)
21.	Cumulative Energy kWh TOD Zone D(Export)
22.	Cumulative Energy kWh TOD Zone E(Export)
23.	Cumulative Energy kWh TOD Zone F(Export)
24.	MD – kVA (Export)
25.	MD kVA TOD Zone A(Export)
26.	MD kVA TOD Zone B(Export)
27.	MD kVA TOD Zone C(Export)
28.	MD kVA TOD Zone D(Export)
29.	MD kVA TOD Zone E(Export)
30.	MD kVA TOD Zone F(Export)
31.	MD kW TOD Zone A(Import)
32.	MD kW TOD Zone B(Import)
33.	MD kW TOD Zone C(Import)
34.	MD kW TOD Zone D(Import)

S. No.	Parameter
35.	MD kW TOD Zone E(Import)
36.	MD kW TOD Zone F(Import)
37.	MD kW TOD Zone A(Export)
38.	MD kW TOD Zone B(Export)
39.	MD kW TOD Zone C(Export)
40.	MD kW TOD Zone D(Export)
41.	MD kW TOD Zone E(Export)
42.	MD kW TOD Zone F(Export)
43.	Three Phase Power Factor (Average P.F. based on kVAh) (Import)
44.	Three Phase Power Factor (Average P.F. based on kVAh) (Export)
45.	Cumulative Tamper Count
46.	Tamper Event of Meter Cover Open with date and time " C Open"
On- Demand Display (Alternate Display) through Push Button	
1.	Real Time Clock – Date and Time
2.	Voltage V_{RN}
3.	Voltage V_{YN}
4.	Voltage V_{BN}
5.	Current I_R
6.	Current I_Y
7.	Current I_B
8.	Last date & time of reset (kVA MD)
9.	Cumulative Energy kVAh (Import)
10.	Cumulative Energy kVAh TOD Zone A (Import)
11.	Cumulative Energy kVAh TOD Zone B (Import)
12.	Cumulative Energy kVAh TOD Zone C (Import)
13.	Cumulative Energy kVAh TOD Zone D (Import)
14.	Cumulative Energy kVAh TOD Zone E (Import)
15.	Cumulative Energy kVAh TOD Zone F (Import)
16.	Cumulative kVArh lag (Import)
17.	Cumulative kVArh lead (Import)
18.	Cumulative Energy kVAh (Export)
19.	Cumulative Energy kVAh TOD Zone A (Export)

S. No.	Parameter
20.	Cumulative Energy kVAh TOD Zone B (Export)
21.	Cumulative Energy kVAh TOD Zone C (Export)
22.	Cumulative Energy kVAh TOD Zone D (Export)
23.	Cumulative Energy kVAh TOD Zone E (Export)
24.	Cumulative Energy kVAh TOD Zone F (Export)
25.	Cumulative kVArh lag (Export)
26.	Cumulative kVArh lead (Export)
27.	High resolution kWh (For calibration)
28.	Rising MD with remaining time up to EOI (For calibration)
29.	Signed Power Factor – R Phase
30.	Signed Power Factor – Y Phase
31.	Signed Power Factor – B Phase
32.	Frequency
33.	Last Tamper Event with date and time

Note:

1. Other kVA MD values shall be available in reset backup data for 13 months.
2. The meter display shall return to Default Display Mode if the "On Demand Push Button" is not operated for 15 sec.

The meter shall display the tamper meter cover open with date & time in auto scroll mode along with other parameters

10.12 Billing Data, Billing History, Load Survey and Tamper Data

10.12.1 **Billing Data**

The Billing Data is summarized as below:

Table 10-4 Billing Data, History, Load Survey and Tamper Data

S. No.	Parameter
1.	Date and Time
2.	Cumulative energy – kWh(Import)
3.	Maximum demand (kVAMD) with Date and time(Import Mode)
4.	Cumulative energy – kWh(Export)
5.	Maximum demand (kVAMD) with Date and time. (Export Mode)
6.	Harmonic Energy (HkWh) (Export)

S. No.	Parameter
7.	Harmonic Energy (HkWh) (Import)

The Net Energy Shall be calculated as per the following formula:

Net Energy = Import Energy – Export Energy

10.12.2 Billing History

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

Legends for kWh and MD shall be as follows:

Table 10-5 Legends for Billing History

Months	Import		Export	
	MD	Energy	MD	Energy
March(Current month)	MD	kWh	MD	kWh
Feb	MD1	K5Wh1	MD1	K5Wh1
Jan	MD2	kWh2	MD2	kWh2
Dec	MD3	kWh3	MD3	kWh3
Nov	MD4	kWh4	MD4	kWh4
Oct	MD5	kWh5	MD5	kWh5
Sept	MD6	kWh6	MD6	kWh6
Aug	MD7	kWh7	MD7	kWh7
July	MD8	kWh8	MD8	kWh8
June	MD9	kWh9	MD9	kWh9
May	MD10	kWh10	MD10	kWh10
April	MD11	kWh11	MD11	kWh11
March	MD12	kWh12	MD12	kWh12

Details of Legend shall be self-explanatory with legends like:

Export →

Import ←

10.12.3 Load Survey parameters

The array of data to be retained inside the meter memory shall be for the last 45 days for a capture period of 30 minutes. The load survey data shall be first in first out basis (FIFO). Load survey data shall be logged on non-time based basis, i.e. if there is no power for more than 24 hours, the day shall not be recorded. Whenever meter is taken out and brought to laboratory, the load survey data shall be retained for the period of actual use of meter.

The load survey data can be retrieved as and when desired and load profiles shall be viewed graphically / analytically with the help of meter application software. The meter application software shall be capable of exporting / transmitting these data for analysis to other user software in spreadsheet format.

The load survey parameters are as below:

Table 10-6Load Survey Parameters

S. No.	Parameter
(1)	Real Time Clock – Date and Time
(2)	Current – IR
(3)	Current – IY
(4)	Current – IB
(5)	Voltage – VRN.
(6)	Voltage – VYN.
(7)	Voltage – VBN.
(8)	Block Energy – kWh with Import & Export Mode.
(9)	Block Energy – kVArh – lag with Import & Export Mode.
(10)	Block Energy – kVArh – lead with Import & Export Mode.
(11)	Block Energy – kVAh with Import & Export Mode.
(12)	Maximum demand (kVAMD) with date & time. (Import).
(13)	Maximum demand (kVAMD) with date & time. (Export).
(14)	Voltage THD in Import Mode
(15)	Voltage THD in Export Mode
(16)	Current THD in Import Mode
(17)	Current THD in Export Mode

10.13 Quantities to be measured and displayed

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

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

In addition to above the meter shall also record the Name plate details, programmable parameters (readable as profile), occurrence and restoration of tamper events along with the parameters (Table 30, 31 and 32 to 39 except 38 respectively) of IS: 15959 / 2011.

Detail of parameters requirement is given in following tables of document enclosed as Schedule III.

Table 10-7 Quantities to be measured

Category C	Parameter group	ANNEX Table No.
LT Consumers Energy Meters	Instantaneous parameters	27
	Block Load Profile parameters	28
	Billing Profile parameters	29
	Name Plate details	30
	Programmable Parameters	31
	Event Conditions	32 to 37
All logging parameters for each of the event condition for 3 phase / 4 Wire	Capture parameters for event (Event Log Profile)	39

10.14 Demonstration

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

10.15 Metering pool

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

10.16 Common Meter Reading Instrument (CMRI)

1. To enable local reading of meters data, a DLMS compliant CMRI shall be provided.
2. The CMRI shall be as per specification given in Annex J of IS: 15959 /2011.
3. It shall be compatible to the DLMS compliant energy meters that are to be procured / supplied on the basis of this specification.
4. The CMRI shall be supplied by the meter manufacturer along with the meter free of cost in the ratio of one for each 100 Nos. meters supplied including user manual and a set of direct communication cords for data downloading to the Laptop or PC for each CMRI.
5. There shall be a provision for auto power save on CMRI, which shall force the instrument in the power saving mode in case of no-activity within 5 minutes.
6. The data shall not be lost in the event the batteries are drained or removed from the CMRI.
7. The CMRI shall have a memory capacity of 8 MB SRAM (Static RAM) with battery backup & upgradeable and BIOS / OS on FLASH / EEPROM Memory of 256 KB.
8. The manufacturer / supplier shall modify the compatibility of CMRI with the meter and the base computer system due to any change in language or any other reasons at their own cost within guarantee period.
9. The CMRI shall be type tested for:
    a. Tests of Mechanical requirement such as Free fall test, Shock Test, Vibration test
    b. Tests of Climatic influences such as Tests of Protection against Penetration of Dust and Water (IP 6X), Dry Heat test, Cold Test, Damp Heat Cyclic Test,
    c. Tests for Electromagnetic Compatibility (EMC),
    d. Test of Immunity to Electromagnetic HF Fields and
    e. Radio Interference Measurement.
10. The equipment offered shall be fully type tested at approved laboratory by National Accreditation Board for Testing and Calibration Laboratories (NABL) as per relevant standards within last 5 years from the date of opening of tender & the type test reports shall be enclosed with the offer

10.17 Computer Software

i. For efficient and speedy recovery of data downloaded through CMRI on base computer, licensed copies of base computer software shall have to be supplied free of cost. This software will be used at number of places up to Division level. As many copies of base computer software as required up to Division level shall be provided by Supplier.
ii. The meter shall be capable to communicate directly with laptop computer. Base Computer Software shall be suitable for all types of dot matrix & inkjet printers.
iii. The Base Computer Software shall be "Windows" based & user friendly. The data transfer shall be highly reliable and fraud proof (No editing shall be possible on base computer as well as CMRI by any means). The software shall have capability to convert all the data into ASCII format.
iv. The total time taken for downloading Billing, Tamper and Load Survey Data for 45 days shall be less than or equal to 5 minutes.
v. Downloading time of only Billing data shall be less than or equal to 20 secs.
vi. It shall be possible to upload the CMRI data to any PC having CMRI software. A consumer based data uploading facility is required so that CMRI shall upload data only in that PC which has the concerned consumers` data. The consumer code + meter no. shall be the key for creating consumers` files or overwriting consumers` files in PC. The software system files and data files shall be stored in different directories.
vii. The "record number field shall be 10 digits Alphanumeric (2 digits for Zones, 2 for Circle & 6 for consumer No.). Before accepting the data for "Record Number" the system shall wait for pressing of "Enter" key.
viii. Two separate fields shall be provided for consumer name and address – one name field of one line, and other Address field of two lines.
ix. The BCS software shall create one single file for the uploaded data, e.g. if CMRI contains the meter readings of, say, 2,000 consumer meters and the said data is uploaded to BCS, then the BCS shall create a single file containing separate records for each consumer meter reading.
x. Also there shall be a provision to give filenames while creating the file.
xi. As and when the meter manufacturer releases new or latest or advanced versions of meter hardware / firmware / software, the same shall be made available to purchaser immediately on the release date free of cost. The latest version shall support all existing hardware / meters in the field.
xii. The meter samples shall be tested by our IT Department for the time required for downloading the data as per specifications and as confirmed by the bidder.
xiii. Downloading software shall also be provided so as to install on our Laptop for downloading data directly on Laptop from meter without the use of CMRI. The software provided on laptop or PC shall be compatible to read the data from USB drive and for that purpose a sample cable (1 No.) shall be provided with USB termination. USB being the de-facto standard, this is the requirement.

Manufacturer may have to depute Hardware Engineers and Software engineers on call basis who shall have thorough knowledge of meter hardware / software used for downloading and converting so as to discuss the problems, if any, or any new development in the hardware / software with Executive Engineer, Store and Purchase, UPCL, Dehradun.

10.18 Connection Diagram and Terminal Markings

The connection diagram of the meter shall be clearly shown on inside portion of the terminal cover and shall be of permanent nature. Meter terminals shall also be marked and this marking shall appear in the above diagram. **Stickers of any kind shall not be accepted**.

10.19 Name plate and Markings

Meter shall have a name plate clearly visible, effectively secured against removal and indelibly and distinctly marked with all essential particulars as per relevant standards. The manufacturer's meter constant shall be marked on the

Name Plate.

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

a) Purchase Order No.
b) Month and Year of manufacture
c) Name of purchaser: i.e. UPCL
d) Guarantee Five Years
e) ISI mark
f) Communication Capability: RS 232 with CAT C. The character height of the same shall be minimum 3 mm in capital letters

The meter Serial No. shall be Bar Coded along with Numeric No. The size of Bar Code shall not be less than 35x5 mm. Meter serial no. and Bar code on sticker shall not be acceptable.

A sticker label containing warning notice in Hindi / English language which is to be stick up on meters front cover or printed on meter name plate with easily readable font size not less than 10 in red colour.

10.20 Tests

10.20.1 **Type Tests**

Meter shall be fully type tested as per IS: 13779 / 1999 (amended up to date) and external AC / DC magnetic influence tests as per CBIP Tech-Report 88 with latest amendments.

a) The Type Test Reports shall clearly indicate the constructional features including Optical port & RS-232 port connectivity of the type tested meter.
b) The type test reports of the meter shall be same as the meter offered. Separate type Test Reports for each offered type of meter shall be submitted.
c) All the Type Tests shall be carried out from Laboratories which are accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) of Govt. of India such as CPRI, ERDA, ERTL, etc. to prove that the meter meets the requirements of specification. Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.
d) The Type Test Certificate as per IS: 13779 / 1999 shall be submitted along with the offer. The Type Test certificate carried out during last five years shall be valid. However, the Type Test Certificate the optical port & RS-232 port connectivity as per Category C of IS: 15959 / 2011 of the type tested meter shall be submitted before commencement of supply and the same shall be got approved from Executive Engineer, S&P, UPCL, Dehradun. The Type test certificate of metering protocol as per IS: 15959 / 2011 shall not be more than 36 months old.
e) Further Purchaser shall reserve the right to pick up energy meters at random from the lots offered and get the meter tested at third party lab i.e. CPRI / agencies listed at Appendix-C of Latest – standardization of AC static electrical energy meters – CBIP publication NO.-304/ NPL / CQAL/ ERTL / ERDA at the sole discretion of the Purchaser.
f) The supplier has no right to contest the test results of the third party lab or for additional test and has to replace/take corrective action at the cost of the supplier.
g) It shall be the responsibility of the supplier to arrange such additional tests and Purchaser shall be informed of the date and time of conduction of tests well in advance to enable him to witness such tests. Test charges of the testing authority, for such successful repeat type tests, shall be reimbursed at actual by the Purchaser.

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

10.20.2 **Acceptance Test**

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

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

Additional Acceptance test of offered Energy meters as stated at cl. No. 21.03 carried out at third party NABL accredited lab shall be submitted and got approved from office of Executive Engineer, Store & Purchase, UPCL, Dehradun before commencement of supply.

10.20.3 **Additional Routine tests**

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

1. Transportation Test: At least 50% of the samples of the meters be tested for error at Imax, Ib and 5% Ib at unity power factor and 50% Imax and 10% Ib at 0.5 lagging Power Factor besides checking them for starting current. The meter shall be tested with meter cover duly tightened and sealed properly. After recording these errors, the meters be put in their normal packing and transported for at least 50 km in any transport vehicle such as pick up van, Jeep, etc. on uneven rural roads and then re-tested at all these loads after the transportation. The variation in errors recorded before and after transportation shall not exceed 1% at higher loads and 1.5% at low loads.
2. Other Acceptance Tests:

    i. *The meter shall withstand continuously for a period of at least 5 minutes at a voltage of 440 V between phase and neutral without damage / problems.*

    ii. *Tamper Conditions as stated in this specification*

    iii. *Glow Wire testing for polycarbonate material*

    iv. *Power Consumption Tests*

    v. *The meter shall comply all the tests for external AC / DC (except 0.2 Tesla AC magnet test) magnetic field as per CBIP Tech Report 88 with latest amendments.*

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

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

    After removal of magnet, meter shall be subjected to accuracy test as per IS 13779 / 1999 (amended up to date). No deviation in error is allowed in the class index as per IS: 13779/ 1999 (amended up to date) & this specification.

    vi. *The meter shall withstand impulse voltage at 10 kV.*

    vii. *The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date. For any higher signals than the present standards and UPCL technical specifications indicated above, the energy meters shall be immune & the accuracy of meter shall not get affected.*

Jammer Test shall be carried out at UPCL testing division lab.

The test 6.21.3.2 (i) to (iv) shall be carried out at factory for each inspected lot at the time of pre-dispatch inspection.

The tests 6.21.3.2 (v), (vi) & (vii) shall be carried out on one sample from first lot as per procedure laid down in IS: 13779 / 1999 (amended up to date) and CBIP Tech. Report 88 in NABL LAB.

The test report shall get approved from Executive Engineer, Store and Purchase, UPCL, Dehradun before commencement of supply.

10.20.4 Limits of error

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

Table 10-8 Limits of error

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

The meters shall be tested at (-) 15% and at (-) 40% of reference voltage as well as (+) 10% and (+) 20% of reference voltage and shall record energy within limits of variation indicated above.

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

10.21Guaranteed technical Parameters

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

10.22 Pre-Dispatch Inspections

All Acceptance Tests and Inspection shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall offer to the inspector representing the purchaser, all the reasonable facilities, free of charge, for inspection and testing, to satisfy him that the material is being supplied in accordance with this specification. The Company's representative / Engineer attending the above testing shall carry out testing on suitable number of meters as per sampling procedure laid down in IS: 13779 / 1999 (amended up to date) and additional acceptance test as per this specification and issue test certificate approval to the manufacturer and give clearance for dispatch. All the meters offered for inspection shall be in sealed condition. The seals of sample meters taken for testing & inspection shall be break open & resealed after inspection. The first lot of meter may be jointly inspected by the Executive Engineer, Testing Division and the Executive Engineer, Inspection Wing.

10.23 Joint Inspection after Receipt At Stores (Random Sample Testing)

For carrying out Random Sample Testing (RST), the sample meters shall be drawn from any one of the stores against inspected lot and same shall be tested at the Testing and Quality Assurance Units. Sample meters shall be drawn as per Annex H of IS: 13779 / 1999 (amended upto date). Sample meters shall be tested by UPCL's testing

engineer in presence of supplier's representative jointly for (i) Starting Current, (ii) Limits of error, (iii) Repeatability of error, (iv) No Load Test as per IS: 13779/1999 (amended upto date), (v) Tamper conditions as per technical specifications and (vi) Data downloading time as per specifications.

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

10.24 Guarantee

The meter & CMRI shall be guaranteed for the period of five years from the date of commissioning or five and half year from the date of dispatch whichever is earlier. The meter / CMRI found defective within above guarantee period shall be replaced by the supplier free of cost, within one month of receipt of intimation. If defective meter / CMRI is not replaced within the specified period as above, the Company shall recover an equivalent amount plus 15% supervision charges from any of the bills of the supplier.

10.25 Packing

1. The meters shall be suitably packed in order to avoid damage during transit or handling. Each meter may be suitably packed in the first instance to prevent ingress of moisture and dust and then placed in a cushioned carton of a suitable material to prevent damage due to shocks during transit. The lid of the carton may be suitably sealed. A suitable number of sealed cartons may be packed in a case of adequate strength with extra cushioning. The cases may then be properly sealed against accidental opening in transit. The packing cases may be marked to indicate the fragile nature of the contents.
2. The following information shall be furnished with the consignment:
    a. Name of the consignee.
    b. Details of consignment.
    c. Destination.
    d. Total weight of the consignment.
    e. Sign showing upper / lower side of the crate.
    f. Sign showing fragility of the material.
    g. Handling and unpacking instructions.
    h. Bill of Material indicating contents of each package and spare material.

10.26 Tender Samples

Tenderer are required to submit 13 (Thirteen) nos. of sample meters of offered type as per technical specifications along with 2 no. of sample CMRI (IR Compliant 1 no. & DLMS compliant 1 No.) and the API software & documentation, etc. to Executive Engineer (Store/Purchase) in the office of the Executive Engineer, Store and Purchase, UPCL, Kaulagarh, Dehradun one working day before the time & date stipulated for submission of offer for testing the sample meters in third party NABL Lab like ERDA, CPRI, CIPET, ERTL, etc. and testing the offered API by our IT Department as per technical specifications.

The offer of those eligible bidders shall only be considered if the samples pass the tests at NABL Lab as well as necessary certification from our IT Department for the offered API. The results of NABL Lab and the certification from IT Department for offered API shall not be disputed and it shall be binding on the bidder.

The required information such as Manufacturer's Name or Trade Name, Sr. No., ISI Certification No., etc. shall be on stickers to be affixed on outer portion of sample meters being submitted along with the offer. Such information shall not be embossed or printed on any part of the sample meter.

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

10.27 Quality Control

1. The purchaser has a right to send a team of experienced engineers for assessing the capability of the firm for manufacturing and testing of meters as per this specification. The team shall be given all assistance and co-operation for inspection and testing at the bidder's works. 3 tender samples shall be kept ready for assessing and testing. The tenderer shall extend all facilities for carrying out the testing of these samples.
2. The meters supplied shall give service for a long period without drifting from the original calibration & performance must be near to zero percent failure.

10.28 Minimum Testing Facilities

1. Manufacturer shall possess fully computerized Meter Test Bench System for carrying out routine and acceptance Tests as per IS: 13779 / 1999 (amended up to date). In addition, this facility shall produce Test Reports for each and every meter. The bidder shall have fully automatic Test Bench having in-built constant voltage, current and frequency source with facility to select various loads automatically and print the errors directly. The list of testing equipments shall be enclosed.
2. The manufacturer shall have the necessary minimum testing facilities for carrying out the following:

S. No	Name of the Test
1.	A.C. Voltage test
2.	Insulation Resistance Test
3.	Test of Accuracy Requirement
4.	Test on limits of errors
5.	Test on meter constant.
6.	Test of starting condition.
7.	Test of no-load condition.
8.	Repeatability of error test.
9.	Test of power Consumption.
10.	Vibration test.
11.	Shock Test.
12.	Transportation Test - as per UPCL specification.
13.	Tamper conditions - as per UPCL specification.
14.	Glow Wire Test.
15.	Long duration test.
16.	Flammability Test.
17.	The manufacturer shall have duly calibrated RSS meter of class 0.1 accuracy
18.	The bidder shall have fully automatic Test Bench having in-built constant voltage current and frequency source with facility to select various loads automatically and print the errors directly

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

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

10.29 Manufacturing Activities

- Meters shall be manufactured using latest and 'state of the art' technology and methods prevalent in electronics industry. The meter shall be made from high accuracy and reliable surface mount technology (SMT) components. All inward flow of major components and sub assembly parts (CT, PT, RTCs / Crystal, LCDs, LEDs, power circuit electronic components etc.) shall have batch and source identification. Multilayer 'PCB' assembly with 'PTH' (Plated through Hole) using surface mounted component shall have adequate track clearance for power circuits. SMT component shall be assembled using automatic 'pick-and-place' machines, Reflow Soldering oven, for stabilized setting of the components on 'PCB'. For soldered PCBs, cleaning and washing of cards, after wave soldering process is to be carried out as a standard practice.
- Assembly line of the manufacturing system shall have provision for testing of sub-assembled cards. Manual placing of components and soldering, to be minimized to items, which cannot be handled by automatic machine. Handling of 'PCB' with ICs / C-MOS components, to be restricted to bare minimum and precautions to prevent 'ESD' failure to be provided.
- Complete assembled and soldered PCB shall undergo functional testing using computerized Automatic Test Equipment. Test points shall be provided to check the performance of each block / stage of the meter circuitry. RTC shall be synchronized with NPL time at the time of manufacture. Meters testing at intermediate and final stage shall be carried out with testing instruments, duly calibrated with reference standard, with traceability of source and date.
- The manufacturer shall submit the list of plant and machinery along with the offer.
- Meter shall be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and reflow solder process. Further, the Bidder shall own or have assured access (through hire, lease or sub-contract, documentary proof shall be attached with the offer) of above facilities. The calibration of meter shall be done in-house.
- Quality shall be ensured at the following stages:
  a. At PCB manufacturing stage, each Board shall be subjected to computerized bare board testing.
  b. At insertion stage, all components shall undergo computerized testing for conforming to design parameters and orientation.
  c. Complete assembled and soldered PCB shall undergo functional testing using Automatic Test Equipment (ATEs).
  d. Important: - Prior to final testing and calibration, all meters shall be subjected to ageing test (i.e. Meters shall be kept in heating chamber for 72 hours at $55^{O}C$ temperature at full load current. After 72 hours, meters shall work satisfactory) to eliminate infant mortality.
- The calibration of meters shall be done in-house.
- The bidders shall submit the list of all (imported as well as indigenous) components to be used in meter, separately along with the offer. List of makes of components is attached herewith as a guide line (Schedule - III).
- Bought out items:

A detailed list of bought out items which are used in the manufacturing of the meter shall be furnished indicating the name of firms from whom these items are procured. The bidder shall also give the details of quality assurance procedures followed by him in respect of the bought-out items.

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

Table 10-9 List of Machinery

Sr. No	List of Plant and Machinery used for production of energy meters	
1.	Fully automatic testing Bench with ICT for testing link less meters	Routine Testing and Calibration of Meters
2.	Semi-automatic testing Bench with MSTV	Routine Testing and Calibration of Meters
3.	IR Tester	Insulation testing
4.	HV Tester	Insulation testing
5.	Error calculators	Error testing
6.	Long duration Running test set ups	Reliability testing
7.	Reference Meters class 0.1 accuracy	Error Calculation
8.	Ultrasonic Welding Machines	Welding of meters
9.	Automatic Pick and Place Machines	Automatic placing of SMT components
10.	Solder Paste Printing Machine	SMT Soldering
11.	Solder Furnace IR reflow	SMT Soldering
12.	PCB Scanner	For testing of PCBs
13.	ATE functional tester	For testing of components
14.	Programmers and Program Loaders	Chip Programming tools
15.	CAD PCB designing setups	PCB designing
16.	Furnace IR type for Hybrid Micro Circuits	Resistance network and HMC manufacturing
17.	Laser Trimming Machines	Trimming of resistances for higher accuracy measurement
18.	Wave Soldering Machines	Wave soldering of PCBs
19.	Humidity Chamber	Accelerated testing for life cycle
20.	Dry Heat Test Chamber	Accelerated testing for life cycle
21.	Thermal Shock Chamber	Accelerated testing for life cycle
22.	Pro-e Mechanical Design stations	Mechanical CAD station
23.	Spark erosion tools fabricating machine	Tool fabrication and die manufacturing
24.	CNC wire cut tool fabrication machine	Tool fabrication and die manufacturing
25.	Injection Moulding Machine	Moulding of plastic materials
26.	CNC milling machine for composite tool fabrication	Tool fabrication and Die manufacturing
27.	Vibration testing machine	Vibration testing of meters
28.	Glow wire test machine	Testing of Plastic material
29.	Fast transient burst testing setup	Type testing of Meters
30.	Short term over current testing setup	Type testing of Meters

Sr. No	List of Plant and Machinery used for production of energy meters	
31.	Magnetic and other testing setup	Tamper Testing
32.	Impulse Voltage Testing Setup	Type testing of Meters
33.	Composite Enviornmental testing chambers	Type testing of Meters

10.30 Quality Assurance Plan

The tenderer shall invariably furnish QAP as specified below along with his offer, the QAP adopted by him in the process of manufacturing.

The bidder shall invariably furnish the following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.

a. Statement giving list of important raw materials, names of sub - suppliers for the raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.

b. Information and copies of test certificates as in (i) above in respect of bought out accessories,

c. List of manufacturing facilities available,

d. Level of automation achieved and list of areas where manual processing exists,

e. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

f. List of testing equipment available with the bidder for final testing of equipment specified and test plan limitation, if any, vis-à-vis, the type, special acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly bought out in schedule of deviation from specified test requirements.

The successful bidder shall within 30 days of placement of order, submit following information to the purchaser.

a. List of raw materials as well as bought out accessories and the names of sub - suppliers selected from those furnished along with offers.

b. Type test certificates of the raw materials and bought out accessories if required by the purchaser.

c. Quality assurance plan (QAP) with hold points for purchaser's inspection. The quality assurance plant and purchasers hold points shall be discussed between the purchaser and bidder before the QAP is finalized.

The contractor shall operate systems which implement the following.

a. **Hold point**: A stage in the material procurement or workmanship process beyond which work shall not proceed without the documental approval of designated individuals organizations. The purchaser's written approval is required to authorize work to progress beyond the hold points indicated in quality assurance plans.
b. **Notification point**: A stage in the material procurement or workmanship process for which advance notice of the activity is required to facilitate witness. If the purchaser does not attend after receiving documented notification in accordance with the agreed procedures and with the correct period of notice, then the work may proceed.

The successful bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing if required by the purchaser and ensure that Quality Assurance program of the contractor shall consist of the quality systems and quality plans with the following details.

a. The structure of the organization.

- The duties and responsibilities assigned to staff ensuring quality of work.
- The system for purchasing taking delivery and verification of material.
- The system for ensuring quality workmanship.
- The system for retention of records.
- The arrangement for contractor's internal auditing.
- A list of administration and work procedures required to achieve and verify contractor's quality requirements.
- These procedures shall be made readily available to the project manager for inspection on request.

b. 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

10.31Component Selection

As per Schedule – III enclosed.

10.32 Schedules

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

10.32.1 **Schedule – I Guaranteed Technical particulars**

As per GTP parameters uploaded on e- tendering site

10.32.2 **Schedule – II Tenderer's experience**

TENDERER'S EXPERIENCE

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

Sr. No. Name of client Order No. & date Qty. ordered Qty. supplied

NAME OF FIRM _____

NAME & SIGNATURE _____

DESIGNATION _____

DATE _____

10.32.3 Schedule - III Component Selection

Table 10-10 Schedule-III Component Selection

Sr. No	Component Function	Requirement	Make & Origin
1.	Current Transformer	The Meters shall be with the current transformers as measuring elements. The current transformer shall withstand for the clauses under 5 & 9 of IS: 13779 / 1999	
2.	Measurement or computing chips	The measurement or computing chips used in the Meter shall be with the Surface mount type.	**USA:** Analog Devices, Cyrus Logic, Atmel, Philips, Teridian. Dallas, ST, Texas Instruments, Motorola, Maxim, National Semiconductors, Freescale, Onsemiconductors **Germany:** Siemens. **South Africa**: SAMES. **Japan**: NEC, Toshiba, Renasas, Hitachi. **Austria**: AMS **Holland**: Philips (N X P)
3.	Memory Chips	The memory chips shall not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. Meter shall have non-volatile memory (NVM). No other type of memory shall be used for data recording and programming. (The life of the NVM is highest) There shall be security isolation between metering circuit, communication circuit, and power circuit	**USA**: Atmel, Teridian, National Semiconductors, Philips, Texas Instruments, ST, Microchip, Spanson (Fujitsu), Ramtron **Japan**: Hitachi, Renasas **Germany**: Siemens
4.	Display Modules	a. The display modules shall be well protected from external UV radiations. b. The display visibility shall be sufficient to read the Meter mounted at height of 0.5 meter as well as at the height of 2 meters (refer 3.2 d for viewing angle. c. The construction of the modules shall be such that the displayed quantity shall not disturbed with the life of display (PIN Type).	**Singapore**: E-smart, Bonafied Technologies, Display Tech. **Korea**: Advantek, Jebon, Union Display Inc., **Japan**: Hitachi, Sony, L&G. **Malaysia**: Crystal Clear Technology

Sr. No	Component Function	Requirement	Make & Origin
		d. It shall be trans- reflective HTN or STN type industrial grade with extended temperature range. HTN – Hyper Twisted Nematic (120°) STN – Super Twisted Nematic (160°)	
5.	Communication Modules	Communication modules shall be compatible for the two ports (one for Optical port for communication with meter reading instruments (CMRI) & the other for the hardwired RS-232 port to communicate with various modems for AMR)	**USA**: Agilent, HP, Fairchild, National Semiconductors, Optonica **Holland**: Philips **Korea**: Phillips. **Japan**: Hitachi. **Taiwan**: Ligitek
6.	Power Supply	The power supply shall be with the capabilities as per the relevant standards. The power supply unit of the meter shall not be affected in case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections. It shall not also be affected by magnet.	SMPS type
7.	Electronic Components	The active & passive components shall be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	**USA**: National Semiconductors, Atmel, Philips, Texas Instruments, BC Component Analog devices, ST, Maxim, Kemet Onsemiconductors, Freescale, Intersil, Raltron, Fairchild, Muruta, Agilent, AVX, Abracon, Sipex, Diode Inc., Honeywell, Power Integration, Fox, Roham. **Japan**: Hitachi, Oki, AVZ or Rcon, Toshiba, Epson, Kemet, Alps, Muruta, TDK, Sanyo, Samsung, Panasonic **India:** Keltron, Incap, VEPL, PEC, RMC, Gujarat Polyavx, Prismatic, MFR Electronic components Pvt. Ltd., Cermet **Korea:** Samsung **Germany:** Vishay, Epcos, Diotech, Kemet
8.	Mechanical Parts	The internal electrical components shall be of electrolytic copper & shall be protected from corrosion, rust etc. The other mechanical components shall be protected from rust,	

Sr. No	Component Function	Requirement	Make & Origin
		corrosion etc. by suitable plating / painting methods.	
9.	Battery	Only non-rechargeable battery shall be used for RTC as well as display in absence of Power since the life & reliability of these are better than the rechargeable batteries.	**USA:** Maxell, Renata **Japan:** Panasonic, Sony, Mitsubishi, Sanyo **Germany:** Varta **France:** Saft **Korea:** Tekcell, Vitzrocell Israel: Tadiran.
10.	RTC and Microcontroller	The accuracy of RTC shall be as per relevant IEC / IS standards.	**USA**: ST, Teridian, Philips, Dallas, Atmel, Motorola, Microchip. **Japan**: NEC, Oki, Epson
11.	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm	

11. Technical Specifications for LT AC Three Phase, Four Wire 50/5 Amps and 100/5 Amps and -/ 5 Amp CT Operated Fully Static AMR Compatible ToD Tri - Vector Net Energy Meter as Per Category "C" of IS: 15959 / 2011

11.1 Scope

This specification covers design, manufacturing, testing, supply and delivery of ISI mark, LT AC, three Phase, four Wire, 50 / 5 Amps or 100/ 5 Amps CT & -/5 Amps operated fully Static and AMR compatible TOD Tri - Vector Net Energy Meters as per Category C of IS: 15959 / 2011 AMMENDED UPTO DATE for measurement of different electrical parameters listed elsewhere in the document including Active Energy (kWh), Reactive Energy (kVArh), Apparent Energy (kVAh) Import / Export mode etc. in three phase, four wire balanced / unbalanced loads of LT Consumers. The meter shall also be capable to record measurement of various cumulative energies Import & Export mode separately so as to calculate the Net Energy.

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

11.1.1 Application

For use on LT consumer installations.

11.2 Service Conditions

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

S. No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

Table 11-1 Service Conditions

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

11.3 Applicable Standards

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

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

CBIP Tech-Report - 304 amended up to date for AC Static Transformer operated Watt Hour & VAR-Hour Meters (class 0.5S).

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

CEA Regulations and JSERC guidelines amended up to date.

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

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

In case the bidder wishes to offer material conforming to the other authoritative standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Copy of such standards with authentic English Translations, shall be furnished along with the offer. In case of conflict related with communication protocol, the Indian standard IS: 15959 / 2011 AMMENDED UPTO DATE Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification shall prevail upon.

For conflict related with other parts of the specification, the order of priority shall be – (i) this technical specification, (ii) IS: 14697 / 1999 amended upto date & CBIP Tech-Report – 304 (iii) IEC (iv) Other authoritative standards.

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

11.4 General Technical Particulars

Table 11-2 Technical Parameters

S. No.	Parameter	
1.	Type	ISI marked LT AC Three Phase, Four Wire 50/5 Amps and 100/5 Amps and -/ 5 Amp CT Operated Fully Static AMR Compatible ToD Tri - Vector Net Energy Meter as per Category C of IS 15959 / 2011 Ammended upto date for LT consumers installation
2.	Frequency	50 Hz ± 5 %
3.	Accuracy Class	0.5S
4.	Current Rating	50/5 Amps and 100/5 Amps or -/ 5 Amp
5.	Rated Basic Current (I_b)	5 Amps
6.	Maximum Continuous Current	Two times (200 %) of I_b.
7.	Starting Current	0.1% of I_b

S. No.	Parameter	
8.	Short time Current	As per IS: 14697 / 1999
9.	Rated Voltage	415 V Ph-Ph or 240 V Ph-N
10.	Voltage Range	+15% to -30% of rated voltage
11.	Temperature	The standard reference temperature for performance shall be 27^0 C The mean temperature coefficient shall not exceed 0.03%
12.	Frequency	50 Hz ±5%.
13.	Power Factor	0.0 Lag – Unity - 0.0 Lead. For leading Power factor, the value of kVAh shall be equal to kWh for the purpose of calculation of average power factor (on the basis of kWh/ kVAh) i.e. the value of kVAh shall be based on lagging value of kVArh & kWh. The kVAH Calculations (Import mode) = Square root of (kWh import) square + kVARH (lag Import) Square. In Export Mode = Square root of ((kWh Export) square + kVARH lag Export + kVARH Lead Export) square) PF shall be upto 3 Decimals.
14.	Power consumption	iii. The active and apparent power consumption in each voltage circuit at reference voltage, reference temperature and reference frequency shall not exceed 1.0 W and 4 VA iv. The apparent power taken by each current circuit, at basic current I_b, reference frequency and reference temperature shall not exceed 2 VA.
15.	Design	Meter shall be designed with application specific integrated circuit (ASIC) or microcontroller; shall have no moving part; electronic components shall be assembled on printed circuit board using surface mounting technology; factory calibration using high accuracy (0.1 class) software based test bench.
16.	Power Supply	SMPS
17.	ISI mark	The meter so supplied must bear the ISI /BIS mark

11.5 Constructional Requirement / Meter Cover & Sealing Arrangement

11.5.1 Construction Features

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

i. Personal safety against electric shock.
ii. Personal safety against effects of excessive temperature;
iii. Protection against spread of fire;
iv. Protection against penetration of solid objects, dust & water in meter.
v. Detection of Fraud / Pilferage

The meter shall be projection type and shall be dust and moisture proof. All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results. All insulating materials used in the construction of the meter shall be substantially non-hygroscopic, non-ageing and of tested quality.

