

Technical Specifications for 1 Phase Electronic Net Energy Meter for Solar metering application

1.0 SCOPE

This specification covers the design, engineering, manufacture, testing and calibration at manufacturer's works before dispatch, packing, supply and delivery of Class 1.0 accuracy, electronic Net energy meter, suitable for connection to LT single phase 2 wire, 240V system. The static whole current electronic meter shall offer current range of 5-30 A, (or 5-60 A) (first digit indicates the Basic Current & second digit indicates the Maximum Current of the respective meters) for tariff purposes, as per requirement given in this specification.

2.0 STANDARDS APPLICABLE

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

S. No.	Standard No.	Title
1	IS 13779 and its latest amendment	Specification of AC Static Watt hour meters class 1.0
2	IS 15959(Part-I) and its latest amendment	Data Exchange for Electricity Meter, Reading, Tariff and Load Control – Companion Specification

Meter matching with requirements of other national or international standards which ensure equal or better performance than the standards mentioned above shall also be considered. When the equipment offered by the tenderer 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. Manufacturer should have valid BIS License for the offered energy meters and ISI mark should be given on meter rating plate. Copy of BIS license needs to be enclosed with the tender.

3.0 CLIMATIC CONDITION

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

1.	Maximum ambient air temperature in shade.	45 Deg. C
2.	Relative humidity	95% non-condensing
3.	Maximum altitude above mean sea level	Up to 1000 meters.
4.	Maximum wind pressure	150 Kg/m. sq.
5.	Average number of tropical monsoon (conditions) per annum	4 months
6.	Average annual rain fall	10 cms to 100 cms.
7.	Seismic level (Horizontal accn)	0.30g
8.	Isoceraunic level (days per year)	40

4.0 General Technical Requirement

4.1 Application	: 1 phase 2 wire
4.2 Rated Secondary Voltage	: 240 volts (Phase to Neutral)
4.3 Current Rating	: 05-30A,5-60 A
4.4 Rated Frequency	: 50 Hz.
4.5 Accuracy class	: 1.0
4.6 Power Factor	: Unity to Zero (all power factor lag / or lead)

The meter shall start and continue to register on application of 0.2% of basic current at Unity P.F., as per relevant standards.

5.0 POWER SUPPLY VARIATION

The meter should be suitable for working with following supply system variations.

System	1 Phase 2 Wire
Specified range of operation	-30% to +20% of reference Voltage i.e. 240 V
Frequency	50Hz \pm 5%

If phase to phase voltage (415V \pm 10%) is applied continuously between phase and neutral of the meter, the meter should not get damaged and continue to record correctly within class 1.0 accuracy after restoration of normal supply.

6.0 ACCURACY

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

7.0 POWER CONSUMPTION

- 1- Voltage Circuit: The active and apparent power consumption in each voltage circuit including the power supply of meter of reference voltage, reference temperature and reference frequency shall be as per IS13779 standard.
- 2- Current Circuit: The apparent power taken by Current circuit at basic current reference and reference temperature shall be as per IS13779 standard.

8.0 STARTING CURRENT

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

Running at no load: When voltage is applied and no current flows in the current circuit, the test output of the meter shall not produce more than one pulse.

9.0 MAXIMUM CONTINUOUS CURRENT

The rated maximum current for the meter shall be 100% of I_{max} at which the meter purports to meet the accuracy requirement. Meter terminals should be suitable to carry 150% of I_{max} .

