

**TECHNICAL SPECIFICATION FOR LT SINGLE PHASE TWO WIRES**  
**5-30 AMPS WHOLE CURRENT STATIC NET ENERGY METER WITH LCD**  
**DISPLAY & ACCURACY CLASS 1.0**

**1.0 SCOPE**

This specification covers the design, manufacture, testing before despatch, supply and random testing after delivery of ISI-marked AC single phase 5-30 Amp. Static (Electronic) Meter of accuracy of class 1.0. Electrical Energy Meters having backlit LCD display .

The meter should be single phase capable to record and display energy in kWh, demand in kW & PF 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.

**2.0 APPLICABLE STANDARDS**

2.1 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 up to-date and latest amendments/ revisions thereof.

Sl 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 equipments (AC)- General Requirements & test conditions Part 11. metering equipments
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.	CBIP, New Delhi technical Report No.304 (Revised July 1996) read with latest Amendments issued till date.	Specification for AC static electrical energy meters.

8.	IS: 9000	Basic Environmental testing procedures for Electronic & Electrical items.
9.	ANSI/IPC-A- 610	Workmanship standard for Acceptability of Electronic Assemblies (A standard developed by Institute for Interconnecting and packaging Circuits)
10.	IS 15959: 2011 IS 15959: 2011	Data exchange for meter reading, tariff and load control - specification Comparison specification

In case of any conflict or discrepancy, the order of precedence shall be

- (i) IS
- (ii) IEC
- (iii) CBIP technical report-304 (read with latest amendments).

NOTE: 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.

## 2.2 BIS STANDARD MARK

Meters shall have BIS Standard 'ISI' Mark and supplier should possess valid BIS License.

## 3.0 CLIMATIC CONDITIONS

The meters shall be suitably designed and treated for normal life and satisfactory operation under the hot and hazardous tropical climate conditions, 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:

i)	Temperature	4° C to 55°C (45°C in shade)
ii)	Relative Humidity	10% - 100% (Sometimes approaches to saturation)
iii)	Average annual rainfall	3000 mm
iv)	Max. wind pressure	150 Kg per Sq. mm
v)	Max. altitude	1000 meters.
vi)	Average No. of dust-storm days per annum	40 days
vii)	Average no. of rainy days per annum	90 days
viii)	No. of months of tropical Monsoon conditions per Annum	3 months
ix)	Isoceraunic level	50 days

#### 4.0 ELECTRICAL SPECIFICATION

##### 4.1 PRINCIPLE PARAMETERS

Class Accuracy	1.0(No drift in accuracy with time)
Rated voltage(Vref)	240 V AC phase to neutral
Voltage variation	Meter should record correct energy for +20% of Vref to -40% of Vref
Frequency	50 Hz $\pm$ 5%
No. of phases	Single phase two wire
System of Earthing	Solidly grounded
Current Range (basic)	5 Amps. ( $I_b$ )
Maximum Current.	600% of $I_b$ (30 A)
Starting current	0.2% $I_b$ at Unity Power Factor in main element
Power factor Range	0 lag - Unity - 0 lead
Power loss	<b>Voltage circuit: The active and apparent power consumption in voltage circuit including the power supply of meter at reference voltage reference Frequency and reference temperature shall not exceed 1.0 watt and 4 VA respectively.</b> <b>(b) Current circuit: The apparent power taken by the current circuit at basic current, reference frequency and reference temp shall not exceed 1.0VA.</b>
Withstand surge voltage of 1.2/50 Micro sec	10KV peak. The testing shall be carried out as per procedure laid down IS: 13779/1999.
Test voltage at 50 Hz for 1min	2 KV rms
Power frequency with stand voltage	440 V for continuous 10 minutes between phase and neutral

##### 4.2. SUPPLY SYSTEM & POWER SUPPLY VARIATION

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 1.1 Vref

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%	$I_b$	1	0.7
		$I_b$	0.5 lag	1.0
ii	10% of 3rd harmonic in current circuit	0.6 $I_b$	UPF	0.6
		0.6 $I_{Max}$	UPF	0.6

However, the vendor can offer meters which can withstand higher variations. Meter shall be functional and able to register energy even if the voltage falls up to 50% of the rated voltage.

#### 4.3 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 IRC. 62053-21.

#### 4.4 AUXILIARY POWER

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

#### 4.5 TEMPERATURE RISE

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

i	Winding	50° C.
ii	External surface of the case	15° C.

#### 4.6 LIMITS OF ERRORS

When meter is under reference conditions, the percentage errors shall not exceed the limits as specified in IS: 13779/1999 (with latest amendments thereof).