11.5.2 Meter case

- The meter base & cover shall be made out of transparent, unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities. The meter case shall also have high impact strength.
- The poly carbonate body of the meter shall conform to IS: 11731 (FV-2 category) besides meeting the test requirement of heat deflection test as per ISO 75, glow wire test as per the IS: 11000 (part 2/SEC-1) 1984 or IEC-60695-2-12, Ball pressure test as per IEC-60695-10-2 and Flammability Test as per UL 94 or as per IS: 11731 (Part-2) 1986. The type test certificate shall be submitted along with the offer.
- The transparent polycarbonate base and cover of meter shall be ultra-sonically welded (continuous welding) so that once the meter is manufactured and tested at factory; it shall not be possible to open the cover at site except the terminal cover. The thickness of material for meter cover and base shall be 2 mm (minimum).
- The meter body shall be type tested for IP51 degree of protection as per IS 12063 against ingress of dust, moisture & vermin. The type test certificate shall be submitted along with the offer
- The meter cover shall be secured to base by means of sealable unidirectional captive screws with two holes.

11.5.3 Terminals and Terminal Blocks

- The terminal block shall be made from high quality non-hygroscopic, fire retardant, reinforced polycarbonate / non-Bakelite material which shall form an extension of the meter case.
- The material of which the terminal block is made shall be capable of passing the tests given in IS: 1336O (Part 6/Sec 17), ISO 75-1 (1993) & ISO 75-2 (1993) for a temperature of 135^0 C and a pressure of 1.8 MPa (Method A).
- The type test certificate shall be submitted along with the offer. The holes in the insulating material which form an extension of the terminal holes shall be of sufficient size to also accommodate the insulation of the conductors.
- The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating.
- Screw connections transmitting contact force and screw fixings which may be loosened and tightened several times during the life of meter shall screw into metal nuts.
- All parts of every terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized.
- Electrical connections shall be so designed that contact pressure is not transmitted through insulating material of the terminal block.
- The terminals, the conductor fixing screws or the external or internal conductors shall not be liable to come into contact with terminal covers.
- Two screws shall be provided in each current & potential terminal for effectively clamping the external leads or thimbles. Each clamping screw shall engage a minimum of three threads in the terminal. The ends of screws shall be such as not to pierce and cut the conductors used.
- The minimum internal diameter of terminal hole shall be as per IS: 14697 / 1999 or CBIP Tech Report 304. The manufacturer shall ensure that the supporting webs between two terminals of the terminal block shall be sufficiently high to ensure that two neighboring terminals do not get bridged by dust and there shall not be any possibility of flash over between adjacent terminals of the terminal block.

11.5.4 Terminal Cover

- The termination arrangement shall be provided with an extended transparent terminal cover as per clause number 6.5.2 of IS: 14697 / 1999 (amended upto date) irrespective of rear connections. The terminal cover shall be made out of same material as that of meter body. The terminal cover shall be unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities. The terminal cover shall be transparent. The terminal cover shall be provided with one side hinge.The terminal cover shall enclose the actual terminals, the conductor fixing screws and unless otherwise specified, a

suitable length of external conductors and their insulation. Independent sealing provision shall be made against opening of the terminal cover and front cover to prevent unauthorized tampering. It is necessary to provide unidirectional screws with two holes for sealing purpose of terminal cover. The meter shall be pilfer-proof & tamper-proof.

- The fixing screws used on the terminal cover for fixing and sealing in terminal cover shall be held captive in the terminal cover. Proper size of grooves shall be provided at bottom of this terminal cover for incoming service connections. When the meter is mounted, no access to the terminals by any means shall be possible without breaking seals(s) of the terminal cover

11.5.5 Resistance to Heat and Fire

The terminal block, the terminal cover, the insulating material retaining the main contacts in position and the meter body shall ensure reasonable safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them.

11.5.6 Seals, Markings and Sticker Labels

- The meter shall be completely factory sealed except the terminal block cover.
- The provision shall be made on the meter for at least two seals to be put by utility user
- The energy meter shall clearly indicate the Export and Import connection marking on the terminal block and terminal cover.
- The "→" indicates that Import terminal / forward and "←" indicates that Export terminal / reverse energy measurement.
- A sticker label containing warning notice in Hindi / English language which is to be stick up on meters front cover or printed on meter name plate with easily readable font size not less than 10 in red colour.
- A Push button facility shall be provided for high resolution reading / alternate mode of display, as brought out elsewhere in this specification

11.5.7 Output Device

- The meter shall have test output accessible from the front and be capable of being monitored with suitable testing equipment while in operation at site. The operation indicator must be visible from front. The test output device shall be provided in the form of blinking LED or other similar devices like blinking LCD. Resolution of the test output device shall be sufficient to enable the starting current test in less than 10 minutes. The pulse rate of output device which is Pulse / kWh and Pulse / kVArh (meter constant) shall be indelibly provided on the nameplate.
- The meter accuracy shall not be affected by magnetic field (AC / DC / Permanent) upto 0.2 Tesla on all the sides of meter, i.e. front, sides, top and bottom of the meter as per CBIP Technical Report 304 with latest amendments. Under influence of any magnetic field (AC / DC / Permanent) above 0.2 Tesla, if the accuracy of the meter gets affected, then the meter shall record energy considering Imax and reference voltage at unity power factor.
- The meter shall also be capable to withstand and shall not get damaged if phase to phase voltage is applied between phases & neutral for five minutes.
- In meter, power supply unit shall be micro control type instead of providing conventional transformer and then conversion to avoid magnetic influence.
- Non specified display parameter in the meter shall be blocked and it shall not be accessible for reprogramming at site.
- Complete metering system shall not be affected by the external electromagnetic interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic fields and DC current in AC supply etc.
- CTs are to be provided with magnetic shielding and shall be tested separately prior to assembly.
- PCB used in meter shall be made by Surface Mounting Technology

11.5.8 Real Time Internal Clock (RTC)

- The real time quartz clock shall be used in the meter for maintaining time (IST) and calendar. The RTC shall be non - rechargeable and shall be pre-programmed for 30 Years Day / date without any necessity for correction. The maximum drift shall not exceed +/- 300 Seconds per year.
- The clock day / date setting and synchronization shall only be possible through password / Key code command from one of the following:
    i. Hand Held Unit (CMRI) or Meter testing work bench and this shall need password enabling for meter.
    ii. From remote server through suitable communication network or Sub-station data logger 'PC'.
- The RTC shall have long life (10 Years) Non rechargeable battery. The RTC battery & the battery for display in case of power failure shall be separate.
- All insulating materials used in the construction of the meter shall be substantially non-hygroscopic, non-ageing and of tested quality.

11.5.9 Meter Accuracy

The meter shall withstand any type of High Voltage and High Frequency surges, which are similar to the surges produced by induction coil type instruments without affecting the accuracy of the meter. The accuracy of the meter shall not be affected with the application of abnormal voltage / frequency generating device such as spark discharge of approximately 35 kV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

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

The accuracy of meter shall be checked before and after the application of above device. The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 14697:1999 amended up to date.

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

The communication of energy meter shall not get affected considering the above feature state in clause 7.6.10.3 and 7.6.10.4

11.5.10 Self-Diagnostic Features

The meter shall keep log in its memory for unsatisfactory functioning or nonfunctioning of Real Time Clock battery.

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

11.5.11 Meter Protocol

The meter protocol shall be as per Annex E - Category C meters of IS: 15959 / 2011 AMMENDED UPTO DATE. The watch dog provided shall invariably protect the hanging of microprocessor during such type of tampering devices.

11.5.12 Communication Capability

- The meter shall be provided with two ports for communication of the measured / collected data as per the IS: 15959 / 2011 amended upto date, i.e. a hardware port compatible with RS 232 specifications (RJ - 11 / RJ - 45 type is also acceptable) which shall be used for remote access through suitable Modem (GPRS / GSM / EDGE / CDMA / PSTN / LPR) and an Optical port complying with hardware specifications detailed in IEC
- This shall be used for local data downloading through a DLMS compliant CMRI. RS 232 port or TCP / IP port as required on terminal block is also acceptable.
- Sealing arrangement for Optical & RS 232 port or TCP / IP port as required shall be provided.
- Both ports shall support the default and minimum baud rate of 9600 bps.
- Necessary chord for Optical Port of minimum length of 1 metre in the ratio 50:1 shall be provided free of cost.

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

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

Meter end, starting 1 to 8 from Left to Right.

Pin no 8 => RX (+)

Pin no 7 => RX (-)

Pin no 3 => TX(+)

Pin no 6 => TX(-)

ii. The interface shall meet all the requirements of RS-232 specifications in terms of Physical media, Network topologies, maximum devices, maximum distance, mode of operation, etc.

iii. Screw type connectors or RJ45 type connectors have to be provided to easily terminate the twisted pair.

- The meter shall have facility to read the default display parameters during Power supply failure. For this purpose an internal battery may be provided.
- The internal battery shall be Ni-mh or Li-ion or NI CD maintenance free battery of long life of 10 years. A suitable Push Button arrangement for activation of this battery shall be provided. Alternatively, push button provided for displaying alternate mode (On Demand Mode) parameters shall also be acceptable for activation of battery during power OFF condition.
- The meter shall withstand any type of High Voltage and High Frequency surges, which are similar to the surges produced by induction coil type instruments without affecting the accuracy of the meter. The accuracy of the meter shall not be affected with the application of abnormal voltage / frequency generating device such as spark discharge of approximately 35 kV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

iv. On any of the phases or neutral terminals.

v. On any connecting wires of the meter (Voltage discharge with 0-10 mm spark gap).

vi. At any place in load circuit.

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

11.5.13 Wire / Cable less Design

- The meter PCB shall be wireless to avoid improper soldering & loose connection / contact.
- The data stored in the meters shall not be lost in the event of power failure. The meter shall have Non Volatile Memory (NVM), which does not need any battery backup. The NVM shall have a minimum retention period of 10 years.
- Reverse reading lock of main kWh reading is to be incorporated with necessary software modification if required additionally.
- The meter shall record and display Fundamental energy excluding Harmonic energy. The energy meter shall record & display harmonic energy separately.

11.6 TOD Timing

There shall be provision for at least 6 (Six) Time of Day (TOD) time zones for energy and demand.

The number and timings of these Time of Day time Zones shall be programmable. At present the time zones shall be programmed as per UPCL existing time zones. These may be subject to change as per notification from UPCL.

11.7 Maximum Demand Integration Period

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

11.8 Maximum Demand Reset

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

a. Communication driven reset through hand held terminal (CMRI).
b. Manual Resetting arrangement with sealing facility.
c. Auto reset at 24:00 hrs. at the end of each billing cycle: Automatic reset at the end of certain predefined period (say, end of the month). This option shall be blocked by default and made programmable through hand held terminal (CMRI) for the actual date required. No push button shall be provided for MD reset.

11.9 Tamper and Fraud Monitoring Features

11.9.1 **Anti-Tamper Features**

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

i. Change of phase sequence: The meter accuracy shall not be affected by change of phase sequence. It shall maintain the desired accuracy in case of reversal of phase sequence.
ii. The meter shall be capable of detecting and recording occurrences and restoration for reverse current of any one or two phases with date & time of occurrence and restoration.
iii. Drawing of current through local Earth: the meter shall register accurate energy even if load is drawn partially or fully through a local earth.
iv. The three-phase meter shall continue to work even without neutral.
v. The three-phase meter shall work in absence of any two phases, i.e. it shall work on any one phase wire and neutral, to record relevant energy.
vi. The meter shall work without earth.
vii. The potential link shall not be provided.
viii. Visual indication shall be provided to safeguard against wrong connections to the meter terminals.
ix. The meter shall be immune to the external magnetic field (AC / DC / Permanent) upto 0.2 Tesla. If the accuracy of the meter gets affected under the influence of magnetic field more than 0.2 Tesla, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering the maximum value current (Imax) at ref. voltage and unity PF in all the three phases. In case of magnetic tamper during export / reverse mode, the energy meter shall record & add the same energy considering I_{max} in import / forward mode.
x. If a consumer tries to steal power by disconnecting the voltage supply of one or two phases of the meter externally or by tampering so that no voltage is available to voltage circuit of meter & normal current is flowing in these phases, the meter shall record the energy at V_{ref}, current available in these phases & UPF.
xi. The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 14697:1999 amended up to date. For any higher signals than the present standards and UPCL technical specifications indicated above, the accuracy of meter shall not get affected, i.e. the energy meter shall remain immune.

11.9.2 Tamper Events

The meter shall work satisfactorily under presence of various influencing conditions like External Magnetic Field, Electromagnetic Field, Radio Frequency Interference, Harmonic Distortion, Voltage / Frequency Fluctuations and Electromagnetic High Frequency Fields, etc. as per relevant IS

- The meter shall record the occurrence and restoration of tamper events of current, voltages, kWh, power factor, event code, date & time etc. listed in Table 32 to 37 of IS: 15959 / 2011.
- In the event the meter is forcibly opened, even by 2 to 4 mm variation of the meter cover, same shall be recorded as tamper event with date & time stamping as per table 37 of IS: 15959 / 2011 and the meter shall continuously display that the cover has been tampered.
- The detection of the tamper event shall be registered in the tamper event register.
- The no. of times the tampering has been done shall also be registered in the meter.
- Tamper Details shall be retrieved by authorized personnel through either of the following:
  i. CMRI.
  ii. Remote access through suitable communication network.

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

All the information of data shall be made available in simple & easy to understand format. The meter shall have features to detect the occurrence and restoration of the following abnormal events:

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

Table 11-3 Tamper Events

S. No.	Description	Occurrence (with Occ. Time 5 min.)	Restoration (with rest. Time 5 min.)
1.	PT Link Missing (Missing Potential)	< 50% of Vref.	> 50% of Vref
2.	Over Voltage in any phase	> 115% of Vref	< 115% of Vref
3.	Low Voltage in any phase	< 70% of Vref	> 70% of Vref
4.	Voltage Unbalance (Diff. of phase voltages)	> 10% Vref	< 10 % Vef
5.	CT open	Zero Amps in one or two phases and current in at least 1 phase is > 5% I_b for 15 minutes	> 3 % I_b for 15 min in the tampered phase for 15 min
6.	Current Unbalance (Diff of phase currents)	> 30 % I_b for 15 min	< 30 % I_b for 15 min
7.	Current Bypass	Bypass Current > 10 % I_b for 15 min	Bypass Current < 10 % I_b for 15 min
8.	Current Reversal	Immediate in case of reverse of any of two phases	Direction of all currents are same.
9.	Over Current in any Phase	> 120 % I_{max}	< 120 % I_{max}
10.	Influence of permanent magnet or AC/ DC electromagnet/ permanent magnet	Immediate	1 Minute after removal
11.	Neutral disturbance	-	-
12.	Power failure	Immediate	
13.	Very low PF	-	-
14.	Meter Cover Opening	2 to 4 mm	-

The energy meter shall be capable to record & display all tampers with indication of "Import / Export" separately with date and time stamping.
For above abnormal conditions, the recording of events shall be on FIFO basis.

11.10 Quantities to be measured and displayed

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

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

In addition to above the meter shall also record the Name plate details, programmable parameters (readable as profile), occurrence and restoration of tamper events along with the parameters (Table 30, 31 and 32 to 39 except 38 respectively of `IS: 15959 / 2011 amended upto date.

Detail of parameters requirement is given in following tables of document enclosed at the end of the document.

Table 11-4 Quantities to be measured and displayed

Category C	Parameter group	ANNEX Table No.
LT Consumers Energy Meters	Instantaneous parameters	27
	Block Load Profile parameters	28
	Billing Profile parameters	29
	Name Plate details	30
	Programmable Parameters	31
	Event Conditions	32 to 37
All logging parameters for each of the event condition for 3 phase / 4 Wire	Capture parameters for event (Event Log Profile)	39

11.11 Display Indicators

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

11.12 Display of Measured Values

- The permanently backlit display shall show relevant information about the parameters to be displayed. The corresponding non-volatile memory shall have a minimum retention time of 10 years. In the case of multiple values presented by a single display, it shall be possible to display the content of all relevant memories. When displaying the memory, the identification of each parameter applied shall be possible.

- The principal unit for the measured values shall be the kilowatt-hour kWh for active energy, kVArh for reactive energy and kVAh for apparent energy. The meter shall have 6 digits (with +/- indication) parameter identifier, permanently backlit Liquid Crystal Display (LCD) with wide viewing angle.
- The size of digit shall be minimum 10x5 mm. The decimal unit shall not be displayed in auto scroll mode.
- However it shall be displayed in push button mode or alternate mode for high resolution display for testing. Auto display cycling push button is required with persistence time of 9 Seconds. LCD shall be suitable for temperature withstand of 70^0 C; the adequate back up arrangement for storing of energy registered at the time of power interruption shall be provided.
- The meter shall be pre-programmed for following details.
    a. Voltage rating: 240 V Phase to Neutral.
    b. CT Ratio: 100/5 Amps or 50/5 Amps or -/5 Amp
    c. MD Integration Period: 30 Minutes real time based.
    d. The meter shall Auto reset kVAMD at 24.00 Hrs. of last day of the month and this value shall be stored in the memory along with the cumulative kWh reading. No reset push button shall be provided.
    e. Average power factor with 2 decimal digits shall be displayed.
    f. The array of data to be retained inside the meter memory shall be for the last 45 days for a capture period of 30 minutes. The load survey data shall be first in first out basis (FIFO).
    g. The meter display shall return to Default Display Mode if the "On Demand" Push Button is not operated for 15 sec.

11.12.1 Minimum Display Capability (Measuring Parameters)

- The sequence of display of various electrical parameters in auto scroll & On Demand mode shall be as per table 27 & 29 (except 8 & 9) of Annex E of IS: 15959 / 2011.Display other than specified below shall be blocked.
- The scroll period for auto scroll shall be 10 sec.
- Default Display Mode (Auto Scrolling) (Scrolling Time 10 secs)

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

Table 11-5 Display Parameters

S. No.	Parameter
1.	LCD check
2.	Real Time Clock – Date and Time
3.	Cumulative Energy kwh (Import)
4.	Cumulative Energy kWh TOD Zone A(Import)
5.	Cumulative Energy kWh TOD Zone B(Import)
6.	Cumulative Energy kWh TOD Zone C(Import)
7.	Cumulative Energy kWh TOD Zone D(Import)
8.	Cumulative Energy kWh TOD Zone E(Import)
9.	Cumulative Energy kWh TOD Zone F(Import)
10.	Cumulative Energy kVAh(Import)
11.	Cumulative Energy kVAh TOD Zone A(Import)

S. No.	Parameter
12.	Cumulative Energy kVAh TOD Zone B(Import)
13.	Cumulative Energy kVAh TOD Zone C(Import)
14.	Cumulative Energy kVAh TOD Zone D(Import)
15.	Cumulative Energy kVAh TOD Zone E(Import)
16.	Cumulative Energy kVAh TOD Zone F(Import)
17.	Cumulative Energy - kVArh - Lag (Import)
18.	Cumulative Energy - kVArh - Lead (Import)
19.	MD – kVA with occurrence date and time (Import)
20.	MD kVA TOD Zone A(Import)
21.	MD kVA TOD Zone B(Import)
22.	MD kVA TOD Zone C(Import)
23.	MD kVA TOD Zone D(Import)
24.	MD kVA TOD Zone E(Import)
25.	MD kVA TOD Zone F(Import)
26.	Cumulative Energy kwh (Export)
27.	Cumulative Energy kWh TOD Zone A(Export)
28.	Cumulative Energy kWh TOD Zone B(Export)
29.	Cumulative Energy kWh TOD Zone C(Export)
30.	Cumulative Energy kWh TOD Zone D(Export)
31.	Cumulative Energy kWh TOD Zone E(Export)
32.	Cumulative Energy kWh TOD Zone F(Export)
33.	Cumulative Energy kVAh (Export)
34.	Cumulative Energy kVAh TOD Zone A(Export)
35.	Cumulative Energy kVAh TOD Zone B(Export)
36.	Cumulative Energy kVAh TOD Zone C(Export)
37.	Cumulative Energy kVAh TOD Zone D(Export)
38.	Cumulative Energy kVAh TOD Zone E(Export)
39.	Cumulative Energy kVAh TOD Zone F(Export)
40.	Cumulative Energy - kVArh - Lag (Export)

S. No.	Parameter
41.	Cumulative Energy - kVArh - Lead (Export)
42.	MD – kVA with occurrence date and time (Export)
43.	MD kVA TOD Zone A(Export)
44.	MD kVA TOD Zone B(Export)
45.	MD kVA TOD Zone C(Export)
46.	MD kVA TOD Zone D(Export)
47.	MD kVA TOD Zone E(Export)
48.	MD kVA TOD Zone F(Export)
49.	Three phase power factor – PF Import
50.	Three phase power factor – PF Export
51.	Meter cover opening – Occurrence with Date and Time
On- Demand Display (Alternate Display) through Push Button	
1.	Real Time Clock – Date and Time
2.	Billing Date
3.	Voltage V_{RN}
4.	Voltage V_{YN}
5.	Voltage V_{BN}
6.	Current I_R
7.	Current I_Y
8.	Current I_B
9.	Last date & time of reset (kVA MD)
10.	Rising MD with remaining time up to EOI (For calibration)
11.	M1 MD- kVA – TOD Zone A (Import)
12.	M1 MD- kVA – TOD Zone B (Import)
13.	M1 MD- kVA – TOD Zone C (Import)
14.	M1 MD- kVA – TOD Zone D (Import)
15.	M1 MD- kVA – TOD Zone E (Import)
16.	M1 MD- kVA – TOD Zone F (Import)
17.	M2 MD- kVA – TOD Zone A (Import)
18.	M2 MD- kVA – TOD Zone B (Import)
19.	M2 MD- kVA – TOD Zone C (Import)
20.	M2 MD- kVA – TOD Zone D (Import)

S. No.	Parameter
21.	M2 MD- kVA – TOD Zone E (Import)
22.	M2 MD- kVA – TOD Zone F (Import)
23.	Signed Power Factor – R Phase (Import)
24.	Signed Power Factor – Y Phase (Import)
25.	Signed Power Factor – B Phase (Import)
26.	M1 MD- kVA – TOD Zone A (Export)
27.	M1 MD- kVA – TOD Zone B (Export)
28.	M1 MD- kVA – TOD Zone C (Export)
29.	M1 MD- kVA – TOD Zone D (Export)
30.	M1 MD- kVA – TOD Zone E (Export)
31.	M1 MD- kVA – TOD Zone F (Export)
32.	M2 MD- kVA – TOD Zone A (Export)
33.	M2 MD- kVA – TOD Zone B (Export)
34.	M2 MD- kVA – TOD Zone C (Export)
35.	M2 MD- kVA – TOD Zone D (Export)
36.	M2 MD- kVA – TOD Zone E (Export)
37.	M2 MD- kVA – TOD Zone F (Export)
38.	Signed Power Factor – R Phase (Export)
39.	Signed Power Factor – Y Phase (Export)
40.	Signed Power Factor – B Phase (Export)
41.	MD – kW with occurrence date and time (Import)
42.	MD – kW – TOD Zone A with occurrence date and time (Import)
43.	MD – kW – TOD Zone B with occurrence date and time (Import)
44.	MD – kW – TOD Zone C with occurrence date and time (Import)
45.	MD – kW – TOD Zone D with occurrence date and time (Import)
46.	MD – kW – TOD Zone E with occurrence date and time (Import)
47.	MD – kW – TOD Zone F with occurrence date and time (Import)
48.	MD – kW with occurrence date and time (Export)
49.	MD – kW – TOD Zone A with occurrence date and time (Export)
50.	MD – kW – TOD Zone B with occurrence date and time (Export)
51.	MD – kW – TOD Zone C with occurrence date and time (Export)
52.	MD – kW – TOD Zone D with occurrence date and time (Export)
53.	MD – kW – TOD Zone E with occurrence date and time (Export)
54.	MD – kW – TOD Zone F with occurrence date and time (Export)
55.	Frequency
56.	Number of MD – kVA reset
57.	Last Tamper Event with date and time

S. No.	Parameter
58.	Signed active power, kW (+ Forward; - Reverse)
59.	Signed reactive power, kVAr (+ Lag; - Lead)
60.	No. of power failures
61.	Cumulative power failure duration
62.	Cumulative Billing Count

Note:

1. Other kVA MD values shall be available in reset backup data for 13 months.
2. The meter display shall return to Default Display Mode if the "On Demand Push Button" is not operated for 15 sec.
3. The meter shall display the tamper meter cover open with date & time in auto scroll mode along with other parameters

11.13 Billing Data, Billing History, Load Survey and Tamper Data

11.13.1 **Billing Data**

The Billing Data is summarized as below:

Table 11-6 Billing Data

S. No.	Parameter
1.	Billing Date
2.	System Power Factor for Billing period
3.	Cumulative energy – kWh(Import)
4.	Cumulative energy – kWh ToD Zone A (Import)
5.	Cumulative energy – kWh ToD Zone B (Import)
6.	Cumulative energy – kWh ToD Zone C (Import)
7.	Cumulative energy – kWh ToD Zone D (Import)
8.	Cumulative energy – kWh ToD Zone E (Import)
9.	Cumulative energy – kWh ToD Zone F (Import)
10.	Cumulative energy – kVArh Lag (Import)
11.	Cumulative energy – kVArh Lead (Import)
12.	Cumulative energy – kVAh (Import)
13.	Cumulative energy – kVAh ToD Zone A (Import)
14.	Cumulative energy – kVAh ToD Zone B (Import)
15.	Cumulative energy – kVAh ToD Zone C (Import)
16.	Cumulative energy – kVAh ToD Zone D (Import)

S. No.	Parameter
17.	Cumulative energy – kVAh ToD Zone E (Import)
18.	Cumulative energy – kVAh ToD Zone F (Import)
19.	Maximum demand (kVAMD) with Occurrence Date and time. (Import)
20.	Maximum demand (kVAMD) ToD Zone A with Occurrence Date and time. (Import)
21.	Maximum demand (kVAMD) ToD Zone B with Occurrence Date and time. (Import)
22.	Maximum demand (kVAMD) ToD Zone C with Occurrence Date and time. (Import)
23.	Maximum demand (kVAMD) ToD Zone D with Occurrence Date and time. (Import)
24.	Maximum demand (kVAMD) ToD Zone E with Occurrence Date and time. (Import)
25.	Maximum demand (kVAMD) ToD Zone F with Occurrence Date and time. (Import)
26.	Cumulative energy – kWh(Export)
27.	Cumulative energy – kWh ToD Zone A (Export)
28.	Cumulative energy – kWh ToD Zone B (Export)
29.	Cumulative energy – kWh ToD Zone C (Export)
30.	Cumulative energy – kWh ToD Zone D (Export)
31.	Cumulative energy – kWh ToD Zone E (Export)
32.	Cumulative energy – kWh ToD Zone F (Export)
33.	Cumulative energy – kVArh Lag (Export)
34.	Cumulative energy – kVArh Lead (Export)
35.	Cumulative energy – kVAh (Export)
36.	Cumulative energy – kVAh ToD Zone A (Export)
37.	Cumulative energy – kVAh ToD Zone B (Export)
38.	Cumulative energy – kVAh ToD Zone C (Export)
39.	Cumulative energy – kVAh ToD Zone D (Export)
40.	Cumulative energy – kVAh ToD Zone E (Export)
41.	Cumulative energy – kVAh ToD Zone F (Export)
42.	Maximum demand (kVAMD) with Occurrence Date and time. (Export)
43.	Maximum demand (kVAMD) ToD Zone A with Occurrence Date and time. (Export)
44.	Maximum demand (kVAMD) ToD Zone B with Occurrence Date and time. (Export)
45.	Maximum demand (kVAMD) ToD Zone C with Occurrence Date and time. (Export)
46.	Maximum demand (kVAMD) ToD Zone D with Occurrence Date and time. (Export)

S. No.	Parameter
47.	Maximum demand (kVAMD) ToD Zone E with Occurrence Date and time. (Export)
48.	Maximum demand (kVAMD) ToD Zone F with Occurrence Date and time. (Export)
49.	Harmonic Energy (HkWh) (Export)
50.	Harmonic Energy (HkWh) (Import)

The Net Energy Shall be calculated as per the following formula

Net Energy = Import Energy – Export Energy

11.13.2 Billing History

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

Legends for kWh and MD shall be as follows:

Table 11-7 Legends for Billing History

Months	Import		Export	
	MD	Energy	MD	Energy
March(Current month)	MD	kWh	MD	kWh
Feb	MD1	K5Wh1	MD1	K5Wh1
Jan	MD2	kWh2	MD2	kWh2
Dec	MD3	kWh3	MD3	kWh3
Nov	MD4	kWh4	MD4	kWh4
Oct	MD5	kWh5	MD5	kWh5
Sept	MD6	kWh6	MD6	kWh6
Aug	MD7	kWh7	MD7	kWh7
July	MD8	kWh8	MD8	kWh8
June	MD9	kWh9	MD9	kWh9
May	MD10	kWh10	MD10	kWh10
April	MD11	kWh11	MD11	kWh11
March	MD12	kWh12	MD12	kWh12

Details of Legend shall be self-explanatory with legends like:

Export →

Import ←

11.13.3 Block Load Survey Data

The Block Load survey data shall be logged on non-time based basis, i.e. if there is no power for more than 24 hours, the day shall not be recorded. Whenever meter is taken out and brought to laboratory, the load survey data shall be retained for the period of actual use of meter. This load survey data can be retrieved as and when desired and load profiles shall be viewed graphically / analytically with the help of meter application software. The meter application software shall be capable of exporting / transmitting these data for analysis to other user software in spreadsheet format.

The Block Load survey data shall be for specified parameters as per table 28 for 3Φ/4W system of measurement with NEUTRAL as reference point of Annex E of IS: 15959 / 2011 AMMENDED UPTO DATE. The specified parameters are summarized as below.

The load survey parameters are as below:

Table 11-8 Load Survey Parameter

S. No.	Parameter
(1)	Real Time Clock – Date and Time
(2)	Current – I_R
(3)	Current – I_Y
(4)	Current – I_B
(5)	Voltage – V_{RN}.
(6)	Voltage – V_{YN}.
(7)	Voltage – V_{BN}.
(8)	Block Energy – kWh with Import & Export Mode.
(9)	Block Energy – kVArh – lag with Import & Export Mode.
(10)	Block Energy – kVArh – lead with Import & Export Mode.
(11)	Block Energy – kVAh with Import & Export Mode.
(12)	Voltage THD in Import Mode
(13)	Voltage THD in Export Mode
(14)	Current THD in Import Mode
(15)	Current THD in Export Mode

11.14 Demonstration

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

11.15 Performance under Influence Quantities

The meters' performance under influence quantities shall be governed by IS: 14697 / 1999 (amended upto date) and CBIP Tech. Report 304; the accuracy of meter shall not exceed the permissible limits of accuracy as per standard IS: 14697 / 1999 (amended upto date). In case of conflict, the priority shall be as per clause no. 5.00 of this specification.

11.16 Metering pool

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

11.17 Common Meter Reading Instrument (CMRI)

- To enable local reading of meters data, a DLMS compliant CMRI shall be provided.
- The CMRI shall be as per specification given in Annex J of IS: 15959 /2011.
- It shall be compatible to the DLMS compliant energy meters that are to be procured / supplied on the basis of this specification.
- The CMRI shall be supplied by the meter manufacturer along with the meter free of cost in the ratio of one for each 100 Nos. meters supplied including user manual and a set of direct communication cords for data downloading to the Laptop or PC for each CMRI.
- There shall be a provision for auto power save on CMRI, which shall force the instrument in the power saving mode in case of no-activity within 5 minutes.
- The data shall not be lost in the event the batteries are drained or removed from the CMRI.
- The CMRI shall have a memory capacity of 8 MB SRAM (Static RAM) with battery backup & upgradeable and BIOS / OS on FLASH / EEPROM Memory of 256 KB.
- The manufacturer / supplier shall modify the compatibility of CMRI with the meter and the base computer system due to any change in language or any other reasons at their own cost within guarantee period.
- The CMRI shall be type tested for
  a) Tests of Mechanical requirement such as Free fall test, Shock Test, Vibration test
  b) Tests of Climatic influences such as Tests of Protection against Penetration of Dust and Water (IP 6X), Dry Heat test, Cold Test, Damp Heat Cyclic Test,
  c) Tests for Electromagnetic Compatibility (EMC),
  d) Test of Immunity to Electromagnetic HF Fields and
  e) Radio Interference Measurement.
- The equipment offered shall be fully type tested at approved laboratory by National Accreditation Board for Testing and Calibration Laboratories (NABL) as per relevant standards within last 5 years from the date of opening of tender & the type test reports shall be enclosed with the offer.

11.18 Computer Software

For efficient and speedy recovery of data downloaded through CMRI on base computer, licensed copies of base computer software shall have to be supplied free of cost. This software will be used at number of places up to Division level. As many copies of base computer software as required up to Division level shall be provided by Supplier.

- The meter shall be capable to communicate directly with laptop computer. Base Computer Software shall be suitable for all types of dot matrix & inkjet printers.
- The Base Computer Software shall be "Windows" based & user friendly. The data transfer shall be highly reliable and fraud proof (No editing shall be possible on base computer as well as CMRI by any means). The software shall have capability to convert all the data into ASCII format.
- The total time taken for downloading Billing, Tamper and Load Survey Data for 45 days shall be less than or equal to 5 minutes.
- Downloading time of only Billing data shall be less than or equal to 20 secs.
- It shall be possible to upload the CMRI data to any PC having CMRI software. A consumer based data uploading facility is required so that CMRI shall upload data only in that PC which has the concerned consumers` data. The consumer code + meter no. shall be the key for creating consumers` files or overwriting consumers` files in PC. The software system files and data files shall be stored in different directories.

- The "record number field shall be 10 digits Alphanumeric (2 digits for Zones, 2 for Circle & 6 for consumer No.). Before accepting the data for "Record Number" the system shall wait for pressing of "Enter" key.
- Two separate fields shall be provided for consumer name and address – one name field of one line, and other Address field of two lines.
- The BCS software shall create one single file for the uploaded data, e.g. if CMRI contains the meter readings of, say, 2,000 consumer meters and the said data is uploaded to BCS, then the BCS shall create a single file containing separate records for each consumer meter reading.
- Also there shall be a provision to give filenames while creating the file.
- As and when the meter manufacturer releases new or latest or advanced versions of meter hardware / firmware / software, the same shall be made available to purchaser immediately on the release date free of cost. The latest version shall support all existing hardware / meters in the field.
- The meter samples shall be tested by our IT Department for the time required for downloading the data as per specifications and as confirmed by the bidder.
- Downloading software shall also be provided so as to install on our Laptop for downloading data directly on Laptop from meter without the use of CMRI.
- The software provided on laptop or PC shall be compatible to read the data from USB drive and for that purpose a sample cable (1 No.) shall be provided with USB termination. USB being the de-facto standard, this is the requirement.

Manufacturer may have to depute Hardware Engineers and Software engineers on call basis who shall have thorough knowledge of meter hardware / software used for downloading and converting so as to discuss the problems, if any, or any new development in the hardware / software with Executive Engineer, Store and Purchase, UPCL, Dehradun.

11.19 Connection Diagram and Terminal Markings

The connection diagram of the meter shall be clearly shown on inside portion of the terminal cover and shall be of permanent nature. Meter terminals shall also be marked and this marking shall appear in the above diagram. **Stickers of any kind shall not be accepted**.

11.20Name plate and Markings

Meter shall have a name plate clearly visible, effectively secured against removal and indelibly and distinctly marked with all essential particulars as per relevant standards. The manufacturer's meter constant shall be marked on the Name Plate.

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

a) Purchase Order No.
b) Month and Year of manufacture
c) Name of purchaser: i.e. UPCL
d) Guarantee Five Years
e) ISI mark
f) **Category of Meter:** Category C – LT CT Consumer Meter. The lettering shall be bold in 3 mm font

The meter Serial No. shall be Bar Coded along with Numeric No. The size of Bar Code shall not be less than 35x5 mm. Meter serial no. and Bar code on sticker shall not be acceptable.

A sticker label containing warning notice in Hindi / English language which is to be stick up on meters front cover or printed on meter name plate with easily readable font size not less than 10 in red colour

11.21 Tests

11.21.1 **Type Tests**

The meter offered shall have successfully passed all type tests described in the IS: 14697 / 1999 (amended upto date), external AC / DC magnetic influence tests as per CBIP Tech Report 304 with latest amendments and the meter data transfer and communication capability as per IS: 15959 / 2011 amended upto date.

- The Type Test Reports shall clearly indicate the constructional features including Optical port & RS-232 port connectivity of the type tested meter.
- The type test reports of the meter shall be same as the meter offered. Separate type Test Reports for each offered type of meter shall be submitted.
- The Type Test Certificate as per IS: 14697 / 1999 (amended upto date) shall be submitted along with the offer. The Type Test certificate carried out during last three years prior to the date of offer shall be valid.
- The Type test certificate of metering protocol as per IS: 15959 / 2011 shall not be more than 36 months old.
- All the type test reports needs to be approved from Executive Engineer, Store and Purchase, UPCL, Dehradun.
- All the Type Tests shall be carried out from Laboratories which are accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) of Govt. of India such as CPRI, ERDA, ERTL, etc. to prove that the meter meets the requirements of specification. Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.
- Further Purchaser shall reserve the right to pick up energy meters at random from the lots offered and get the meter tested at third party lab i.e. CPRI / agencies listed at Appendix-C of Latest – standardization of AC static electrical energy meters – CBIP publication NO.-304/ NPL / CQAL/ ERTL / ERDA at the sole discretion of the Purchaser.
- The supplier has no right to contest the test results of the third party lab or for additional test and has to replace/take corrective action at the cost of the supplier.
- It shall be the responsibility of the supplier to arrange such additional tests and Purchaser shall be informed of the date and time of conduction of tests well in advance to enable him to witness such tests. Test charges of the testing authority, for such successful repeat type tests, shall be reimbursed at actual by the Purchaser.