10.0 GENERAL & CONSTRUCTIONAL REQUIREMENTS

- 10.1** 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.
- Personal safety against electric shock
 - Personal safety against effects of excessive temperature.
 - Protection against spread of fire
 - Protection against penetration of solid objects, dust & water
- 10.2** 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 Polycarbonate casing of projection mounting type.
- 10.3** 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 during operating life by providing suitable protective coating.
- 10.4** The meter shall at least conform to the degree of protection IP 51 for protection against ingress of dust, moisture and vermin's.
- 10.5** The meter shall be supplied with a transparent extended terminal block cover (ETBC). Extended terminal cover shall have preferably top side hinge arrangement so that it remains associated with meter always.
- 10.6** The meter case, terminal block and ETBC shall be made of unbreakable, high grade non-flammable polycarbonate or equivalent high grade and good quality engineering plastic. The terminal block should have terminal holes and shall be of sufficient size to accommodate the conductors, meeting the requirement of IS 13779.
- 10.7** The meter case shall have one full transparent window for display. The window shall be integrated part with the meter case in such a way that it cannot be removed undamaged.
- 10.8** 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 terminals shall be made of brass to provide better conductivity. The clearance and creepage distance shall conform to relevant clause of IS 13779:1999.
- 10.9** The meter shall be compact in design. The entire 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.

10.10 Meter should have pushbutton / capacitive touch arrangement to avoid water/fluid injection inside of meter circuit.

10.11 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 in phase and neutral both.

10.12 The meter shall have a design life of at least 10 years.

11.0 ANTI-TAMPER FEATURES

The meter should have features to prevent/detect common ways of tamper and fraud.

11.1 Drawing of current through local earth

The meter shall register accurate energy even if the 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 annunciator shall be made available.

11.2 Drawing of load by disconnecting Neutral of meter & outgoing Earth:

When neutral is disconnected from both load side and supply side, the meter should record energy as per rated parameters (V_{ref} , UPF & actual current). However, meter shall start registering energy at a current of 1.0 Amps under these tamper conditions. Accuracy should be within $\pm 4\%$ for this case.

It is preferable to have metering with the help of internal battery of adequate capacity under single wire mode suitable for life of the meter.

11.3 Influence of external High Magnetic Field

Meter shall be provided with appropriate magnetic shielding so that any external magnetic field (A.C. electromagnet or D.C. magnet) as per the value specified in IS 13779 (With latest amendment) applied on meter would not affect the proper functioning of meter.

However, the meter should log the presence of abnormal magnetic induction with date & time in case the meter is affected. Under such conditions the positive variation may be beyond 4%. Meters shall offer compliance to requirements of CBIP-325 and its amendments for tampering using external magnets and meter should record energy at I_{max} whenever the meter gets affected during that condition.

The magnet event indication in the form of annunciator shall be available under such condition

11.4 Meter Body Opening :

It is preferable to have a single integrated base and cover so that chances of cover opening are reduced. Even if the meter case is removed forcibly, it should leave a clear evidence of being opened. The meter shall additionally have provision for detection and logging of opening of meter cover. The meter must detect / log with date and time meter body opening tamper, body opening tamper must also be logged in absence of power supply.

11.5 Neutral Disturbance

The measurement by meter shall not get influenced by injection of spurious signals (like AC Voltages/chopped AC signal/DC signal / pulsating DC etc) in neutral of meter. The meter shall be immune to other common forms of Neutral Disturbance using diode, variable resistance and capacitor circuits in neutral. In case the meter accuracy is disturbed under ND, it should be able to log the event and record energy at reference parameters (V_{ref} , UPF and actual current) with the error band of $\pm 4\%$. The neutral disturbance event indication in the form of annunciator shall be available under such condition.

11.6 Abnormal voltage/frequency field application

The accuracy of the meter would not be affected with the application of abnormal voltage/ frequency generating device having spark discharge of approximately 35KV. The meter will 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 phase or neutral terminals.
- ii) On any connecting wires of the meter.
- iii) Voltage discharge with 0-10 mm spark gap.
- iv) Spark on meter body.
- v) At any place in load circuit.

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

11.7 Events

The meter shall be capable of recording minimum 200 events in memory with date and time stamp. Following events should be logged in different compartments as per IS 15959 on FIFO basis

- Earth loading/ Load imbalance (Partial/Full earth)
- Power on off
- Magnetic influence in case meter is affected.
- Neutral Disturbance in case meter is affected.
- Front cover open (Non Roll over event)
- Single Wire/missing neutral metering

12.0 DISPLAY

- 12.1 The measured value(s) shall be displayed on Liquid Crystal display (LCD) display. The height of the digit shall be minimum 8.0 mm. The KWh energy registration under normal power on condition shall take place on minimum 5 complete digits and 1 decimal. LCD should contain the suitable legends/annunciators for event notification.
- 12.2 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.
- 12.3 For accessing display, meter shall have one actuator. On short press, next display shall activate.