#### 4.7 INFLUENCE QUANTITIES

The meter shall work satisfactorily with accuracy as per limit of IS:13779 (until not specified otherwise in this specification) under presence of the following quantities:

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

## 5.0 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.

## 5.1 METER CASE

- a) Meter case (base and cover) and Extended Terminal Block Cover (ETBC) shall be made of Unbreakable Flame retardant High grade UV stabilized Poly Carbonate with minimum thickness of 2.0 mm and of good dielectric and Mechanical strength.
- b) Meter case (base and cover) and extended terminal block cover (ETBC) should be injection moulded in UV stabilized poly-carbonate. The Meter Cover and ETBC shall be kept fully transparent and the meter base shall be semi-transparent / non-transparent / opaque. The moulded meter case should not change in colour, Shape, size, dimensions when subjected to 200 hrs on UV test as per ASTM D 53. It should withstand 650°C glow wire test and heat deflection test as per ISO 75. The BRSKOM reserves the right to conduct tests for material verification at any time.
- c) The window portion shall be fully transparent, unbreakable UV stabilized polycarbonate for easy reading of all the displayed values/ parameters, nameplate details and calibrating LED. The window should be scratch and break resistant and silicon coated. It should not fade in course of time and become opaque causing inconvenience for reading.
- d) The meter cover should be ultrasonically welded with the meter base. The cover shall not just be held with base on two points of sealing. It should be supported all along the boundary of base and cover of the meter as well, so that even before ultrasonic welding, the cover should be fit perfectly with the base. The 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

**Note:** The main cover of one of the sample meters to be submitted along with the bid should be ultrasonically welded. The main cover of other sample meter need not be ultrasonically welded, as at the time of sample testing, it shall be opened to ascertain conformity of meter's internal parts as

  
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per specification.

e) The Meter case shall have the following properties of plastic material:

1	Physical water Absorption	%	Max. 0.35	ASTMD 570/ IS:5133(part 2) :1969
2	Electrical Dielectric Strength at 90° C. in oil.	KV/ MM	Min 16	ASTMD 149
3	Thermal HDT	° C	Min. 125	ASTMD 6481 ISO 75
4	Flammability			
	a) Rating b) Glow wire test 650°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 1 any equivalent std.
	b) Flexural strength	MPa	Min.90	ISO 1781 any equivalent std.
	c) Modulus of Elasticity	MPa	Min. 2000	ISO 1781 any equivalent std.
	d) Izod impact Strength notched 23 Deg. C.	KJ/Sq.M	Min.8	ISO 180/ 1A or any equivalent std.

## 5.2 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. The moulded terminal block shall be made from best quality phenol formaldehyde/high impact strength UV stabilized Glass filled Poly Carbonate conforming to IS: 13779/1999(latest amended) having adequate insulating properties and mechanical strength with tin-plated 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:

- 1) The flame retardant rating of V 0 as per UL 94 testing.
- 2) The glow wire test for temperature of 960°C as per IS: 11000 (Part-2/Sec.1) or IEC 60695-2-1.
- 3) Heat deflection temperature (HDT) test of 135°C as per ISO 75 or ASTM D-648
- 4) Ball pressure test at 125°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 vendor 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%  $I_{max}$  Current -and made of electroplated (or tinned) brass. Any other provision which meets this in a better manner / way shall also be considered. The vendor 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 adequately designed for inserting up to 16mm<sup>2</sup> Aluminum stranded armoured cable sizes and shall be capable of carrying continuous current up to 150% of  $I_{max}$ . The holes in the insulating material of the terminal block, which form an extension of the terminal holes, shall be of sufficient size to accommodate the insulation of the conductors also. The clearance and creepage distances shall not be less than values specified in clause 6.6. of IS: 13779: 1999. Further, the supporting webs between the two terminals of the terminal block should be sufficiently high to ensure that the two neighboring terminals do not get bridged by dust or a flash over does not take place.
- 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 a cover which covers the meter terminals and generally the ends of the external wires or cables connected to the terminals and can be sealed independently of the meter cover. When the meter is mounted on the meter board and thereafter energized, no access to the terminals shall be possible without breaking the seals of the terminal cover.
- j) Terminal cover shall be hinged. The hinges should be concealed type. The sealing arrangement of the meter should be such that meter terminals shall be rendered inaccessible after the terminal cover is sealed. Provision for the seal should be made on front side of the meter terminal cover. The ETBC shall be designed such that the meter's internal parts are not accessible for tampering without

  
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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 manufacture.

### **5.3 CTs/SHUNT ARRANGEMENT :**

The meter shall be based on CT and shunt. This is necessary to ensure accurate recording by the meter during the condition when DC component exists in the load, EMCT/Shunt currents to be compared and higher of the two to be used for measurement. Specific confirmation to be submitted by the vendor s that accuracy of measurement will not suffer due to utilization of shunt on account of thermal stability and temperature coefficient, up to an operational temperature of 80°C. Shunt shall comply with IS: 13779. Shunt to be provided for phase circuit & CTs shall be provided to Neutral .

The CTs shall have proper magnetic shields and shall be mounted with the meter base through proper fixing arrangement so that it should have a firm support and should not move from its position in any case.

### **5.4 DISPLAY PARAMETERS AND TYPE OF DISPLAY :**

a) The meter should have bright LCD electronic display with backlit having minimum description of parameters (e.g. words like kWh, kW, Power factor, Billing parameters)/character height X width of 8 mm X 5mm or higher and with minimum 6 digits .