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

11.21.2 **Acceptance Test**

- All acceptance tests as per IS: 11731 (Part-2)/ 1986, heat deflection test as per ISO:75, glow wire test as per the IS:11000 (part 2/SEC-1) 1984 OR IEC PUB 60695-2-12, Ball pressure test as per IEC--60695-10-2 and Flammability Test as per UL 94 or as per IS: 11731 (Part-2)/ 1986 shall be carried out on the meter body.
- Criteria for selection for such tests and performance requirements shall be as per IS: 14697 / 1999 (Amended upto date).
- Additional Acceptance test of offered Energy meters as stated at cl. No. 21.03 carried out at third party NABL accredited lab shall be submitted and got approved from office of Executive Engineer, Store & Purchase, UPCL, Dehradun before commencement of supply.

11.21.3 **Additional Routine tests**

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

- Transportation Test: At least 50% of the samples of the meters be tested for error at Imax, Ib and 5% Ib at unity power factor and 50% Imax and 10% Ib at 0.5 lagging Power Factor besides checking them for starting current. The meter shall be tested with meter cover duly tightened and sealed properly. After

recording these errors, the meters be put in their normal packing and transported for at least 50 km in any transport vehicle such as pick up van, Jeep, etc. on uneven rural roads and then re-tested at all these loads after the transportation. The variation in errors recorded before and after transportation shall not exceed 1% at higher loads and 1.5% at low loads.

- Other Acceptance Tests:

The meter shall withstand continuously for a period of at least 5 minutes at a voltage of 440 V between phase and neutral without damage / problems.

1. Tamper Conditions as stated in this specification
2. Glow Wire testing for polycarbonate material
3. Power Consumption Tests
4. The meter shall comply all the tests for external AC / DC (except 0.2 Tesla AC magnet test) magnetic field as per CBIP Tech Report 304 with latest amendments.
5. Moreover, the magnetic influence test for permanent magnet of 0.5 Tesla for a minimum period of 15 minutes shall be carried out by putting the magnet on the meter body.
6. If the accuracy of the meter gets affected during the test, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering maximum value current (Imax) and reference voltage at unity power factor.
7. After removal of magnet, meter shall be subjected to accuracy test as per IS 14697 / 1999 (amended up to date).
8. No deviation in error is allowed in the class index as per IS: 13779/ 1999 (amended up to date) & this specification.
9. The meter shall withstand impulse voltage at 10 kV.
10. The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 14697:1999 amended up to date. For any higher signals than the present standards and UPCL technical specifications indicated above, the energy meters shall be immune & the accuracy of meter shall not get affected.

Jammer Test shall be carried out at UPCL testing division lab.

The test 7.21.3.2 (i) to (iv) shall be carried out at factory for each inspected lot at the time of pre-dispatch inspection.

The tests 7.21.3.2 (v), (vi) & (vii) shall be carried out on one sample from first lot as per procedure laid down in IS: 14697 / 1999 (amended up to date) and CBIP Tech. Report 304 in NABL LAB.

The test report shall get approved from Executive Engineer, Store and Purchase, UPCL, Dehradun before commencement of supply.

11.21.4 Limits of error

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

Table 11-9 Limits of Error

Sr. No.	Influence Quantities	Current Value	Power factor	Limits of variation in % error for class 1 meters
a)	Voltage variation	Ib	1	0.7
	– 15% to +10%	Ib	0.5 lag	1.0
b)	Voltage variation	Ib	1	1.1

Sr. No.	Influence Quantities	Current Value	Power factor	Limits of variation in % error for class 1 meters
	– 40% & + 20%	Ib	0.5 lag	1.5

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

11.22 Guaranteed technical Parameters

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

11.23 Pre Dispatch Inspection

All Acceptance Tests and Inspection shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall offer to the inspector representing the purchaser, all the reasonable facilities, free of charge, for inspection and testing, to satisfy him that the material is being supplied in accordance with this specification. The Company's representative / Engineer attending the above testing shall carry out testing on suitable number of meters as per sampling procedure laid down in IS: 14697 / 1999 (amended up to date) and additional acceptance test as per this specification and issue test certificate approval to the manufacturer and give clearance for dispatch. All the meters offered for inspection shall be in sealed condition. The seals of sample meters taken for testing & inspection shall be break open & resealed after inspection. The first lot of meter may be jointly inspected by the Executive Engineer, Testing Division and the Executive Engineer, Inspection Wing.

11.24 Joint Inspection after Receipt at Stores (Random Sample Testing)

From each lot (lot means the total number of meters received in a Store out of inspected and approved lot by Electrical Executive Engineer (Inspection Wing) or purchaser's representative under one approval letter) of meters received at Stores, Store Centers. 5 sample meters shall be drawn (meters received in damage condition shall not be selected as samples) and these meters shall be tested by our Testing Engineer in presence of Supplier / Supplier's representative jointly for (i) Starting Current, (ii) Limits of error, (iii) Repeatability of error, (iv) No Load Test as per IS: 13779/1999 (amended upto date), (v) Tamper conditions as per technical specifications and (vi) Data downloading time as per specifications.

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

11.25 Guarantee

The meter & CMRI shall be guaranteed for the period of five years from the date of commissioning or five and half year from the date of dispatch whichever is earlier. The meter / CMRI found defective within above guarantee period shall be replaced by the supplier free of cost, within one month of receipt of intimation. If defective meter

/ CMRI is not replaced within the specified period as above, the Company shall recover an equivalent amount plus 15% supervision charges from any of the bills of the supplier.

11.26 Packing

- The meters shall be suitably packed in order to avoid damage during transit or handling. Each meter may be suitably packed in the first instance to prevent ingress of moisture and dust and then placed in a cushioned carton of a suitable material to prevent damage due to shocks during transit. The lid of the carton may be suitably sealed. A suitable number of sealed cartons may be packed in a case of adequate strength with extra cushioning. The cases may then be properly sealed against accidental opening in transit. The packing cases may be marked to indicate the fragile nature of the contents.
- The following information shall be furnished with the consignment;
    a. Name of the consignee.
    b. Details of consignment.
    c. Destination.
    d. Total weight of the consignment.
    e. Sign showing upper / lower side of the crate.
    f. Sign showing fragility of the material.
    g. Handling and unpacking instructions.
    h. Bill of Material indicating contents of each package and spare material.

11.27 Tender Samples

Tenderer are required to submit 13 (Thirteen) nos. of sample meters of offered type as per technical specifications along with 2 no. of sample CMRI (IR Compliant 1 no. & DLMS compliant 1 No.) and the API software & documentation, etc. to Executive Engineer (Store/Purchase) in the office of the Executive Engineer, Store and Purchase, UPCL, Kaulagarh, Dehradun one working day before the time & date stipulated for submission of offer for testing the sample meters in third party NABL Lab like ERDA, CPRI, CIPET, ERTL, etc. and testing the offered API by our IT Department as per technical specifications.

The offer of those eligible bidders shall only be considered if the samples pass the tests at NABL Lab as well as necessary certification from our IT Department for the offered API. The results of NABL Lab and the certification from IT Department for offered API shall not be disputed and it shall be binding on the bidder.

The required information such as Manufacturer's Name or Trade Name, Sr. No., ISI Certification No., etc. shall be on stickers to be affixed on outer portion of sample meters being submitted along with the offer. Such information shall not be embossed or printed on any part of the sample meter.

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

11.28 Quality Control

- The purchaser has a right to send a team of experienced engineers for assessing the capability of the firm for manufacturing and testing of meters as per this specification. The team shall be given all assistance and co-operation for inspection and testing at the bidder's works. 3 tender samples shall be kept ready for assessing and testing. The tenderer shall extend all facilities for carrying out the testing of these samples.
- The meters supplied shall give service for a long period without drifting from the original calibration & performance must be near to zero percent failure.

11.29 Minimum Testing Facilities

Manufacturer shall possess fully computerized Meter Test Bench System for carrying out routine and acceptance Tests as per IS: 14697/1999 (amended up to date). Test Reports for each and every meter shall be generated. The list of testing equipment shall be enclosed. The manufacturer shall have the necessary minimum testing facilities for carrying out the following tests:

a. AC Voltage Test
b. Insulation resistance measurement,
c. Test on No load condition,
d. Test on Limits of error
e. Test on Starting current,
f. Test on Accuracy requirement,
g. Test of Power consumption,
h. Repeatability of error test
i. Shock Test
j. Vibration Test
k. Transportation test,
l. Tamper conditions
m. Long Duration Test
n. The manufacturer shall have duly calibrated RSS meter of class 0.1 or better accuracy.
o. The manufacturer shall have Glow Wire Testing facility.
p. The bidder shall have fully automatic Test Bench having in-built constant voltage, current and frequency source with facility to select various loads automatically and print the errors directly.

11.29.1 **Meter Software**

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

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

11.30 Manufacturing Activities

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

automatic machine. Handling of 'PCB' with ICs / C-MOS components, to be restricted to bare minimum and precautions to prevent 'ESD' failure to be provided.

- Complete assembled and soldered PCB shall undergo functional testing using computerized Automatic Test Equipment. Test points shall be provided to check the performance of each block / stage of the meter circuitry. RTC shall be synchronized with NPL time at the time of manufacture. Meters testing at intermediate and final stage shall be carried out with testing instruments, duly calibrated with reference standard, with traceability of source and date.
- The manufacturer shall submit the list of plant and machinery along with the offer.
- Quality shall be ensured at the following stages:
  a. At PCB manufacturing stage, each Board shall be subjected to computerized bare board testing.
  b. At insertion stage, all components shall undergo computerized testing for conforming to design parameters and orientation.
  c. Complete assembled and soldered PCB shall undergo functional testing using Automatic Test Equipment (ATEs).
  d. Important: - Prior to final testing and calibration, all meters shall be subjected to ageing test (i.e. Meters shall be kept in heating chamber for 72 hours at $55^{O}C$ temperature at full load current. After 72 hours, meters shall work satisfactory) to eliminate infant mortality.
- The calibration of meters shall be done in-house.
- The bidders shall submit the list of all (imported as well as indigenous) components to be used in meter, separately along with the offer. List of makes of components is attached herewith as a guide line (Schedule -III).
- Bought out items: A detailed list of bought out items which are used in the manufacturing of the meter shall be furnished indicating the name of firms from whom these items are procured. The bidder shall also give the details of quality assurance procedures followed by him in respect of the bought out items.
- List of Plant and Machinery used for production of energy meters.

Table 11-10 List of Plant and machinery

Sr. No	List of Plant and Machinery used for production of energy meters	
1.	Fully automatic testing Bench with ICT for testing link less meters	Routine Testing and Calibration of Meters
2.	Semi-automatic testing Bench with MSTV	Routine Testing and Calibration of Meters
3.	IR Tester	Insulation testing
4.	HV Tester	Insulation testing
5.	Error calculators	Error testing
6.	Long duration Running test set ups	Reliability testing
7.	Reference Meters class 0.1 accuracy	Error Calculation
8.	Ultrasonic Welding Machines	Welding of meters
9.	Automatic Pick and Place Machines	Automatic placing of SMT components
10.	Solder Paste Printing Machine	SMT Soldering
11.	Solder Furnace IR reflow	SMT Soldering
12.	PCB Scanner	For testing of PCBs
13.	ATE functional tester	For testing of components
14.	Programmers and Program Loaders	Chip Programming tools
15.	CAD PCB designing setups	PCB designing

Sr. No	List of Plant and Machinery used for production of energy meters	
16.	Furnace IR type for Hybrid Micro Circuits	Resistance network and HMC manufacturing
17.	Laser Trimming Machines	Trimming of resistances for higher accuracy measurement
18.	Wave Soldering Machines	Wave soldering of PCBs
19.	Humidity Chamber	Accelerated testing for life cycle
20.	Dry Heat Test Chamber	Accelerated testing for life cycle
21.	Thermal Shock Chamber	Accelerated testing for life cycle
22.	Pro-e Mechanical Design stations	Mechanical CAD station
23.	Spark erosion tools fabricating machine	Tool fabrication and die manufacturing
24.	CNC wire cut tool fabrication machine	Tool fabrication and die manufacturing
25.	Injection Moulding Machine	Moulding of plastic materials
26.	CNC milling machine for composite tool fabrication	Tool fabrication and Die manufacturing
27.	Vibration testing machine	Vibration testing of meters
28.	Glow wire test machine	Testing of Plastic material
29.	Fast transient burst testing setup	Type testing of Meters
30.	Short term over current testing setup	Type testing of Meters
31.	Magnetic and other testing setup	Tamper Testing
32.	Impulse Voltage Testing Setup	Type testing of Meters
33.	Composite Enviornmental testing chambers	Type testing of Meters

11.31 Quality Assurance Plan

The tenderer shall invariably furnish QAP as specified below along with his offer, the QAP adopted by him in the process of manufacturing.

The bidder shall invariably furnish the following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.

a. Statement giving list of important raw materials, names of sub - suppliers for the raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.

b. Information and copies of test certificates as in (i) above in respect of bought out accessories,

c. List of manufacturing facilities available,

d. Level of automation achieved and list of areas where manual processing exists,

e. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

f. List of testing equipments available with the bidder for final testing of equipment specified and test plan limitation, if any, vis-à-vis, the type, special acceptance and routine tests specified in the

relevant standards. These limitations shall be very clearly bought out in schedule of deviation from specified test requirements.

The successful bidder shall within 30 days of placement of order, submit following information to the purchaser.

a. List of raw materials as well as bought out accessories and the names of sub - suppliers selected from those furnished along with offers.

b. Type test certificates of the raw materials and bought out accessories if required by the purchaser.

c. Quality assurance plan (QAP) with hold points for purchaser's inspection. The quality assurance plant and purchasers hold points shall be discussed between the purchaser and bidder before the QAP is finalized.

The contractor shall operate systems which implement the following.

a. **Hold point**: A stage in the material procurement or workmanship process beyond which work shall not proceed without the documental approval of designated individuals organizations. The purchaser's written approval is required to authorize work to progress beyond the hold points indicated in quality assurance plans.
b. **Notification point**: A stage in the material procurement or workmanship process for which advance notice of the activity is required to facilitate witness. If the purchaser does not attend after receiving documented notification in accordance with the agreed procedures and with the correct period of notice, then the work may proceed.

The successful bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing if required by the purchaser and ensure that Quality Assurance program of the contractor shall consist of the quality systems and quality plans with the following details.

a. The structure of the organization.

- The duties and responsibilities assigned to staff ensuring quality of work.
- The system for purchasing taking delivery and verification of material.
- The system for ensuring quality workmanship.
- The system for retention of records.
- The arrangement for contractor’s internal auditing.
- A list of administration and work procedures required to achieve and verify contractor's quality requirements.
- These procedures shall be made readily available to the project manager for inspection on request.

b. 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

11.32 Component Selection

As per Schedule – III enclosed.

11.33 Schedules

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

11.33.1 **Schedule – I Guaranteed Technical particulars**

As per GTP parameters uploaded on e- tendering site

11.33.2 **Schedule – II Tenderer's experience**

TENDERER'S EXPERIENCE

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

Sr. No. Name of client Order No. & date Qty. ordered Qty. supplied

NAME OF FIRM _____

NAME & SIGNATURE _____

DESIGNATION _____

DATE _____

11.33.3 Schedule - III Component Selection

Sr. No	Component Function	Requirement	Make & Origin
1.	Current Transformer	The Meters shall be with the current transformers as measuring elements.	The current transformer shall withstand for the clauses under 5 & 9 of IS: 14697 / 1999
2.	Measurement or computing chips	The measurement or computing chips used in the Meter shall be with the Surface mount type.	**USA:** Analog Devices, Cyrus Logic, Atmel, Philips, Teridian. Dallas, ST, Texas Instruments, Motorola, Maxim, National Semiconductors, Freescale, Onsemiconductors **Germany:** Siemens. **South Africa**: SAMES. **Japan**: NEC, Toshiba, Renasas, Hitachi. **Austria**: AMS **Holland**: Philips (N X P)
3.	Memory Chips	The memory chips shall not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. Meter shall have non-volatile memory (NVM). No other type of memory shall be used for data recording and programming. (The life of the NVM is highest) There shall be security isolation between metering circuit, communication circuit, and power circuit	**USA**: Atmel, Teridian, National Semiconductors, Philips, Texas Instruments, ST, Microchip, Spanson (Fujitsu), Ramtron **Japan**: Hitachi, Renasas **Germany**: Siemens
4.	Display Modules	a. The display modules shall be well protected from external UV radiations. b. The display visibility shall be sufficient to read the Meter mounted at height of 0.5 meter as well as at the height of 2 meters (refer 3.2 d for viewing angle. c. The construction of the modules shall be such that the displayed quantity shall not disturbed with the life of display (PIN Type). d. It shall be trans- reflective HTN or STN type industrial grade with extended temperature range. HTN – Hyper Twisted Nematic (120°)	**Singapore**: E-smart, Bonafied Technologies, Display Tech. **Korea**: Advantek, Jebon, Union Display Inc., **Japan**: Hitachi, Sony, L&G. **Malaysia**: Crystal Clear Technology **Hong Kong:** Genda **China:** Success, Tinma,Hiajing, Truly

Sr. No	Component Function	Requirement	Make & Origin
		STN – Super Twisted Nematic (160°)	
5.	Communication Modules	Communication modules shall be compatible for the two ports (one for Optical port for communication with meter reading instruments (CMRI) & the other for the hardwired RS-232 port to communicate with various modems for AMR)	**USA**: Agilent, HP, Fairchild, National Semiconductors, Optonica **Holland**: Philips **Korea**: Phillips. **Japan**: Hitachi. **Taiwan**: Ligitek
6.	Optical Port	Optical Port shall be used to transfer the meter data to Meter reading instrument. The mechanical construction of the port shall be such to facilitate the data transfer easilty.	**USA:** HP National, Semiconductor, Maxim **Holland / Korea**: Phillips **Japan:** Hitachi **Taiwan:** Ligitek
7.	Power Supply	The power supply shall be with the capabilities as per the relevant standards. The power supply unit of the meter shall not be affected in case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections. It shall not also be affected by magnet.	SMPS type
8.	Electronic Components	The active & passive components shall be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	**USA**: National Semiconductors, Atmel, Philips, Texas Instruments, BC Component Analog devices, ST, Maxim, Kemet Onsemiconductors, Freescale, Intersil, Raltron, Fairchild, Muruta, Agilent, AVX, Abracon, Sipex, Diode Inc., Honeywell, Power Integration, Fox, Roham. **Japan**: Hitachi, Oki, AVZ or Rcon, Toshiba, Epson, Kemet, Alps, Muruta, TDK, Sanyo, Samsung, Panasonic **India:** Keltron, Incap, VEPL, PEC, RMC, Gujarat Polyavx, Prismatic, MFR Electronic components Pvt. Ltd., Cermet **Korea:** Samsung **Germany:** Vishay, Epcos, Diotech, Kemet

Sr. No	Component Function	Requirement	Make & Origin
9.	Mechanical Parts	The internal electrical components shall be of electrolytic copper & shall be protected from corrosion, rust etc. The other mechanical components shall be protected from rust, corrosion etc. by suitable plating / painting methods.	
10.	Battery	Only non-rechargeable battery shall be used for RTC as well as display in absence of Power since the life & reliability of these are better than the rechargeable batteries.	**USA:** Maxell, Renata **Japan:** Panasonic, Sony, Mitsubishi, Sanyo **Germany:** Varta **France:** Saft **Korea:** Tekcell, Vitzrocell Israel: Tadiran.
11.	RTC and Microcontroller	The accuracy of RTC shall be as per relevant IEC / IS standards.	**USA**: ST, Teridian, Philips, Dallas, Atmel, Motorola, Microchip. **Japan**: NEC, Oki, Epson
12.	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm	

12. Technical Specifications Three Phase Four Wire CT / PT Operated 0.5 S Class, 1 Amp or 5 Amps Fully Static AMR Compatible ToD Tri – Vector Net Energy Meter as Per Category "C" Of IS: 15959 / 2011 for use of HT Consumer

12.1 Scope

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

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

12.1.1 Application

For use on HT consumer installations.

12.2 Service Conditions

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

S. No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

Table 12-1 Service Conditions

Moderately hot and humid tropical climate conducive to rust and fungus growth.

12.3 Applicable Standards

The applicable standards are as below:

- IS: 15959 / 2011 Data Exchange for Electricity Meter Reading, Tariff and Load Control – companion specification for Category C Meters
- IS: 14697 / 1999 (amended up to date) for AC Static Transformer operated Watt-hour and VAR-hour Meters, Class 0.5 S – Specification.
- CBIP Tech-Report - 88 amended up to date for AC Static Transformer operated Watt Hour & VAR-Hour Meters (class 0.5S).
- IS: 15707 / 2006: Specification for Testing, evaluation, installation & maintenance of AC Electricity Meters-Code of Practice.
- CEA Regulations and JSERC guidelines amended up to date.

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

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

In case the bidder wishes to offer material conforming to the other authoritative standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Copy of such standards with authentic English Translations, shall be furnished along with the offer. In case of conflict related with communication protocol, the Indian standard IS: 15959 / 2011 AMMENDED UPTO DATE Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification shall prevail upon.

For conflict related with other parts of the specification, the order of priority shall be – (i) this technical specification, (ii) IS: 14697 / 1999 amended upto date & CBIP Tech-Report – 304 (iii) IEC (iv) Other authoritative standards.

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

12.4 General Technical Particulars

Table 12-2 Technical Parameters

S. No.	Parameter	
1.	Type	ISI marked LT AC Three Phase, Four Wire 50/5 Amps and 100/5 Amps and -/ 5 Amp CT Operated Fully Static AMR Compatible ToD Tri - Vector Net Energy Meter as per Category C of IS 15959 / 2011 Ammended upto date for LT consumers installation
2.	Frequency	50 Hz ± 5 %
3.	Accuracy Class	0.5S
4.	PT Secondary Voltage	63.5 V pH- N
5.	Rated Basic Current (I_b)	1 Amp; 5 Amps
6.	Maximum Continuous Current	Two times (200 %) of I_b.
7.	PT Ratio	$\frac{11}{\sqrt{3}} / \frac{110}{\sqrt{3}}$ or $\frac{33}{\sqrt{3}} / \frac{110}{\sqrt{3}}$

S. No.	Parameter	
8.	CT Ratio	1 / 1 amps ; 5 / 5 Amps
9.	Starting Current	0.1% of I_b
10.	Short time Current	As per IS: 14697 / 1999
11.	Rated Voltage	110 V Ph-Ph or 3 x 63.5 V Ph-N
12.	Voltage Range	+15% to -30% of rated voltage
13.	Temperature	The standard reference temperature for performance shall be 27^0 C The mean temperature coefficient shall not exceed 0.03%
14.	Frequency	50 Hz ±5%.
15.	Power Factor	0.0 Lag – Unity - 0.0 Lead. For leading Power factor, the value of kVAh shall be equal to kWh for the purpose of calculation of average power factor (on the basis of kWh/ kVAh) i.e. the value of kVAh shall be based on lagging value of kVArh & kWh. The kVAH Calculations (Import mode) = Square root of (kWh import) square + kVARH (lag Import) Square. In Export Mode = Square root of ((kWh Export) square + kVARH lag Export + kVARH Lead Export) square) PF shall be upto 3 Decimals.
16.	Power consumption	v. The active and apparent power consumption in each voltage circuit at reference voltage, reference temperature and reference frequency shall not exceed 1.0 W and 4 VA vi. The apparent power taken by each current circuit, at basic current I_b, reference frequency and reference temperature shall not exceed 2 VA.
17.	Design	Meter shall be designed with application specific integrated circuit (ASIC) or microcontroller; shall have no moving part; electronic components shall be assembelled on printed circuit board using surface mounting technology; factory calibration using high accuracy (0.1 class) software based test bench.
18.	Power Supply	SMPS
19.	ISI mark	The meter so supplied must bear the ISI /BIS mark

12.5 Constructional Requirement / Meter Cover & Sealing Arrangement

12.5.1 Construction Features

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

i. Personal safety against electric shock.
ii. Personal safety against effects of excessive temperature;
iii. Protection against spread of fire;
iv. Protection against penetration of solid objects, dust & water in meter.
v. Detection of Fraud / Pilferage

The meter shall be projection type and shall be dust and moisture proof. All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results. All insulating materials used in the construction of the meter shall be substantially non-hygroscopic, non-ageing and of tested quality.

12.5.2 Meter case

- The meter base & cover shall be made out of transparent, unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities. The meter case shall also have high impact strength.
- The poly carbonate body of the meter shall conform to IS: 11731 (FV-2 category) besides meeting the test requirement of heat deflection test as per ISO 75, glow wire test as per the IS: 11000 (part 2/SEC-1) 1984 or IEC-60695-2-12, Ball pressure test as per IEC-60695-10-2 and Flammability Test as per UL 94 or as per IS: 11731 (Part-2) 1986. The type test certificate shall be submitted along with the offer.
- The transparent polycarbonate base and cover of meter shall be ultra-sonically welded (continuous welding) so that once the meter is manufactured and tested at factory; it shall not be possible to open the cover at site except the terminal cover. The thickness of material for meter cover and base shall be 2 mm (minimum).
- The meter body shall be type tested for IP51 degree of protection as per IS 12063 against ingress of dust, moisture & vermin. The type test certificate shall be submitted along with the offer
- The meter cover shall be secured to base by means of sealable unidirectional captive screws with two holes.
- The energy meter shall clearly indicate the Export and Import connection marking on the terminal block and terminal cover. The "I" indicates that import terminal which is for solar system and "E" indicates that Export terminal which is for utility connection.

12.5.3 Terminals and Terminal Blocks

- The terminal block shall be made from high quality non-hygroscopic, fire retardant, reinforced polycarbonate / non-Bakelite material which shall form an extension of the meter case.
- The material of which the terminal block is made shall be capable of passing the tests given in IS: 1336O (Part 6/Sec 17), ISO 75-1 (1993) & ISO 75-2 (1993) for a temperature of 135^0 C and a pressure of 1.8 MPa (Method A).
- The type test certificate shall be submitted along with the offer. The holes in the insulating material which form an extension of the terminal holes shall be of sufficient size to also accommodate the insulation of the conductors.
- The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating.
- Screw connections transmitting contact force and screw fixings which may be loosened and tightened several times during the life of meter shall screw into metal nuts.
- All parts of every terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized.
- Electrical connections shall be so designed that contact pressure is not transmitted through insulating material of the terminal block.
- The terminals, the conductor fixing screws or the external or internal conductors shall not be liable to come into contact with terminal covers.
- Two screws shall be provided in each current & potential terminal for effectively clamping the external leads or thimbles. Each clamping screw shall engage a minimum of three threads in the terminal. The ends of screws shall be such as not to pierce and cut the conductors used.
- The minimum internal diameter of terminal hole shall be as per IS: 14697 / 1999 or CBIP Tech Report 304. The manufacturer shall ensure that the supporting webs between two terminals of the terminal block shall be sufficiently high to ensure that two neighboring terminals do not get bridged by dust and there shall not be any possibility of flash over between adjacent terminals of the terminal block.

12.5.4 Terminal Cover

- The termination arrangement shall be provided with an extended transparent terminal cover as per clause number 6.5.2 of IS: 14697 / 1999 (amended upto date) irrespective of rear connections. The terminal cover shall be made out of same material as that of meter body.
- The terminal cover shall be unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities. The terminal cover shall be transparent. The terminal cover shall be provided with one side hinge.
- The terminal cover shall enclose the actual terminals, the conductor fixing screws and unless otherwise specified, a suitable length of external conductors and their insulation. Independent sealing provision shall be made against opening of the terminal cover and front cover to prevent unauthorized tampering. It is necessary to provide unidirectional screws with two holes for sealing purpose of terminal cover. The meter shall be pilfer-proof & tamper-proof.
- The fixing screws used on the terminal cover for fixing and sealing in terminal cover shall be held captive in the terminal cover. Proper size of grooves shall be provided at bottom of this terminal cover for incoming service connections. When the meter is mounted, no access to the terminals by any means shall be possible without breaking seals(s) of the terminal cover.

12.5.5 Resistance to Heat and Fire

The terminal block, the terminal cover, the insulating material retaining the main contacts in position and the meter body shall ensure reasonable safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them.

12.5.6 Seals, Markings and Sticker Labels

- The meter shall be completely factory sealed except the terminal block cover.
- The provision shall be made on the meter for at least two seals to be put by utility user
- The energy meter shall clearly indicate the Export and Import connection marking on the terminal block and terminal cover.
- The "→" indicates that Import terminal / forward and "←" indicates that Export terminal / reverse energy measurement.
- A sticker label containing warning notice in Hindi / English language which is to be stick up on meters front cover or printed on meter name plate with easily readable font size not less than 10 in red colour.
- A Push button facility shall be provided for high resolution reading / alternate mode of display, as brought out elsewhere in this specification

12.5.7 Output Device

- The meter shall have test output accessible from the front and be capable of being monitored with suitable testing equipment while in operation at site. The operation indicator must be visible from front. The test output device shall be provided in the form of blinking LED or other similar devices like blinking LCD. Resolution of the test output device shall be sufficient to enable the starting current test in less than 10 minutes. The pulse rate of output device which is Pulse / kWh and Pulse / kVArh (meter constant) shall be indelibly provided on the nameplate.
- The meter accuracy shall not be affected by magnetic field (AC / DC / Permanent) upto 0.2 Tesla on all the sides of meter, i.e. front, sides, top and bottom of the meter as per CBIP Technical Report 304 with latest amendments. Under influence of any magnetic field (AC / DC / Permanent) above 0.2 Tesla, if the accuracy of the meter gets affected, then the meter shall record energy considering Imax and reference voltage at unity power factor.
- The meter shall also be capable to withstand and shall not get damaged if phase to phase voltage is applied between phases & neutral for five minutes.
- In meter, power supply unit shall be micro control type instead of providing conventional transformer and then conversion to avoid magnetic influence.

- Non specified display parameter in the meter shall be blocked and it shall not be accessible for reprogramming at site.
- Complete metering system shall not be affected by the external electromagnetic interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic fields and DC current in AC supply etc.
- CTs are to be provided with magnetic shielding and shall be tested separately prior to assembly.
- PCB used in meter shall be made by Surface Mounting Technology

12.5.8 Real Time Internal Clock (RTC)

- The real time quartz clock shall be used in the meter for maintaining time (IST) and calendar. The RTC shall be non - rechargeable and shall be pre-programmed for 30 Years Day / date without any necessity for correction. The maximum drift shall not exceed +/- 300 Seconds per year.
- The clock day / date setting and synchronization shall only be possible through password / Key code command from one of the following:
  i. Common meter reading instrument (CMRI), Laptop Computer or Meter testing work bench and this shall need password enabling for meter.
  ii. From remote server through suitable communication network or Sub-station data logger 'PC'.
- The RTC shall have long life (10 Years) Non-rechargeable battery. The RTC battery & the battery for display in case of power failure shall be separate.
- All insulating materials used in the construction of the meter shall be substantially non-hygroscopic, non-ageing and of tested quality.

12.5.9 Meter Accuracy

- The meter shall withstand any type of High Voltage and High Frequency surges, which are similar to the surges produced by induction coil type instruments without affecting the accuracy of the meter. The accuracy of the meter shall not be affected with the application of abnormal voltage / frequency generating device such as spark discharge of approximately 35 kV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:
  i. On any of the phases or neutral terminals.
  ii. On any connecting wires of the meter (Voltage discharge with 0-10 mm spark gap).
  iii. At any place in load circuit.
- The accuracy of meter shall be checked before and after the application of above device.
- The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 14697:1999 amended up to date.
- For any higher signals than the present standards and UPCL technical specifications indicated above, the accuracy of meter shall not get affected, i.e. the energy meter shall be immune.

The communication of energy meter shall not get affected considering the above feature state in clause 8.5.10.3 and 8.5.10.4

12.5.10 Self-Diagnostic Features

- The meter shall keep log in its memory for unsatisfactory functioning or nonfunctioning of Real Time Clock battery.
- All display segments: "LCD Test" display shall be provided for this purpose.

12.5.11 Meter Protocol

- The meter protocol shall be as per Annex E - Category C meters of IS: 15959 / 2011 AMMENDED UPTO DATE.
- The watch dog provided shall invariably protect the hanging of microprocessor during such type of tampering devices.

12.5.12 Communication Capability

- The meter shall be provided with two ports for communication of the measured / collected data as per the IS: 15959 / 2011 amended upto date, i.e. a hardware port compatible with RS 232 specifications (RJ - 11 / RJ - 45 type is also acceptable) which shall be used for remote access through suitable Modem (GPRS / GSM / EDGE / CDMA / PSTN / LPR) and an Optical port complying with hardware specifications detailed in IEC
- This shall be used for local data downloading through a DLMS compliant CMRI. RS 232 port or TCP / IP port as required on terminal block is also acceptable.
- Sealing arrangement for Optical & RS 232 port or TCP / IP port as required shall be provided.
- Both ports shall support the default and minimum baud rate of 9600 bps.
- Necessary chord for Optical Port of minimum length of 1 metre in the ratio 50:1 shall be provided free of cost.

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

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

Meter end, starting 1 to 8 from Left to Right.

Pin no 8 => RX (+)

Pin no 7 => RX (-)

Pin no 3 => TX(+)

Pin no 6 => TX(-)

ii. The interface shall meet all the requirements of RS-232 specifications in terms of Physical media, Network topologies, maximum devices, maximum distance, mode of operation, etc.

iii. Screw type connectors or RJ45 type connectors have to be provided to easily terminate the twisted pair.

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

v. The internal battery shall be Ni-mh or Li-ion or NI CD maintenance free battery of long life of 10 years. A suitable Push Button arrangement for activation of this battery shall be provided. Alternatively, push button provided for displaying alternate mode (On Demand Mode) parameters shall also be acceptable for activation of battery during power OFF condition.

vi. The meter shall withstand any type of High Voltage and High Frequency surges, which are similar to the surges produced by induction coil type instruments without affecting the accuracy of the meter. The accuracy of the meter shall not be affected with the application of abnormal voltage / frequency generating device such as spark discharge of approximately 35 kV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

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

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

12.5.13 Wire / Cable less Design

- The meter PCB shall be wireless to avoid improper soldering & loose connection / contact.
- The data stored in the meters shall not be lost in the event of power failure. The meter shall have Non Volatile Memory (NVM), which does not need any battery backup. The NVM shall have a minimum retention period of 10 years.
- Reverse reading lock of main kWh reading is to be incorporated with necessary software modification if required additionally.
- The meter shall record and display Fundamental energy excluding Harmonic energy. The energy meter shall record & display harmonic energy separately.

12.6 TOD Timing

There shall be provision for at least 6 (Six) Time of Day (TOD) time zones for energy and demand.

The number and timings of these Time of Day time Zones shall be programmable. At present the time zones shall be programmed as per UPCL existing time zones. These may be subject to change as per notification from UPCL.

12.7 Maximum Demand Integration Period

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

12.8 Maximum Demand Reset

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

a. Communication driven reset through hand held terminal (CMRI).
b. Manual resetting arrangement with sealing facility
c. Auto reset at 24:00 hrs at the end of each billing cycle: Automatic reset at the end of certain predefined period (say, end of the month). This option shall be blocked by default and made programmable through hand held terminal (CMRI) for the actual date required. No push button shall be provided for MD reset.

12.9 Tamper and Fraud Monitoring Features

12.9.1 Anti-Tamper Features

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

- The meter accuracy shall not be affected by change of phase sequence. It shall maintain the desired accuracy in case of reversal of phase sequence.
- The meter shall continue to work even without neutral.
- The meter shall work in absence of any two phases i.e. it shall work on any one phase wire and neutral, to record relevant energy.
- If the accuracy of the meter gets affected under the influence of magnetic field more than 0.2 Tesla, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering the maximum value current (Imax) at ref. voltage and unity PF in all the three phases.
- In case of magnetic tamper during export / reverse mode, the energy meter shall record & add the same energy considering Imax in import / forward mode.
- If a consumer tries to steal power by disconnecting the voltage supply of one or two phases of the meter externally or by tampering so that no voltage or partial voltage (< 50% of Vref) is available to voltage circuit of meter & current is flowing in that phase, the meter shall record energy at Vref, current available in these phases & UPF.
- The meter shall be capable of detecting and recording occurrences and restoration for reverse current of any one or two phases with date & time of occurrence and restoration.
- The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 14697:1999 amended up to date. For any higher signals than the present standards and UPCL technical specifications indicated above, the energy meters shall be immune & the accuracy of energy meter shall not get affected.
- The separate slot with 10 no. occurrences of EMI/EMC tamper along with date & time stamp shall be provided.

12.9.2 Tamper Events

The meter shall work satisfactorily under presence of various influencing conditions like External Magnetic Field, Electromagnetic Field, Radio Frequency Interference, Harmonic Distortion, Voltage / Frequency Fluctuations and Electromagnetic High Frequency Fields, etc. as per relevant IS

- The meter shall record the occurrence and restoration of tamper events of current, voltages, kWh, power factor, event code, date & time etc. listed in Table 32 to 37 of IS: 15959 / 2011.
- In the event the meter is forcibly opened, even by 2 to 4 mm variation of the meter cover, same shall be recorded as tamper event with date & time stamping as per table 37 of IS: 15959 / 2011 and the meter shall continuously display that the cover has been tampered.
- The detection of the tamper event shall be registered in the tamper event register.
- The no. of times the tampering has been done shall also be registered in the meter.
- Tamper Details shall be retrieved by authorized personnel through either of the following:

  (i) CMRI.