Specifications for Single phase meter 1.0

- 12.4** The register shall be able to record and display starting from zero, for a minimum of 1500 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.
- 12.5** 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 CMRI/meter reading print out.

DISPLAY SEQUENCE

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

A) Auto Display Mode:

The display shall have „ON“ time of at least 10 sec. for each measured values for auto display cycling.

The following parameters 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. Cumulative Net Active energy reading (kWh)
7. Last Bill / last month Active energies (Import & Export)
8. Instantaneous Load (KW)
9. Last Bill /last month Maximum demand in kW (Import & Export)
10. Billing counts
11. Cumulative Tamper Occurrence Count
12. Last Bill / last month Power Factor Import
13. Last Bill/ last month Power Factor Export

B) Actuator Mode(Push Mode):-

The following parameters in the similar sequence shall be displayed one after the other, with press of push button each time. Each parameter shall display for minimum 10 seconds

1. LCD Test.
2. Real Time
3. Date
4. Cumulative Active energy Import reading (kWh)
5. Cumulative Active energy Export reading (kWh)
6. Cumulative Net Active energy reading (kWh)
7. Last Bill Active energies (Import & Export)
8. Instantaneous phase voltage
9. Phase and Neutral Line current
10. Instantaneous PF
11. Frequency
12. Maximum demand kW for Current month (Import & Export)
13. Tamper information (Last occurred and restored event with date and time)

The meter shall also be capable of offering a high resolution display mode which shall enable conducting of dial testing by the user in the shortest possible time and hence as a minimum.

13.0 MAXIMUM DEMAND REGISTRATION & Billing History

Meter shall record billing parameters for last 12 months as per IS 15959. Meter shall continuously monitor & calculate the average maximum demand for each demand interval time of 30 minutes and maximum of these in a calendar month shall be stored along with date and time when it occurred. The maximum demand shall automatically reset at 24:00 hrs. of the last date of each calendar month for which minimum 30 years calendar shall be programmed by the manufacturer.

The integration period shall be set as 30 minutes, on real-time basis.

The billing purpose parameters (active Import and Export energy, maximum demand in kW) shall be registered and shall be available for a minimum period of last 12 months.

14.0 TIME OF USE MONITORING

The meter shall offer the capability of time of use monitoring for energy. Minimum 4 rate registers shall be capable of being configured for TOD monitoring for Peak/Off peak hours. The time accuracy will be adjusted through any hand held device (like CMRI, Mobile app etc) wherever required.

15.0 LOAD PROFILE RECORDING

The meter shall be capable of monitoring and recording load profile information for voltage, active energy import and export for every 30 minutes interval for at least 1500 Hrs duration.

16.0 MIDNIGHT ENERGY SNAPSHOT RECORDING

The meter shall be capable of recording energy snapshot for at least 35 days.

17.0 SELF DIAGNOSTIC FEATURE

The meter shall be capable of performing complete self diagnostic check to monitor integrity of data memory location at all time. The meter shall have indication for unsatisfactory/nonfunctioning/malfunctioning of the following:

- a) Self-Diagnostic status
- b) Battery status

18.0 METER READING UNDER POWER OFF MODE

Provision to read the meter in no power condition shall be made. In case of power failure Auto mode shall be disabled. The actuator shall be used for displaying the Bill 1 KWh, Bill 1 maximum demand kW on display. In case of power failure meter data download for History energy, maximum Demand & all the events through CMRI (common meter reading instrument) shall be possible. Industrial grade primary battery of long life shall be used.

19.0 COMMUNICATION

19.1 LOCAL COMMUNICATION PORT

The energy meter shall have a galvanically isolated IEC optical communication port located in front of the meter for data transfer to or from a hand held Data Collection Device.

20.0 CMRI/BCS REQUIREMENTS

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

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 user shall have the flexibility to select the parameters to be converted into ASCII file. The vendor shall also supply the necessary CMRI software.