The LCD shall be of STN (Super Twisted Kneumatics) type, construction suitable for temperature withstand of 80°C (storage) and 65° C (operation). The LCD Display should have a wide viewing angle of 45° to 60° cone, up to one meter distance.

The registered parameter shall not be affected or lost by power failure. The display shall not be affected by electrical & Mechanical disturbances. The Nonvolatile Memory (NVM) shall have a minimum retention time of 12 years under unpowered condition i.e. the NVM shall have a storage life (without use) of 12 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

  
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accuracy class of meters as per IS.

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 for both import & export at 24.00 Hrs on the last day of the month for each calendar month and the same should go to memory.

**5.41 ) Display Parameters:** The meter shall display the required parameters in

Two different modes as follows:

**a ) 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:-

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

Each parameter shall be on meter display for 10 seconds and the time between two auto-cycles shall be 120 seconds.

**b) Push Button Mode:-**

In addition to the auto display mode parameters, the following parameters shall be displayed on pressing the push button as well as downloadable to the BCS through the CMRI.

1. LCD Test.
2. Real Time
3. Date
4. Instantaneous phase voltage, current
5. Cumulative Active energy import reading (kWh)
6. Cumulative Active energy export reading (kWh).
7. Last Bill Active Import and Export energy .
8. Last Bill Maximum demand (kW) -Import and Export.
9. Supply Frequency.
10. Instantaneous PF.
11. Instantaneous neutral current

The legends for kWh and MD should be as below:

Months	MD	Import		Export	
		Energy	PF	Energy	PF
Sept (Current month)	MD	kWh	pf	kWh	pf
August	MD1	kWh1	Pf1	kWh1	Pf1
July	MD 2	kWh2	Pf2	kWh2	Pf2
June	MD3	kWh3	Pf3	kWh3	Pf3
May	MD4	kWh4	Pf4	kWh4	Pf4
April	MD5	kWh5	Pf5	kWh5	Pf5
March	MD6	kWh6	Pf6	kWh6	Pf6

Details of the legends shall be self-explanatory with signed legend like  
 → import ← export

**c) Load survey parameters :**

Following parameters shall be made available for last 60 days with integration period of 30 min:

- Real time clock
- Energy import
- Export energy
- Net energy
- Reactive in Q1, Q2, Q3, Q4 with 30min capture time

These load survey and history data can be retrieved with the help of Meter Reading Instrument on local interrogation or remotely using the remote communication interface.

**Note:**

1. DOT matrix type LCD shall not be accepted.
2. The LCD display of the meter should be backlit. The back lit should not glow during power off condition.
3. The RTC accuracy should be within  $\pm 5$  minutes per year as per CBIP 304 applicable for Class 1.0 Energy meters. The crystal should be temperature compensated for temperature range of 0 to 50°C.
4. The display with push button shall be auto off type after the completion of display cycle and it should revert back to normal auto scroll reading after approximately 10 seconds. It shall not be necessary to keep button pressed and continue the display cycle. Fresh button press will be required after resumption of auto scroll cycle to display the above parameter again.

**d) LCD least count :** The internal least count of energy recording shall not be more than 0.01 kWh. Hence, every 0.01 kWh consumption will be internally stored. Also, there shall be no loss of energy registration on account of frequent power outages due to high start up time of the meter.

To verify the above, the meter will be switched ON/OFF 40 times at rated voltage, Ib and UPF for energy recording on display with decimal digit should be within 0.4 kWh of the energy, it should register, as per its accuracy at that load. This will be verified during inspection of meters.

**e) Self Diagnostic Features**

- (i) 'LCD Segment Check' shall be provided to check all display segments.
- (ii) The meter shall display unsatisfactory functioning or non-functioning of Real Time clock battery.

**f) Meter reading at Power outage:**

The meter shall have internal rechargeable battery and / or industrial grade long life battery (Lithium) with sufficient capacity to enable the meter reader to take meter reading even under power off conditions.

The above battery activated through push button during power failure, shall be available throughout the design life (10 years) of the Meter. No power shall be consumed from this circuit when mains are available. The same push button shall be used for displaying the readings included in auto scroll mode only during power outage.

In any case RTC battery shall not be used for display under power off condition.

**g) Maximum Demand registration and MD resets:** Meter shall continuously monitor and calculate the average maximum demand of each demand Interval time of 30 minutes and maximum of these in a calendar month shall be stored. The maximum demand shall automatically reset at 24:00 hours of the last date of each calendar month for which minimum 30 years calendar shall be programmed by the manufacturer. The cumulative kWh should also be recorded at 24:00 hours on the last date of each calendar month for previous six months for both export & import.

**h) Power factor shall also be registered in the manner of kWh & MD.**

**i) Real Time Clock And Battery:** The MD integration cycle shall be on the basis of Real time clock of the meter. The maximum drift in real time clock of the meter shall not exceed  $\pm 5$  minutes per year or better 5.7 and crystal should be temperature compensated for temperature range of 0 to 50°C when powered by internal battery or supply. A lithium battery of adequate storage energy shall be used for energy supply to real time clock during no voltage or power off condition. The minimum guaranteed life of battery should be ten years.