  (ii) Remote access through suitable communication network.

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

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

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

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

Table 12-3 Tamper Data

S. No.	Description	Occurrence (with Occ. Time 5 min.)	Restoration (with rest. Time 5 min.)
1.	PT Link Missing (Missing Potential)	< 50% of Vref.	> 50% of Vref
2.	Over Voltage in any phase	> 115% of Vref	< 115% of Vref
3.	Low Voltage in any phase	< 70% of Vref	> 70% of Vref
4.	Voltage Unbalance (Diff. of phase voltages)	> 10% Vref	< 10 % Vef
5.	CT open	Zero Amps in one or two phases and current in at least 1 phase is > 5% I_b for 15 minutes	> 3 % I_b for 15 min in the tampered phase for 15 min
6.	Current Unbalance (Diff of phase currents)	> 30 % I_b for 15 min	< 30 % I_b for 15 min
7.	Current Bypass	Bypass Current > 10 % I_b for 15 min	Bypass Current < 10 % I_b for 15 min
8.	Current Reversal	Immediate in case of reverse of any of two phases	Direction of all currents are same.
9.	Over Current in any Phase	> 120 % I_{max}	< 120 % I_{max}
10.	Influence of permanent magnet or AC/ DC electromagnet/ permanent magnet	Immediate	1 Minute after removal
11.	Neutral disturbance	-	-

S. No.	Description	Occurrence (with Occ. Time 5 min.)	Restoration (with rest. Time 5 min.)
12.	Power failure	Immediate	
13.	Very low PF	-	-
14.	Meter Cover Opening	2 to 4 mm	-

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

12.10 Quantities to be measured and displayed

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

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

In addition to above the meter shall also record the Name plate details, programmable parameters (readable as profile), occurrence and restoration of tamper events along with the parameters (Table 30, 31 and 32 to 39 except 38 respectively of `IS: 15959 / 2011 amended upto date.

Detail of parameters requirement is given in following tables of document enclosed at the end of the document

Table 12-4 Quantities to be Measured and displayed

Category C	Parameter group	ANNEX Table No.
LT Consumers Energy Meters	Instantaneous parameters	27
	Block Load Profile parameters	28
	Billing Profile parameters	29
	Name Plate details	30
	Programmable Parameters	31
	Event Conditions	32 to 37
All logging parameters for each of the event condition for 3 phase / 4 Wire	Capture parameters for event (Event Log Profile)	39

12.11 Display Indicators

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

12.12 Display of Measured Values

- The permanently backlit display shall show relevant information about the parameters to be displayed. The corresponding non-volatile memory shall have a minimum retention time of 10 years. In the case of multiple values presented by a single display, it shall be possible to display the content of all relevant memories. When displaying the memory, the identification of each parameter applied shall be possible.
- The principal unit for the measured values shall be the kilowatt-hour kWh for active energy, kVArh for reactive energy and kVAh for apparent energy. The meter shall have 6 digits (with +/- indication) parameter identifier, permanently backlit Liquid Crystal Display (LCD) with wide viewing angle.
- The size of digit shall be minimum 10x5 mm. The decimal unit shall not be displayed in auto scroll mode.
- However it shall be displayed in push button mode or alternate mode for high resolution display for testing. Auto display cycling push button is required with persistence time of 9 Seconds. LCD shall be suitable for temperature withstand of 70^0 C; the adequate back up arrangement for storing of energy registered at the time of power interruption shall be provided.
- The meter shall be pre-programmed for following details.
    a. Voltage rating: 240 V Phase to Neutral.
    b. CT Ratio: 100/5 Amps or 50/5 Amps or -/5 Amp
    c. MD Integration Period: 30 Minutes real time based.
    d. The meter shall Auto reset kVAMD at 24.00 Hrs. of last day of the month and this value shall be stored in the memory along with the cumulative kWh reading. No reset push button shall be provided.
    e. Average power factor with 2 decimal digits shall be displayed.
    f. The array of data to be retained inside the meter memory shall be for the last 45 days for a capture period of 30 minutes. The load survey data shall be first in first out basis (FIFO).
    g. The meter display shall return to Default Display Mode if the "On Demand" Push Button is not operated for 15 sec.

12.12.1 Minimum Display Capability (Measuring Parameters)

- The sequence of display of various electrical parameters in auto scroll & On Demand mode shall be as per table 27 & 29 (except 8 & 9) of Annex E of IS: 15959 / 2011.Display other than specified below shall be blocked.
- The scroll period for auto scroll shall be 10 sec.
- Default Display Mode (Auto Scrolling) (Scrolling Time 10 secs)

All the following parameters will be available in Default Display (Auto Scrolling Mode):

Table 12-5 Display Parameters

S. No.	Parameter
1.	LCD check
2.	Real Time Clock – Date and Time
3.	Cumulative Energy kwh (Import)
4.	Cumulative Energy - kVArh - Lag (Import)
5.	Cumulative Energy - kVArh - Lead (Import)
6.	Cumulative Energy kVAh (Import)
7.	MD – kVA with occurrence date and time (Import)
8.	Three Phase Power Factor – PF (Import)

S. No.	Parameter
9.	Cumulative Energy kwh (Export)
10.	Cumulative Energy - kVArh - Lag (Export)
11.	Cumulative Energy - kVArh - Lead (Export)
12.	Cumulative Energy - kVAh (Export)
13.	MD – kVA with occurrence date and time (Export)
14.	Three Phase Power Factor – PF (Export)
15.	No.of MD – kVA Reset
16.	Cumulative Tamper Counter
17.	Meter Cover Opening – Occurrence with Date and Time
18.	Rising MD with Elapsed Time
On- Demand Display (Alternate Display) through Push Button	
1.	Cumulative energy – kWh ToD Zone A (Import)
2.	Cumulative energy – kWh ToD Zone B (Import)
3.	Cumulative energy – kWh ToD Zone C (Import)
4.	Cumulative energy – kWh ToD Zone D (Import)
5.	Cumulative energy – kWh ToD Zone E (Import)
6.	Cumulative energy – kWh ToD Zone F (Import)
7.	Cumulative energy – kVAh ToD Zone A (Import)
8.	Cumulative energy – kVAh ToD Zone B (Import)
9.	Cumulative energy – kVAh ToD Zone C (Import)
10.	Cumulative energy – kVAh ToD Zone D (Import)
11.	Cumulative energy – kVAh ToD Zone E (Import)
12.	Cumulative energy – kVAh ToD Zone F (Import)
13.	MD – kVA – TOD Zone A with occurrence date and time (Import)
14.	MD – kVA – TOD Zone B with occurrence date and time (Import)
15.	MD – kVA – TOD Zone C with occurrence date and time (Import)
16.	MD – kVA – TOD Zone D with occurrence date and time (Import)
17.	MD – kVA – TOD Zone E with occurrence date and time (Import)
18.	MD – kVA – TOD Zone F with occurrence date and time (Import)
19.	Cumulative energy – kWh ToD Zone A (Export)
20.	Cumulative energy – kWh ToD Zone B (Export)
21.	Cumulative energy – kWh ToD Zone C (Export)
22.	Cumulative energy – kWh ToD Zone D (Export)

S. No.	Parameter
23.	Cumulative energy – kWh ToD Zone E (Export)
24.	Cumulative energy – kWh ToD Zone F (Export)
25.	Cumulative energy – kVAh ToD Zone A (Export)
26.	Cumulative energy – kVAh ToD Zone B (Export)
27.	Cumulative energy – kVAh ToD Zone C (Export)
28.	Cumulative energy – kVAh ToD Zone D (Export)
29.	Cumulative energy – kVAh ToD Zone E (Export)
30.	Cumulative energy – kVAh ToD Zone F (Export)
31.	MD – kVA – TOD Zone A with occurrence date and time (Export)
32.	MD – kVA – TOD Zone B with occurrence date and time (Export)
33.	MD – kVA – TOD Zone C with occurrence date and time (Export)
34.	MD – kVA – TOD Zone D with occurrence date and time (Export)
35.	MD – kVA – TOD Zone E with occurrence date and time (Export)
36.	MD – kVA – TOD Zone F with occurrence date and time (Export)
37.	MD – kVA reset count
38.	Last date and Time of MD – kVA reset
39.	Real Time Clock – Date and Time
40.	Voltage V_{RN}
41.	Voltage V_{YN}
42.	Voltage V_{BN}
43.	Current I_R
44.	Current I_Y
45.	Current I_B
46.	Signed Power Factor – R Phase (Import)
47.	Signed Power Factor – Y Phase (Import)
48.	Signed Power Factor – B Phase (Import)
49.	Signed Power Factor – R Phase (Export)
50.	Signed Power Factor – Y Phase (Export)
51.	Signed Power Factor – B Phase (Export)
52.	Frequency
53.	High resolution kWh (for Calibration)
54.	High resolution kVArh (for Calibration)
55.	M1 MD – kVA – TOD Zone A with occurrence date and time (Import)
56.	M1 MD – kVA – TOD Zone B with occurrence date and time (Import)
57.	M1 MD – kVA – TOD Zone C with occurrence date and time (Import)

S. No.	Parameter
58.	M1 MD – kVA – TOD Zone D with occurrence date and time (Import)
59.	M1 MD – kVA – TOD Zone E with occurrence date and time (Import)
60.	M1 MD – kVA – TOD Zone F with occurrence date and time (Import)
61.	M2 MD – kVA – TOD Zone A with occurrence date and time (Import)
62.	M2 MD – kVA – TOD Zone B with occurrence date and time (Import)
63.	M2 MD – kVA – TOD Zone C with occurrence date and time (Import)
64.	M2 MD – kVA – TOD Zone D with occurrence date and time (Import)
65.	M2 MD – kVA – TOD Zone E with occurrence date and time (Import)
66.	M2 MD – kVA – TOD Zone F with occurrence date and time (Import)
67.	M1 MD – kVA – TOD Zone A with occurrence date and time (Export)
68.	M1 MD – kVA – TOD Zone B with occurrence date and time (Export)
69.	M1 MD – kVA – TOD Zone C with occurrence date and time (Export)
70.	M1 MD – kVA – TOD Zone D with occurrence date and time (Export)
71.	M1 MD – kVA – TOD Zone E with occurrence date and time (Export)
72.	M1 MD – kVA – TOD Zone F with occurrence date and time (Export)
73.	M2 MD – kVA – TOD Zone A with occurrence date and time (Export)
74.	M2 MD – kVA – TOD Zone B with occurrence date and time (Export)
75.	M2 MD – kVA – TOD Zone C with occurrence date and time (Export)
76.	M2 MD – kVA – TOD Zone D with occurrence date and time (Export)
77.	M2 MD – kVA – TOD Zone E with occurrence date and time (Export)
78.	M2 MD – kVA – TOD Zone F with occurrence date and time (Export)
79.	Last Tamper Event with date and time
Test Mode Display	
1.	High resolution total kWh (Import)
2.	High resolution total kVArh (Import) Lag
3.	High resolution total kVArh (Import) Lead
4.	High resolution total kVAh (Import)
5.	Rising Demand Import kVA with elapsed time (Simultaneously displayed)
6.	High resolution total kWh (Export)
7.	High resolution total kVArh (Export) Lag
8.	High resolution total kVArh (Export) Lead
9.	High resolution total kVAh (Export)
10.	Rising Demand Export kVA with elapsed time (Simultaneously displayed)
Note: 1. Other kVA MD values shall be available in reset backup data for 6 months. 2. The meter display shall return to Default Display Mode if the "On Demand Push Button" is not operated for 15 sec.	

S. No.	Parameter
	All test mode parameters shall have resolution of 4 decimal places. a. It shall be possible to scroll through the parameters (up & down) manually in all the three display modes. b. Manual display Hold / Unhold facility shall be provided. The meter shall return to Auto scrolling mode if Unhold activation is not done for 30 minutes.

12.13 Billing Data, Billing History, Load Survey and Tamper Data

12.13.1 Billing Data

The Billing data shall be as per table 29 of Annex E of IS: 15959 /2011 amended upto date

The Billing Data is summarized as below:

Table 12-6 Billing Data

S. No.	Parameter
1.	Billing Date
2.	System Power Factor for Billing period
3.	Cumulative energy – kWh(Import)
4.	Cumulative energy – kWh ToD Zone A (Import)
5.	Cumulative energy – kWh ToD Zone B (Import)
6.	Cumulative energy – kWh ToD Zone C (Import)
7.	Cumulative energy – kWh ToD Zone D (Import)
8.	Cumulative energy – kWh ToD Zone E (Import)
9.	Cumulative energy – kWh ToD Zone F (Import)
10.	Cumulative energy – kVArh Lag (Import)
11.	Cumulative energy – kVArh Lead (Import)
12.	Cumulative energy – kVAh (Import)
13.	Cumulative energy – kVAh ToD Zone A (Import)
14.	Cumulative energy – kVAh ToD Zone B (Import)
15.	Cumulative energy – kVAh ToD Zone C (Import)
16.	Cumulative energy – kVAh ToD Zone D (Import)
17.	Cumulative energy – kVAh ToD Zone E (Import)
18.	Cumulative energy – kVAh ToD Zone F (Import)
19.	Maximum demand (kVAMD) with Occurrence Date and time. (Import)

S. No.	Parameter
20.	Maximum demand (kVAMD) ToD Zone A with Occurrence Date and time. (Import)
21.	Maximum demand (kVAMD) ToD Zone B with Occurrence Date and time. (Import)
22.	Maximum demand (kVAMD) ToD Zone C with Occurrence Date and time. (Import)
23.	Maximum demand (kVAMD) ToD Zone D with Occurrence Date and time. (Import)
24.	Maximum demand (kVAMD) ToD Zone E with Occurrence Date and time. (Import)
25.	Maximum demand (kVAMD) ToD Zone F with Occurrence Date and time. (Import)
26.	Cumulative energy – kWh(Export)
27.	Cumulative energy – kWh ToD Zone A (Export)
28.	Cumulative energy – kWh ToD Zone B (Export)
29.	Cumulative energy – kWh ToD Zone C (Export)
30.	Cumulative energy – kWh ToD Zone D (Export)
31.	Cumulative energy – kWh ToD Zone E (Export)
32.	Cumulative energy – kWh ToD Zone F (Export)
33.	Cumulative energy – kVArh Lag (Export)
34.	Cumulative energy – kVArh Lead (Export)
35.	Cumulative energy – kVAh (Export)
36.	Cumulative energy – kVAh ToD Zone A (Export)
37.	Cumulative energy – kVAh ToD Zone B (Export)
38.	Cumulative energy – kVAh ToD Zone C (Export)
39.	Cumulative energy – kVAh ToD Zone D (Export)
40.	Cumulative energy – kVAh ToD Zone E (Export)
41.	Cumulative energy – kVAh ToD Zone F (Export)
42.	Maximum demand (kVAMD) with Occurrence Date and time. (Export)
43.	Maximum demand (kVAMD) ToD Zone A with Occurrence Date and time. (Export)
44.	Maximum demand (kVAMD) ToD Zone B with Occurrence Date and time. (Export)
45.	Maximum demand (kVAMD) ToD Zone C with Occurrence Date and time. (Export)
46.	Maximum demand (kVAMD) ToD Zone D with Occurrence Date and time. (Export)
47.	Maximum demand (kVAMD) ToD Zone E with Occurrence Date and time. (Export)
48.	Maximum demand (kVAMD) ToD Zone F with Occurrence Date and time. (Export)
49.	Maximum demand (kW MD) Occurrence Date and time. (Import)

S. No.	Parameter
50.	Maximum demand (kW MD) ToD Zone A with Occurrence Date and time. (Import)
51.	Maximum demand (kW MD) ToD Zone B with Occurrence Date and time. (Import)
52.	Maximum demand (kW MD) ToD Zone C with Occurrence Date and time. (Import)
53.	Maximum demand (kW MD) ToD Zone D with Occurrence Date and time. (Import)
54.	Maximum demand (kW MD) ToD Zone E with Occurrence Date and time. (Import)
55.	Maximum demand (kW MD) ToD Zone F with Occurrence Date and time. (Import)
56.	Maximum demand (kW MD) Occurrence Date and time. (Export)
57.	Maximum demand (kW MD) ToD Zone A with Occurrence Date and time. (Export)
58.	Maximum demand (kW MD) ToD Zone B with Occurrence Date and time. (Export)
59.	Maximum demand (kW MD) ToD Zone C with Occurrence Date and time. (Export)
60.	Maximum demand (kW MD) ToD Zone D with Occurrence Date and time. (Export)
61.	Maximum demand (kW MD) ToD Zone E with Occurrence Date and time. (Export)
62.	Maximum demand (kW MD) ToD Zone F with Occurrence Date and time. (Export)
63.	Harmonic Energy (HkWh) (Export)
64.	Harmonic Energy (HkWh) (Import)

The Net Energy Shall be calculated as per the following formula

Net Energy = Import Energy – Export Energy

12.13.2 Billing History

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

Legends for kWh and MD shall be as follows:

Table 12-7 Legends for Billing Data

Months	Import		Export	
	MD	Energy	MD	Energy
March(Current month)	MD	kWh	MD	kWh
Feb	MD1	K5Wh1	MD1	K5Wh1
Jan	MD2	kWh2	MD2	kWh2
Dec	MD3	kWh3	MD3	kWh3
Nov	MD4	kWh4	MD4	kWh4

Months	Import		Export	
Oct	MD5	kWh5	MD5	kWh5
Sept	MD6	kWh6	MD6	kWh6
Aug	MD7	kWh7	MD7	kWh7
July	MD8	kWh8	MD8	kWh8
June	MD9	kWh9	MD9	kWh9
May	MD10	kWh10	MD10	kWh10
April	MD11	kWh11	MD11	kWh11
March	MD12	kWh12	MD12	kWh12

Details of Legend shall be self-explanatory with legends like:

Export →

Import ←

12.13.3 Block Load Survey Data

The Block Load survey data shall be logged on non-time based basis, i.e. if there is no power for more than 24 hours, the day shall not be recorded. Whenever meter is taken out and brought to laboratory, the load survey data shall be retained for the period of actual use of meter. This load survey data can be retrieved as and when desired and load profiles shall be viewed graphically / analytically with the help of meter application software. The meter application software shall be capable of exporting / transmitting these data for analysis to other user software in spreadsheet format.

The Block Load survey data shall be for specified parameters as per table 28 for 3Φ/4W system of measurement with NEUTRAL as reference point of Annex E of IS: 15959 / 2011 AMMENDED UPTO DATE. The specified parameters are summarised as below.

The load survey parameters are as below.

Table 12-8 Block Load Survey Data

S. No.	Parameter
(1)	Real Time Clock – Date and Time
(2)	Current – I_R
(3)	Current – I_Y
(4)	Current – I_B
(5)	Voltage – V_{RN}.
(6)	Voltage – V_{YN}.
(7)	Voltage – V_{BN}.
(8)	Block Energy – kWh with Import & Export Mode.
(9)	Block Energy – kVArh – lag with Import & Export Mode.
(10)	Block Energy – kVArh – lead with Import & Export Mode.
(11)	Block Energy – kVAh with Import & Export Mode.

S. No.	Parameter
(12)	Voltage THD in Import Mode
(13)	Voltage THD in Export Mode
(14)	Current THD in Import Mode
(15)	Current THD in Export Mode

12.14 Demonstration

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

12.15 Performance under Influence Quantities

The meters' performance under influence quantities shall be governed by IS: 14697 / 1999 (amended upto date) and CBIP Tech. Report 304; the accuracy of meter shall not exceed the permissible limits of accuracy as per standard IS: 14697 / 1999 (amended upto date). In case of conflict, the priority shall be as per clause no. 5.00 of this specification.

12.16 Metering pool

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

12.17 Common Meter Reading Instrument (CMRI)

- To enable local reading of meters data, a DLMS compliant CMRI shall be provided.
- The CMRI shall be as per specification given in Annex J of IS: 15959 /2011.
- It shall be compatible to the DLMS compliant energy meters that are to be procured / supplied on the basis of this specification.
- The CMRI shall be supplied by the meter manufacturer along with the meter free of cost in the ratio of one for each 100 Nos. meters supplied including user manual and a set of direct communication cords for data downloading to the Laptop or PC for each CMRI.
- There shall be a provision for auto power save on CMRI, which shall force the instrument in the power saving mode in case of no-activity within 5 minutes.
- The data shall not be lost in the event the batteries are drained or removed from the CMRI.
- The CMRI shall have a memory capacity of 8 MB SRAM (Static RAM) with battery backup & upgradeable and BIOS / OS on FLASH / EEPROM Memory of 256 KB.
- The manufacturer / supplier shall modify the compatibility of CMRI with the meter and the base computer system due to any change in language or any other reasons at their own cost within guarantee period.
- The CMRI shall be type tested for:
    a) Tests of Mechanical requirement such as Free fall test, Shock Test, Vibration test
    b) Tests of Climatic influences such as Tests of Protection against Penetration of Dust and Water (IP 6X), Dry Heat test, Cold Test, Damp Heat Cyclic Test,
    c) Tests for Electromagnetic Compatibility (EMC),
    d) Test of Immunity to Electromagnetic HF Fields and
    e) Radio Interference Measurement.
- The equipments offered shall be fully type tested at approved laboratory by National Accreditation Board for Testing and Calibration Laboratories (NABL) as per relevant standards within last 5 years from the date of opening of tender & the type test reports shall be enclosed with the offer.

12.18 Computer Software

- For efficient and speedy recovery of data downloaded through CMRI on base computer, licensed copies of base computer software shall have to be supplied free of cost. This software will be used at number of places up to Division level. As many copies of base computer software as required up to Division level shall be provided by Supplier.
- The meter shall be capable to communicate directly with laptop computer. Base Computer Software shall be suitable for all types of dot matrix & inkjet printers.
- The Base Computer Software shall be "Windows" based & user friendly. The data transfer shall be highly reliable and fraud proof (No editing shall be possible on base computer as well as CMRI by any means). The software shall have capability to convert all the data into ASCII format.
- The total time taken for downloading Billing, Tamper and Load Survey Data for 45 days shall be less than or equal to 5 minutes.
- Downloading time of only Billing data shall be less than or equal to 20 secs.
- It shall be possible to upload the CMRI data to any PC having CMRI software. A consumer based data uploading facility is required so that CMRI shall upload data only in that PC which has the concerned consumers` data. The consumer code + meter no. shall be the key for creating consumers` files or overwriting consumers` files in PC. The software system files and data files shall be stored in different directories.
- The "record number field shall be 10 digits Alphanumeric (2 digits for Zones, 2 for Circle & 6 for consumer No.). Before accepting the data for "Record Number" the system shall wait for pressing of "Enter" key.
- Two separate fields shall be provided for consumer name and address – one name field of one line, and other Address field of two lines.
- The BCS software shall create one single file for the uploaded data, e.g. if CMRI contains the meter readings of, say, 2,000 consumer meters and the said data is uploaded to BCS, then the BCS shall create a single file containing separate records for each consumer meter reading.
- Also there shall be a provision to give filenames while creating the file.
- As and when the meter manufacturer releases new or latest or advanced versions of meter hardware / firmware / software, the same shall be made available to purchaser immediately on the release date free of cost. The latest version shall support all existing hardware / meters in the field.
- The meter samples shall be tested by our IT Department for the time required for downloading the data as per specifications and as confirmed by the bidder.
- Downloading software shall also be provided so as to install on our Laptop for downloading data directly on Laptop from meter without the use of CMRI.
- The software provided on laptop or PC shall be compatible to read the data from USB drive and for that purpose a sample cable (1 No.) shall be provided with USB termination. USB being the de-facto standard, this is the requirement.

Manufacturer may have to depute Hardware Engineers and Software engineers on call basis who shall have thorough knowledge of meter hardware / software used for downloading and converting so as to discuss the problems, if any, or any new development in the hardware / software with Executive Engineer, Store and Purchase, UPCL, Dehradun.

12.19 Connection Diagram and Terminal Markings

The connection diagram of the meter shall be clearly shown on inside portion of the terminal cover and shall be of permanent nature. Meter terminals shall also be marked and this marking shall appear in the above diagram. **Stickers of any kind shall not be accepted**.

12.20 Name plate and Markings

Meter shall have a name plate clearly visible, effectively secured against removal and indelibly and distinctly marked

with all essential particulars as per relevant standards. The manufacturer's meter constant shall be marked on the Name Plate.

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

a) Purchase Order No.
b) Month and Year of manufacture
c) Name of purchaser: i.e. UPCL
d) Guarantee Five Years
e) ISI mark
f) **Category of Meter:** Category C – HT (PT / CT) Consumer Meter. The lettering shall be bold in 3 mm font.

The meter Serial No. shall be Bar Coded along with Numeric No. The size of Bar Code shall not be less than 35x5 mm. Meter serial no. and Bar code on sticker shall not be acceptable.

A sticker label containing warning notice in Hindi / English language which is to be stick up on meters front cover or printed on meter name plate with easily readable font size not less than 10 in red colour

12.21 Tests

12.21.1 Type Tests

The meter offered shall have successfully passed all type tests described in the IS: 14697 / 1999 (amended upto date), external AC / DC magnetic influence tests as per CBIP Tech Report 304 with latest amendments and the meter data transfer and communication capability as per IS: 15959 / 2011 amended upto date.

- The Type Test Reports shall clearly indicate the constructional features including Optical port & RS-232 port connectivity of the type tested meter.
- The type test reports of the meter shall be same as the meter offered. Separate type Test Reports for each offered type of meter shall be submitted.
- The Type Test Certificate as per IS: 14697 / 1999 (amended upto date) shall be submitted along with the offer. The Type Test certificate carried out during last three years prior to the date of offer shall be valid.
- The Type test certificate of metering protocol as per IS: 15959 / 2011 shall not be more than 36 months old.
- All the type test reports needs to be approved from Executive Engineer, Store and Purchase, UPCL, Dehradun.
- The Type test certificate of metering protocol as per - Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification may also be acceptable alongwith offer for evaluation purpose only.
- All the Type Tests shall be carried out from Laboratories which are accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) of Govt. of India such as CPRI, ERDA, ERTL, etc. to prove that the meter meets the requirements of specification. Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.
- Further Purchaser shall reserve the right to pick up energy meters at random from the lots offered and get the meter tested at third party lab i.e. CPRI / agencies listed at Appendix-C of Latest – standardization of AC static electrical energy meters – CBIP publication NO.-304/ NPL / CQAL/ ERTL / ERDA at the sole discretion of the Purchaser.
- The supplier has no right to contest the test results of the third party lab or for additional test and has to replace/take corrective action at the cost of the supplier.
- It shall be the responsibility of the supplier to arrange such additional tests and Purchaser shall be informed of the date and time of conduction of tests well in advance to enable him to witness such tests. Test charges of the testing authority, for such successful repeat type tests, shall be reimbursed at actual by the Purchaser.

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

12.21.2 **Acceptance Test**

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

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

Additional Acceptance test of offered Energy meters as stated at cl. No. 21.03 carried out at third party NABL accredited lab shall be submitted and got approved from office of Executive Engineer, Store & Purchase, UPCL, Dehradun before commencement of supply.

12.21.3 **Additional Routine tests**

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

- Transportation Test: At least 50% of the samples of the meters be tested for error at Imax, Ib and 5% Ib at unity power factor and 50% Imax and 10% Ib at 0.5 lagging Power Factor besides checking them for starting current. The meter shall be tested with meter cover duly tightened and sealed properly. After recording these errors, the meters be put in their normal packing and transported for at least 50 km in any transport vehicle such as pick up van, Jeep, etc. on uneven rural roads and then re-tested at all these loads after the transportation. The variation in errors recorded before and after transportation shall not exceed 1% at higher loads and 1.5% at low loads.
- Other Acceptance Tests:
    1. The meter shall withstand continuously for a period of at least 5 minutes at a voltage of 440 V between phase and neutral without damage / problems.
    2. Tamper Conditions as stated in this specification
    3. Glow Wire testing for polycarbonate material
    4. Power Consumption Tests
    5. The meter shall comply all the tests for external AC / DC (except 0.2 Tesla AC magnet test) magnetic field as per CBIP Tech Report 304 with latest amendments.
- Moreover, the magnetic influence test for permanent magnet of 0.5 Tesla for a minimum period of 15 minutes shall be carried out by putting the magnet on the meter body.
- If the accuracy of the meter gets affected during the test, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering maximum value current (Imax) and reference voltage at unity power factor.
- After removal of magnet, meter shall be subjected to accuracy test as per IS 14697 / 1999 (amended up to date).
    6. No deviation in error is allowed in the class index as per IS: 13779/ 1999 (amended up to date) & this specification.
    7. The meter shall withstand impulse voltage at 10 kV.
    8. The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 14697:1999 amended up to date. For any higher signals than the present standards and UPCL technical specifications indicated above, the energy meters shall be immune & the accuracy of meter shall not get affected.

Jammer Test shall be carried out at UPCL testing division lab.

The test 8.21.3.2 (i) to (iv) shall be carried out at factory for each inspected lot at the time of pre-dispatch inspection.

The tests 8.21.3.2 (v), (vi) & (vii) shall be carried out on one sample from first lot as per procedure laid down in IS: 14697 / 1999 (amended up to date) and CBIP Tech. Report 88 in NABL LAB.

The test report shall get approved from Executive Engineer, Store and Purchase, UPCL, Dehradun before commencement of supply.

12.22 Guaranteed technical Parameters

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

12.23 Pre-Dispatch Inspections

All Acceptance Tests and Inspection shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall offer to the inspector representing the purchaser, all the reasonable facilities, free of charge, for inspection and testing, to satisfy him that the material is being supplied in accordance with this specification. The Company's representative / Engineer attending the above testing shall carry out testing on suitable number of meters as per sampling procedure laid down in IS: 14697 / 1999 (amended up to date) and additional acceptance test as per this specification and issue test certificate approval to the manufacturer and give clearance for dispatch. All the meters offered for inspection shall be in sealed condition. The seals of sample meters taken for testing & inspection shall be break open & resealed after inspection. The first lot of meter may be jointly inspected by the Executive Engineer, Testing Division and the Executive Engineer, Inspection Wing.

12.24 Joint Inspection after Receipt At Stores (Random Sample Testing)

From each lot (lot means the total number of meters received in a Store out of inspected and approved lot by Electrical Executive Engineer (Inspection Wing) or purchaser's representative under one approval letter) of meters received at Stores, Store Centers. 5 sample meters shall be drawn (meters received in damage condition shall not be selected as samples) and these meters shall be tested by our Testing Engineer in presence of Supplier / Supplier's representative jointly for (i) Starting Current, (ii) Limits of error, (iii) Repeatability of error, (iv) No Load Test as per IS: 13779/1999 (amended upto date), (v) Tamper conditions as per technical specifications and (vi) Data downloading time as per specifications.

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

12.25 Guarantee

The meter & CMRI shall be guaranteed for the period of five years from the date of commissioning or five and half year from the date of dispatch whichever is earlier. The meter / CMRI found defective within above guarantee period shall be replaced by the supplier free of cost, within one month of receipt of intimation. If defective meter / CMRI is not replaced within the specified period as above, the Company shall recover an equivalent amount plus 15% supervision charges from any of the bills of the supplier.

12.26 Packing

- The meters shall be suitably packed in order to avoid damage during transit or handling. Each meter may be suitably packed in the first instance to prevent ingress of moisture and dust and then placed in a cushioned carton of a suitable material to prevent damage due to shocks during transit. The lid of the carton may be suitably sealed. A suitable number of sealed cartons may be packed in a case of adequate

strength with extra cushioning. The cases may then be properly sealed against accidental opening in transit. The packing cases may be marked to indicate the fragile nature of the contents.

- The following information shall be furnished with the consignment;
    a. Name of the consignee.
    b. Details of consignment.
    c. Destination.
    d. Total weight of the consignment.
    e. Sign showing upper / lower side of the crate.
    f. Sign showing fragility of the material.
    g. Handling and unpacking instructions.
    h. Bill of Material indicating contents of each package and spare material.

12.27 Tender Samples

Tenderer are required to submit 11 (Eleven) nos. of sample meters of offered type as per technical specifications along with 2 no. of sample CMRI (IR Compliant 1 no. & DLMS compliant 1 No.) and the API software & documentation, etc. to Executive Engineer (Store/Purchase) in the office of the Executive Engineer, Store and Purchase, UPCL, Kaulagarh, Dehradun one working day before the time & date stipulated for submission of offer for testing the sample meters in third party NABL Lab like ERDA, CPRI, CIPET, ERTL, etc. and testing the offered API by our IT Department as per technical specifications.

The offer of those eligible bidders shall only be considered if the samples pass the tests at NABL Lab as well as necessary certification from our IT Department for the offered API. The results of NABL Lab and the certification from IT Department for offered API shall not be disputed and it shall be binding on the bidder.

The required information such as Manufacturer's Name or Trade Name, Sr. No., ISI Certification No., etc. shall be on stickers to be affixed on outer portion of sample meters being submitted along with the offer. Such information shall not be embossed or printed on any part of the sample meter.

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

12.28 Quality Control

- The purchaser has a right to send a team of experienced engineers for assessing the capability of the firm for manufacturing and testing of meters as per this specification. The team shall be given all assistance and co-operation for inspection and testing at the bidder's works. 3 tender samples shall be kept ready for assessing and testing. The tenderer shall extend all facilities for carrying out the testing of these samples.
- The meters supplied shall give service for a long period without drifting from the original calibration & performance must be near to zero percent failure.

12.29 Minimum Testing Facilities

Manufacturer shall possess fully computerized Meter Test Bench System for carrying out routine and acceptance Tests as per IS: 14697/1999 (amended up to date). Test Reports for each and every meter shall be generated. The list of testing equipment shall be enclosed. The manufacturer shall have the necessary minimum testing facilities for carrying out the following tests:

a. AC Voltage Test
b. Insulation resistance measurement,

c. Test on No load condition,

d. Test on Limits of error

e. Test on Starting current,

f. Test on Accuracy requirement,

g. Test of Power consumption,

h. Repeatability of error test

i. Shock Test

j. Vibration Test

k. Transportation test,

l. Tamper conditions

m. Long Duration Test

n. The manufacturer shall have duly calibrated RSS meter of class 0.1 or better accuracy.

o. The manufacturer shall have Glow Wire Testing facility.

p. The bidder shall have fully automatic Test Bench having in-built constant voltage, current and frequency source with facility to select various loads automatically and print the errors directly.

12.29.1 **Meter Software**

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

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

12.30 Manufacturing Activities

- Meters shall be manufactured using latest and 'state of the art' technology and methods prevalent in electronics industry. The meter shall be made from high accuracy and reliable surface mount technology (SMT) components. All inward flow of major components and sub assembly parts (CT, PT, RTCs / Crystal, LCDs, LEDs, power circuit electronic components etc.) shall have batch and source identification. Multilayer 'PCB' assembly with 'PTH' (Plated through Hole) using surface mounted component shall have adequate track clearance for power circuits. SMT component shall be assembled using automatic 'pick-and-place' machines, Reflow Soldering oven, for stabilized setting of the components on 'PCB'. For soldered PCBs, cleaning and washing of cards, after wave soldering process is to be carried out as a standard practice.
- Assembly line of the manufacturing system shall have provision for testing of sub-assembled cards. Manual placing of components and soldering, to be minimized to items, which cannot be handled by automatic machine. Handling of 'PCB' with ICs / C-MOS components, to be restricted to bare minimum and precautions to prevent 'ESD' failure to be provided.
- Complete assembled and soldered PCB shall undergo functional testing using computerized Automatic Test Equipment. Test points shall be provided to check the performance of each block / stage of the meter circuitry. RTC shall be synchronized with NPL time at the time of manufacture. Meters testing at intermediate and final stage shall be carried out with testing instruments, duly calibrated with reference standard, with traceability of source and date.
- The manufacturer shall submit the list of plant and machinery along with the offer.
- Quality shall be ensured at the following stages:
  a. At PCB manufacturing stage, each Board shall be subjected to computerized bare board testing.

b. At insertion stage, all components shall undergo computerized testing for conforming to design parameters and orientation.
c. Complete assembled and soldered PCB shall undergo functional testing using Automatic Test Equipment (ATEs).
d. **Important**: - Prior to final testing and calibration, all meters shall be subjected to ageing test (i.e. Meters shall be kept in heating chamber for 72 hours at 55^{O}C temperature at full load current. After 72 hours, meters shall work satisfactory) to eliminate infant mortality.

- The calibration of meters shall be done in-house.
- The bidders shall submit the list of all (imported as well as indigenous) components to be used in meter, separately along with the offer. List of makes of components is attached herewith as a guide line (Schedule -III).
- Bought out items: A detailed list of bought out items which are used in the manufacturing of the meter shall be furnished indicating the name of firms from whom these items are procured. The bidder shall also give the details of quality assurance procedures followed by him in respect of the bought out items.
- List of Plant and Machinery used for production of energy meters.