21.0 MARKING OF THE METER

The marking on every meter shall be in accordance with relevant clauses of IS 13779. 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) Year of manufacture
- f) Reference Voltage
- g) Rated Current
- h) Principal unit(s) of measurement
- i) Meter Constant (imp/kwh)
- j) Class index of meter
- k) "Property of _____"

22.0 CONNECTION DIAGRAM & TERMINAL MARKINGS

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

23.0 OUTPUT DEVICE

The meter shall 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 shall be provided in the form of LED output.

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

24.0 ELECTRO-MAGNETIC 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.

25.0 MINIMUM TESTING FACILITIES

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

- AC voltage test
- Insulation resistance test
- Test of limits of errors
- Test of meter constant
- Test of starting condition
- Test of no load condition
- Repeatability of error test
- Test of power consumption

The manufacturer should have duly calibrated Reference standard meter of Class 0.2 accuracy or better. Manufacturer also should possess fully computerized meter test bench system for carrying out the relevant routine/acceptance tests as well as facility to generate test reports for each and every meter tested.

26.0 TESTS

The test reports/certificate/records for all type tests specified having been successfully performed on the type of the meter offered shall be submitted with the tender. The bidder shall clearly bring out the deviations from this specification clause by clause whether on account of tests or manufacturing process or features incorporated in the meter. The tender lacking with above information and without supporting test reports for meter meeting the requirement of tests laid in this specification are likely to be rejected.

a) Type Tests:

The Energy meter offered shall be fully type tested at any accredited test laboratory as per IS 13779 relevant standards but test reports shall not be more than Five years old from the date of opening of bid. The bidder shall furnish type test reports along with the bid.

Type test for 05-60A will cover these sub ranges 5-30A & 10-60A

b) Acceptance Test :

All acceptance tests as stipulated in the relevant standards shall be carried out by the supplier in the presence of the purchaser's representative.

c) Routine Tests:

All routine tests as stipulated in the relevant standards shall be carried out and routine test-certificates/reports shall be submitted to the purchaser for approval and also placed inside individual meter packing. Three copies of user manual shall be required in soft copy (CD).

Tamper Logic threshold of 1P meter for Solar application

Annexure – 1

Tamper Logic & threshold values for 1 Ph. 2 Wire WC Net static energy meters				
Sr. No.	Tampers/ Failures	Logic/Condition	Persistence time	
			Occurrence Time (min)	Recovery Time (min)
1	Magnetic logging	As per CBIP 325	Immediately	Immediately
2	Earth Load tamper	Meter Should log the event. Occurrence: The difference between phase and neutral current > 5% of I_b Restoration: The difference between phase and neutral current < 5% of I_b	1	1
3	Neutral Disturbance	Meter Should log the event Error limit: +4% to -4% Occurrence: Voltage > 125% of V_{ref} or Voltage < 70% of V_{ref} ; Current > 10% of I_b Restoration: Voltage < 115% of V_{ref} , Current > 10% of I_b The meter shall record energy proportional to current * V_{ref} (240 V)*UPF Meter should log the event in case of neutral is disturbed through Resistance, Capacitance, Diode, AC chopped signal, Pulsating DC signals etc.	1	1
4	Neutral Missing	Occurrence: When neutral is disconnected from both load side and supply side, the meter should record energy as per rated parameters (V_{ref}) and log the event . At a current > 500mA(under NM) (where battery is used for voltage reference).Meter will perform the fraud energy registration above 500mA assuming V_{ref} from battery and UPF. At a current > 1amps (under NM) (where 3rd CT is used) meter will perform fraud energy registration above 1A assuming V_{ref} from 3rd CT and UPF. Restoration at Voltage > 190V, current > 250mA	1	1
5	Top Cover Open Logging	Meter Should log the cover open event	Immediately	NA

Direct Connected 3 ph- net Meter

TECHNICAL SPECIFICATION FOR STATIC 3 PHASE 4 WIRE DIRECT CONNECTED STATIC TRIVECTOR NET ENERGY METER

1. OBJECTIVE & SCOPE

This specification shall cover design, engineering, manufacture, assembly, and inspection, testing at manufacturer's works before dispatch, supply and delivery at destination anywhere in "state", Class 1.0 accuracy class static 3 phase—4 wire tri-vector Net energy meter. The meter shall be suitable for measurement of energy and power, demand requirement in an AC balanced/unbalanced system over a power factor range of zero lag to unity. These meters should have communication port to interface for remote meter reading.