  
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## 5.5 OUTPUT DEVICE

The meter shall have a test output device in the form of calibration LED of red colour and minimum intensity 10 mCD (milli-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 clearance of calibration LED from any of the sides of window portion shall be approximately 20mm.

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

Since the sequence of the output pulses may not be homogeneous, the vendor shall state the minimum number of pulse counts to ensure measurement accuracy of at least 1/10th of the specified error limits as per class of the meter at various test points.

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

## 5.6 CALIBRATION

The meters should be software calibrated and factory calibrated and there shall not be any mechanical form of calibration technique, such as mechanical preset/trim pot or potentiometer so that any adjustment in calibration is not possible after freezing the meter constant. This is to ensure that meter cannot be tampered at site.

## 5.7 COMMUNICATION CAPABILITY

- a) The meter shall have provision of a galvanically isolated optical port to download the data locally through CMRI and an additional RS232 port, which shall be used for remote reading as well as data transfer through PSTN/Optical fiber/GSM/CDMA/PLCC etc. coupled with appropriate modem based on communication backbone chosen. It shall not be possible to re-programme or make any change in the meter through CMRI. The vendor shall supply necessary base computer software for reading / viewing of meter data and converting to user defined ASCII files formats. The user shall have the flexibility to select the parameters to be converted into ASCII file. The vendor shall also supply the necessary CMRI software
- b) For speedy and efficient data downloading through CMRI on base computer, licensed copies of base computer software shall have to be supplied free of cost. The software provided shall be user friendly and menu driven on Windows based operating system. The meter reading software should also be provided for CMRI.

- c) One copy of each software on every CMRI is to be provided. The compatibility of transferring data from meter to CMRI and CMRI to base computer system should be easily established. The data transfer should be highly reliable and fraud proof.
- d) No editing shall be possible on CMRI and base computer by any means. The software shall have capability to convert the entire data into ASCII format.
- e) Free of cost training for the use of software shall also be provided by the supplier. The software should have programmable facility to restrict the access to the information recorded at different security levels.
- f) The software should have polling feature with optional selection of parameters to be downloaded for AMR application.
- g) The protocol used in the meter shall have to be provided at the time of supply for the purpose of Automatic Meter Reading System. Past suppliers shall have to submit a written undertaking that they will provide protocol for meters supplied so far. They will also ensure that protocol for the type of meters supplied in the past will be provided.
- h) It shall be the responsibility of the meter manufacturer to provide the required software free of cost to enable the use of optical as well as RS232 port for reading and retrieving the data from the meter through CMRI and AMR and to download the data to PC. However, optical port and RS 232 shall be as per IEC 61107 standards.
- i) The Vendor shall arrange demonstration of the local and remote data transfer process at their own cost. Only such of the Vendor s, successfully demonstrating shall be considered. The date of demonstration shall be intimated to the techno commercially responsive firms.
- j) Necessary upgrades of software shall be supplied free of cost for downloading simultaneously the existing parameters and any parameters added in future specifications of meters.
- k) RS232 port should be provided under the terminal cover so that it cannot be accessed without opening the terminal cover. Optical port shall have separate suitable sealing facility.

#### **5.8 TAMPER AND FRAUD PROTECTION**

The meter should have tamper and fraud protection features so as to continue to register active energy under the following conditions.

**a. Use of Earthing:**

- (i) The earth indication in form of LCD icon shall be switched on. The meter has to record energy in appropriate register (import / export) whenever earth is used instead of neutral. (ii) Any

  
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combination of conditions described above under (a) and (b) (i) meter should register accurately.

- b. Neutral Missing:** When the neutral from both incoming and outgoing side are disconnected and the load is taken through earth, the meter should record energy as per rated voltage, rated frequency and unity power factor (Lag) in proportion to the current drawn with accuracy of meter within  $\pm 3\%$ . In such cases the meter shall record with a minimum current of 1Amp. However the manufacturer may specify the minimum starting Current for this condition. The meter shall be link less type. Energy has to register in the appropriate import/ export depending upon flow current.
- c. DC Immunity:** The meter should not saturate on passing of direct current which can cause the meter either to stop recording or record inaccurately as per IS: 13779 (latest version).

Apart from the above 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. In such circumstances, the meter shall record as per  $V_{ref}$  and actual load and such event shall be recorded in lamper register.

- d. External Magnetic Field:** The meters shall comply with the requirements of CBIP technical Report No.304 (with latest amendments) on application of external magnetic fields (A.C. and D.C.) as per the value(s) specified in the CBIP Report. Besides the above, in case of abnormal magnetic induction of 0.5 Tesla permanent magnet, the functioning of meter shall be in line with the abnormal magnetic influence as per CBIP 304".

- c. The threshold values for different tamper features shall be as under:**

- i. The starting current of main measuring element (between 1 & 4) shall be 0.2%  $I_b$  and that of neutral element (between 2&3) shall not exceed 2% of  $I_b$ .
- ii. The threshold value for recording of energy under tamper condition (b)(i) above shall in no case be more than 2%  $I_b$ .