Table 12-9 List of Plant and Machinery

Sr. No	List of Plant and Machinery used for production of energy meters	
1.	Fully automatic testing Bench with ICT for testing link less meters	Routine Testing and Calibration of Meters
2.	Semi-automatic testing Bench with MSTV	Routine Testing and Calibration of Meters
3.	IR Tester	Insulation testing
4.	HV Tester	Insulation testing
5.	Error calculators	Error testing
6.	Long duration Running test set ups	Reliability testing
7.	Reference Meters class 0.1 accuracy	Error Calculation
8.	Ultrasonic Welding Machines	Welding of meters
9.	Automatic Pick and Place Machines	Automatic placing of SMT components
10.	Solder Paste Printing Machine	SMT Soldering
11.	Solder Furnace IR reflow	SMT Soldering
12.	PCB Scanner	For testing of PCBs
13.	ATE functional tester	For testing of components
14.	Programmers and Program Loaders	Chip Programming tools
15.	CAD PCB designing setups	PCB designing
16.	Furnace IR type for Hybrid Micro Circuits	Resistance network and HMC manufacturing
17.	Laser Trimming Machines	Trimming of resistances for higher accuracy measurement
18.	Wave Soldering Machines	Wave soldering of PCBs
19.	Humidity Chamber	Accelerated testing for life cycle
20.	Dry Heat Test Chamber	Accelerated testing for life cycle
21.	Thermal Shock Chamber	Accelerated testing for life cycle

Sr. No	List of Plant and Machinery used for production of energy meters	
22.	Pro-e Mechanical Design stations	Mechanical CAD station
23.	Spark erosion tools fabricating machine	Tool fabrication and die manufacturing
24.	CNC wire cut tool fabrication machine	Tool fabrication and die manufacturing
25.	Injection Moulding Machine	Moulding of plastic materials
26.	CNC milling machine for composite tool fabrication	Tool fabrication and Die manufacturing
27.	Vibration testing machine	Vibration testing of meters
28.	Glow wire test machine	Testing of Plastic material
29.	Fast transient burst testing setup	Type testing of Meters
30.	Short term over current testing setup	Type testing of Meters
31.	Magnetic and other testing setup	Tamper Testing
32.	Impulse Voltage Testing Setup	Type testing of Meters
33.	Composite Environmental testing chambers	Type testing of Meters

12.31 Quality Assurance Plan

The tenderer shall invariably furnish QAP as specified below along with his offer, the QAP adopted by him in the process of manufacturing.

The bidder shall invariably furnish the following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.

a. Statement giving list of important raw materials, names of sub - suppliers for the raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.

b. Information and copies of test certificates as in (i) above in respect of bought out accessories,

c. List of manufacturing facilities available,

d. Level of automation achieved and list of areas where manual processing exists,

e. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

f. List of testing equipments available with the bidder for final testing of equipment specified and test plan limitation, if any, vis-à-vis, the type, special acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly bought out in schedule of deviation from specified test requirements.

The successful bidder shall within 30 days of placement of order, submit following information to the purchaser.

a. List of raw materials as well as bought out accessories and the names of sub - suppliers selected from those furnished along with offers.

b. Type test certificates of the raw materials and bought out accessories if required by the purchaser.

c. Quality assurance plan (QAP) with hold points for purchaser's inspection. The quality assurance plant and purchasers hold points shall be discussed between the purchaser and bidder before the QAP is finalized.

The contractor shall operate systems which implement the following.

a. **Hold point**: A stage in the material procurement or workmanship process beyond which work shall not proceed without the documental approval of designated individuals organizations. The purchaser's written approval is required to authorize work to progress beyond the hold points indicated in quality assurance plans.
b. **Notification point**: A stage in the material procurement or workmanship process for which advance notice of the activity is required to facilitate witness. If the purchaser does not attend after receiving documented notification in accordance with the agreed procedures and with the correct period of notice, then the work may proceed.

The successful bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing if required by the purchaser and ensure that Quality Assurance program of the contractor shall consist of the quality systems and quality plans with the following details.

a. The structure of the organization.

- The duties and responsibilities assigned to staff ensuring quality of work.
- The system for purchasing taking delivery and verification of material.
- The system for ensuring quality workmanship.
- The system for retention of records.
- The arrangement for contractor’s internal auditing.
- A list of administration and work procedures required to achieve and verify contractor's quality requirements.
- These procedures shall be made readily available to the project manager for inspection on request.

b. 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

12.32 Component Selection

As per Schedule – III enclosed.

12.33 Schedules

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

12.33.1 **Schedule – I Guaranteed Technical particulars**

As per GTP parameters uploaded on e- tendering site

12.33.2 **Schedule – II Tenderer's experience**

TENDERER'S EXPERIENCE

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

Sr. No. Name of client Order No. & date Qty. ordered Qty. supplied

NAME OF FIRM _____

NAME & SIGNATURE _____

DESIGNATION _____

DATE _____

12.33.3 Schedule - III Component Selection

Sr. No	Component Function	Requirement	Make & Origin
1.	Current Transformer	The Meters shall be with the current transformers as measuring elements.	The current transformer shall withstand for the clauses under 5 & 9 of IS: 14697 / 1999
2.	Measurement or computing chips	The measurement or computing chips used in the Meter shall be with the Surface mount type.	**USA:** Analog Devices, Cyrus Logic, Atmel, Philips, Teridian. Dallas, ST, Texas Instruments, Motorola, Maxim, National Semiconductors, Freescale, Onsemiconductors **Germany:** Siemens. **South Africa**: SAMES. **Japan**: NEC, Toshiba, Renasas, Hitachi. **Austria**: AMS **Holland**: Philips (N X P)
3.	Memory Chips	The memory chips shall not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. Meter shall have non-volatile memory (NVM). No other type of memory shall be used for data recording and programming. (The life of the NVM is highest) There shall be security isolation between metering circuit, communication circuit, and power circuit	**USA**: Atmel, Teridian, National Semiconductors, Philips, Texas Instruments, ST, Microchip, Spanson (Fujitsu), Ramtron **Japan**: Hitachi, Renasas **Germany**: Siemens
4.	Display Modules	e. The display modules shall be well protected from external UV radiations. f. The display visibility shall be sufficient to read the Meter mounted at height of 0.5 meter as well as at the height of 2 meters (refer 3.2 d for viewing angle. g. The construction of the modules shall be such that the displayed quantity shall not disturbed with the life of display (PIN Type). h. It shall be trans- reflective HTN or STN type industrial grade with extended temperature range. HTN – Hyper Twisted Nematic (120°)	**Singapore**: E-smart, Bonafied Technologies, Display Tech. **Korea**: Advantek, Jebon, Union Display Inc., **Japan**: Hitachi, Sony, L&G. **Malaysia**: Crystal Clear Technology **Hong Kong:** Genda **China:** Success, Tinma,Hiajing, Truly

Sr. No	Component Function	Requirement	Make & Origin
		STN – Super Twisted Nematic (160°)	
5.	Communication Modules	Communication modules shall be compatible for the two ports (one for Optical port for communication with meter reading instruments (CMRI) & the other for the hardwired RS-232 port to communicate with various modems for AMR)	**USA**: Agilent, HP, Fairchild, National Semiconductors, Optonica **Holland**: Philips **Korea**: Phillips. **Japan**: Hitachi. **Taiwan**: Ligitek
6.	Optical Port	Optical Port shall be used to transfer the meter data to Meter reading instrument. The mechanical construction of the port shall be such to facilitate the data transfer easilty.	**USA:** HP National, Semiconductor, Maxim **Holland / Korea**: Phillips **Japan:** Hitachi **Taiwan:** Ligitek
7.	Power Supply	The power supply shall be with the capabilities as per the relevant standards. The power supply unit of the meter shall not be affected in case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections. It shall not also be affected by magnet.	SMPS type
8.	Electronic Components	The active & passive components shall be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	**USA**: National Semiconductors, Atmel, Philips, Texas Instruments, BC Component Analog devices, ST, Maxim, Kemet Onsemiconductors, Freescale, Intersil, Raltron, Fairchild, Muruta, Agilent, AVX, Abracon, Sipex, Diode Inc., Honeywell, Power Integration, Fox, Roham. **Japan**: Hitachi, Oki, AVZ or Rcon, Toshiba, Epson, Kemet, Alps, Muruta, TDK, Sanyo, Samsung, Panasonic **India:** Keltron, Incap, VEPL, PEC, RMC, Gujarat Polyavx, Prismatic, MFR Electronic components Pvt. Ltd., Cermet **Korea:** Samsung **Germany:** Vishay, Epcos, Diotech, Kemet

Sr. No	Component Function	Requirement	Make & Origin
9.	Mechanical Parts	The internal electrical components shall be of electrolytic copper & shall be protected from corrosion, rust etc. The other mechanical components shall be protected from rust, corrosion etc. by suitable plating / painting methods.	
10.	Battery	Only non-rechargeable battery shall be used for RTC as well as display in absence of Power since the life & reliability of these are better than the rechargeable batteries.	**USA:** Maxell, Renata **Japan:** Panasonic, Sony, Mitsubishi, Sanyo **Germany:** Varta **France:** Saft **Korea:** Tekcell, Vitzrocell Israel: Tadiran.
11.	RTC and Microcontroller	The accuracy of RTC shall be as per relevant IEC / IS standards.	**USA**: ST, Teridian, Philips, Dallas, Atmel, Motorola, Microchip. **Japan**: NEC, Oki, Epson
12.	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm	

13. Technical Specifications for AC Static single phase, two wire (10-60 Amp) rating, Whole Current, Bi- Directional, Class-1 Accuracy Energy Meters for Net Metering for solar power generators with Box

13.1 Scope

This specification covers the design, engineering, manufacture, assembly stage-testing, inspection and testing before supply of A.C. single phase two wire static whole current bi-directional electronic energy meters of accuracy class 1.0 and current rating 10-60Amps, with backlit LCD display for net metering for solar power generators as per requirement given in this specification. The above meters shall be supplied in a pilfer proof box (cup-board) which shall be weather proof made of poly-carbonate with flame retardant properties as per technical specification. The meter and meter box (cup-board) shall be supplied in suitable packing so as to withstand transit shock. The meter should be single phase two wire, two element type capable to record and display energy (Import, Export & Net) in kWh and demand in kW for single phase two wire A.C. loads for power factor range of Zero Lag-Unity-Zero lead, as per requirement given in this specification.

The meter shall have facility for downloading data with proper security via an optically isolated or an infrared communication port. Proper data security should be available with the meters so that no data alteration of meter should not be possible through the meter-reading instrument / HHT to avoid meter tampering.

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 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 necessary for their effective and trouble free operation of the system for energy measurement. 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.

The offered meter shall have BIS certification i.e. the offered meters shall be ISI marked and bidder shall have to furnish the notarized ISI license as on date of bid opening. Firm must have NABL accredited lab for acceptance tests of energy meters as per IS. Bidder must have CMMI-DEV maturity level-3 certificate for software development.

13.2 Climatic Conditions

The meters to be supplied against this specification should be suitable for satisfactory continuous operation under the following tropical conditions. Meters should be capable of maintaining required under hot, tropical and dusty climatic conditions.

Table 13-1: Climatic Conditions

S. No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-5
3	Relative humidity range (%)	10 to 100

S. No.	Particulars	Value
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

7.2.2 Tropical Treatment

The meters shall be suitably designed and treated for normal life and satisfactory operation under hot & hazardous tropical climate conditions and shall be dust and vermin proof. All the parts & surface, which are subject 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 injurious effect of excessive humidity.

13.3 Standards Applicable

Unless otherwise specified elsewhere in this specification, the performance & testing of the meters shall conform to the following Indian/International standards with updated and latest amendments /revisions thereof.

Table 13-2 Standards applicable

1.	IS:13779-1999 (with latest amendments)	Specification for AC static watt hour meters Class 1 & 2
2.	IEC 62052–11	Electricity metering equipment (AC) – General requirements & test conditions Part 11. metering equipment
3.	IEC 62053-21	Electricity Metering equipments (AC)- particular Requirements – Part – 21 Static meters for active Energy (class 1 & 2)
4.	IEC 62053-61	Electricity Metering Equipment (a.c.)-Particular requirement-Part- 61 -Power consumption and voltage requirements
5.	IEC – 61000-4-5 (2001-04)	Electromagnetic capability, Testing and measurement Techniques, Surge immunity test
6.	IEC 61358:1996	Acceptance inspection for direct connected AC static Watt hour meter for active energy (class 1 & 2)
7.	IS: 14772:2000	Specification for boxes for the enclosure of electrical accessories
8.	CBIP, New Delhi technical Report No. 88 (revised July 1996) read with latest edition /amendments issued till date.	Specification for AC static electrical energy meters.
9.	IS : 9000	Basic Environmental testing procedures for Electronic & Electrical items.

In case of any conflict or discrepancy the order of precedence shall be (i) IS (ii) IEC (iii) CBIP technical report-88 (read with latest edition/amendments). In case of any difference between the provisions of these standards and the provisions of this specification, the provisions contained in this specification shall prevail.

13.4 Principal Parameters

The meter shall conform to following parameters:

Table 13-3 Principal Parameters

1.	Type of installation	Outdoor installation (inside meter box)
2.	System Voltage	240 V,-40% to +20% (phase to neutral)
3.	System frequency	50 Hz ± 5%
4.	No. of phases	Single phase two wire
5.	System of earthing	solidly grounded
6.	Resistance to surge /impulse voltage of 1.2 / 50 Microsecond	10 kV peak
7.	Test Voltage at 50 Hz for 1 minute	2 kV rms
8.	Meter should be able to with stand up to 450 V P-N for 15 minutes continuously	

13.5 Technical Requirements

a) Rated voltage (Vref) :240 V phase to neutral (Single phase, two wire system)
b) Rated current :Basic current 10 A (Ib) Max. current 60A (Imax)

13.6 Supply System & Power Supply Variation

The supply system shall be LT 240 volts, phase to neutral, single phase two wire.

The extreme power supply variation for which an operating meter should withstand without damage and without degradation of its metrological characteristics when it is subsequently operated under its normal operating conditions shall be as follows:

Specified operating range :0.80 to 1.1Vref

Limit range of operation :0.60 to 1.2 Vref

The limits of error for voltage variation of + 20% to -40 % of Vref, shall be as under:

i)	Voltage variation between – 40% to +20%	Ib Ib	1 0.5 lag	0.7 1.0
ii)	10% of 3rd harmonic in current circuit	0.6 Ib 0.6Imax	UPF UPF	0.6 0.6

However, the bidder can offer meters which can withstand higher variations. Meter shall be functional & able to register energy even if the voltage falls up to 50% of the rated voltage.

13.7 Power Factor Range:

The meter shall be suitable for full power factor range from zero(lagging) through unity.

13.8 Accuracy

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

13.9 Power Consumption

a) Voltage circuit: The active and apparent power consumption in voltage circuit including the power supply of meter at reference voltage reference frequency and reference temp. shall not exceed 1.0 watt and 8 VA respectively.
b) The apparent power taken, under normal operating condition, by the current circuit at basic current, reference frequency and reference temp shall not exceed 1VA.

13.10 Starting Current

Meter should start registering energy at 0.2 % of Ib at UPF in main and neutral circuit.

13.11 Running With No – Load

When 70% and 120% of rated voltage is applied with no current flowing in current circuit, the test output of the meter shall not produce more than one pulse / count. The minimum test period for this test shall be as per clause 8.3.2 of IEC 62053-21.

13.12 Auxiliary Power

The meter shall draw power for working of electronic circuit from phase and neutral.

13.13 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) Each current circuits of 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 normal time constant) carrying 1.25 times the reference voltage, the temperature rise of the respective parts shall not exceed the value given below and above an ambient temperature of 50^0 C.
    a. Winding :50^0 C
    b. External surface of the case :15^0 C

13.14 General and Constructional Requirements

Meter shall be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. The following should be ensured:

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
v. Protection against fraud.
vi. Prevention against pilferage.

13.15 Meter Case

a) Meter case (base and cover) and extended terminal block cover (ETBC) shall be made of unbreakable high grade flame retardant & injection moulded in UV stabilized poly carbonate with minimum thickness of 2.0

mm on all sides. Meter case (base and cover) and ETBC shall be totally transparent but supplier may provide translucent /opaque meter base. In case supplier offers meter with single moulded base & cover, translucent /opaque base & cover of meters shall also be accepted. The material shall be of good dielectric strength and mechanical strength. The name plate shall be very small in size and shall preferably be transparent. It shall not obstruct the visibility of components.

b) The moulded meter case should not change in colour, Shape, size, dimensions when subjected to 200 hrs on UV test as per ASTMD 53. It should withstand 650 deg. C. glow wire test and heat defection test as per ISO 75.

c) The manufacturer shall emboss on the base and cover the name of the material they have used in an abbreviated form e.g. PCFR (to denote what they have used - flame retardant poly carbonate).

d) The meter cover shall be fixed on meter base with the help of 2 nos. internal locks so that after pressing the cover on the base the cover will be fixed and cannot be opened without breaking the internal locks.

e) The meter cover & base shall have provision of fixing a push fit seal in the pre moulded female part on the cover & base of the meter so that after fitting the push fit seal in this, the meter box and cover cannot be opened. This arrangement shall be provided in 2 points, one at left side and one on right side.

f) Supplier may provide meters with internal locking arrangement through unidirectional screws or endless rivets and provision of two nos. of push fit polycarbonate seals on left side & right side of meter base & cover, however supplier shall ensure that it is not possible to lift the meter cover from the meter base at all without breaking cover. Although meters with arrangement as mentioned at 'e' shall be preferred.

g) Meter base and cover should be made in a single mould or the meter shall be seamlessly ultrasonically welded. The seamless ultrasonic welding of meter case shall be such that if in case of any attempt to open the meter cover from base, there should be a clearly visible evidence of opening / tampering of meter case.

h) The meter case of the sample meters to be furnished after opening of Part-I by the successful bidders only, should be as per above and at the time of sample testing, it shall be opened to ascertain conformity of seamless ultrasonic welding as per specification.

i) The meter case shall have the following properties of plastic material:

S. No.	Property	Units	Value	Standards
1.	Physical water absorption	%	Max. 0.35	ASTMD 570/ IS:5133(part 2) :1969
2.	Electrical Dielectric strength at 90 deg. C. in oil.	KV/ MM	Min 16	ASTMD 149
3	Thermal HDT	Deg.C	Min. 125	ASTMD 648/ ISO 75
4.	Flammability a) Rating b) Glow wire test 650^0 C		 FV 2 Passes	 UL94/ IS:11000(part 2-sec-1) IEC-60695-2-1-12 & IS:11000-2-1
5.	Mechanical a) Tensile strength b) Flexural strength c) Modulus of Elasticity d) Izod impact strength notched 23^0 C	 MPa MPa MPa KJ/Sq.M	 Min. 50 Min. 90 Min. 2000 Min. 8	 ISO 527 / any equivalent standard ISO 178 / any equivalent standard ISO 178 / any equivalent standard ISO 180/1A or any equivalent standard

13.16 Meter Box:

a) Meter box shall be made of transparent polycarbonate material. It shall be weather proof, capable of withstanding temperature of boiling water for 5 minutes continuously without distortion or softening. It

shall withstand glow wire test at 650^0 C as per IS: 1100. HDT of polycarbonate material shall be 120^0 C at 1.8MPaoC.

b) Minimum thickness of box shall 2.0 mm from all sides.
c) The meter box shall have tapering down roof for easy flow of rain water.
d) Groove shall be provided by the firm in the meter box cover at the place of optical port for taking reading through MRI without opening the meter box cover.
e) Meter box shall be totally transparent (top & bottom) press fit type with non-detachable (4 nos.) push fit arrangement which shall be an integral part of meter box and cannot be detached from the base without breakage along with specially designed molded polycarbonate tamper proof transparent seals at two points from the front side with serial no, company logo & purchase name.
f) The size of meter box (length, breadth and height) shall be such that there should be a minimum of 20 mm clearance on all sides from the meter sides except the bottom side which should be minimum 60 mm from the lower edge of terminal block and 15 mm clearance on front and 10mm clearance from back of the meter.
g) The cover shall be made overlapping type having collars on all four sides. The box shall be provided with semicircular / circular gasket of sufficient size to completely fit in the grooves of the base. The gasket should be made of neoprene rubber. The base of the meter box must have a groove to hold the gasket and the overlap of the top cover with the base must be minimum 6 mm (with gasket).
h) It should be possible to access the push button of the meter without opening the main meter box cover and suitable arrangement for access to meter push button shall be provided.
i) There should be no internal elevation of excess plastic wall of window of meter box as it is hampering the meter reading process.
j) A general arrangement for fixing the meter shall be made inside the box. The design of the meter box will be such as to facilitate easy wiring and terminals should be easily approachable. Soft rubber gasket for protection from ingress of dust and moisture shall be provided on all around cover. The meter box shall have minimum 4 Nos. holes of 6mm dia for fixing the meter box on wall / wooden board.
k) The manufacturer shall emboss or fix a sticker on the base and cover the name of the material they have used in an abbreviated form e.g. PCFR (to denote what they have used - flame retardant poly carbonate).
l) On front side of meter box there should be provision of purchaser's name embossed or printed on a good quality sticker placed on inside of the box.

For every 1000 Nos. meters with meter box, 5 Nos. spare meter boxes shall be provided by the supplier free of cost for replacement purpose, etc.

13.17 Test for Meter Case (Base & Cover) & Meter Box

The following tests complying with IS: 14772:2000 (with latest amendment) are to be conducted on the meter case (base & cover) & meter box at any independent NABL accredited laboratory and test reports shall be submitted to Superintending Engineer (I&QA), UPCL within 15 days from the date of order.

i. Test of material identification
ii. Test for mechanical strength
iii. Test for water absorption
iv. Test for stability at high temperature
v. Test for withstanding temperature boiling water for 5 minutes continuously for non-distortion or softening of material.
vi. Glow wire test at 650^0 C as per IS :11000

13.18 Terminal Block, Terminal And Extended Terminal Block Cover

a) The terminal block shall be moulded type made of non-hygroscopic, flame-retardant material having good dielectric and mechanical strength. The moulded terminal block shall be made from best quality phenol formaldehyde conforming to IS: 13779-1999 (latest amended) having adequate insulating properties and mechanical strength with brass inserts for connecting terminals.

The terminal block should satisfy all the conditions specified in IS: 13779 and IEC 62052 - 11. The material of the terminal block should fulfill the requirement of following tests:

i. The flame retardant rating of V0 as per UL 94 testing.
ii. The glow wire test for temperature of 960^0 C as per IS: 11000 (Part-2/Sec.1) or IEC 60695-2-1.
iii. Heat deflection temperature (HDT) test of 135^0 C. as per ISO 75 or ASTM D-648
iv. Ball pressure test at 125^0 C as per IEC 60335-1.

b) The base of the meter should extend to enclose the three sides (back and two sides) of the terminal block.
c) The current circuit conductors of the meter shall be connected to its current terminals from inside the meter terminal block adopting procedure prescribed in either B-1 or B-2 of the recommended methods under IS:13779. Any other method which meets these requirements in a better manner/way shall also be considered. The bidder should elaborate the arrangement adopted.
d) 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% Imax. Current and made of electroplated (or tinned) brass. Any other provision which meets this in a better manner / way shall also be considered. The bidder should elaborate the provision adopted.
e) 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 shall be provided in each incoming and outgoing terminal 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.
f) The internal diameter of the terminal holes should be minimum 5.5 mm and should be adequately designed for inserting up to 16 mm2 Aluminum stranded armoured cable sizes and shall be capable of carrying continuous current up to 150% of Imax. The holes in the insulation 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.
g) The voltage circuit and the 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 circuit.
h) 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.
i) The meter shall be supplied with extended terminal block cover (ETBC). The ETBC shall be extended by minimum 25mm below the terminal block. To facilitate separate sealing, a raised support arrangement or a slot type arrangement with 2mm hole, which shall constitute an integral part of ETBC cover shall be provided. The terminal cover of the meter should be fixed to the terminal block in such a way that it should

not be possible to open the terminal cover once in locked position after installation without breaking the terminal cover or leaving visible evidence of tampering. The seal shall be placed in the meter box at specified place (not in loose condition) for providing sealing at site, after installation. The ETBC shall be designed such that the meter's internal parts are not accessible for tampering without breaking the seal(s). Suitable barriers in moulding shall be provided such that direct access to incoming/outgoing terminals is not possible through gaps left in cable entry holes after insertion of main/load side cables. The terminal cover shall be engraved/screen printed with logo of manufacturer and purchaser (if possible).

The alignment of incoming cable terminals on meter terminal block should be such that it is not directly in-line with the cable hole/gland on the meter box body, so that there is no chance of inserting any wire/cable from the gland hole directly to the incoming terminal on the TB to avoid probability of theft by making direct connection. If the holes for incoming and outgoing cables are provided on the sides of meter box then the same shall also be acceptable.

The terminal cover shall be provided with one colored polycarbonate tamper proof seal with suitable interlocking arrangement. The seal shall be embossed /indelibly marked or laser etched with serial number & logo of manufacturer with name, UPCL visible from front. Provision for seal should be made at one point from the front side of the meter terminal cover. The meter terminal cover shall be rendered inaccessible after the terminal cover press fit with base & sealed. The seal shall be placed in the meter at specified place (not in loose condition) to ensure sealing at site after meter installation.

13.19 Display Parameters and Type Of Display

The meter should have bright LCD electronic display with backlit of white/green/purple screen with black digit having minimum description of parameters (e.g. words like kWh, kW, BP Values etc) / character height X width of 8mm X 5mm or higher in auto scroll mode. The meter should have 6 digits display for reading/measuring parameters apart from liquid display.

By default the meter shall continuously display only Real time, date, whole digit active cumulative (import, export & net) energy (kWh) & maximum demand (import, export) (kW) without decimal point with 30 minutes integration of the current month with date & time. However, in Push button mode, all parameters shall be displayed. The LCD shall be of STN (Super Tested Pneumatics) type, construction suitable for temperature withstand of 80 deg. C (storage) and 65 deg. C (operation). The LCD Display should have a wide viewing angle of 45 deg to 60 deg cone, up to one meter distance.

Meter data shall not be lost in the event of power failure. The meter shall keep the energy and maximum demands recorded in its non-volatile memory independent of battery backup, so that in the event of power failure / damage of the meter the last reading of such billing quantities should not be lost.

The display shall not be affected by electrical & Mechanical disturbances. The Non-volatile Memory (NVM) shall have a minimum retention time of 10 years under un-powered condition i.e. the NVM shall have a storage life (without use) of 10 years. The battery back up memory will not be considered as NVM.

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

For clear visibility of the display of the meter reading at a distance, large viewing area with large display icons is preferred.

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

When the meter is placed in oven at a constant temperature of 65^0 C for period of 30 minutes, the character of LCD should not deform.

After keeping the meter at a constant temperature of 80^0 C for period of 30 minutes and when restored at normal temperature, the LCD should work satisfactorily.

The display of various parameters shall be scrolling one after another. The meter shall be capable to measure & display continuously 'Active energy kWh' at all the loads & power factors i.e. Zero lag – Unity – zero lead. The meter should also have provision for Automatic recording of cumulative kWh at 24.00 Hrs on the last day of the month for each calendar month & the same should go to memory.

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

13.19.1 Display parameters & type of Display

Auto-Display (Mode-1) shall display the following parameters in sequence continuously scrolling one after another. The display shall have "ON" time of at least 10 sec. for each measured values for auto display cycling:

i. Meter Serial No.
ii. Date
iii. Real Time
iv. Import Cumulative Active energy (kWh)
v. Export Cumulative Active energy (kWh)
vi. Net Cumulative Active energy (kWh)
vii. Import Present MD (kW)
viii. Export Present MD (kW)
ix. Instantaneous Load (kW)

Maximum Demand integration period shall be 30 Minutes. Auto resetting of MDI should be done at 24:00 hours of last day of each calendar month, for which manufacturer will program the calendar for minimum 30 years. However meter shall also have provision of maximum demand resetting through CMRI with proper security.

The following parameters shall be displayed, one after other, with press of push button (mode-2) provided on the meter. The display shall have on time of approx. 10 seconds for each measured value.

1. LCD segment check
2. Date (dd/mm/yy)
3. Real Time (hh/mm)
4. Meter Serial No.
5. Import Cumulative kWh
6. Export Cumulative kWh
7. Net Cumulative kWh (Cumulative Import kWh minus (-) Cumulative Export kWh)
8. Import Maximum Demand (kW) for the current & last 6 resets.
9. Export Maximum Demand (kW) for the current & last 6 resets.
10. High resolution display in kWh& kVAH with 2+4 (or higher no. of decimal digits) energy format (for dial test)
11. Instantaneous Voltage (V)
12. Instantaneous Current (I)
13. Instantaneous Load (kW & kVA)
14. Instantaneous Power Factor (PF)
15. Average Power Factor of current month **(for both import & export).**
16. Power OFF hours since last reset billing period.
17. Frequency.
18. Magnetic interference indication.
19. Cumulative power OFF hours.
20. LBP- Cumulative Import kWh reading at the time of prior to last reset
21. LBP- Cumulative Export kWh reading at the time of prior to last reset
22. LBP - Cumulative Import kVAh reading at the time of prior to last reset

23. LBP - Cumulative Export kVAh reading at the time of prior to last reset
24. LBP - Import Average PF at the time of prior to last reset
25. LBP - Export Average PF at the time of prior to last reset
26. LBP - Import Maximum demand in kW at the time of prior to last reset
27. LBP - Export Maximum demand in kW at the time of prior to last reset
28. Power OFF hours for the last billing period (LBP)
29. Cumulative Meter Power ON duration
30. MD reset count
31. Tamper Count

Display shall automatically come back to the auto-scroll mode, if the push-button is not pressed for one minute.

Note:

i. DOT matrix type LCD shall not be accepted.
ii. The LCD display of the meter should be backlit. The back lit should not glow during power off condition.
iii. The RTC accuracy should be as per CBIP report. Provision to set RTC through HHT/CMRI/communication should be provided.

DISPLAY IN LIGHTNING

Since Uttarakhand is highly prone to lightning, the meter shall be designed & manufactured in such a way that the display & working of the meter shall remain perfect even in case of lightening surges.

LCD least count

Even though the display shall be with out decimal digit in push button mode and in auto scroll mode, the internal least count of energy recording shall not be more than 0.01kWh. Hence, every 0.01 kWh consumption will be internally stored. Also, there be no loss of energy registration on account of frequent power outages due to high start up time of the meter.

To verify this, meter shall be switched off after pulses equal to 0.01 kWH are generated. This process shall be repeat 100 times; the kWH reading should increase by 1.0. This shall be verified during inspection of meter.

Meter reading at power outage

Provision to read the meter in no power condition shall be made. In case of power failure Auto mode shall not function. The same push button shall be used for displaying the Real time, date, whole digit active cumulative forward energy (kWh) & maximum demand (kW) without decimal point with 30 minutes integration of the current month with date & time shall be displayed. In case of power failure data downloading for Historical energy, maximum demand & all the tamper events through CMRI (common meter reading instrument) shall be possible. The battery life shall be 10 years. To verify that the sample meters are not having chargeable capacitor, the samples will be kept in power off conditions for 48 hours and then meters will be checked by pressing the push button and the CMRI shall be done.

In any case, RTC Battery Power shall not be used for display under Power off condition. During power failure, the reading should be taken only after pressing of push button.

Maximum Demand registration and MD resets

Meter shall continuously monitor and calculate the average maximum demand for each demand integration period of 30 minutes and the maximum of these shall be stored along with date and time, when it occurred. The meter shall be capable to perform MD reset automatically through RTC (pre-scheduled) or communication through optical port using CMRI, laptop computer at site and remotely from central server with meter configuration software.

The automatic MD reset shall be performed at the end of every month i.e. 00.00 hours of last day of the month. It shall be possible to change the automatic MD reset date and time through optical even after installation of meter with special software and password protection.

Last twelve months MD values with date and time stamp shall be stored in the memory. These data including the last twelve month's cumulative kWH (import, export & net) readings, tamper information along with meter serial number shall be possible to read by downloading through optical port on CMRI or laptop computers. Meter should also maintain the history of last 65 days of energy consumption (kWH & MD) at 24:00 hours of each day & this should be downloadable through CMRI.

"The meter shall also provide half hourly load survey for kWh (import, export & net) for the last 65 days."

OUTPUT DEVICE

The meter shall have a test output device in the form of calibration LED of red colour and minimum intensity 10 mCD (mili-Candela) accessible from the front and shall be capable of being monitored conveniently with suitable testing equipment while in operation at site. The location of calibration LED should be such that the calibration pulses can be sensed easily through the sensor.

The relation between test output and the indication on display shall comply with the marking on the name plate (impulse per kwh).

The bidder shall state the necessary number of pulse count(s) to ensure measurement accuracy of at least $1/10^{th}$ of class of the meter at the different test points.

The resolution of the test output pulse(s) should be sufficient to enable conduction of the starting current in less than 10 minutes and accuracy test at the lowest load with desired accuracy within 5 minutes.

13.20 Communication Capability (Through Optical Port):

The meter shall have provision of optical port on the front side of meter to transfer the data locally through CMRI and shall be capable of being hooked to a remote metering device such as modem, etc. for future to enable Automatic meter reading. Bidder shall prove communication of Modem with their meter in front of samples testing team.

Software required for CMRI and meter reading protocols shall be supplied by the supplier free of cost. The meter reading software provided shall be GUI based, user friendly and menu driven on window based operating system. Free of cost training for the use of software shall also be provided by the supplier. The software should have polling feature with optional selection of parameters to be downloaded for AMR application. The software should have programmable facility to restrict the access to the information recorded at different security levels.

The supplier shall provide API (application program interface)**/**protocol of the meter in CD form for AMR purpose to UPCL along with the supply.

13.21 Real Time Clock & Calendar:

The meter should have real time clock (RTC), which can be synchronized remotely with the utility's system clock through configuration software. In case of meter connected to AMR system through GSM/GPRS/PLCC modem, the meter should be able to synchronize its clock with the system time. Battery used for meter display during power off condition shall be separate from the battery used for real time clock. This shall be verified by removing the display battery and verifying that the power down display is inactive and RTC has accurate time after reconnecting the battery after 1minute or more of its removal.

13.22 Tamper And Fraud Protection

The meter should have tamper and fraud protection features to prevent / defect common ways of tamper and fraud. Meter shall continue to register active energy accurately under the following conditions.

a) Reversal of line & load terminals: On reversal (interchange) of input (line) and output (load) terminals – the reverse indication in the form of LCD icon.
b) Interchanging of phase & neutral: On reversal (interchange) of phase and neutral at the mains or incoming supply side of meter terminals the meter shall record energy accurately so that consumption of power will be positive. However, when load & supply side of meter is interchanged then computation of power shall be reverse & meter shall display Reverse icon.
c) Drawing of current through local earth: Using earth in place of neutral (i.e. when load is not terminated back to the meter and instead current is drawn partially or fully through a local earth) irrespective of the phase and neutral connections to the meter. The earth indication in the form of LCD icon.
d) Neutral Missing should be available.
e) Influence of high magnetic field: The meter accuracy or accuracy display under normal conditions shall not be affected by placement of a external magnetic field (0.5 tesla (DC) and 0.2 tesla (AC)) permanent magnet, size minimum 70x70x50mm, of 0.5 Tesla ±5% anywhere on the surface of the meter without meter box. The magnetic test shall be conducted on both phase & neutral circuit & if the same is applied beyond 10 sec. meter shall start recording energy at Imax.
f) When the neutral from both incoming & outgoing side are disconnected and the load is taken through earth, the threshold value for recording of energy under tamper condition using earth in place of neutral shall in no case be more than 1A. This is to be provided through battery. The accuracy of the meter shall be tested at various load points from 2A to 60A (Imax) and accuracy of meter shall be within ±3%. The energy recording shall also be verified at 2A by running the meter for 1kWH and switching the meter ON & OFF to verify that the meter records energy.
g) Influence of DC signal: The meter should record energy as per voltage measured between incoming phase and neutral terminals when DC signal is injected on the neutral terminal of the meter through Diode. The test in this condition will be carried out at Vref. applied to incoming phase & input terminal of diode. The circuit diagram for DC injection test(s) is enclosed.
h) The meter shall be capable to store tampered kWH values under three different condition i.e. load reversal, earthed (full or partial) and neutral loss, in three separate registers apart from being added into the cumulative register.
i) Any combination of the conditions described above under (a), (b) & (c)
j) The threshold values for different tamper features shall be as under:
k) The starting current of main measuring element (between 1 & 4) shall be 0.2% Ib and that of neutral element (between 2&3) shall not exceed 0.2% of Ib.

13.22.1 **Neutral Tampering**

The meter shall record energy proportional to the current and 240 V when any of the temper circuits enclosed as annexure 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 from 70% of rated voltage to rated voltage. The meters shall record in positive variation. The meter should be immune to such neutral disturbances.

The threshold value for this tamper should be less than equal to 210V. In case phase current & neutral current are equal, then this tamper should not occur even if voltage drops below 210 V.

For circuit No. 4: Timer switch circuit should be tested at values Pon=1.0 sec, Poff=1.0 sec. Manufacturer should state Threshold values and occurrence and restoration timing in the tender offer against all the four circuit tampers enclosed.

13.22.2 **Application of Abnormal Voltage / Frequency:**

The accuracy of the meter should not be affected with the application of abnormal voltage/frequency generating device such as spark discharge of approximately 35kV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

a) On any of the phases or neutral terminals

b) On any connecting wires of the meter
c) Voltage discharge with 0-10 mm spark gap
d) At any place in load circuit
e) Spark on meter body

The accuracy of meter shall be checked before and after the application of above device(s) with site conditions. Protection from spark plug / abnormal frequency should be available.

i. Ferrite beads should be used for protection from EMI.

The bidder should furnish the details as to how their meter is able to detect/protect the above tampers and fraud with sketches and phasor diagrams wherever necessary. If bidder has any better proposal for temper logic, the same may be submitted along with the offer for purchaser's consideration. Additional features if any in their meter may also be clearly indicated.

Sketches for aforesaid tamper conditions are enclosed.

ii. In the MRI report of meter the first & last tamper occurrence shall be available with date & time.
iii. Meter cover open event should be available and in case the top cover of meter is opened by any means then "COVER OPEN"/message/prominent indication should be continuously displayed on the screen & reading can be taken only through MRI/ push button. The date & time of the event should be logged in the memory and the same should be available in the MRI report.
iv. Apart from above mentioned tampers, meter shall be immune to the low frequency low voltage device (Jammer).
v. The software shall record minimum 200 Nos. tamper events including magnetic events.