2. SERVICE CONDITION

The meter shall be suitable for satisfactory continuous operation under the following tropical conditions:-

Maximum ambient temperature	:	55 °C
Maximum ambient temperature in shade	:	45 °C
Relative Humidity	:	10 to 95%
Maximum wind pressure	:	150 Kg/m. sq.
Maximum altitude above mean seal level	:	1000 meters
Isoceraunic level	:	50 days/year
Seismic level (Horizontal acceleration)	:	0.3g
Moderately hot and humid tropical climate		

3. APPLICABLE STANDARDS

The whole current energy meter shall be of accuracy Class 1.0 and conform to relevant clauses of following standards or report: -

1.	IS 13779 and its latest amendment	AC Static Transformer Operated Watt-hour and VAR-Hour Meters, class 1.0.
2.	IS 15959(Part-I) and its latest amendment	Data Exchange for Electricity Meter Reading Tariff and Load Control – Companion Specification

Unless otherwise specified elsewhere in this specification the static meters shall conform to the latest version available of the standard as specified above.

4. GENERAL TECHNICAL REQUIREMENT

- 4.1 Application : 3 phase 4 wire
4.2 Rated Secondary Voltage : 230/240 volts (Phase to Neutral)
4.3 Current Rating : 10-60, 10-100A
4.4 Rated Frequency : 50 Hz.
4.5 Accuracy class : 1.0
4.6 Power Factor : Unity to Zero (all power factor lag / or lead)
4.7 The meter shall start and continue to register on application of 0.2% of basic current at Unity P.F., as per relevant standards and shall work satisfactorily with the following supply system variation:
Voltage: $V_{ref} + 20\%$ to -30%
Frequency: 50 Hz $\pm 5\%$
4.8 Temperature: The standard reference temperature for performance shall be 27 °C.
4.9 The meter shall be able to continuously withstand phase to phase voltage of 450V for 5 minutes.

Direct Connected 3 ph- net Meter

5. INFLUENCE QUANTITIES:

The meter should be designed and protected such that all external effects and influences shall not change its performance & shall work satisfactorily within guaranteed accuracy limits, as specified in IS 13779, under the presence of influence quantities.

6. CONSTRUCTION

The case, winding, voltage circuit, sealing arrangements, registers, terminal block, terminal cover & name plate etc, shall be in accordance with the relevant standards. The meter should be compact & reliable in design, easy to transport & immune to vibration & shock involved in the transportation & handling.

The meter should employ latest technology such as Application Specific Integrated Circuit (ASIC) to ensure reliable performance. The mounting of the components on the PCB should be Surface Mounted Technology (SMT) type except some power supply related component. The electronic components used in the meter should be of high quality.

6.1 GENERAL MECHANICAL REQUIREMENTS

The construction of the meter shall be rigid & suitable to withstand shock & vibration involved in transportation & handling, as specified in IS 13779. 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 personal safety against electric shock, safety against effect of excessive temperature, protection against spread of fire, protection against penetration of solid objects, dust and water. The design of meter shall conform to IP 51 class degree of protection.

6.2 TROPICAL TREATMENT

All parts, which are subject to corrosion under normal working conditions, shall be protected effectively. Any protective coating shall not be liable to damage by ordinary handling or damage due to exposure to air, under normal working conditions. Meters shall withstand solar radiation. The meters shall be suitably designed and treated for normal life & satisfactory operation under the hot and hazardous tropical climatic conditions as specified in clause no. 2. The meter shall work from -10°C to +60°C and RH 95% non-condensing type.