- f. 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. 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.
- iii) Voltage discharge with 0-10 mm spark gap
- iv) At any place in load circuit

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

  
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site conditions. Also, meter shall be tested for Immunity to Conducted Disturbances in accordance to IEC 62052-11 and any other tests as per relevant standards can be carried out.

The vendor 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 vendor has any better proposal for tamper 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.

- g. The meter cover should be ultrasonically welded with meter base/ issued be designed such a way 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, meter shall display TAMPER permanently.

#### **5.8.1 TAMPER EVENTS:-**

Meter should have features to detect and login occurrence and restoration of following tamper events with time and date.

**Earthing:** Persistence time 5 minutes.

**Neutral Missing:** Persistence time 5 minutes.

**Magnetic Tamper:** Magnetic Tamper, when Magnetic field of 0.5 Tesla (Direct Current) is applied. It shall be as per CBIP 304 with latest amendments.

Details of last twenty-five such Tamper Events with time and date of occurrence and twenty-five restorations should be stored in memory of the meter.

#### **5.9 SEALING ARRANGEMENT OF THE METER**

The meters shall be factory calibrated and ultrasonically welded and sealed Suitably before despatch.

The meter cover shall be permanently ultrasonically welded to the meter base.

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 / chemically welded meter base with cover foolproof from tampering, two numbers of push-fit and double anchor type colourless transparent (see through), tamper evident, moulded polycarbonate seals of 18x14x7 size shall be provided on the meter case-cover boundary. Good quality seals should have six digits non repeated numbers with embossing on both sides - one side with the logo of the manufacturer and the on the other side the logo of the concerned BESCO. Only patented seals (seals from the manufacturer who has official right to manufacture the seal) shall be used. Seals can with stand up to 270 deg C, so that it can not be tampered by boiling like ordinary plastic seals. Two sealing screws shall be provided for proper sealing of the meter cover so that access to the internal part shall not be

possible without breaking the seal.

Additionally, two sealing holes shall be provided on meter case suitable for inserting sealing wire of min. 2mm dia.

One no. of sealing screws should also be provided to seal the terminal cover by the purchaser.

The above sealing inserting arrangement shall be integral part of moulded case. The provision of sealing shall also be integral part of the meter and the seals shall not be supplied loose with the meter.

A tracking and recording software for all new seals shall be provided by the manufacturer of the meter so as to track total movement of seals starting from manufacturing, procurement, storage, record keeping, installation, series of inspections, removal and disposal.

#### **5.10 FIXING ARRANGEMENT OF METER**

Every 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 the fixing of the meters. The lower fixing holes shall be provided on terminal block under the sealed terminal cover and meter is fixed by two screws so that after sealing the terminal cover both fixing screws cannot be accessed. Deleted

#### **5.11 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 a transparent meter box. The name plate details or Serial Number affixed in form of sticker shall not be accepted. 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 of the meter.
- 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) Purchaser's order Number & date.
- l) Guarantee period - 5 years.
- m) Bar Coding of serial number, month & year of manufacture of the meter.
- n) Sign of insulation.
- o) ISI mark with license number.

#### 5.12 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 from the inside portion of terminal cover. Connecting terminals of current and voltage shall be in the sequence of Phase (in)-Neutral (in)- Neutral (out)- Phase(out). Further to this, terminal marking i.e. M1, L1 etc. should be clearly embossed on terminal block which is visible distantly from outside.

#### 5.13 COMPONENTS

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

Sr.No.	Component function/Feature	Requirement
1	Measurement/computing chips	The measurement or computing chips used in the Meter should be with the Surface mount type along with the ASICs.
2	Memory chips	The memory chips should not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges.
3	Display modules	<ul style="list-style-type: none"> <li>a) The display modules should be well protected from the external UV radiations.</li> <li>b) The display visibility should 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 ).</li> <li>c) The construction of the modules should be such that the displayed quantity should not disturbed with the life of display ( PIN Type ).</li> <li>d) It should be STN type industrial grade with extended temperature range.</li> </ul>
4	Communication Modules	Communication modules should be compatible for the two <del>RS 232</del> ports ( one for optical port for communication with meter reading instruments & the other for the hardwired RS 232 port to communicate with various modems for AMR )

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5	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.
6	Power supply	The power supply should be with the Capabilities as per the relevant standards. The power supply unit of the meter should not be affected in case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections. Power supply should be unaffected by the magnet.
7	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.
8	Mechanical parts	a) 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.
9	Battery	Maintenance free Lithium with guaranteed life of 10 years
10	RTC & Micro controller.	The accuracy of RTC shall be as per relevant IEC / IS standards.
11	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm.

The relevant certificate / performance guarantee certificate from the original manufacturers shall be furnished to the BESCO officers at the time of inspection.