13.23 Sealing Arrangement Of The Meter

The meter cover shall be permanently seamlessly ultrasonically welded to the meter base and push fitted. It shall not be possible to open the meter cover without permanently damaging the meter cover or base, easily visible from the front. In order to make the ultrasonically welded meter base with cover fool proof from tampering, two numbers of push-fit moulded seals shall be provided on the meter case-cover boundary as below:

The meter shall be sealed with two nos. of specially designed and moulded coloured polycarbonate tamper proof seals, to be inserted on each side of meter case, with internal locking arrangement embossed or indelibly marked or laser etched with serial number and UPCL and manufacturer logo visible from the front and matching with the serial number of the meter or firm shall provide seal tracking software. The seals shall become unserviceable and irreplaceable in case of any attempt to tamper the meter.

Alternately, supplier may provide meters with internal locking arrangement through unidirectional screws or endless rivets and provision of two nos. of push fit polycarbonate seals on left side & right side of meter base & cover, however supplier shall ensure that it is not possible to lift the meter cover from the meter base at all without breaking cover. Although meters with arrangement as mentioned at 7.1 'e' shall be preferred.

Additionally, two sealing holes shall be provided on meter case suitable for inserting sealing wire of min. 2mm dia.

13.24 Fixing Arrangement Of Meter

The meter shall be fitted to the base of the Meter box through 3 No. screws.

13.25 Marking Of Meter

The meter terminal marking and mounting arrangement should be as per Indian installation practices. The marking on every meter shall be in accordance with IS:13779/IEC 62052-11.

Every meter shall have name plate beneath the meter cover window portion such that the name plate cannot be accessed without opening the meter cover. The marking on the name plate shall be indelible, distinct and readable from outside the meter housed inside the box. The name plate marking should not fade or otherwise be adversely affected by UV exposure with lapse of time. The basic markings on the meter name plate shall be as follows:

a) Manufacturer's name or trade mark and place of manufacture
b) Designation of type
c) Number of phases and wires for which the meter is suitable
d) Serial number
e) Month and year of manufacture
f) Reference voltage, frequency
g) Basic current and rated maximum current in Amps
h) Principal unit(s) of measurement
i) Meter constant (imp/ kwh)
j) Class index of meter
k) "Property of UPCL"
l) Purchaser's order Number & date
m) Guarantee period - 5 years
n) Bar Coding of serial number, month & year of manufacture of the meter
o) Sign of insulation
p) Seamless Ultrasonic Welded (not required in single mould of meter base and cover)
q) ISI mark with license number

13.26 Connection Diagram and Terminal Markings

The connection diagram of the meter shall be clearly shown on the meter name plate and shall be of permanent nature. Alternatively, connection diagram can be permanently engraved on the inside portion of terminal cover. Further to this, terminal marking i.e. M1, L1 etc. should be clearly embossed on terminal block which is visible from distantly.

13.27 Salient Features

The meter shall have following additional salient features:

a) 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. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.
b) Even if phase to phase voltage i.e. 480 volts is supplied for 15 minutes between phase and neutral of the meter, the meter should not get damaged and continue to record correctly within class 1 accuracy after restoration of normal supply.
c) The meter should not saturate up to 900% Ib and should record energy accurately for P.F. range 0 lag – unity - 0 lead.
d) The meter should not have any form of mechanical adjustments such as trim-pots potentiometer etc. for calibration. The meter shall be tested, calibrated and sealed at manufacturer's works before dispatch. Further, no modification of calibration shall be possible at site by any means what so ever. The meter shall be software calibrated. All important data such as calibration data, billing parameters and cumulative kWH should be stored in internal NVM to the main processing circuit and it should not be possible to change it through standard serial communication.

e) The short-time over current rating shall be 30 Imax for one half cycle at rated frequency as per clause No. 9.2.3 of IS:13779/ Clause 7.2 of IEC 62053-21
f) The meter shall withstand impulse voltage test at the rated impulse voltage of 10 KV (for meters of protective class-II) as per clause 7.3.2 of IEC 62052-11:2003.
g) Single LED shall be provided for test output pulse (Impulse / kWh-Red). For other conditions such as phase reversal and earth, icon shall be provided on LCD display.
h) The meter shall be provided with CT/Shunt in main circuit as well as in neutral circuit.
i) The location of calibration LED (preferably at the center) should be such that the calibration pulses can be sensed easily through the sensor.
j) **READING FACILITY AT POWER SUPPLY FAILURE:**
In case of absence of power supply, the meter should be capable to display the measured quantities by pressing push button only or can read through Common meter reading instrument (CMRI) with the help of internal battery. The battery used for RTC shall not be used for this purpose. Life of the battery should be at least 10 years.
k) The meter shall be integrated with two current sensors to measure the load currents. Main current sensor shall be provided between the phase terminals (supply & load) and the neutral sensor shall be provided between the neutral terminals (supply & load) of the meter. The meter should also be capable to correctly record the energy within the accuracy class 1.0 for current flowing through its neutral sensor, for entire range of current and power factors, as applicable and specified in national / international standards. In addition same rating & type of meter shall be tested for its neutral sensor, for all tests as specified in applicable IS 13779 / IEC 61036 including the starting current test as specified in this specification.
l) Meter should have facility for reading through push button only and complete data can be fetched through optical port from outside the box even in case of power OFF condition. This facility shall be provided by powering the meter through a separate internal long life battery with trickle charging from main supply source under normal conditions and this battery shall not damage the meter during prolong idle storage of meter.

13.28 General

a) All electrically live screws shall be of brass/ nickel tin plated. All other screws shall be electro plated.
b) The meter shall draw power for its working through phase and neutral.
c) The terminal inserts shall be of heavily tinned brass.
d) The meter shall conform to the degree of protection IP 51 of IS:12063/ IEC 62052-11 clause 5.9 for protection against ingress of dust, moisture and vermin.
e) There should not be any creepage in the meter even at 120% & 70 % of supply voltage.
f) The meter should be free from jumps during sudden switching of heavy loads / or transient voltage spikes.
g) Meter shall display direct reading and without multiplying factor.

13.29 Electromagnetic Compatibility and Interference Requirement

The meter shall meet EMI/EMC requirements as specified in the relevant standards described in clause 2.0 of this specification and shall also be protected against radiated interference from either magnetic or radio frequency sources.The offered whole current meter shall also withstand DC Immunity test as per relevant standard so as to ensure that the meter current circuits do not saturate on passage of direct current.

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

The disturbance(s)/discharge(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.

13.30 Manufacturing Activities

i. All the materials, electronics and power 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.
iv. The electronic components used in the meter shall be of high quality and there shall be no drift in the accuracy of the meter at least upto 10 years. Further, the Bidder should own or have exclusive access (through hire, lease or sub-contract) of the afore-mentioned facilities.

Adequate documents regarding exclusive hire or exclusive lease shall be made available. In case of sub-contract, it shall be ensured that the sub-contractor is not carrying out sub-contracting for any other bidder in the above tender. The bidder shall indicate with the name and location of such facility alongwith an undertaking and certificate from the utility and any ambiguity on such a confirmation shall result in immediate disqualification of the bidder.

The above shall be verified during works inspection or material inspection also and if any ambiguity is found, it shall be considered as a breach of contract by the successful bidder.

Bidders without in-house design, development and manufacturing facility as above or who are buying populated PCBs will not be considered as meter manufacturers.

The PCB material should be of glass epoxy FR-4 grade conforming to relevant standards.

v. All insulating materials used in the construction of meters shall be non-hygroscopic, non-aging and of tested quality. All parts which are likely to develop correction shall be effectively protected against correction by providing suitable protective coating.
vi. Quality should be ensured at the following stages:

a) At PCB manufacturing stage, each board must 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 equipment (testing zig).
d) Prior to final testing and calibration, all meters shall be subjected to accelerated ageing test to eliminate infant mortality.

vii. The calibration of meters shall be done in-house.
viii. A detailed list of bought-out items and list of components which are used in the manufacturing of the meter should be furnished indicating the name of firms which are to be selected from Annexure-II (Make of the components for bidder).
ix. 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(s) may also be furnished.

13.31 Type Test

a) The type test certificates for all tests as per IS:13779-1999/relevant IEC standard (latest amendments) will be furnished along with tender. Type test certificates from any one of the standard laboratories such as NPL/ERTL/CPRI/ERDA (NABL accredited for particular equipment/ test) shall only be considered.

b) Type test certificates from educational institute(s) will not be accepted. The type test certificates shall not be more than 24 months (2 years) old from the date of bid opening.

c) Additional Type Test :-
In addition to the test mentioned at (a) above, supplier shall have to furnish the following type test reports.

i. DC influence test as per IS: 13779-1999 or IEC 62053-21, in phase circuit.
ii. The test of influence of supply voltage shall be carried out as per clause no. 12.7.2.1 of IS:13779/1999, except the interruption time should be variable from 10 mili sec to 5 sec. instead of SXX`time.
iii. Test of voltage variation as per this specification.
iv. The meter shall withstand impulse voltage test at the rated impulse voltage of 10 KV (for meters of protective class-II) as per clause 7.3.2 of IEC 62052-11:2003.

The type test certificates of the above additional tests shall also be submitted alongwith the bid.

The following information should be clearly mentioned in the type test reports:

i. Type of Display i.e. whether counter type or LCD display.
ii. Details of Shunts / CT used in main and neutral circuit.
iii. Accuracy at different loads and PF for both main and neutral circuit separately

13.32 Guaranteed Technical Particulars

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

13.33 Inspection And Testing

a) All Acceptance tests as laid down in the ISS/IEC and this specification shall be carried out.

b) Following tests shall also be carried out as Acceptance tests by adopting methods specified in ISS:13779/ISO:9000/ as per relevant IEC standard / CBIP 88 (latest edition/ amended)

i. AC voltage test.
ii. Test of meter constant
iii. Tests of limits of error clause. 11.11 of IS:13779 at 400 % Ib, 600% Ib and 800 % Ib at pf 0.5 lag, 0.8 lead & unity.
iv. Vibration Test
v. Shock Test

Vibration & shock test shall be carried out as acceptance test by adopting procedure laid down in ISS: 13010/1990 and its latest amendments.

vi. Voltage variation test as per this specification.
vii. Test of no-load condition at 70% and 120 % of rated voltage. The minimum test period shall be as per clause 8.3.2 of IEC 62053-21.
viii. Test of DC components in AC circuits - The limits of variation in percentage error shall be 3.0% for class 1 meter at Imax/root2 and UPF, as per Annexure-D of IS:13779.
ix. Diode injection test as per clause 7.7 of this specification.
x. Accuracy test under following anti tamper conditions:

- Phase neutral interchanged

- Ph-neutral normally connected and load earthed
- Phase neutral interchanged and load earthed
- Supply and load side interchanged and load earthed
- Supply and load side interchanged and reversed and load earthed
- Normal connection with partial earth load
- Neutral Disconnected at both sides
- (The single line connections diagram of different tamper conditions are enclosed with the specification).

xi. Test of MRCT on both elements in case of tamper features as per cl. 7.7 of this specification.

xii. Permanent magnet test (as specified in Clause 7.7e of this specification). Separate battery for Display and RTC shall also be verified as per clause 7.6 of this specification

xiii. The inspecting officer shall verify that no DC supply/ signal is given to reference meter during the DC injection test.

xiv. The accuracy of display parameters shall be verified at the time of inspection in line with class of accuracy of meter.

xv. The accuracy of the meter shall be checked & it should not be affected with the application of abnormal voltage/frequency generating device such as spark discharge of approximately 35 KV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

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

The accuracy of meter shall be checked before and after the application of above device(s) with site conditions.

xvi. When the meter is placed in oven at a constant temperature of 65º C for period of 120 minutes, the character of LCD should not deform. After keeping the meter at a constant temperature of 80 ºC for period of 120 minutes and when restored at normal temperature, the LCD should work satisfactorily.

c) Number of samples for test from each lot shall be selected as per provision of IS. The criteria for selection of No. of samples and for acceptance of lot will be as under:

i. The sampling plan shall be as per IS: 13779 with maximum lot size of 5,000 Nos. meters for quantity offered for Inspection. The sub-lot size shall be taken accordingly i.e. either 5,000 Nos. or less as applicable on quantity offered for inspection.

32 Samples shall be selected at random from the each sub lot of meters and acceptance test as per relevant standards and additional acceptance tests as per technical specification as listed above shall be carried out on these samples.

If the quantity offered is 5,000 Nos. or less than 5,000 Nos. but in both case 32 samples shall be randomly selected. If the quantity offered is more than 5,000 Nos. then 32 samples shall be randomly selected for each sub lot of meters. For example, if offered quantity is 12000 Nos. then 32 samples shall be selected from each sub lot as mentioned below:

- From Ist sub lot of 5000 Nos. meters– 32 samples
- From IInd sub lot of 5000 Nos. meters – 32 samples
- From sub lot of remaining 2000 Nos. meters – 32 samples
- The samples should be selected on random basis and they should be selected in such a way that they represent the entire lot of meters offered for inspection.

ii. Following procedure shall be adopted to clear the tested lot:

A sample of 32 meters selected from sub lot of 5000 Nos. meters shall be tested for tests mentioned above. Any meter failing in any one of these tests shall be considered defective. If the number of defectives found in the

sample is less than or equal to 1, the lot shall be considered to be conforming to these tests. If the number of defectives is greater than or equal to 4, the lot shall be considered as not conforming to these tests. If the number of defectives is between 1 and 4 i.e. either 2 or 3, a further sample of 32 meters shall be taken from the offered meters and shall be subjected to these tests. If the number of defectives is two samples combined is less than 4, the lot shall be considered as conforming to these tests, otherwise rejected.

iii. In case of rejection of offered lot as per two above, supplier shall have to re-offer entirely new lot of meters for inspection and testing. Inspection and testing shall be carried out as per procedure and if the lot fails for consecutive second time, order shall be cancelled. The expenditure incurred in re-inspection & testing shall be recovered from the supplier. Further, firm shall be debarred for participation in any tender of same item of any capacity in UPCL for two years from the date of rejection of material along with forfeiture of Security Deposit submitted by the supplier against the order.

iv. 10% quantity from each lot of meters supplied after satisfactory inspection & testing at supplier's works shall be marked and sent by Superintending Engineer (MM) to electronic test lab of UPCL at 18-EC Road, Dehradun for testing and clearance of that lot. Final payment, etc. shall be subject to clearance of above tests.

d) For every 50000 nos. meters, Inspection & Quality Assurance wing of UPCL will get samples tested for all or any of the selected tests at UPCL's cost at any Govt. NABL test house at any stage of supply. In case of failure, the payment of bidder shall be withheld. UPCL shall also reserve the right to cancel the balance quantity and to take any suitable action as deemed fit.

e) S.E. (I&QA) shall ensure the testing of meters selected from the lot.

13.34 Packing And Forwarding Of Energy Meters

Each meter with meter box shall be packed in superior quality three-ply corrugated cardboard carton or thermocol packing box. Such single cartons shall be additionally packed in five (5) ply corrugated cardboard carton accommodating 12-24 meters with meter boxes for easy transportation, storage & handling.

13.35 Samples

Bidders will have to submit two nos. sample meters as per the specification along with their bid offers at the time of opening of tender for complete testing of meter as per specification. Sample meters should be submitted to Superintending Engineer (Inspection & Quality Assurance), V.C.V. Gabar Singh Bhawan, UPCL, Dehradun for arranging the testing of samples at its Test Lab as per provision of technical specification for his final approval of samples. Part-II (price-bid) of those firms shall be opened whose sample meter will clear the testing.

Vendor shall have to submit predefined copies of all the software (meter reading software for CMRI, Base computer software for meter data analysis and technical details).

Bidders shall provide sample meters without any identification of their name inside or outside the meters. The identification should be provided through a removable sticker fixed on the top of the meter case. If any permanent identification provided inside the meter, the sample shall not be accepted.

UPCL also reserves the right to get additional samples tested for all or any of the selected tests at supplier's cost at any independent NABL test house at any stage of supply if so considered necessary to ensure that the quality of meters being offered for inspection. In case of failure, the payment of bidder shall be withheld. UPCL also reserves the right to cancel the balance quantity and to take any suitable action as deemed fit.

13.36 Performance Guarantee:

i. The meter shall be guaranteed for a period of at least five years from the date of receipt of meter at site or UPCL stores. If the meter is found defective within the above guarantee period, supplier will have to replace the same free of cost with a new meter along with box with new serial number.

ii. Meters are to be replaced within 90 days from the date of lifting the same by the supplier, otherwise the cost of meter and 15% supervision charges will be deducted or recovered from pending bills, bank guarantees or by any other means as deemed fit.

iii. Executive Engineer, Electricity Test Division will inform Supplier about meter gone defective within guarantee period with meter serial no. and purchase order no. & date, for lifting the defective meters under intimation to Executive Engineer, Electricity Store Division. Such meters will be lifted by the supplier within 45 days from date of intimation (date of intimation will be deemed as date of information letter by Executive Engineer, Electricity Test Division). If the defective meters are not lifted within 45 days, demurrage charges of Rs. 5/- per meter per day will be charged. Amount of demurrage charges will be informed by Executive Engineer, Test Division to Executive Engineer, Electricity Store Division.

The cumulative damage rate during guarantee period should not exceed:

a. Upto one year-2%.
b. Upto two years-3%
c. Upto three years-4%
d. More than four years-5%

If the supplier fails to adhere to the above requirement, UPCL may take any penal action against the supplier upto and including debarring/blacklisting.

13.37 Quality Assurance Plan

The design life of the meter shall be minimum 20 years and to prove the design life, the firm shall have at least the following quality Assurance Plan:

a) The factory shall be completely dust proof.
b) The testing rooms shall be temperature and humidity controlled as per relevant standards.
c) The testing and calibrating equipments should be automatic and all test equipment shall have their valid calibration certificates.
d) 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.
e) During the manufacturing of the meters the following checks shall be carried out.

i. The assembly of parts shall be done with the help of jigs and fixtures so that human errors are eliminated.
ii. The meters shall be batch tested on automatic, computerized test bench and the results shall be printed directly without any human errors.

The bidder shall invariably furnish the following information alongwith his bid, failing which his bid shall be liable for rejection. The information shall be separately given for individual type of material offered.

f) 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 bidder's representative and copies of test certificates.
g) Information and copies of test certificates as in (i) above in respect of bought out accessories.
h) List of manufacturing facilities available.
i) Level of automation achieved and list of areas where manual processing exists.
j) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

k) List of testing equipment available with the bidder for final testing of equipment specified and test-plant limitations, if any, vis-a –vis the 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 provided with the tender.

13.38 Accuracy of Meters

There will be no drift in the accuracy of the meters supplied against this purchase order for a period of 10 year (life time) from the date of supply. In case any drift is noticed / found beyond permissible limits during guarantee period of 5 years, the supplier shall recalibrate such a meter for correct accuracy, and in the event recalibration is not possible, replace such meter (s) with box with new meter(s) with box without any extra cost.

Note: All extra loose seals should be of polycarbonate double lock with logo of manufacturer with name and with different Serial No./ Series (A, B, C, - - - -) to that of seals on meter body).

13.39 Technical Specification for Moulded Meter Box Suitable For Single Phase Static Energy Meters

13.39.1 Scope:

This specification covers the moulding and supply of moulded cupboard suitable to house the single phase energy meters. The meter box shall be suitable for wall mounting.

20.1 Material And Standards

The meter box i.e. base and cover shall be made of injection moulded, unbreakable, high grade flame retardant polycarbonate with minimum thickness of 2.0 mm on all sides having good dielectric and mechanical strength. The top cover of the meter box must be totally transparent without any provision of the separate window arrangement. The material must be 'UV' stabilized to ensure that the moulded meter box should not change in colour shape, size, dimension when subjected to 200 hrs. on U-V ageing test.

The meter box should have tapered surface / corners to prevent stay of rain water at the top of the meter box.

The meter box should be capable of withstanding the mechanical, electrical and thermal stresses as well as the affects of humidity which are likely to be encountered in service, at the same time ensuring desired degree of safety. The plastic material should be adequately stabilized against detrimental effects of light and weather. The surface appearance of moulded part must be smooth, non-porous and homogenous, free of ripples, defects and marks. No fillers of fibers should be visible at any place. The meter box shall comply in all respect with the requirement of latest amended IS:14772/2000 "General requirements for enclosures for accessories for household and similar fixed electrical installations". Applicable degree of protection shall be IP 42 or better.

13.39.2 Properties Of Plastic Material

The plastic material which is to be used by the bidder for these moulded meter boxes must have the following properties:

S.No.	Property	Units	Value
1.	Physical Water Absorption	%	Max. 0.35
2.	Thermal HDT	Deg. C	Min. 125.
3.	Flammability a) b) Glow wire test @ 650 Deg. C	Rating	FV 2 Passes

S.No.	Property	Units	Value
4.	Mechanical		
	a) Tensile Strength	MPa	Min. 50
	b) Flexural strength	Mpa	Min. 90
	c) Modulus of Elasticity	Mpa	Min. 2000
	d) Izod impact strength notched 23 deg. C.	KJ/Sq.m	Min 8

13.39.3 Service Conditions

Maximum ambient air temperature	: 50 deg.C
Maximum ambient air temperature in shade	: 45 deg.C
Maximum temperature attainable by the meter exposed to sun.	: 60deg.C
Minimum ambient temperature	: (-) 5 deg.C
Average daily ambient air temperature	: 40 deg.C
Maximum relative humidity	: 95 %
Number of months of tropical monsoon condition	: 4 months
Maximum altitude above mean sea level	: 3000 meters
Average annual rain fall	: 10-100 cms
Maximum annual rain fall	: 1450 mm
Maximum wind pressure	: 200 kg /sq.m
Isoceraunic level (days per year)	: 40
Seismic level (horizontal accn.)	: 0.30 g
Permitted noise level	: 45. db

13.39.4 GENERAL & CONSTRUCTIONAL REQUIREMENTS

METER MOUNTING INSIDE THE METER BOX

The meter base support inside the box is raised by about 5 mm in the box for ease of wiring. Fixing arrangement of meter to the base of meter box should be as per relevant clause of this specification.

INCOMING AND OUTGOING CABLE ARRANGEMENT

Suitable circular holes shall be provided at the bottom of the meter box for inlet and outlet cables with glands suitable for 16 sq. mm two core aluminum cable, made of brass or engineering plastic for the cable securely fixed to the bottom of the meter box on both side by chuck nuts.

FIXING ARRANGEMENT OF METER BOX

For fixing the meter box to wall or wooden board, 4 nos. holes (two top side holes to be keyholes) of minimum 6 mm dia, shall be provided at the four corners of meter box. The meter is to be installed in the meter box and the box in assembled condition shall have provision to fix it to a pole or on wall. The 4 nos. self threaded screws and plastic roll plug of min. size of 4mm dia and 25 mm long shall be provided with each meter box.

MARKING / EMBOSSING

The following information shall be clearly & indelibly embossed (not printed) on the cover and base of the meter box (except Sr. No. of the meter - which may be indelibly printed inside the base of meter box and also on the meter box cover with inkjet printing). The meter box Sr. No. shall be same as of Sr. No. of the meter housed inside that particular meter box:

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- Property of " UPCL".
- Name/ Brand name of Manufacturer.
- Meter Sr. No. (printed on both the base & cover of meter box) through sticker from inside
- Month and year of manufacture through sticker from inside

DRAWING

Detailed dimensional drawing & detailed leaflets showing clearly the dimensions & material for meter box and its constructional features should be furnished with the tender offer.

SAMPLE

Furnishing of samples shall be as per clause No. 16.0 of technical specifications.

PACKING

Packing shall be as per clause No. 15.0 of technical specifications.

TESTS

A) TYPE TESTS:

The meter box offered shall be fully type tested as per relevant standards and this technical specification (table below). The bidder must furnish one set of type test reports and the dimensional drawing (duly approved by Type Testing agency) along with the tender. The type test report should be from independent recognized testing laboratory / house whose calibration of testing instruments should have traceability to NABL/NPL/ or equivalent. The type tests mentioned below must not have been conducted earlier than two years from the date of opening of bid.

LIST OF TESTS TO BE CARRIED OUT ON MOULDED METER BOX

S. No.	Test particulars		Type of Tests			
1.	IS:14772	Clause 7	Marking	T		A
2.	As per Bidder's drawing		Dimensions	T		A
3.	IS:14772	Clause 9	Protection against electric shock	T	R	A
4	IS:14772	Clause 11	Construction	T		
5	IS 14772	Clause 12	Resistance to ageing, to humid condition, to ingress of solid object and to harmful ingress of water.	T		
6.	IS : 14772	Clause 13	Mechanical strength	T		
7.	IS :14772	Clause 14	Resistance to heat	T		
8.	IS:14772	Clause 16	Resistance to rusting	T		
9.	IS:14772	Clause 17	Resistance to tracking			

S. No.	Test particulars		Type of Tests	
10.	IS:8620/1996		Test for resistance to heat & fire. Glow wire test at 650 deg. C as per cl. 4 to 10 of IEC 695-2-1	T
11.	IS:13411	Annex-H	Heat deflection temperature (Min. 125 degC.)	T
12	IS : 4249		Self Extinguishing property of spirit burner test.	T
13.	IS:8623/1993	(Part-1) 18.2.2.2	Verification of dielectric properties, insulation test with 500V DC magger	T
14.	CIPET/IR Spectrometry		Material identification.	T
15	IS:13411/1992	Annexure D	Test for water absorption (Max. 0.35)	T

Note: Applicable degree of protection shall be IP 42 or better.

Legend: T = Type Test, R = Routine Test, A = Acceptance Test

B) ACCEPTANCE TESTS

The acceptance tests as indicated in the above table shall be carried out at the -time of inspection of the offered material.

C) ROUTINE TESTS

The routine tests as stipulated in the above table shall be carried out and routine test certificates / reports shall be submitted to the purchaser's inspecting officer at the time of inspection of the offered material.

Notes:

i. Where facilities do not exist at supplier's works for carrying out one or more above tests such test(s) may be got carried out at any of the approved laboratories such as CIPET centers / IIT, Delhi / Shriram test house, Delhi.
ii. The sampling plan for carrying out the acceptance tests shall be same as in case of energy meters.

INSPECTION

The inspection may be carried out as per inspection clause mentioned in the tender specification.

GUARANTEED TECHNICAL PARTICULARS

The bidder shall furnish all the necessary information as desired in the schedule of GTP appended at Annexure. If the bidder desire to furnish any other information in addition to the details as asked for the same may be furnished against the last item for box of this schedule.

ANNEXURE – II

MAKE OF THE COMPONENTS FOR BIDDER

All the material & electronic power components used in the manufacture of the meter shall be of highest quality & reputed makes so as to ensure higher reliability, longer life and sustained accuracy.

SI. No.	Item	Requirement	Makes and origin
1	Measurement / Computing Chips	The measurement / computing chips used in the meter shall be with the surface mount type (SMT) along with the ASICs.	**USA:** Analog Devices, Cyrus LOGIC Atmel, Phillips, Texas Instrument, Renasas, teridian, Motorola, ST micro electronic. **South Africa**: SAMES **Japan:** Hitachi, NEC, Oki free scale semi conductors, MMI, Maxim, Siemens
2	Memory Chips	The memory chips shall not be affected by the external parameters like sparking, high voltage spikes or electrostatic discharges.	**USA:** Atmel, National Semiconductors, Texas Instruments, Phillips, ST micro Electronics, Renasas. **Japan:** NEC, Hitachi, Oki Microchip, Siemens, ramtron,numonyx, Micron
3	Display Modules	The display modules shall be well protected from the external UV radiations. The display visibility shall be sufficient to read the meter mounted between height of 0.5m and 2m. The construction of the modules shall be such that the displayed quantity shall not be disturbed through out the life of display. It shall be trans-reflective STN (Super Twisted Nematic) industrial grade type.	**Japan:** Hitachi, Sony, YEBOO Jiya (Haijing) & Tianma
4	Optical Port	The mechanical construction of the port shall be such to facilitate the data transfer easily.	**USA:** National Semiconductors, Everlight, HP, Agilant, optanik, Siemens, Osram Electronics **Holland/Korea:** Phillips **Japan:** Hitachi, Sharp **Germany:** LITEON Fairchild
5	P.C.B.	Glass Epoxy, fire resistance grade FR4.	**Reputed Make**
6	Electronic Components	The active & passive components shall be of the surface mount type and are to be handled and soldered by the state of art assembly processes.	USA: National Semiconductors, Atmel, Phillips, Texas Instruments, ST, onsemi. Japan: Hitachi, Okai, AVX, Ricoh Korea: Samsung, EPCOS Toshiba & Siemens
7	Battery	Lithium with guaranteed life of 10 years.	Varta, Teridian, Sanyo, national renota, Panasonic, ST, Epson, Maxell, intersil, Mitsubishi, Teckcell, Saft
8	RTC / Micro Controller	The accuracy of RTCD shall be as per relevant IEC / IS standards.	**USA:** Phillips, Dallas, Atmel, Motorola, Microchip, Texas instruments, ST, Epson, intersil, renasas **Japan:** NEC or Okai Teridian

14. Technical Specification for 11kV Indoor/Outdoor & 33kV Outdoor Metering Cubicle with Current Transformer & Potential Transformer

14.1 Scope

This specification covers the design, fabrication, painting and supply of metal cabinet, supply of components, wiring, testing at works, packing and supply on destination basis and performance testing of 11kV & 33KV self-equipped metering cubicle. Trivector meter is not in the scope of supply. The metering cubicle shall be suitable for indoor/outdoor application.

It is not the intent to specify completely herein all details of the design and construction of equipment. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship mentioned in clause 4.0 and shall be capable of performing in continuous commercial operation upto the supplier's guarantee 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 this judgment, is not in accordance therewith. The equipment offered 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 supplier's supply, irrespective of whether those are specifically brought out in this specification and / or the commercial order or not.

14.2 Climatic Conditions

The meters to be supplied against this specification should be suitable for satisfactory continuous operation under the following tropical conditions. Meters should be capable of maintaining required under hot, tropical and dusty climatic conditions.

Table 14-1: Climatic Conditions

S.No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

14.3 Standards Applicable

Unless otherwise specified elsewhere in this specification, the performance & testing of the meters shall conform to the following Indian/International standards with updated and latest amendments/revisions there of –

Table 14-2: Standards Applicable

S. No.	Standard No.	Title
1	IS – 2071	Method Of High Voltage Testing
2	IEC- 185	Current Transformers
3	IEC- 270	Partial Discharge Measurement
4	IEC – 60	High Voltage Test Techniques
5	IEC – 8263	Method of RIV test on high voltage Insulators
6	IEC – 186	Voltage Transformers
7	IS – 2705	Current Transformers
8	IS – 3156	Voltage Transformers
9	IS – 11322, IEC -44 - Part 4, IEC – 137	Partial Discharge Measurement
10	IS – 12063	Classification of degree of protection provided by enclosures of Electrical equipment
11	IS – 3427	HT switchgear and control gear

14.4 Standard Technical Specifications

The equipment covered in this specification shall meet the following technical requirements:

14.4.1 System Parameters

Table 14-3: Standard Parameters

S.No.	Item	Specification	
1	Rated voltage	11kV	33kV
2	Highest System Voltage	12 kV	36 kV
3	Short circuit withstand current and duration (KA rms/sec)	11 kV	33 kV
	FOR 100/5A,	13.10 kA	26.20 kA
	For 60/5 A	13.10 kA	13.10 kA
	FOR 30/5A	6.70 kA	6.70 kA
	FOR 20/5A	3.00 kA	6.70 kA
	FOR 5/5A	3.00 kA	3.00 kA
4	Frequency	50 Hz	50 Hz

14.4.2 Current Transformers

Table 14-4: Current Transformers

S.No.	Item	Specification	
1	Type	Single Phase, cast resin	
2	Insulation class	'E'	
3	Rated voltage	11KV	33KV
4	Rated primary current (A)	5,20,30,60,100 and higher	
5	Rated secondary current (A)	5	
6	Basic insulation level (KV)	12/ 28/ 75	36/ 70/ 170
	One minute power frequency withstand voltage (kVrms)	28	70

S.No.	Item	Specification	
	1.2/50 microsecond impulse voltage (kVP)	75	170
7	Rated continuous thermal current	1.2 times the rated current	
8	Burden (VA)	10 VA	
9	Accuracy class	0.5	
10	Instrument security factor	5 or less	
11	Core details	Single core	
12	Short circuit withstand current and duration (kA rms/sec)	11 KV	33 KV
	FOR 100/5A	13.10 kA	26.20 kA
	FOR 60/5A	13.10 kA	13.10 kA
	FOR 30/5A	6.70 kA	6.70 kA
	FOR 20/5A	3.00 kA	6.70 kA
	FOR 5/5A	3.00 kA	3.00 kA
13	Rated dynamic withstand current (KVP)	2.5 Times STC	
14	Applicable standard	IS-2705	

14.4.3 Potential Transformer

Table 14-5: Potential Transformer

S.No.	Item	Specification	
1	Rated primary voltage (V)	11000/√ 3	33000/√ 3
2	Rated secondary voltage (V)	110/√ 3	
3	Ratio Tap	Single Ratio	
4	Core details & purpose	Single core & commercial metering	
5	Type	Resin Cast	
6	Insulation class	E	
7	Insulation level		
	One minute power frequency Withstand voltage (KVrms)	28	70
	1.2/50 microsecond impulse voltage (KVP)	75	170
8	Applicable standard		
9	Ratio(V)	(11000/√ 3) / (110/√ 3)	(33000/√ 3) / (110/√ 3)
10	Rated burden	50VA	
11	Class of accuracy	0.5	

14.4.4 Metal Cabinet

Table 14-6: Metal Cabinet

S.No.	Item	Specification
1	Overall dimensions	As per drawing
2	Material	Mild Steel
3	Plate Thickness	
	Side plates (mm)	2 mm

S.No.	Item	Specification
	Bottom Plates (mm)	2 mm
	Top Plate (mm)	2 mm

14.4.5 Bus bars/ connecting strips

Table 14-7: Bus Bars/ connecting strips

S.No.	Item	Specification
1	Material	E. C. Grade Copper
2	Cross Section	Rectangular
		25mm X 6mm

14.5 General Arrangement

The metering cubicle shall be installed electrically in between the incoming supply point and the step down transformer of consumers' installation. The general arrangement of the cabinet shall be as per the enclosed drawing and final drawing approval has to be obtained after approval of prototype sample, as mentioned at clause 11.0 As shown in the general arrangement drawing, the metering cubicle shall be provided with following components suitably mounted:

a) Nos. 11/33 kV class current transformer (CTs).
b) Nos. 11/33 kV class Potential transformer (PTs).
c) Tinned copper busbars/connecting links totally covered by resin casting.
d) The secondary wires from the terminals of CTs & PTs in the CT/PT. Compartment shall be covered by resin cast blocks and the secondary wires shall be brought in the metering compartment through rubber bush and shall be left open duly crimped with suitable pin type dcopper lugs.
e) Resin cast bushing board/s with arrangement to receive Reychem or equivalent type of cable terminations for incoming and outgoing supply points.
f) Adequate number of PVC cable glands to receive purchaser's incoming and / or outgoing cables.
g) Electronic safety lock (optional).

The principal parameters of all the above said components are listed in previous section and the General technical requirements are described hereinafter.

The metering cubicle shall consist of four metal enclosed compartments as follows:

- C.T. / P.T. Compartment 1 Nos.
- Cable termination compartment 2 Nos.
- Meter compartment 1 Nos.

14.5.1 C.T. / P.T. Compartment

- 3 nos. of C.T.s & 3 nos. of P.T.s shall be mounted in this compartment. Resin cast boards shall be provided on the two sides leading to two cable compartments.
- The inside terminals of the resin cast bushings, the primary terminals of CTs and primary terminals of PTs shall be connected by 25 mm X 6mm size links of electrolytic grade tinned copper. All the terminals and links shall be covered by resin casting in rectangular blocks so that no HT part is accessible.
- The secondary wiring of CTs & PTs shall be carried out by 1100 V grade multi-stranded single core copper cable. Size of copper cable shall be 4 sq. mm. for CTs & 2.5 sq. mm. for PTs. Other end of these wires shall be brought to the meter compartment, crimped with suitable pin type of copper lugs. Entire wiring of cubicle except in the meter compartment shall be covered by resin casting in rectangular block so as not to have easy access without breaking of resin casting.

- The CTs & PTs shall be firmly mounted on bottom plate of this compartment. Additional support if necessary may be provided for mounting CT/PT so that the bushing terminals, CT primary terminals & PT primary terminals are at same horizontal level.
- The CT/PT Compartment shall be provided with detachable top cover having 5 to 10 degree slope from the front to rear side with the canopy on front side.
- The detachable top cover shall be provided with suitable interlock so that the same cannot be opened without opening the door of the meter compartment.
- As the CT/PTs incorporated in the cubicles are of resin cast type, ventilation for sufficient air circulation will have to be provided. This should be done by providing air-vent pipes as shown in the drawing.

14.5.2 Cable compartments

- Cable compartments for housing purchaser's cable/ cable terminations shall be provided on both sides.
- Detachable gland-plates shall be provided, at the bottom side of this compartment, for accommodating 11/33 kV XLPE, 3 core cables (120 Sq.mm. to 300 Sq.mm.).
- Detachable covers shall be provided on sides of these compartments and the roof shall be sloping 5 to 10 degrees towards the ends with canopy.
- Two Nos. of danger boards of M.S. plate shall be provided as per enclosed drawing.