6.3 METER CASE (Cover and Base)

The housing of the meter shall be safe high-grade engineering plastic or any other high quality insulating material and shall be very compact in design. All the insulation materials used in the construction of meter shall be non-hygroscopic, non-ageing & of tested quality, capable of withstanding resistant to heat & fire. Manufacturer can suggest the better design option which helps the utility in theft prevention and revenue protection measures.

6.4 TERMINALS -TERMINAL BLOCK

The base of the meter shall have a terminal block at the bottom made out of high grade engineering plastic so as to facilitate bottom connection and having capability to carry maximum value of current.

The material of the terminal block shall be capable of passing the tests given in IS 13779.

The terminal holes in the insulating material shall be of sufficient size to accommodate the insulation of the conductors. The diameter of the terminal hole for current terminals shall not be less than 8.5 / 9.5 mm & shall be of adequate length in order to have proper grip of conductors / crimping pins with the help of two screws.

The terminal block shall satisfy all the conditions such as clearance & creepage distance between terminals & surrounding part of the meter as specified in relevant clause of IS 13779 standard. The material of terminal connection should qualify the testing requirement as covered in relevant standard.

Direct Connected 3 ph- net Meter

The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there shall have 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 shall not be transmitted through insulating material.

6.5 TERMINAL BLOCK COVER

The terminals block cover for the energy meters shall be extended transparent type, which can be sealed independently of the meter cover. The ETBC shall have sufficient clearance space for inserting cables. ETBC shall have a top side hinge arrangement for easy access of terminal for wire termination.

There shall be provision of fixing of seals so that screws cannot be loosened without breaking the seals.

The terminals shall not be accessible without removing the seal(s) of terminal cover when energy meter is mounted on the meter board.

6.6 DISPLAY SCROLLING

Meter should have display access function/scrolling and have a capacitive touch / Push Button arrangement to avoid water/fluid injection inside of meter circuit.

6.7 QUALITY

Overall the quality of the meter should be good and the service life of the meter shall be more than the guarantee period. The material, components used for manufacturing the meter shall be of premium quality. The LCD display shall not fade with time and the display annunciators should be visible. Functionality of the meter shall not be affected by the harsh environmental conditions. Quality meters shall be given preference and the performance of previous installed meters shall be analysed before awarding the tender. Aesthetically, the meter shall be of premium quality.

7. COMMUNICATION PORT

a) LOCAL COMMUNICATION PORT

The energy meter shall have a galvanically isolated IEC 1107 optical communication port located in front of the meter for data transfer to or from a hand held data collection device.

b) REMOTE COMMUNICATION PORT

Meter shall have an additional communication port (RS 232) to interface external modem for remote data collection. RS 232 port shall be located under the terminal cover.

8. DATA DOWNLOADING CAPABILITY

Meter shall support a communication baud rate as per IS 15959 on optical port as well as RS 232 remote communication port. It shall be possible to read selective data from the meter as specified in the standard. Further, bidder shall furnish the interface document to fetch the metering data from optical and remote communication port.

9. DISPLAY SPECIFICATION

The measured value(s) shall be displayed on eight digit, seven segments Liquid Crystal Display (LCD) display unit/register, having suitable legibility from 1 meter distance.

Direct Connected 3 ph- net Meter

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 Non Volatile memory(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 annunciators.

The register shall be able to record and display starting from zero, for a minimum of 1500 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.

The principle unit for the measured values shall be kWh for active energy & kVArh for reactive energy.

It is preferable to have billing parameters in manual scrolling mode. All instantaneous and diagnostic displays shall be part of separate page which will help to reduce manual reading time.

10. ELECTROMAGNETIC COMPATIBILITY

The static energy meters shall conform to requirements listed in relevant standards and shall also be protected against radiated interference from either magnetic or radio-frequency source.