**5.14. Component specifications:**

The meter shall be designed and manufacture using SMT (Surface Mount Technology) components, except for power supply components, LED/ LCD etc. which are PTH type. All the material and electronic power components used in the manufacture of the meter shall be of highest quality and reputed makes so as to ensure higher reliability, longer life and sustained accuracy

Sl.No	Component Function/ Feature	Requirement	Make/ origin
1	Current Element	The meter should be with the current transformers as measuring elements. The current transformer should withstand for the clauses under 5 & 9 of IS- 13779/ 1999.	The current transformer should withstand for the clauses under 5 & 9 of IS- 13779/ 1999.
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, SMAES, NEC Texas Instruments, Phillips Dallas, Maxim, Toshiba, Renesas, Siemens, National Semiconductor, ST, Teridian

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3	Memory Chips	The memory computing chips should not be affected by the external parameters like sparking, high voltage spikes or electrostatic discharges. Meter shall have nonvolatile 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.	Atmel, National Semiconductor, Microchip, Texas Instruments, Phillips, Hitachi, Teridian, Toshiba, Renasas ST, Siemens, Prolific technology
4	Display modules	The display modules should be well protected from the external UV radiations. The display visibility should 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). The construction of the modules should be such that the displayed quantity should not be disturbed with the life of display. It should be trans reflective Htn or STN type industrial grade with extended temperature range.	Haijing, Holtek, Bonafied Technologies, Advantek, Truly Semiconductor, Hitachi, Sony, Tianma, Fairchild, sony, Tianma, Fairchild Semiconductor, Genda, Prolific Techonolgy
5	Communication modules	Communication modules should be compatible for two ports (one for optical port for communication with meter reading instruments & the other for the hardwired RS-232 port to communicate with various modems for AMR.	National Semiconductors, Hitachi, Texas Instruments, Philps, 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 Philps, HP, Everlight, Korea, Osram
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. It should not also be affected by magnet.	SMPS Type
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.	Philps, Toshiba, Fairchild, Murata, Rohm, Siemens, National Semiconductors, ATMEL, TEXAS instruments, Hitachi, Ligitec, OKI, EPCOS, TDK, Epson, Panasonic.
9	Mechanical part	The internal electrical components should be protected 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	

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10	Battery	Maintenance free battery (Ni-mh or Li-ion) of long life of 15 years. Makes & origin: Varta, Tedrium, Sanyo or national. Only non rechargeable battery should be used for RTC as well as display in absence of power since the life & reliability of these are better than the rechargeable batteries. Lithium-ion with guaranteed life of 10 years	Renata, Panasonic, Varta, Tedrium, Sanyo, National, Tadiran, Duracell, Tekcell, Sony, Saft
11	RTC/ Micro controller	The accuracy of RTC shall be as per relevant IEC/ IS standards	Philps, Dallas, Atmel, Motorola, NEC, Renesas, Hitachi, Xicor, Texas Instruments, NEC, OKI, Epson, ST
12	P.C.B	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6mm	

### 5.15 LED/LCD INDICATIONS

a) LEDs /LCDs shall be provided for following indications:

- 1) LED for Test output pulse (Imp/kwh) - Red
- 2) LCD ICON for load earthing
- 3) LCD ICON for neutral missing
- 5) LCD ICON for magnetic tamper

However, except for the test output pulse LED, all the other indications can be alternatively provided as Icon on backlit LCD display. LED shall be of low power consumption and distinctly visible from distance.

b) LED indication /LCD display shall be provided when current measurement is through neutral circuit.

c) The location of calibration LED (preferably at the center) should be such that the calibration pulses can be sensed easily through the sensor. The clearance of calibration LED from any of the sides of window portion shall be approximately 20mm.

### 6.0 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. 415 volts is supplied 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.

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- c) The meter should not saturate up to 720%  $I_b$  and should record energy accurately for P.F. range a 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 whatsoever. 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  $I_{max}$  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.
- g) *The meter shall have internal rechargeable battery and / or industrial grade long life battery with sufficient capacity to enable the meter reader to take meter reading even under power off conditions. The above battery activated through push button during power failure, shall be available throughout the design life (10 years) of the Meter. No power shall be consumed from this circuit when mains are available. The same push button shall be used for displaying the readings included in auto scroll mode only during power outage.*
- In any case RTC battery shall not be used for display under power off condition.*

## 7.0 GENERAL

- a) All electrically live screws shall be of nickel/tin plated brass.
- 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/ transient voltage spikes.
- g) Meter shall display direct reading and without multiplying factor.
- h) 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 vendor .
- i) The vendor shall furnish details of memory used in the meter.

## **8.0 ELECTROMAGNETIC COMPATIBILITY AND INTERFERENCE REQUIREMENT**

The meter shall meet EMI/EMC requirements as specified in the relevant standards described earlier in 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.

## **9.0 MANUFACTURING ACTIVITIES**

- a) All the materials, electronics and power components, ICs used in the manufacture of the meter shall be of highest quality and reputed make like mentioned in this specification to ensure higher reliability, longer life and sustained accuracy and there shall be no drift in the accuracy of the meter at least upto 10 years.
- b) The manufacturer should use application specific integrated circuit ASIC or Micro controller for metering functions.
- c) 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.