14.5.3 Meter Compartment

- Meter compartment with front door shall be provided on front side of the CT/PT compartment.
- The rubber gaskets shall be provided on stationary part of the compartment so that edges of door shall rest on it.
- The door shall be provided with Godrej-Ultra lock.
- The door shall be provided with non-resettable mechanical impulse counter to monitor the number of times the door has been opened.
- The door shall be supported by strong, heavy duty concealed type (hinges shall not be accessible from outside) hinges.
- Toughened glass window of size 150 X 100 X 5 mm for easily viewing the energy meter should be provided. The glass should be provided with suitable weather proof seal to prevent ingress of rain water and any screws, bolts and nuts for fixing the glass should not be accessible from outside . Hinged metal cover to the glass window shall be provided to shield the glass from sun rays and mechanical damages.
- The metering components shall be provided with 'Heat-lon' lining all over the inside.
- Roof of the metering component shall be slopping 5 to 10 degrees towards front side with canopy.
- The words 'J.B.V.N.L.' of 100 mm height shall be punched/embossed on front side door.

14.6 General Features

- The metering cubicle shall comprise of rigid welded structural frame enclosed completely by M.S sheets of not less than 2 mm thickness. Structural frame and supporting angles should be of M.S angle of size 50x50x6 mm minimum. All the compartments of the cubicle shall be welded from inside and detachable covers/components should be bolted. Bolts with hole shall be provided for sealing purpose at opposite corners of the top cover. The fabrication of the cubicle should be such that there is no ingress of water.
- All doors and removable covers shall be gasketed all around with neoprene gaskets and the metering cubicle shall meet the requirements of IP – 55 protection as per IS- 12063, if the air –vents are closed.
- The metering cubicle shall be mounted on concrete plinth of 2 feet height so as to bring the meter window at normal eye level. A bottom frame of M.S. angles as shown in the drawings shall be provided, duly welded, for mounting the cubicle on the plinth.
- Lifting hooks of suitable size shall be provided at the top for lifting the cubicle.
- The metering cubicle shall be painted by powder coating after proper cleaning. The colour shall be 'Light Gray'. Finished painted appearance of equipment shall present an aesthetically pleasing appearance, free from dents and uneven surfaces.

14.7 Earthing

- Nine independent G.I. earthling bolts of at least M 10 size should be provided on sides so that the inside and outside earthling can be done. It should be firmly welded to the sides.
- An earthling bus of copper strip of size 25 x 3 mm shall be provided and extended throughout the length of the metering cubicle. It shall be bolted /brazed to the framework at two points. PT primarily earthling may be made at 2 locations by 25 x 3 mm copper strips.
- All non-current carrying metal work of the switchboard shall be efficiently bonded to the earth bus.
- Hinged doors shall be earthed through flexible earthling braid.

14.8 Cable Glands

The sizes of 11/33 kV power cable being arranged by the purchaser for incoming and/or outgoing supply shall be 120 sq. mm to 300 sq. mm XLPE CABLES.

The bidder shall provide connecting leads of adequate size with terminal clamps for connecting cable terminals to bus bars. The arrangements shall be suitable for double bolt connection as shown in the drawing. Two sets of one plain washer and one cup washer and two nuts and one bolt shall be provided for the purchasers incoming/outgoing cable connections. The bidder's scope shall also include necessary number of heavy duty PVC cable glands for terminating 11/33kV power cables.

14.9 Instrument Transformers

- The current transformers (CTs) and potential transformers (PTs) shall conform to the requirement stipulated in relevant standards.
- The CTs & PTs shall be of cast resin type (Insulation Class 'E') and shall be able to withstand the thermal and mechanical stresses resulting from the maximum short circuit & momentary current ratings specified. These shall be completely encapsulated.
- The resin used for manufacturing of CT/PT and Bushing Board shall be of reputed make and resin casting shall be carried out under vacuum by hot setting process only. Cold setting epoxy resin of reputed make should be used for casting over complete inside wiring, connecting strips on HV side.
- CTs /PTs shall have polarity marks indelibly marked on each transformer and at the associated terminal block.
- CTs/PTs shall be of the single phase type.1.5 Core lamination shall be of high grade steel or other equivalent alloy.
- Name plate showing particulars and connection diagram shall be provided. They shall be made of non-corrosive material, shall be indelibly punched/painted and shall be firmly fixed on the body of instrument transformer.
- The CTs & PTs shall be suitable for floor mounting in the cubicle.

14.10 Tests

14.10.1 Acceptance and Routine Tests

Following tests shall be carried out as acceptance and routine tests.

a) For Current Transformers.
   - All tests as per clause No.9.1.2 of IS – 2705 (Part-I) 1992.

b) For Potential Transformer.
   - All tests as per clause No. 9.1.2 of IS-3156 (Part-I) 1992

c) For Complete Unit:
   - Temperature rise test on complete unit at rated current of cubicle.
   - Power frequency withstand test at 28 kV, 50 kV and 70 kV for 11 kV and 33 kV cubicle respectively.

d) Overall dimension.

- For CTs and PTs required tested shall be carried out at the original manufacturer's works in the presence of purchaser's representative.

14.10.2 Type Tests

For the CTs and PTs, the type tests shall be carried out for each voltage class and for each rating of short time withstand current with lowest CT ratio.

For Current Transformer:

All testes (Except High Voltage power frequency wet withstand test) as per clause No. 9.1.1 of IS-2705 (Part-I) 1992. Amended up to date, considering outdoor application of CTs.

- Short time current tests.
- Temperature rise test.
- Lightning impulse test for CT for service in electrically exposed installation.
- Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class.

For Potential Transformer:

All testes (Except High Voltage power frequency wet withstand test) as per clause No. 9.1.1 of IS-3156 (Part-I) 1992. Amended up to date, considering outdoor application of PTs.

- Temperature rise test.
- Lightning impulse test for PT for service in electrically exposed installation.
- Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class.

For Complete Unit:

- Temperature rise test on complete unit at the rated current of cubicle of each voltage class with highest C.T. ratio. (IS 3427(1997)).
- Power Frequency Withstand Test at 28 kV, 50kV and 70kV for 11Kv and 33 KV cubicle respectively.
- Impulse Wave Withstand test at 75 kV, 125kV & 170kV for 11kV and 33 KV cubicles (considering that the cubicles are meant for outdoor use) as per IS-2071.
- Type test for IP-55 protection as per category '1' as mentioned as per clause no. 7.5 of IS 12063.
- Short time withstand current test, shall be performed on the cubicle by passing a current of 13.1 KA for 1 Sec. for 11kV and 26.2 KA for 1 sec. for 33kV, with CT/PT bypassed. (IS 3427-1997).

14.10.3 Type Test Reports

The HT Metering cubicles, CTs and PTs shall be fully type tested as per relevant IS and this specification. The tenderer shall furnish detailed type test reports of all the type tests for offered CTs, PTs and HT Metering Cubicles. For these CTs & PTs, the type tests shall be for each voltage class and for each rating of short time current. These tests should have been carried within 5 years prior to the date of submission of type test reports. If TTRs as above are not submitted on or before due date and time, the offer shall stand rejected. The purchaser reserves the right to demand repetition of some or all TTRs in presence of purchaser's representative at purchaser's cost. In case the unit fails in any one type test, the complete supply shall be rejected.

All above type tests shall be carried out at NABL Laboratories to prove that the complete HT Metering Cubicles, CTs and PTs offered meet the requirements of specification. The successful tenderer shall take approval/waival of type tests from CE (S&P), UPCL Dehradun prior to commencement of supply.

14.10.4 Minimum Testing Facilities

The Tenderer must clearly indicate the details of testing facilities available at the works of manufacturer and that the facilities are adequate to carry out all routine and acceptance tests. These facilities should be available to UPCL's Engineers, if deputed to carry out or witness the tests at the manufacturer's works.

For CT/PT at original manufacturer's works:

- Class of accuracy test panel for CTs with phase angle and ratio error measuring unit with Current source, Burden box and standard CT.
- Class of accuracy test panel for PTs with phase angle and ratio error measuring unit with Voltage source, Burden box and standard PT.
- Partial discharge test setup.
- Resistance Voltage Divider.
- High Frequency Generator Set with control panel.
- Milli Ohms Meter.
- Over voltage inter turn test equipment.

HT Metering Cubicle:

- Power Frequency Withstand Test Generator Set with control panel.
- Current source for temperature rise test with digital ammeter, volt meter, temperature indicators and Tong Tester.

Minimum Manufacturing Facilities:

The tenderer should have following minimum manufacturing facilities in house to prove his reliability as a manufacturer of HT Metering Cubicle.

a) Power operated shearing machine.
b) Power operated press brake.
c) Power operated press.

The tenderer shall furnish details of Powder Coating process employed.

14.11 Prototype and Drawing

The successful bidder will have to offer a prototype sample for inspection before bulk manufacturing. The prototype sample will be inspected by a team of purchaser's representatives. On approval of prototype the bidder will have to submit the drawings accordingly and get it approved from C.E. (S&P) before bulk manufacturing and supply. No additional delivery period will be permitted for approval of prototype and drawings.

14.12 Inspection

The inspection may be carried out by the purchaser at any stage of manufacture. The successful tenderer 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 equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

14.13 Documentation

The tenderer shall furnish two sets of following drawings and documents along with his offer.

- Complete assembly drawings of the metering cubicle showing plan, elevation and typical sectional views and locations of cable boxes, bus bars, metering compartment and TV meter.
- Foundation plan showing location of foundation channels, anchor bolts and anchors, floor plan and openings for cables etc.
- Type test certificates for type testing of bought out items, if already carried out.
- Descriptive pamphlets and literature of bought out items including CT characteristic curves etc.

14.14 Guarantee

The manufacturer shall provide a guarantee of 54 months from the date of commissioning or 60 months from the date of dispatch whichever is earlier. Bidders shall guarantee to repair or replace the meters and meter boxes (if

supplied), which are found to be defective/ inoperative at the time of installation, or become inoperative/ defective during guarantee period. Replacements shall be effected within 1 month from the date of intimation. If during the guarantee period, the materials are found defective or sub-standard, the same will have to be repaired/replaced free of cost by the supplier within 30 days of intimation. If the defective materials are not replaced/rectified as per above guarantee clause, the Company shall recover twice the equivalent amount from any of the bills of the supplier or from performance guarantee so deposited by the supplier. Life of battery used for the meter should be guaranteed for 10 (ten) years.

14.15 Packing & Forwarding

The equipment shall be packed in cartons / 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. Supplier without any extra cost shall supply any material found short inside the packing cases immediately.

The packing shall be done as per the standard practice as mentioned in IS 15707 2006. Each package shall clearly indicate the marking details (for e.g., manufacturer's name, Sr. Nos. of meters in the package, quantity of meter, and other details as per supply order). However, he should ensure the packing is such that, the material should not get damaged during transit by Rail/ Road.

14.16 Schedules

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

Unless otherwise brought out separately by the tenderer, the equipment offered shall be claimed to conform to the specification, scrupulously. The discrepancies between the specification and the catalogues or literature submitted as part of the offer shall not be considered as valid unless specifically brought out.

14.16.1 Schedule I [GTP in e-tendering]

As per section 9.4 of this technical specifications

14.16.2 Schedule II

Tenderer shall furnish here a list of similar orders executed/ under execution by him to whom a reference may be made by purchaser in case he considers such a reference necessary.

Table 14-8: Schedule II

S.No.	Name of client & description of items ordered	Value of order	Period of supply & commissioning	Name & Address to whom reference may be made
1	2	3	4	5

15. Technical Specification for 11 KV Outdoor Type Current Transformers

15.1. Scope

The specification covers the design, manufacture, testing at manufacturer's works and supply of 11 KV Current Transformers complete with all accessories and spares suitable for outdoor use. Single phase, Outdoor, oil filled hermetically sealed with dead tank.

15.2. Service Conditions

Equipment/material to be supplied against this specification shall be suitable for satisfactory continuous operation under the tropical conditions as follows.

Table 15-1: Tropical conditions for continuous operation

S.No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

15.3. Standards

The Current Transformers shall conform in all respects to IEC-185 & IS 2705 part-I, II, III & IV (amended up to date) except where specified otherwise. The equipment meeting any other authoritative standard which ensures equal or better quality than the standard mentioned above shall also be acceptable. Where the equipment offered conforms to any other standard the salient features of difference between the standards adopted and specified shall be clearly brought out in the tender.

15.4. Specific Technical Requirements

S.No.	Item	Specification
1	Reference standard	IS 2705 (Part I to IV)/IEC 185
2	System voltage	
	A. Normal	11 kV
	B. Highest	12 kV
3	Supply frequency	50 Hz
4	System Neutral earth	Solidly earthed
5	Insulation level	

S.No.	Item	Specification	
	A. Impulse	75 kV peak	
	B. 1 min power frequency voltage	28 kV rms	
6	CT installation	Outdoor, single phase unit	
7	Type	Oil insulated or dry type	
8	Current		
	A. Normal	600 amp / 400 amp	
	B. Short time rating	12.5 kA rms for 3 sec (for current above 150 Amp)	
		12.5 kA rms for 1 sec (for current below 150 Amp)	
9	One minute power frequency Withstand voltage between Secondary terminal & earth	3kV	
10	Installation safety factor	Less than 5	
11	Clear height of bushing	370 mm (Bird clearance)	
12	Minimum creepage	25 mm/kV	
13	CT details	**Incomer**	**Outgoing**
	I) Ratio	600-300-150/5-5-5 a 600-300-150/5-5 a	400-200-100/5-5 a
14	II) Class of accuracy		
	A) Core I (Metering)	0.5	0.5
	B) Core II (O/C protection)	5P10	5P10
	C) Core III (Protection)	5P10	
15	III) Burden (every core)	15 VA	15 VA

15.5. General Technical Requirements

Current transformers, three per circuit breaker, shall be of outdoor, single phase oil immersed dead tank type and shall comply with IEC185 and IS2705, suitable for operation in hot and humid atmospheric conditions described in service condition. They shall be mounted on the bracket. The CT tank should be Hot Dip galvanized as per relevant ISS to prevent corrosion of all exposed metal parts.

3 core CTs will be provided for 10 MVA Power Transformers having differential protection and 2 core CTs will be provided for 11KV Feeder, incomer & 5MVA Power Transformers where differential protection is not provided.

15.5.1 Core

a) High grade non- ageing cold rolled grain-oriented silicon steel of low hysteresis loss and permeability shall be used for the core so as to ensure specified accuracy at both normal and over currents. The flux density shall be limited to ensure that there is no saturation during normal service.
b) The instrument security factor of the metering core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current.
c) The protection core to be used for earth fault and over current protection shall be designed for minimum saturation factor of 20 for the highest setting. The magnetizing curves for the core shall be furnished.
d) CT core to be used for differential protection shall be of PS class.

15.5.2 Windings

Primary Winding

It shall be made of high conductivity rigid copper wire. The primary winding current density shall not exceed the limit of 1.6 Amp per sq. mm for normal rating.

The design current density for short circuit current as well as conductivity of metal used for primary winding shall be as per IS 2705. The calculation for the selection of winding cross section shall be furnished by contractor.

The continuous current rating of the primary winding shall be one hundred and fifty Percent of the normal rated current.

Secondary Winding

The secondary windings shall be made of electrolytic copper with suitable insulation. The conductor shall be of adequate cross- section so as to limit the temperature rise even during short circuit conditions. The insulation of windings and connections shall be free from composition liable to soften, shrink or collapse during service.

For multi ratio design, the multi ratio will be achieved by reconnection of the primary winding or secondary winding. The excitation current of the CT shall be as low as possible. The contractor shall furnish the magnetization curves for all the cores.

The terminal box shall be dust free & vermin proof. The size of the terminal box shall be big enough to enable easy access and working space with the use of normal tools.

Secondary windings of current transformers shall be used for metering, instrumentation and protection and shall be rated for continuous current of one hundred and fifty percent of normal rated current of primary winding.

15.5.3 Marking

Polarity shall be indelibly marked on each current transformer and at the lead and termination at associated terminal blocks. CTs with multi ratio winding shall be clearly tabulated to show the connections required for different ratios. Similar numbers shall be marked on terminal block arrangement and wiring diagram. Apart from the above marking and those to be provided as per IEC 185 or IS 2705, other markings shall be provided in consultation with owner.

15.5.4 Construction

The current transformer enclosures shall be made of high-quality steel and shall be hot dip galvanized and shall be able to withstand and stresses occurring during transportation and the terminal and mechanical stresses resulting from maximum short circuit current in service. The primary winding and terminals shall be in a tank and supported by a hollow porcelain insulator. The secondary connection shall be conducted through the hollow insulator and terminated in a terminal box mounted on the base plate.

15.5.5 Sealing

Each current transformer shall be supplied filled with insulating oil complying with IEC296 or IS115 and shall be hermetically sealed to prevent atmosphere coming in contact with oil, avoiding frequent filtration and change of oil.

The current transformers shall have provision for draining and re-filling insulation oil after drying.

15.5.6 Insulating Oil

The current transformer shall be complete with new insulating oil. The quantity of insulating oil for first filling of the equipment and complete specification of oil proposed to be used shall be stated in the bid. The oil shall conform to the requirements of latest issue of IEC296 or IS115.

To ensure prevention of oil leakage, the manufacturer will give following details supported by drawings:

- Location of emergence of Primary & Secondary terminals
- Interface between porcelain & metal tanks

- Cover of the secondary terminal box

Any nut & bolt and screw used for fixation of the interfacing porcelain bushing for taking out the terminals shall be provided on flanges cemented to the bushings & not on the porcelain.

If gasket joints are used, Nitrite Butyl Rubber gasket shall be used. The grooves shall be machined with adequate space for accommodating gasket under pressure.

The CT shall be vacuum filled with oil after processing. It will be properly sealed to eliminate breathing & to prevent air & moisture from entering the tank. The sealing methods/arrangement shall be described by the contractor & be approved by the owner

15.5.7 Fittings and Accessories

Fittings and accessories listed below shall be supplied with each current transformer

- Oil level gauge
- Oil filling hole and cap;
- Pressure relief device;
- HV terminal connectors;
- Two earthing terminals and strips with necessary nut, bolts and washers;
- Name and rating plate;
- Terminal box with LV terminal connections;
- Mounting nuts, bolts and washers;

Any other fittings deemed essential by the Supplier shall also be supplied with each current transformer.

The oil level gauge shall be mounted in such a way that the oil level can be clearly seen from ground level.

A dust, vermin and weather proof terminal box shall be provided at the lower end of the current transformer for terminating the secondary windings. The box shall have a bolted cover plate complete with gaskets. The terminal box shall have terminal blocks, cable gland plate and cable glands with shrouds suitable for different sizes of PVC insulated control cables 650/1100V grade as per IEC227 or IS1554. The terminal blocks shall have covering of moulded insulation materials complete with brass studs, washers, nuts and lock nuts suitable for termination of 2X2.5 sq mm wires. The termination shall be made by crimping lugs or bare wire with insulating sleeves at ends.

The terminal box enclosure shall have protection as per class IP 55 as defined in IEC529 or IS13947.

15.5.8 CT Junction Box/Console Box

Each set of 3 current transformers for three phase shall be provided with a common junction box mounted on the circuit breaker supporting structure at a convenient position to accommodate the secondary wire of CT and other control cables of Purchaser. Separate terminals for testing the relays and instruments and short circuiting of each current transformer secondary wires shall be provided in it. The junction box enclosure shall have the same protection features as for the terminal box. It shall be provided with terminal blocks, gland plates and glands suitable for different sizes of cables. Facilities shall be provided for earthing the CT secondary wires in the junction box.

15.5.9 Bushings

Oil filled/condenser type, porcelain bushing shall be used on the current transformers. The porcelain shall be homogenous thoroughly verified and impervious to moisture. The blazing of porcelain shall be uniform brown colour free from blisters, burns and other similar defects. Bushing shall have ample insulation, mechanical strength and rigidity for the purpose for which they will be used. There shall be no undue stressing of any part of bushings due to temperature changes and adequate means shall be provided to accommodate conductor expansion. The bushings shall be so designed that when operated at highest system voltage specified in clause 3.3, there will be no electric discharge in between the conductors and the bushings. No corrosion or injury shall be caused to conductor insulation or supports by the formation of substances produced by chemical action. The insulation on bushings shall be co-coordinated with that of the current transformer such that the flash over if any, will occur

only external to the current transformers. The bushings should not cause radio interference when operated at rated voltage .In general the bushings shall conform to the latest issue of IS 2099 or equivalent.

15.5.10 Hollow Porcelain Insulators

The insulators of the current transformers shall conform to latest edition of IS5621 and shall be subjected to and successfully pass the tests listed in this standard and in IEC211. The hollow porcelain insulators shall be brown glazed and shall meet the requirements indicated in this specification. The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength.

Each of the bushings shall be complete with the following-

- Bio-metallic expansion type terminal connector
- Oil level side gauge and convenient means of filling, sampling and draining of oil.
- Adjustable arcing horns.

15.5.11 Insulation Level

The current transformers shall be designed to withstand impulse test voltages and power frequency test voltages as specified in this specification.

15.5.12 Terminal Connections

The CTs shall be provided with bi-metallic solder less clamp and rigid type terminal connectors on the top tank for connection to the HV terminals. They shall be universal type suitable for both horizontal and vertical connections.

Two earthing terminals complete with necessary hardware shall be provided on each CT for connecting to earth continuity conductor to be provided. The earthing terminals shall be identified by means of appropriate symbol marked in a legible and indelible manner adjacent to the terminals. The terminals shall be adequately sized to meet the full earth fault current envisaged. Suitable terminal connector for earth connection shall also be supplied size of Terminal connectors however shall be confirmed at the time of approval of drawing.

15.5.13 CT Mounting Bracket

The supporting structure shall be fitted with a bracket for supporting the three oil filled 11KV single phase current transformers. The support bracket shall be provided opposite the circuit breaker poles and shall ensure adequate clearance between the breaker poles and the CTs. The drawings of the structure with bracket shall be subject to Purchaser's approval before fabrication.

15.5.14 Galvanization

All the ferrous parts including nuts bolts etc shall be hot dip galvanized as per IS 2629-1966 (As amended up to date).

15.5.15 Spare Parts

The tenderer shall quote separately for spares recommended by them for five years operation of equipment covered by this specification. The purchaser will decide the actual quantity of spare parts to be ordered on the basis of the list and the item wise prices for spares called for in the price schedule.

15.5.16 Completeness of Equipment

Any fitting accessories or apparatus which may not have been specifically mentioned in this specification but are usual or necessary in the equipment for satisfactory functioning shall be deemed to be included in the contract and shall be supplied without any extra cost. All plant and equipment shall be complete in all details whether such details are mentioned in the specification or not.

15.6. Tests and Inspection

The CTs shall be tested in accordance with the requirements of the type tests and routine tests as per the latest issues IEC185 or IS2705.

15.6.1 Type Tests

Type test reports (less than five years old as on due date of tender) of tests carried out on 11 kv CT's at CPRI/ NABL accredited laboratory shall be furnished by the bidder along with offer otherwise offer shall be rejected.

The tests to be conducted shall include;

- Lightning impulse voltage;
- Power frequency wet withstand voltage ;
- Temperature rise;
- Short time current; o Composite error;
- Accuracy test (for measuring core);
- Instrument security current (for measuring core);
- Current error and phase displacement (for protection core)

15.6.2 Routine Tests

- Verification of terminal marking and polarity;
- Power frequency dry withstand test on primary windings;
- Power frequency dry withstand test on secondary windings;
- Power frequency dry withstand test between sections;
- Over voltage inter-turn test;
- Composite error;
- Turn ratio;
- Accuracy test (for measuring core);
- Current error and phase displacement (for protection core);
- Knee point voltage and magnetizing current test (for PS class); xi. Secondary winding resistance (for PS class).
- Insulation Resistance Test.

15.7. Guarantee

The material will be guaranteed against defective materials, bad workmanship and unsatisfactory performance for a period of 30 months from the date of delivery. If during the guarantee period, the materials are found defective or sub-standard, the same will have to be replaced/repaired free of cost by the supplier within 30 days of intimation.

15.8. Drawings and Instructions Manual

The tenderer shall submit with the tender the following drawings to enable the purchaser to assess the suitability of the equipment.

- General layout and assembly drawings of the equipment
- Arrangement of terminal equipment
- Schematic drawings of electric power to control circuit
- Graph showing the performance of the equipment

Drawings necessary to demonstrate compliance with any critical, dimensional requirements such as for transportation, fitting within the restricted space, clearance required etc.

These drawings shall show sufficiently over all dimensions clearance and space requirements of all apparatus to be furnished to enable the purchaser to determine the design and layout of the installation.

Soon after the award of the contract the manufacturer shall submit the drawing duly describing the equipment in detail for approval.

The following drawings are to be supplied as part of the contract-

- Outline dimension drawings

- Assembly drawings
- Cross sectional view of the instrument transformer
- Foundation diagram
- Wiring diagram with polarity marks
- Magnetization curves

Executive Engineer (Stores), UPCL will be the final authority for approving the drawings submitted by the tenderer.

Seven copies of the instructions manual covering instructions for installation and maintenance check test shall be supplied by the contractor as a part of the contract.

15.9. Schedule

15.9.1. Schedule – I [Guaranteed Technical Particulars for 12 KV out Door Current Transformers]

S.No.	Particulars of GTP Parameter	Offered
1	Manufacturers name & Type	
2	Manufacturer's type Designation.	
3	Whether Conforming to standards	
4	Rated Voltage in kv	
5	Rated primary current (Amps)	
6	Rated Secondary current (Amp)	
7	Whether conforming to Details of Cores	
8	Secondary resistance corrected to 75ºc (in Ohm)	
9	Magnetizing current (in ma)	
10	Rated dynamic withstand current (kap) as per Annexure- I at	
11	Rated short time withstands current for 1 sec. Duration	
12	One minute dry power frequency withstand voltage	
13	One minute wet power frequency withstand voltage	
14	1.2/50 micro-second impulse withstand voltage (kv P)	
15	The die-electric withstand values(kv p) of external and internal insulation	
16	One minute power frequency withstands voltage of secondary winding (kv rms)	
17	Minimum creepage distance in mm	
18	Weight of oil (kg).	
19	Total Weight (kg).	
20	Mounting details	
21	Overall dimension.	
22	Magnetization curves	
23	Type of winding	
24	Cross section area of primary winding	
25	Cross section area of secondary winding	
26	No. Of Primary turns	

S.No.	Particulars of GTP Parameter	Offered
27	No. Of secondary turns	
28	Current density of primary winding	
29	Primary terminal	
30	Type of insulation & Temperature rise limits applicable	
31	Whether Current transformer conforms to the Temperature rise limits	
32	Whether Type test reports (within five years) are submitted along with the offer?	
33	Type of oil compensation	
34	Whether Experience sheet is submitted along with the offer?	
35	Whether Two year continuous servicing performance certificate is submitted along with the offer?	
36	Whether Turn over sheet is submitted along with the offer?	
37	Whether Drawings are submitted along with the offer?	
38	Whether Test tap is provided?	
39	Type of Pressure release device provided?	
40	Partial discharge level	
41	Rated continuous thermal current	
42	Current security factor	
43	Type of insulation material used	

16. Technical Specifications for 11 KV Outdoor Type Potential Transformer

16.1. Scope

The scope of this specification covers design, manufacturing, testing, supply, transportation, insurance (transit and storage), erection, site testing & commissioning of 11 kV Potential Transformer suitable for outdoor service.

16.2. Service Conditions

Equipment/Material to be supplied against this specification shall be suitable for satisfactory continuous operation under the Tropical Conditions given below:

Table 16-1: Tropical conditions for continuous operation

Sr. No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

16.3. Standards

The cables shall comply with latest revision of the following Indian Standards unless otherwise stipulated in the specification.

All references to Indian Standards shall be deemed to be complying with latest amendments to the respective IS, if any.

Table 16-2: Standards

S. No.	IS	IEC	Item
1	Is 3156	IEC 186	Voltage transformers
2	Is 2099		Bushings for alternating voltages above 1000 Volts
3	Is 1147		Dimensions for Porcelain Transformer Bushings
4	Is 115		New insulating oils
5	Is 13947(part I)		Glossary of terms relating to metal containers
6	Indian electricity Rules 1956/ CEA regulations, 2010		Indian electricity Rules 1956/ CEA regulations, 2010
7		IEC 815	Guide for the selection of insulators in respect of polluted condition

16.4. Basic Technical requirements

The 11KV outdoor voltage transformers are required to meet the following basic technical requirement (Reference standards IEC186, IS3156 and associated standards listed in the specification).

Table 16-3: Basic Technical requirements

Sr. No	Particulars	Requirements
1	Type	Single phase
2	Nominal/ Highest system voltage, phase to phase	11kv / 12kv
3	Instrumentation, Metering and Protection Application	
4	Number of secondary windings	1
5	Rated normal burden (minimum acceptable)	200 VA
6	Rated primary voltage	11 kV
7	Rated secondary voltage	110 V
8	System neutral earthing	Solidly earthed
9	Class of accuracy	0.5
10	Rated insulation level (Primary winding) (Phase to earth)	
11	One minute power frequency withstand voltage to earth (wet and dry) rms	28kv
12	Impulse withstand voltage to earth with 1.2/50 sec wave of +ve and -ve polarity (peak)	75kv
13	One minute power frequency withstand voltage of secondary winding (rms)	
14	Between phase to earth	3kv
15	Between sections	3kv
16	Rated voltage factor	
17	Continuous	1.2
18	For 30 seconds	1.5
19	Creepage distance to earth in mm per kv of highest phase to phase system voltage	25

16.5. General Technical Requirements

The voltage transformers to be supplied under this specification shall be of outdoor, single phase dead tank double wound, oil immersed type, complying with IEC185 and IS3156 suitable for operation in hot and humid atmospheric conditions described in this document. To prevent corrosion of the exposed surfaces, the tank should be hot dip galvanized. They shall have separate HV and LV windings and shall be suitable for use as bus VTs in 33/11kv substations.

16.5.1 Duty Requirement

11KV Voltage transformer for all the indicating instruments and measuring meters in the primary substation on 11KV side.

16.5.2 Porcelain Insulator

External parts of the voltage transformers which are under continuous electrical stress shall be of hollow porcelain insulators complying with latest edition of IS6521 tested as per IEC211. The creepage and flashover distance of the insulators shall be dimensioned and the type and profile designed in accordance with IEC815 or IS13134 and shall

be suitable for the worst environmental conditions for heavily polluted atmosphere and shall be not less than 25mm per kV of highest phase to phase system voltage with protected creepage distance minimum 50 percent of the total. Internal surfaces of hollow insulators shall also be glazed.

The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength.

All porcelain used on the voltage transformers shall have the following properties high strength, homogeneity, uniform glaze, free from cavities and other flaws and a high quality uniform finish porcelain components shall withstand the maximum expected static and dynamic loads to which the voltage transformers may be subjected during their service life. The clear height of porcelain housing shall be at least 430 mm.

The insulation of the hollow porcelain insulators shall be coordinated with that of the voltage transformers to ensure that any flash over occurs only externally.

16.5.3 Core

High grade non-ageing cold rolled grain oriented silicone steel of low hysteresis loss and permeability shall be used for core so as to ensure accuracy at both normal and or over Voltages. There shall be no saturation at any stage during operation.

The instrument security factor of the core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current or over voltages.

16.5.4 Windings

Primary Winding

It shall be made of insulated electrolytic copper wire and covered with double paper insulation. The insulation of windings and connections shall be free from composition liable to soften, looze, shrink or collapse during service. The neutral end of the winding shall be brought outside for earthing.

The conductor shall be of adequate cross-section so as to limit the temperature rise even during maximum over voltages.

The current rating of the primary winding shall be one hundred and fifty percent of the normal rated burden and the windings shall be suitable to withstand continuously the maximum system voltage.

Secondary Winding

It shall be made of insulated copper wire of electrolytic grade and covered with double paper insulation. The terminal box shall be dust free & vermin proof. The size of the terminal box shall be big enough to enable easy access and working space with the use of normal tools.

The secondary winding of the voltage transformers shall also be suitable for continuous over voltage corresponding to the maximum system voltage at the primary winding. The winding supports shall be suitably reinforced to withstand normal handling and the thermal and dynamic stresses during operation without damage.

The voltage transformer secondary circuits will be taken out to form the star point and earthed at one point outside the voltage transformers.

16.5.5 Marking

Both primary and secondary winding terminals shall be clearly and indelibly marked to show polarity in accordance with IEC186. The connections required for different secondary windings in case of multi- winding voltage transformers shall be clearly indicated in terminal blocks and the wiring diagrams.

16.5.6 Tank

Both expansion chamber and tank of the voltage transformers shall be made of high quality steel and shall be hot dip galvanized and shall be able to withstand the stress occurring during transit and all thermal and mechanical

stresses resulting from maximum short circuit current during operation. It shall be fabricated of MS steel sheet of min. 3.15 mm thickness for sides & 5 mm for top & bottom.

16.5.7 Insulating Oil

The voltage transformers shall be supplied filled with new insulating oil. The oil shall conform to the requirements of latest issue of IEC296 of IS115. The quantity of insulating oil for first filling of the equipment and complete specification of oil proposed to be used shall be stated in the bid.

The manufacturer will give following details supported by drawings:

- Location of emergence of Primary & Secondary terminals
- Interface between porcelain & metal tanks
- Cover of the secondary terminal box

Any nut & bolt and screw used for fixation of the interfacing porcelain bushing for taking out the terminals shall be provided on flanges clamped to the bushings & not on the porcelain directly.

If gasket joints are used, Nitrite Butyl Rubber gasket shall be used. The grooves shall be in machined with adequate space for accommodating gasket under pressure.

The PT shall be vacuum filled with oil after processing. It will be properly sealed to eliminate breathing & to prevent air & moisture from entering the tank. The sealing methods/arrangement shall be described by the contractor & be approved by the owner.

16.5.8 Sealing

If gasket joints are used, Nitrite Butyl Rubber gasket shall be used. The grooves shall be machined with adequate space for accommodating gasket under pressure. The voltage transformers shall be supplied filled with insulating oil and shall be hermetically sealed to prevent atmosphere coming in contact with oil, avoiding filtration and change of oil.

16.5.9 Fitting and Accessories

Fittings and accessories listed below shall be supplied with each voltage transformer

- Oil level gauge.
- Oil drain, sampling and filling hole with cap;
- Pressure relief device;
- HV terminals;
- Two earthing terminals with necessary nuts, bolts and washers; vi. Name and rating plate;
- Secondary terminal box with LV terminal connections; viii. Mounting nuts, bolts and washers;
- L.V HRC cartridge fuses for the protection of secondary winding;
- Any other fitting deemed essential by the contractor shall also be supplied along with each voltage transformer
- The oil level gauge shall be mounted in such a way that the oil level can be clearly seen from the ground level.

The name and rating plate shall contain all the particulars as provided in IEC186 and also the name of the employer and year of manufacture. They shall comply with the clause termed label in this specification.

16.5.10 Secondary Terminal Box

A dust, vermin and weather proof terminal box shall be provided at the lower end of each voltage transformer for terminating the secondary windings. The box shall have a bolted removable cover plate complete with gaskets. The terminal box shall have cable gland plate and cable glands with shrouds suitable for entry of 4 core x2.5mm2 PVC insulated control cables as per IEC227 or IS1554.

The terminal box enclosure shall have protection of class IP 55 as defined in IEC529 or IS13947 and shall be painted or galvanized in accordance with specification of Surface Treatment.

16.5.11 Terminal Blocks

Terminal blocks of brass studs rated for 10 Amps continuous current, 650 Volt grade enclosed in moulded insulating materials shall be provided with adequate electrical clearance for terminating the secondary wiring and outgoing connections. The terminal blocks shall be suitable for termination of 2.5mm^2 wires. The termination shall be made by crimping Jugs or bare wire with insulating sleeves at ends. All terminals must be marked with numbers and wire termination provided with numbered ferrules for identification.

16.5.12 Fuse Protection

The secondary windings shall be protected by HRC cartridge fuses in fuse holder consisting of carriers and bases. The carriers and bases shall be of high grade flame retarding and non-hygroscopic moulded insulating materials with hard glass surface. Each fuse shall be identified with engraved plastic label.

16.5.13 Circuit Diagram

A durable copy of the circuit wiring diagram shall be affixed to the inner side of the terminal box cover. Labels shall be provided inside the cover to describe the functions of various items of equipments.

16.5.14 Termination

The equipment shall be supplied with HV electrical connection terminals of a size and rating appropriate for all the duties, including overload duty specified for the equipment. The terminals shall be of the bi-metallic type, suitable for connection of all aluminium alloy conductor (AAAC) or aluminium conductor steel reinforced (ACSR). In general connections using palm type solder-less sockets shall be preferred. The proposed method of connections shall be stated in the offer and shall be subject to approval by the Purchaser. Where the terminals are of the clamp type, they shall be suitable for taking a range of conductors appropriate to the rating of the equipment.

All nuts, bolts, washers and spring washers required to complete the connection shall be supplied with the equipment.

The primary terminal shall be of standard size of 30 mm dia. X 80 mm length of heavily tinned (min. Thickness 15 micron) electrolytic copper of 99.99 % conductivity.

The secondary terminals studs shall be provided with at least 3 nuts and two plain washers, these shall be made of brass duly nickeled. The min. Stud outer dia. shall be 10 mm & length 15 mm. The min spacing between the centres of the adjacent studs shall be 1.5 times the outer dia. of the stud.

16.5.15 Polarity

The polarity shall be marked on each PT at the secondary terminals in the terminal box. There shall be MCB of suitable rating at secondary terminals.

16.5.16 Earthing Terminal

Two earthing terminals complete with necessary hardware shall be provided on each voltage transformer for connecting to earth continuity conductors of the Employer. They shall be of electroplated brass and of adequate size to carry the earth fault current.

Two earthing terminals shall be provided on the metallic tank of size 16 mm dia. & 30 mm length each with one plain washer & one nut for connection to the station earth mat. The earthing terminals shall be identified by means of appropriate symbol marked in a legible and indelible manner adjacent to the terminals.

16.6. Test and Inspections

The voltage transformers shall be tested in accordance with the requirements of the type tests and routine tests as provided in the latest issues of IEC186 or IS3516.