Further, the Vendor 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 subcontractor is not carrying out sub-contracting for any other vendor in the above tender. The vendor shall indicate with the name and location of such facility along with an undertaking and certificate from the utility and any ambiguity on such a confirmation shall result in immediate disqualification of the vendor.

  
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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 vendor .

Vendor s without in-house design, development and manufacturing facility as above will not be considered as meter manufacturers.

The PCB material should be of glass epoxy FR-4 grade conforming to relevant standards.

- d) 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 corrosion shall be effectively protected against corrosion by providing suitable protective coating.
- e) Quality should be ensured at the following stages:
  - (i) At PCB manufacturing stage, each board shall be subjected to bare board testing.
  - (ii) At insertion stage, all components should undergo testing for conforming to design parameters and orientation.
  - (iii) Complete assembled and soldered PCB should undergo functional testing using test equipments (testing jig).
  - (iv) Prior to final testing and calibration, all meters shall be subjected to accelerated ageing test to eliminate infant mortality.
- f) The calibration of meters shall be done in-house.
- g) The vendor should submit the list of all components used in the meter along with the offer.
- h) 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 vendor shall also give the details of quality assurance procedures followed by him in respect of the bought - out items.
- i) 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.

## **10.0 TESTS**

### **10.1 TYPE TESTS**

- a) **Type test as per IS:13779:** The type test certificates for all tests as per IS 13779 - 1999 (with latest amendments) shall required to be furnished along with offer. Type test certificates from any one of the standard Laboratories such as CPRI/ERDA/NPL/ERTL (NABL accredited for particular equipment/ test) shall only be considered. Type test certificates from Educational institute(s) will not be accepted. The type test certificates shall not be more than 03 years old from the date of bid opening. In absence of these type test reports, offer shall be rejected. Type tests should have been

  
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conducted on meter having similar constructional and other features.

b) **Additional Type Test:** In addition to the test mentioned at (a) above vendor shall also have to furnish the following type test reports.

- i. External AC/DC magnetic influence tests as per CBIP Technical Report-304.
- ii. DC influence test as per IS:13779-1999 or IEC 62053-21, in phase circuit.
- iii. Immunity to Conducted Disturbances in accordance to IEC 62052 -11.
- iv. 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 msec to 5 sec. instead of fixed time.
- v. Test of voltage variation as per this specification.
- vi. Compliance of anti-tamper features as per Clause 5.8 of this specification.
- vii. The meter shall withstand impulse voltage test at the rated impulse voltage of 10 kV as per procedure laid down in the IS: 13779/1999.

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.

The purchaser reserve the right to demand repetition of some or all the type tests at purchaser's cost.

#### 10.2 ACCEPTANCE TESTS (Before commencement of outlet)

The approved vendors shall manufacture at least 10% quantity of annual requirement and offer inspection call.

a) **List of Acceptance Tests:** Meter shall pass all the Acceptance test as laid down in IS: 13779/1999 (with latest amendments). In addition, following tests shall also be carried out as Acceptance tests by adopting methods specified in IS: 13779/IS: 9000/other relevant IEC standard/ CBIP Tech. Report-304 / (latest amended)/ this specification.

- i) Voltage variation test as per this specification.
- ii) Test of DC components in AC circuits - The limits of variation in percentage error shall be 3.0% for class 1 meter at  $I_{max}/\sqrt{2}$  and UPF, as per annexure D of IS: 13779.
- iii) Diode injection test as per clause 5.8 (d) of this specification. The inspecting officer shall verify that no DC supply/ signal is given to reference meter during the DC injection test.
- iv) 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.

v Permanent magnet test (as specified in Clause 5.8(e) of this specification).

vi) External magnetic fields (A.C. and D.C.) as per CBIP Technical Report No.304 (with latest amendments.)

vii) Glow wire test for polycarbonate material.

viii) Withstand impulse voltage test at 10 kV shall be carried out on one sample

From first lot as per procedure laid down in IS: 13779/1999 in NABI. lab.

ix) The accuracy of display parameters shall be verified at the time of inspection in line with class of accuracy of meter.

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

xi) If phase to phase voltage i.e. 415 volts is supplied between phase and neutral of the meter, the meter should not get damaged and continue to record correctly after restoration of normal supply.

xii) The accuracy of the meter may also be checked and 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.

**Sampling Plan For Acceptance Test:** 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.

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S No	Particular of tests	Sampling plan for the lot of 1001 and above	Criteria for acceptance of lot
1	No load test and minimum starting current test	32 nos.	As per clause II-3.1 of IS
2	All other acceptance tests including meter constant test as per IS & GTP except repeatability of error test, vibration test and shock test in sequence to be mutually agreed between Manufacturer and Inspecting officer.	8 nos out of above 32 samples passing tests at sr. no. 1.	As per clause II-3.2 of IS Annex.H
3	Repeatability of error test, vibration test and shock test, in sequence.	3 Nos. out of above 8 samples passing tests at sr. no. 2	Each sample should pass all three tests.

The sampling plan shall be as per IS: 13779 except that maximum lot size may be read as 10,000 Nos. If offered quantity is more than 10000 Nos., sub-lots of maximum 10000 Nos. shall be taken for acceptance tests. Samples shall be selected at random from the each lot/sub lot of meters and acceptance test as per relevant standards and additional acceptance tests as per technical specification shall be carried out on these samples.

**(c) Facilities for conducting Acceptance Test:** Vendor s should have all the facilities at their works to carry out acceptance test mentioned above in Cl.11.2 (a). The reference standard meters used for conducting tests shall be calibrated periodically at any NABL Accredited Test laboratories and test certificates shall be available at Works for verification by purchaser's representative. Any substandard meter used for testing shall be calibrated using the above mentioned reference/standard meters. **Vendor s shall have clearly mentioned the fact that they have all facilities to carry out Acceptance Test as mentioned at Cl.11.2 (a) and, any false information in this regard shall be treated as breach of contract by the supplier and purchase order placed, if any, shall be liable for cancellation.**

### 10.3 ROUTINE TESTS

All the Routine tests as laid down in IS: 13779/1999 (with latest amendments) along with Anti-Tamper Feature tests as described in Cl.5.8 of this specification shall be conducted on each and every meter by the manufacturer. Test results may be asked to be produced at any time by the purchaser or its representative. One set of routine test reports shall accompany each dispatch consignment for reference.

**Vendor s shall have clearly mentioned the fact that they have all facilities to carry out Acceptance Test as mentioned at Cl 11.2 (a) and, any false information in this regard shall be treated as breach of contract by the supplier and purchase order placed, if any, shall be liable for cancellation.**

#### **11.0 GUARANTEED TECHNICAL PARTICULARS**

If the vendor desires to furnish any other information (s) in addition to the details as asked for, the same may be furnished against the last item of this schedule.

#### **12.0 PACKING AND FORWARDING**

The meters 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. Proper arrangement for lifting, such as lifting hooks or handles etc., shall be provided. Any material found short or broken inside the packing cases shall be supplied immediately by supplier without any extra cost.

The packing shall be done as per the manufacturer's standard practice. However, packing should be safe and water-proof and manufacturer should ensure the packing is such that, the material should not get damaged during transit by Rail/Road.

#### **13.0 REPLACEMENT OF DEFECTIVE METERS**

The meters declared defective by the consignees and/or by meter testing lab shall be replaced by the supplier up to the full satisfaction of the purchaser at the cost of supplier within 14 days of intimation by purchaser/stores officer.

#### **14.0 MAINTENANCE & GUARANTEE:**

The meter shall be guaranteed for a period of Five years from the date of receipt of material. The vendor shall replace the defective meters within a period of 14 days from the date of intimation from the concerned consumer or from BESCO authorities. The guarantee for the replaced meters shall start from the date of such replacement which shall be marked on name plate. In case defective meters are not replaced in stipulated period the penalty as per clause of delay in delivery shall be applicable.

#### **15.0 QUALITY ASSURANCE PLAN**

*(a) The design life of the meter shall be minimum 10 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 equipments 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) Meter frame dimensions tolerance shall be minimum.

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

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

(b) The vendor 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.

(i) Statement giving list of important raw materials, names of sub suppliers for the raw materials.

(ii) List of manufacturing facilities available.

(iii) Level of automation achieved and list of areas where manual processing exists.

(iv) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

(v) Special features provided in the equipment to make it maintenance free.

(vi) List of testing equipment available with the vendor 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.

(c) The outlets of manufacturer which pass the tests as per the clause 10(b) will be continued for a period of one year. The supplier shall maintain record of the issue of meters and this can be checked by BESCO representative of the officer of the rank of Executive Engineer at all reasonable times. Any time after one year, the meters will again be picked up from the outlets at random and the meters will be tested at CPRI/NABL accredited labs at the cost of BESCO.

If the meter fails in testing, the outlets are liable for closure. After three years of opening of outlets further renewal of contract is again subject to type tests at the cost of supplier and price negotiations with BESCO at that point of time. In case of any disagreement in cost/quality after three years, outlets will be closed and retendered. The supplier shall keep the outlets open for at least 6 months (after three years) or till such other alternative arrangements are made.

#### **16.0 ACCURACY OF METERS**

There will be no drift in the accuracy of the meters supplied against this purchase order for a period of 10 years (life time) from the date of supply. In case any drift is noticed / found beyond permissible


  
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limits during this period, the supplier shall recalibrate such a meter for correct accuracy, and in the event recalibration is not possible, replace such meter (s) by new meter(s) without any extra cost.

#### **17.0 DOCUMENTATION**

1. The vendor shall furnish following along with bid;
  - (i) One set of drawing clearly indicating the general arrangements, fitting details, electrical connections etc.
  - (ii) Technical leaflets (user manual) giving operating instructions.
  - (iii) A list of all components used in the meter.
2. One set of operating manual shall be supplied to each consignee for every 100 Nos. of meters.
3. One set of routine test certificates shall accompany each dispatch consignment.

  
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