16.6.1 Type Tests

Type test reports (less than five years old as on due date of tender) of tests carried out on 11 kv PT's at CPRI/ NABL accredited laboratory shall be furnished by the bidder along with offer otherwise offer shall be rejected.

The tests to be conducted shall include;

- Lightning impulse voltage test;
- High voltage power frequency wet withstand voltage;
- Temperature rise test;
- Short circuit withstand capability test; Determination of limits of voltage error and phase displacement

16.6.2 Routine Tests

- Verification of terminal marking and polarity;
- Power frequency withstand tests on primary winding;
- Power frequency dry withstand tests on secondary winding;
- Power frequency withstand tests between sections;
- Determination of limits of voltage errors and phase displacement; Partial discharge measurement.
- Insulating Resistance measurement.

16.6.3 Temperature Rise

The temperature rise of any part of the voltage transformer under continuous operating and exposed in the direct rays of the sun shall not exceed the permissible limits as provided in IEC publication 186 or IS3156. These shall not be exceeded when corrected for the difference between the ambient temperature at site and the ambient temperature specified in the standard. The correction proposed shall be stated in the bid.

16.7. Drawings and Instructions Manual

The tenderer shall submit with the tender the following drawings to enable the purchaser to assess the suitability of the equipment.

a) General layout and assembly drawings of the equipment
b) Arrangement of terminal equipment
c) Schematic drawings of electric power to control circuit
d) Graph showing the performance of the equipment
e) Drawings necessary to demonstrate compliance with any critical, dimensional requirements such as for transportation, fitting with in the restricted space, clearance required etc.

These drawings shall show sufficiently over all dimensions clearance and space requirements of all apparatus to be furnished to enable the purchaser to determine the design and layout of the installation.

Soon after the award of the contract the manufacturer shall submit the drawing duly describing the equipment in detail for approval.

The following drawings are to be supplied as part of the contract:

- Outline dimension drawings
- Assembly drawings
- Cross sectional view of the instrument transformer
- Foundation diagram
- Wiring diagram with polarity marks
- Magnetization curves

Executive Engineer (Stores), UPCL will be the final authority for approving the drawings submitted by the tenderer.

Seven copies of the instructions manual covering instructions for installation and maintenance check test shall be supplied by the contractor as a part of the contract.

16.8. Schedules

16.8.1. Schedule – I [Guaranteed Technical Particulars for 12 KV out Door Potential Transformers]

Table 16-4: Guaranteed Technical Particulars for 12 KV out Door Potential Transformers

S.No.	Particulars of GTP Parameter	Offered
1	Manufacturers name & Type of PT	
2	Manufacturer's type Designation.	
3	Whether Conforming to standards	
4	Rated Primary Voltage in kv	
5	Number of secondary windings	
6	Rated secondary voltage (Volts)	
7	Rated burden (VA)	
8	Accuracy class	
9	Highest system voltage (kv)	
10	Quantity of oil (Liters)	
11	Type of insulation & Temperature rise limits applicable	
12	Whether Potential transformer conforms to the Temperature rise limits	
13	Rated voltage factor & time	
14	One minute power frequency withstand voltage test (dry) (kv rms)	
15	One minute power frequency withstand voltage test (wet) (kv rms)	
16	1.2/50 microsecond impulse wave withstand test voltage (kv P)	
17	One minute power frequency withstand voltage on secondary (kv rms)	
18	Minimum Creepage distance (mm)	
19	Weight of oil (kg)	
20	Total weight (kg)	
21	Overall dimensions	
22	Mounting details	
23	Primary terminals	
24	Whether Type test reports (within 5 years) are submitted along with the offer?	
25	Type of oil compensation	
26	Whether experience sheet is submitted along with the offer?	
27	Whether two year continuous servicing performance certificate is submitted along with the offer?	
28	Whether Turn over sheet is submitted along with the offer?	
29	Whether Drawings are submitted along with the offer?	
30	Whether Pressure release device is provided?	
31	Type of insulation material used for PT	
32	Actual Clearance between live part and ground (mm)	

17. Technical Specification for Dual Core Current Transformer for substation metering and protection

17.1. Scope

The specification covers the design, manufacture, testing at manufacturer's works and supply of 11 KV dual core Current Transformers complete with all accessories and spares suitable for outdoor use. Single phase, Outdoor, oil filled hermetically sealed with dead tank.

17.2. Service Conditions

Equipment/material to be supplied against this specification shall be suitable for satisfactory continuous operation under the tropical conditions as follows:

Table 17-1: Tropical conditions for continuous operation

S.No.	Particulars	Value
1	Maximum ambient temperature (Deg. Celsius)	50
2	Minimum temperature (Deg. Celsius)	-5
3	Relative humidity range (%)	10 to 100
4	Maximum annual rainfall (mm)	1500
5	Maximum wind pressure (kg/sq m)	195
6	Wind speed zones (m/s)	47 & 39
7	Maximum altitude above mean sea level (m)	3000
8	Isoceraunic level (days/year)	50
9	Seismic level (Horizontal acceleration) (g)	0.13

17.3. Standards

The Current Transformers shall conform in all respects to IEC-185 & IS 2705 part-I, II, III & IV (amended up to date) except where specified otherwise. The equipment meeting any other authoritative standard which ensures equal or better quality than the standard mentioned above shall also be acceptable. Where the equipment offered conforms to any other standard the salient features of difference between the standards adopted and specified shall be clearly brought out in the tender.

17.4. General Technical Requirements

Current transformers, three per circuit breaker, shall be of outdoor, single phase oil immersed dead tank type and shall comply with 2705/1992 & IS 11322, suitable for operation in hot and humid atmospheric conditions described in service condition. They shall be mounted on the bracket. The CT tank should be Hot Dip galvanized as per relevant ISS to prevent corrosion of all exposed metal parts.

SI No.	Description	Required Specifications
1.	Type of C.T.	11 KV wound type, Double core, Double Ratio
2.	Rated Voltage	11 KV
3	Highest System Voltage	12 KV
4.	Transformation ratios	600-300/5-5A & 400-200/5-5A
5.	Rated burden	10 VA for Metering & 15 VA for Protection
6.	Frequency	50 Hz
7.	Class of Accuracy	0.5 for metering & 5P10 for protection
8.	Application	Metering /Protection
9.	One Minute high voltage power frequency withstand voltage on primary winding	28 KV (r.m.s.)
10.	One Minute high voltage power frequency withstand voltage on secondary winding	3 KV (r.m.s.)
11.	Short time thermal current rating & its duration	18.4 KA for 1 second
12.	Rated dynamic current	2.5 times rated short time current
13.	1.2/50 micro second Impulse voltage with stand test	75 KV (Peak)
14.	Partial Discharge test	To be carried out on each CT at manufacturer's works as a Routine test
15.	Confirming to IS	IS 2705/1992 & IS 11322
16.	Suitable for	11 KV Indoor type BHEL, Siemens, Crompton, Biecco make VCB

17.5.1 Core

e) High grade non- ageing cold rolled grain-oriented silicon steel of low hysteresis loss and permeability shall be used for the core so as to ensure specified accuracy at both normal and over currents. The flux density shall be limited to ensure that there is no saturation during normal service.
f) The instrument security factor of the metering core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current.
g) The protection core to be used for earth fault and over current protection shall be designed for minimum saturation factor of 20 for the highest setting. The magnetizing curves for the core shall be furnished.
h) CT core to be used for differential protection shall be of PS class.

17.5.2 Windings

Primary Winding

It shall be made of high conductivity rigid copper wire. The primary winding current density shall not exceed the limit of 1.6 Amp per sq. mm for normal rating.

The design current density for short circuit current as well as conductivity of metal used for primary winding shall be as per IS 2705. The calculation for the selection of winding cross section shall be furnished by contractor.

The continuous current rating of the primary winding shall be one hundred and fifty Percent of the normal rated current.

Secondary Winding

The secondary windings shall be made of electrolytic copper with suitable insulation. The conductor shall be of adequate cross- section so as to limit the temperature rise even during short circuit conditions. The insulation of windings and connections shall be free from composition liable to soften, shrink or collapse during service.

For multi ratio design, the multi ratio will be achieved by reconnection of the primary winding or secondary winding. The excitation current of the CT shall be as low as possible. The contractor shall furnish the magnetization curves for all the cores.

The terminal box shall be dust free & vermin proof. The size of the terminal box shall be big enough to enable easy access and working space with the use of normal tools.

Secondary windings of current transformers shall be used for metering, instrumentation and protection and shall be rated for continuous current of one hundred and fifty percent of normal rated current of primary winding.

17.5.3 Marking

Polarity shall be indelibly marked on each current transformer and at the lead and termination at associated terminal blocks. CTs with multi ratio winding shall be clearly tabulated to show the connections required for different ratios. Similar numbers shall be marked on terminal block arrangement and wiring diagram. Apart from the above marking and those to be provided as per IEC 185 or IS 2705, other markings shall be provided in consultation with owner.

17.5.4 Construction

The current transformer enclosures shall be made of high quality steel and shall be hot dip galvanized and shall be able to withstand and stresses occurring during transportation and the terminal and mechanical stresses resulting from maximum short circuit current in service. The primary winding and terminals shall be in a tank and supported by a hollow porcelain insulator. The secondary connection shall be conducted through the hollow insulator and terminated in a terminal box mounted on the base plate.

17.5.5 Sealing

Each current transformer shall be supplied filled with insulating oil complying with IEC296 or IS115 and shall be hermetically sealed to prevent atmosphere coming in contact with oil, avoiding frequent filtration and change of oil.

The current transformers shall have provision for draining and re-filling insulation oil after drying.

17.5.6 Insulating Oil

The current transformer shall be complete with new insulating oil. The quantity of insulating oil for first filling of the equipment and complete specification of oil proposed to be used shall be stated in the bid. The oil shall conform to the requirements of latest issue of 2705/1992 & IS 11322.

To ensure prevention of oil leakage, the manufacturer will give following details supported by drawings:

- Location of emergence of Primary & Secondary terminals
- Interface between porcelain & metal tanks
- Cover of the secondary terminal box

Any nut & bolt and screw used for fixation of the interfacing porcelain bushing for taking out the terminals shall be provided on flanges cemented to the bushings & not on the porcelain.

If gasket joints are used, Nitrite Butyl Rubber gasket shall be used. The grooves shall be machined with adequate space for accommodating gasket under pressure.

The CT shall be vacuum filled with oil after processing. It will be properly sealed to eliminate breathing & to prevent air & moisture from entering the tank. The sealing methods/arrangement shall be described by the contractor & be approved by the owner

17.5.7 Fittings and Accessories

Fittings and accessories listed below shall be supplied with each current transformer

- Oil level gauge
- Oil filling hole and cap;
- Pressure relief device;
- HV terminal connectors;
- Two earthing terminals and strips with necessary nut, bolts and washers;
- Name and rating plate;
- Terminal box with LV terminal connections;
- Mounting nuts, bolts and washers;

Any other fittings deemed essential by the Supplier shall also be supplied with each current transformer.

The oil level gauge shall be mounted in such a way that the oil level can be clearly seen from ground level.

A dust, vermin and weather proof terminal box shall be provided at the lower end of the current transformer for terminating the secondary windings. The box shall have a bolted cover plate complete with gaskets. The terminal box shall have terminal blocks, cable gland plate and cable glands with shrouds suitable for different sizes of PVC insulated control cables 650/1100V grade as per IEC227 or IS1554. The terminal blocks shall have covering of moulded insulation materials complete with brass studs, washers, nuts and lock nuts suitable for termination of 2X2.5 sq mm wires. The termination shall be made by crimping lugs or bare wire with insulating sleeves at ends.

The terminal box enclosure shall have protection as per class IP 55 as defined in IEC529 or IS13947.

17.5.8 CT Junction Box/Console Box

Each set of 3 current transformers for three phase shall be provided with a common junction box mounted on the circuit breaker supporting structure at a convenient position to accommodate the secondary wire of CT and other control cables of Purchaser. Separate terminals for testing the relays and instruments and short circuiting of each current transformer secondary wires shall be provided in it. The junction box enclosure shall have the same protection features as for the terminal box. It shall be provided with terminal blocks, gland plates and glands suitable for different sizes of cables. Facilities shall be provided for earthing the CT secondary wires in the junction box.

17.5.9 Bushings

Oil filled/condenser type, porcelain bushing shall be used on the current transformers. The porcelain shall be homogenous thoroughly verified and impervious to moisture. The blazing of porcelain shall be uniform brown colour free from blisters, burns and other similar defects. Bushing shall have ample insulation, mechanical strength and rigidity for the purpose for which they will be used. There shall be no undue stressing of any part of bushings due to temperature changes and adequate means shall be provided to accommodate conductor expansion. The bushings shall be so designed that when operated at highest system voltage specified in clause 3.3, there will be no electric discharge in between the conductors and the bushings. No corrosion or injury shall be caused to conductor insulation or supports by the formation of substances produced by chemical action. The insulation on bushings shall be co-coordinated with that of the current transformer such that the flash over if any, will occur only external to the current transformers. The bushings should not cause radio interference when operated at rated voltage .In general the bushings shall conform to the latest issue of IS 2099 or equivalent.

17.5.10 Hollow Porcelain Insulators

The insulators of the current transformers shall conform to latest edition of IS5621 and shall be subjected to and successfully pass the tests listed in this standard and in IEC211. The hollow porcelain insulators shall be brown glazed and shall meet the requirements indicated in this specification. The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength.

Each of the bushings shall be complete with the following-

- Bio-metallic expansion type terminal connector
- Oil level side gauge and convenient means of filling, sampling and draining of oil.
- Adjustable arcing horns.

17.5.11 Insulation Level

The current transformers shall be designed to withstand impulse test voltages and power frequency test voltages as specified in this specification.

17.5.12 Terminal Connections

The CTs shall be provided with bi-metallic solder less clamp and rigid type terminal connectors on the top tank for connection to the HV terminals. They shall be universal type suitable for both horizontal and vertical connections.

Two earthing terminals complete with necessary hardware shall be provided on each CT for connecting to earth continuity conductor to be provided. The earthing terminals shall be identified by means of appropriate symbol marked in a legible and indelible manner adjacent to the terminals. The terminals shall be adequately sized to meet the full earth fault current envisaged. Suitable terminal connector for earth connection shall also be supplied size of Terminal connectors however shall be confirmed at the time of approval of drawing.

17.5.13 CT Mounting Bracket

The supporting structure shall be fitted with a bracket for supporting the three oil filled 11KV single phase current transformers. The support bracket shall be provided opposite the circuit breaker poles and shall ensure adequate clearance between the breaker poles and the CTs. The drawings of the structure with bracket shall be subject to Purchaser's approval before fabrication.

17.5.14 Galvanization

All the ferrous parts including nuts bolts etc shall be hot dip galvanized as per IS 2629-1966 (As amended up to date).

17.5.15 Spare Parts

The tenderer shall quote separately for spares recommended by them for five years operation of equipment covered by this specification. The purchaser will decide the actual quantity of spare parts to be ordered on the basis of the list and the item wise prices for spares called for in the price schedule.

17.5.16 Completeness of Equipment

Any fitting accessories or apparatus which may not have been specifically mentioned in this specification but are usual or necessary in the equipment for satisfactory functioning shall be deemed to be included in the contract and shall be supplied without any extra cost. All plant and equipment shall be complete in all details whether such details are mentioned in the specification or not.

17.5. Tests and Inspection

The CTs shall be tested in accordance with the requirements of the type tests and routine tests as per the latest issues 2705/1992 & IS 11322.

17.6.1 Type Tests

Type test reports (less than five years old as on due date of tender) of tests carried out on 11 kv CT's at CPRI/ NABL accredited laboratory shall be furnished by the bidder along with offer otherwise offer shall be rejected.

The tests to be conducted shall include;

- Power frequency wet withstand voltage ;
- Temperature rise;
- Short time current; o Composite error;
- Accuracy test (for measuring core);
- Instrument security current (for measuring core);
- Current error and phase displacement (for protection core)

17.6.2 Routine Tests

- Verification of terminal marking and polarity;
- Power frequency dry withstand test on primary windings;
- Power frequency dry withstand test on secondary windings;
- Power frequency dry withstand test between sections;
- Over voltage inter-turn test;
- Composite error;
- Turn ratio;
- Accuracy test (for measuring core);
- Current error and phase displacement (for protection core);
- Knee point voltage and magnetizing current test (for PS class); xi. Secondary winding resistance (for PS class).
- Insulation Resistance Test.

17.6. Guarantee

The material will be guaranteed against defective materials, bad workmanship and unsatisfactory performance for a period of 30 months from the date of delivery. If during the guarantee period, the materials are found defective or sub-standard, the same will have to be replaced/repaired free of cost by the supplier within 30 days of intimation.

17.7. Drawings and Instructions Manual

The tenderer shall submit with the tender the following drawings to enable the purchaser to assess the suitability of the equipment.

- General layout and assembly drawings of the equipment
- Arrangement of terminal equipment
- Schematic drawings of electric power to control circuit
- Graph showing the performance of the equipment

Drawings necessary to demonstrate compliance with any critical, dimensional requirements such as for transportation, fitting within the restricted space, clearance required etc.

These drawings shall show sufficiently over all dimensions clearance and space requirements of all apparatus to be furnished to enable the purchaser to determine the design and layout of the installation.

Soon after the award of the contract the manufacturer shall submit the drawing duly describing the equipment in detail for approval.

The following drawings are to be supplied as part of the contract-

- Outline dimension drawings
- Assembly drawings
- Cross sectional view of the instrument transformer
- Foundation diagram
- Wiring diagram with polarity marks
- Magnetization curves

Executive Engineer (Stores), UPCL will be the final authority for approving the drawings submitted by the tenderer.

Seven copies of the instructions manual covering instructions for installation and maintenance check test shall be supplied by the contractor as a part of the contract.

17.8. Schedule

17.8.1. Schedule – I [Guaranteed Technical Particulars for 12 KV out Door Current Transformers]

S.No.	Particulars of GTP Parameter	Offered
44	Manufacturers name & Type	
45	Manufacturer's type Designation.	
46	Whether Conforming to standards	
47	Rated Voltage in kv	
48	Rated primary current (Amps)	
49	Rated Secondary current (Amp)	
50	Whether conforming to Details of Cores	
51	Secondary resistance corrected to 75ºc (in Ohm)	
52	Magnetizing current (in ma)	
53	Rated dynamic withstand current (kap) as per Annexure- I at	
54	Rated short time withstands current for 1 sec. Duration	
55	One minute dry power frequency withstand voltage	
56	One minute wet power frequency withstand voltage	
57	1.2/50 micro-second impulse withstand voltage (kv P)	
58	The die-electric withstand values(kv p) of external and internal insulation	
59	One minute power frequency withstands voltage of secondary winding (kv rms)	
60	Minimum creepage distance in mm	
61	Weight of oil (kg).	
62	Total Weight (kg).	

S.No.	Particulars of GTP Parameter	Offered
63	Mounting details	
64	Overall dimension.	
65	Magnetization curves	
66	Type of winding	
67	Cross section area of primary winding	
68	Cross section area of secondary winding	
69	No. Of Primary turns	
70	No. Of secondary turns	
71	Current density of primary winding	
72	Primary terminal	
73	Type of insulation & Temperature rise limits applicable	
74	Whether Current transformer conforms to the Temperature rise limits	
75	Whether Type test reports (within five years) are submitted along with the offer?	
76	Type of oil compensation	
77	Whether Experience sheet is submitted along with the offer?	
78	Whether Two year continuous servicing performance certificate is submitted along with the offer?	
79	Whether Turn over sheet is submitted along with the offer?	
80	Whether Drawings are submitted along with the offer?	
81	Whether Test tap is provided?	
82	Type of Pressure release device provided?	
83	Partial discharge level	
84	Rated continuous thermal current	
85	Current security factor	
86	Type of insulation material used	

18. Annexure tables for parameters (AMR enabled meters)

18.1 Annexure table 27 (Instantaneous parameters)

S. No. (1)	Parameter (2)	OBIS Code A.B.C.D.E.F (3)	Interface Class /Attribute (4)
i)	Real time clock, date and time	0.0.1.0.0.255	8
ii)	Current, I_R	1.0.31.7.0.255	3
iii)	Current, I_Y	1.0.51.7.0.255	3
iv)	Current, I_B	1.0.71.7.0.255	3
v)	Voltage, V_{RN} / V_{RY}	1.0.32.7.0.255	3
vi)	Voltage, V_{YN}	1.0.52.7.0.255	3
vii)	Voltage, V_{BN} / V_{BY}	1.0.72.7.0.255	3
viii)	Signed power factor, *R*-phase	1.0.33.7.0.255	3
ix)	Signed power factor, *Y*-phase	1.0.53.7.0.255	3
x)	Signed power factor, *B*-phase	1.0.73.7.0.255	3
xi)	Three phase power factor, PF	1.0.13.7.0.255	3
xii)	Frequency – Hz	1.0.14.7.0.255	3
xiii)	Apparent power, kVA	1.0.9.7.0.255	3
xiv)	Signed active power, kW (+ Forward; – Reverse)	1.0.1.7.0.255	3
xv)	Signed reactive power, kvar (+ Lag; – Lead)	1.0.3.7.0.255	3
xvi)	Number of power — failures	0.0.96.7.0.255	1
xvii)	Cumulative power — OFF duration in min	0.0.94.91.8.25	3
xviii)	Cumulative tamper count	0.0.94.91.0.25	1
xix)	Cumulative billing count	0.0.0.1.0.255	1
xx)	Cumulative programming count	0.0.96.2.0.255	1
xxi)	Billing date	0.0.0.1.2.255	3
xxii)	Cumulative energy, kWh (Import)	1.0.1.8.0.255	3/2
xxiii)	Cumulative energy, kWh (Export)	1.0.2.8.0.255	3/2
xxiv)	Cumulative energy kvarh-Q1	1.0.5.8.0.255	3/2
xxv)	Cumulative energy kvarh-Q2	1.0.6.8.0.255	3/2
xxvi)	Cumulative energy kvarh-Q3	1.0.7.8.0.255	3/2

S. No. (1)	Parameter (2)	OBIS Code A.B.C.D.E.F (3)	Interface Class /Attribute (4)
xxvii)	Cumulative energy kvarh-Q4	1.0.8.8.0.255	3/2
xxviii)	Cumulative energy, kVAh (Import)	1.0.9.8.0.255	3/2
xxix)	Cumulative energy, kVAh (Export)	1.0.10.8.0.255	3/2
xxx)	Maximum demand, kW	1.0.1.6.0.255	4/2, 5
xxxi)	Maximum demand, kVA	1.0.9.6.0.255	4/2, 5

NOTES:

1 Signed Power factor: (+) indicates lag and (–) indicates lead.
2 The parameters at Sl No. (xvii) to (xx) and (xxii) to (xxix) hold cumulative values at that instant from the date of manufacturing.
3 The above list is identified for the purpose of communication to HHU, DCU or HES.
4 Item at Sl No. (xix) refers to the Billing Period Counter.
5 Item at Sl No. (xxi) — Data type to be same as for attribute 2 of IC = 8, Clock. If not specified the billing date shall be first day of the month and time shall be 00:00hrs.
6 The RTC-Time format by default shall be HH:MM: SS.
7 Signed power factor shall be verified at rated voltage, rated current and rated frequency at 0.5 lag and 0.8 lead.
8 Power and Energy related parameters shall be verified at UPF, 0.5 lag and 0.8 lead.
9 The parameters at Sl No. xxiii, xxv, xxvi and xxix are applicable only for meters supporting —import and export‖ energy measurement.
10 VRN, VYN and VBN are for 3φ/4W meter and VRY and VBY are for 3φ/3W meter
11 The parameter current IY and signed power factor, Y – phase are not applicable for 3φ/ 3W meter
12 Please refer Annexure F IS14697 for Quadrant (Q1-Q4) definitions
13 For Sl No. (xxx) and (xxxi), the attributes 2 and 5 of indicated IC shall be captured in instantaneous profile. The attribute 3 of indicated IC shall be captured in Scaler profile. The RTC — Time format shall be HH:MM

18.2 Annexure table 28(Block Load Profile Parameters)

Sl No. (1)	Parameter (2)	OBIS Code A.B.C.D. E.F (3)	Interface Class/ Attribute (4)
i)	Real Time Clock, Date and Time	0.0.1.0.0.255	8/2
ii)	Current, I_R	1.0.31.27.0.255	3/2
iii)	Current, I_Y	1.0.51.27.0.255	3/2
iv)	Current, I_B	1.0.71.27.0.255	3/2
v)	Voltage, V_{RN} / V_{RY}	1.0.32.27.0.255	3/2
vi)	Voltage, V_{YN}	1.0.52.27.0.255	3/2
vii)	Voltage, V_{BN} / V_{BY}	1.0.72.27.0.255	3/2

NOTES

i. The parameters listed in this table are for load survey purpose and are logged as per the block period time.
ii. The parameters at Sl No. (ii) to (vii) are the average values during the block period time and stored at the end of that time block.
iii. The parameters at Sl No. (viii) to (xv) are the actual energy consumption during that time block.
iv. The RTC-time format by default shall be HH:MM.
v. Energy related parameters shall be verified at UPF, 0.5 lag and 0.8 lead.
vi. The time stamp shall be at the end of the capture period (Ist entry value is 00:15 or 00:30 min as applicable and last entry value is 00:00 hrs next day).
vii. Support for selective access shall be as defined in 11.3 of IS 15959 (Part 1).
viii. The parameters at Sl. No. (ix, xi xii, xv) are applicable only for meters supporting —import and export‖ energy measurement.
ix. VRN, VYN and VBN are for 3φ/4W meter and VRY and VBY are for 3φ/3W meter
x. The parameter current IY is not applicable for 3φ/ 3W meter

18.3 Annexure table 29(Billing profile parameters)

Sl No. (1)	Parameter (2)	OBIS Code	Interface Class No./ Attribute (4)
i)	Billing date	0.0.0.1.2.255	3/2
ii)	System power factor for billing period import	1.0.13.0.0.255	3/2
iii)	Cumulative energy, kWh	1.0.1.8.0.255	3/2
iv)	Cumulative energy, kWh for TZ1	1.0.1.8.1.255	3/2
v)	Cumulative energy, kWh for TZ2	1.0.1.8.2.255	3/2
vi)	Cumulative energy, kWh for TZ3	1.0.1.8.3.255	3/2
vii)	Cumulative energy, kWh for TZ4	1.0.1.8.4.255	3/2
viii)	Cumulative energy, kWh for TZ5	1.0.1.8.5.255	3/2
ix)	Cumulative energy, kWh for TZ6	1.0.1.8.6.255	3/2
x)	Cumulative energy, kWh for TZ7	1.0.1.8.7.255	3/2
xi)	Cumulative energy, kWh for TZ8	1.0.1.8.8.255	3/2
xii)	Cumulative energy, kVAh	1.0.9.8.0.255	3/2
xiii)	Cumulative energy, kVAh for TZ1	1.0.9.8.1.255	3/2
xiv)	Cumulative energy, kVAh for TZ2	1.0.9.8.2.255	3/2
xv)	Cumulative energy, kVAh for TZ3	1.0.9.8.3.255	3/2
xvi)	Cumulative energy, kVAh for TZ4	1.0.9.8.4.255	3/2
xvii)	Cumulative energy, kVAh for TZ5	1.0.9.8.5.255	3/2
xviii)	Cumulative energy, kVAh for TZ6	1.0.9.8.6.255	3/2
xix)	Cumulative energy, kVAh for TZ7	1.0.9.8.7.255	3/2
xx)	Cumulative energy, kVAh for TZ8	1.0.9.8.8.255	3/2
xxi)	MD, kW	1.0.1.6.0.255	4/2, 5
xxii)	MD, kW for TZ1	1.0.1.6.1.255	4/2, 5
xxiii)	MD, kW for TZ2	1.0.1.6.2.255	4/2, 5
xxiv)	MD, kW for TZ3	1.0.1.6.3.255	4/2, 5
xxv)	MD, kW for TZ4	1.0.1.6.4.255	4/2, 5
xxvi)	MD, kW for TZ5	1.0.1.6.5.255	4/2, 5
xxvii)	MD, kW for TZ6	1.0.1.6.6.255	4/2, 5
xxviii)	MD, kW for TZ7	1.0.1.6.7.255	4/2, 5
xxix)	MD, kW for TZ8	1.0.1.6.8.255	4/2, 5
xxx)	MD, kVA	1.0.9.6.0.255	4/2, 5
xxxi)	MD, kVA for TZ1	1.0.9.6.1.255	4/2, 5
xxxii)	MD, kVA for TZ2	1.0.9.6.2.255	4/2,5
xxxiii)	MD, kVA for TZ3	1.0.9.6.3.255	4/2, 5
xxxiv)	MD, kVA for TZ4	1.0.9.6.4.255	4/2, 5
xxxv)	MD, kVA for TZ5	1.0.9.6.5.255	4/2, 5
xxxvi)	MD, kVA for TZ6	1.0.9.6.6.255	4/2, 5
xxxvii)	MD, kVA for TZ7	1.0.9.6.7.255	4/2, 5
xxxviii)	MD, kVA for TZ8	1.0.9.6.8.255	4/2, 5
xxxix)	Billing Power ON duration in Minutes (During billing period)	0.0.94.91.13.255	3/2
lx)	Cumulative energy, kWh (Export)	1.0.2.8.0.255	3/2
lxi)	Cumulative energy, kVAh (Export)	1.0.10.8.0.255	3/2

Sl No. (1)	Parameter (2)	OBIS Code	Interface Class No./ Attribute (4)
lxii)	Cumulative energy, kvarh-Q1	1.0.5.29.0.255	3/2
lxiii)	Cumulative energy, kvarh-Q2	1.0.6.29.0.255	3/2
lxiv)	Cumulative energy, kvarh-Q3	1.0.7.29.0.255	3/2
lxv)	Cumulative energy, kvarh-Q4	1.0.8.29.0.255	3/2

NOTES

i. Support for selective access shall be as defined in 11.3 of IS 15959 (Part 1).
ii. The current cycle billing parameters shall be readable as the values of the latest billing period, on demand. This shall be in addition to the last 6 billing period data which shall be available in the profile buffer as the last 6 entries in the buffer.
iii. The captured attributes in case of Interface Class 4 (Extended register) used for MD values will be attributes 2 and 5 (Value and Time stamp).
iv. The Billing Date - Time format by default shall be HH:MM.
v. Billing Date and Time shall be current date and current time.
vi. The parameters at Sl No. (lx, lxi, lxiii, lxiv) are applicable only for meters supporting both forward (import) and reverse (export) measurement.
vii. If not specified, the billing date shall be first day of the month and time shall be 00:00 h

18.4Annexure table 30 (Name Plate Details)

Sl No.	Parameter	OBIS Code	Interface Class
i)	Meter Serial Number	0.0.96.1.0.255	1 (Data)
ii)	Device ID	0.0.96.1.2.255	1
iii)	Manufacturer name	0.0.96.1.1.255	1
iv)	Firmware version for meter	1.0.0.2.0.255	1
v)	Meter type	0.0.94.91.9.255	1
vi)	Category	0.0.94.91.11.255	1
vii)	Current rating	0.0.94.91.12.255	1
viii)	Meter year of manufacture	0.0.96.1.4.255	1

NOTES

i. For item Sl No. (v), value —8‖ indicates 3P-4W LTCT smart meter, —9‖ indicates 3P-3W HTCT smart meter and —10‖ indicates 3P-4W HTCT smart meter.
ii. For item (vi) a value D3 indicates Three phase a.c. static Transformer operated watthour smart meter for HV/LV consumer application.
iii. For item (vii) shall indicate current range (Ib-Imax) A.
iv. For item at Sl No. (viii) year is mandatory and the format is yyyy

18.5 Annexure Table 31(Programmable parameters)

S. No.	Parameter	OBIS Code A.B.C.D.E.F	Interface Class
1	Demand Integration Period	1.0.0.8.0.255	1
2	Profile Capture Period	1.0.0.8.4.255	1
3	Single-action Schedule for Billing Dates	0.0.15.0.0.255	22
4	Activity Calendar for Time Zones	0.0.13.0.0.255	20
5	RS 485 Device address	0.0.22.0.0.255	23
6	Image Transfer	0.0.44.0.0.255	18
7	Metering Mode	0.0.94.96.19.255	1
8	LLS secret	0.0.40.0.2.255	15
9	HLS key	0.0.40.0.e.255 (e=3, 5)	15
10	Global key change	0.0.43.0.0.255	64
11	Image activation single action schedule	0.0.15.0.2.255	22
12	ESWF	0.0.94.91.26.255	1
13	MD Reset	0.0.10.0.1.255	9 (method 1)

NOTES

i. The parameters are programmable by the utility engineers with required access rights.
ii. Unit for Demand Integration Period and Profile capture period is in _seconds‘. The Demand Integration Period shall be 1800s (default) and programmable to 900s. The Profile capture period shall be 1800s (default) and programmable to 900 or 1800s.
iii. On change of time zones settings, the on-going billing cycle data will be generated and a new billing cycle shall be commenced as per new activity calendar.
iv. Programming of any of the parameters shall increment the _Cumulative programming count‘ value.
v. The RTC - Time format by default shall be HH:MM:SS.
vi. Sl No. (vi) Programmability is applicable only for meters with RS485 ports.
vii. For Sl No. (viii), value shall be represented in unsigned char format and interpreted as below 0 => means Forwarded only metering mode
    a. => means —Import and Export‖ mode
viii. Parameter listed at Sl No. (vii) shall have Execute access and Parameter listed at Sl.No.(xii) shall have set access in FW association only
ix. Parameter listed at Sl.No. (xiv) shall have Execute access in US association
x. Parameter listed at Sl.No. (xii) shall have Read Write access in FW association and Read only access in US association
xi. Parameters listed at Sl.No. (x) and (xi) shall have Execute access in US association
xii. Parameter listed at Sl.No. (ix) shall have Write only access in US association

18.6Annexure table 32(Events Voltage Related)

Sl.No	Event ID	Description
i)	1	R-Phase — Voltage missing — Occurrence
ii)	2	R-Phase — Voltage missing — Restoration
iii)	3	Y-Phase — Voltage missing — Occurrence
iv)	4	Y-Phase — Voltage missing — Restoration
v)	5	B-Phase — Voltage missing — Occurrence
vi)	6	B-Phase — Voltage missing — Restoration
vii)	7	Over voltage in any phase — Occurrence
viii)	8	Over voltage in any phase — Restoration
ix)	9	Low Voltage in any phase — Occurrence
x)	10	Low voltage in any phase — Restoration
Xi)	11	Voltage unbalance — Occurrence
xii)	12	Voltage unbalance — Restoration

NOTES

i. These are the event conditions generally recorded in consumer meters, utilities may select any the above event conditions based on their practice. The need and applicability of these events for other type of meters shall be considered by utility.
ii. Occurrence is considered an event.
iii. For each of the events a certain list of parameters will be captured.
iv. The list capture parameters are given in Table A11. The utility shall select the required parameters from Table A11 as per their practice.
v. For each of the occurrence event captured, the cumulative tamper count value shall be incremented
vi. Capture parameters mentioned in Table A11 are captured when event occurrence and restoration is logged.
vii. The attributes of each of the IC (Interface class) is to be identified while finalizing the Specification.
viii. Support for selective access shall be as defined in 11.3 of IS 15959 (Part 1).
ix. Sl. No. (iii) and (iv) are not applicable for 3φ/3W meter

18.7 Annexure table 33(Events Current Related)

Sl.No	Event ID	Descriptions
1	51	R Phase — Current reverse — Occurrence
2	52	R Phase — Current reverse — Restoration
3	53	Y Phase — Current reverse — Occurrence
4	54	Y Phase — Current reverse — Restoration
5	55	B Phase — Current reverse — Occurrence
6	56	B Phase — Current reverse — Restoration
7	63	Current unbalance — Occurrence
8	64	Current unbalance — Restoration
9	65	Current bypass — Occurrence
10	66	Current bypass — Restoration
11	67	Over current in any phase — Occurrence
12	68	Over current in any phase — Restoration
13	57	R Phase — Current Open — Occurrence
14	58	R Phase — Current Open — Restoration
15	59	Y Phase — Current Open — Occurrence
16	60	Y Phase — Current Open — Restoration
17	61	B Phase — Current Open — Occurrence
18	62	B Phase — Current Open — Restoration

18.8Annexure table 34(Events Power Related)

Sl.No	Event ID	Description
1	101	Power failure (3 phase) — Occurrence
2	102	Power failure (3 phase) — Restoration

18.9Annexure table 35(Events Transaction Related)

Sl.No	Event ID	Description
1	151	Real Time Clock – Date and Time
2	152	Demand Integration Period
3	153	Profile Capture Period
4	154	Single-action Schedule for Billing Dates
5	155	Activity Calendar for Time Zones
6	157	New firmware activated
7	156	RS485 device address
8	161	LLS secret (MR) change
9	162	HLS key (US) change
10	163	HLS key (FW) change
11	164	Global key change (encryption and authentication)
12	165	ESWF change
13	166	MDI reset

18.10 Annexure table 36(Other Related Events)

Sl.No	Event ID	Description
i)	201	Abnormal External Magnetic Influence – Occurrence
ii)	202	Abnormal External Magnetic Influence – Restoration
iii)	203	Neutral disturbance (HF, dc or alternate method) – Occurrence
iv)	204	Neutral disturbance (HF, dc or alternate method) – Restoration
v)	205	Low PF — Occurrence
vi)	206	Low PF — Restoration
vii)	209	Plug in Communication module removal – Occurrence
viii)	210	Plug in Communication module removal – Restoration
xi)	213	Configuration changed to —Forwarded only‖ mode
xii)	214	Configuration changed to —Import-Export‖ mode

Sl.No	Event ID	Description
xiii)	215	Overload- Occurrence
xiv)	216	Overload- restoration

18.11 Annexure table 37(Non Rollover Events)

Sl.No	Event ID	Description
i)	251	Meter cover opening — Occurrence