10.1 IMMUNITY TO ELECTROMAGNETIC DISTURBANCE

The meter shall be designed in such a way that conducted or radiated electromagnetic disturbance as well as electrostatic discharge do not damage or substantially influence the meter and meter shall work satisfactorily under these conditions as per relevant standards

NOTE: the disturbances to be considered are: -

- (a) Harmonics
- (b) Voltage dips and short interruptions
- (c) Conducted transients
- (d) D.C. and A.C. magnetic fields
- (e) Electromagnetic fields
- (f) Electrostatic discharges

10.2 RADIO INTERFERENCE SUPPRESSIONS

The meter shall not generate noise, which could interfere with other equipment, and meter shall work satisfactorily as per relevant standards

10.3 INFLUENCE OF HIGH MAGNETIC FIELD

The meters shall be provided appropriate magnetic shielding so that any external magnetic field (AC/DC electromagnet) as per IS 13779 applied on meter would not affect the proper functioning of the meter and meter shall work satisfactorily as per relevant standards.

11. STARTING CURRENT

The meter shall start and continue to register at the current 0.2% of Ib.

12. RUNNING WITH NO LOAD

When the 115% of rated voltage is applied with no current flowing in the current circuit, the meters shall not register any energy and test output of the meter shall not be more than one pulse/count on "no load".

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13. POWER CONSUMPTION

- 13.1 The active and apparent power consumption in each voltage circuit at reference voltage; temperature and frequency shall be as per the IS13779
- 13.2 The apparent power consumption in each current circuit at basic current, reference frequency and reference temperature shall be as per the IS13779.

14. TIME OF USE MONITORING

The meter shall offer the capability of time of use monitoring for energy. Minimum 4 rate registers shall be capable of being configured for TOD monitoring for Peak/Off peak hours. The time accuracy will be adjusted through any hand held device (like CMRI, Mobile app etc) wherever required.

15. CALIBRATION & TEST OUTPUT

All the meters shall be tested, calibrated and sealed at works before dispatch. Further, no modification of calibration shall be possible at site by any means.

However, it shall be possible to check the accuracy of energy measurement of the meter in the field by means of LED output on meter. Meter should have two calibration LEDs for accuracy measurement for different energies. Out of these, one should be kept fixed on kWh and other one shall be configurable for rest two (kVAh, kVAh).

16. CONNECTION DIAGRAM

The connection diagram of the meter shall be clearly shown for 3 phase 4 wire system, on the terminal cover.

17. QUANTITIES TO BE MEASURED:

The meter shall be able to provide the following data as per IS 15959.

- a) Instantaneous Parameters
- b) Block Profile / Load Survey data for 30 minute capture time block.
- c) Parameters for billing main energy and TOU register both for following energy channels.
- d) Meter shall be capable of displaying the following parameters. The display of various parameters shall be continuously scrolling after another. The display shall have " ON" time of at least 10 sec. for each measured values for auto display cycling.
 - i. Active import energy
 - ii. Active export energy
 - iii. Net active (import - export),
 - iv. Reactive import(Q1+Q2) energy
 - v. Reactive export(Q3+Q4) energy,
 - vi. Apparent lag + lead while active import,
 - vii. Apparent lag + lead while active export
 - viii. Billing Power Factor for Import & Export
 - ix. Maximum Demand Import & Export (kVA , kW)
- d) Abstract quantities
 - Name Plate Details
 - Programmable parameters
- e) Event Conditions.

The meter shall be able to measure and provide the parameters listed in the guideline document.

Direct Connected 3 ph- net Meter

18. ABNORMAL EVENTS:

The meter should have features to detect the occurrence and restoration (minimum 200 events) of, at least, the following common abnormal events:

- a) **Missing Potential:** The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of Potential failure (one phase or two phases). All potential missing cases shall be considered as power failure.
- b) **Current imbalance:** The meter shall be capable of detecting and recording occurrence and restoration with date and time of Current unbalance (for more than a defined persistence time).
- c) **Power on/off:** The meter shall be capable to record power on /off events in the meter memory. All potential failure should record as power off event.
- d) **Magnetic Influence** - The Meter shall be capable of detecting and recording of presence of abnormal magnetic influence near the meter, if the magnetic influence affects the meter functionality. The meter should record at I_{max} on account of magnetic influence. Appropriate information shall be available under display parameter for magnet event.
- e) **Voltage unbalance** – Meter shall detect voltage unbalance if there is unbalance in voltages.
- f) **Over Current** – When load condition at any phase i.e. Line current at any phase goes more than defined limit , this will be detected as Over current condition.
- g) **CT Open** – The meter should detect phase wise current circuit open when the circuit is opened from meter side.
- h) **CT Bypass** – The condition should be detected whenever the current terminal is bypassed in the meter
- i) **Neutral Disturbance** – The meter should detect neutral disturbance if any spurious signal is applied at the meter's neutral.
- j) **High and Low Voltage:** The meter should detect under and over voltage events respectively if voltage falls / rise from defined limits.
- k) **Cover Open:** The meter shall be able to detect cover open occurrence event if cover is opened in mains on or off condition.
- l) A separate register is additionally required for defraud energy registration.

The above shall be selectable and will be in line with IS 15959: Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification

The meter shall keep records for the minimum last 200 events (occurrence + restoration) for above abnormal conditions. Each event shall be logged with date and time of occurrence/restoration with snapshot of voltage, current, power factor and active energy (except cover open, power on-off).

It shall be possible to retrieve the abnormal event data locally using a hand held unit (HHU) through the meter's optical port & same can be viewed / analyzed at base computer end in simple and easily understandable format.

19. ABNORMAL VOLTAGE/FREQUENCY DEVICE TEST:

The accuracy of the meter would not be affected with the application of abnormal voltage/ frequency generating device having spark discharge of approximately 35KV. The meter will be tested by feeding the output of this device to meter in any of the following manner for 10 minutes (2 Minutes each on below):

Direct Connected 3 ph- net Meter

- i) On any of the phase or neutral terminals.
- ii) On any connecting wires of the meter.
- iii) Voltage discharge with 0-10 mm spark gap.
- iv) Spark on meter body.
- v) At any place in load circuit.

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

20. BILLING HISTORY & LOAD SURVEY: -

The meter shall have sufficient non-volatile memory for recording history of energy parameters for minimum last twelve billing cycles (Bill date shall be 00 hrs of the 1st date of the calendar month by default – programmable)

- i. Active import energy
- ii. Active export energy
- iii. Net active (import - export),
- iv. Reactive import(Q1+Q2) energy
- v. Reactive export(Q3+Q4) energy,
- vi. Apparent lag + lead while active import,
- vii. Apparent lag + lead while active export
- viii. Billing Power Factor for Import & Export
- ix. Maximum Demand Import & Export (kVA , kW)

Following parameters shall be made available for last 45 days with integration period of 30 min:

- Active import energy
- Active export energy
- Reactive import(Q1+Q2) energy
- Reactive export(Q3+Q4) energy,
- Apparent energy import,
- Apparent energy export
- Phase wise voltage
- Phase wise current
-

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.

21. Daily Energy snapshot

- The meter shall record the daily mid night energy snap for 60 days for active import energy, Active export energy(kWh) and Apparent Energy import, Apparent energy export, Net active energy

22. MD REGISTRATION

The meter shall continuously monitor and calculate maximum demand for each interval of time, which may be programmable as a block of 30 minutes . At the end of every demand integration period the new calculated MD shall be compared with the previous MD and meter shall store whichever value is higher.

23. 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 at all time. The meter shall have indication for unsatisfactory/non-functioning/malfunctioning of the following:

Direct Connected 3 ph- net Meter

- a) Time and date on meter display
- b) All display segments on meter display
- c) Self diagnostic (RTC, NVM information) on display

24. OTHER SALIENT FEATURES OF METERS

- a) The meter shall have provision of reading in the absence of power through an internal battery of adequate capacity. It shall be possible to access the display in power off condition. It shall also be possible to do meter data download through a suitable hand held device (like CMRI , mobile app, laptop etc) under power off condition.
- b) The meter should work accurately irrespective of phase sequence of the supply.

25. TEST AND TEST CONDITIONS

- Acceptance test: All acceptance tests as per relevant standards shall be carried out in the presence of utility representatives.
- Routine Test: All the routine tests as per –IS 13779 shall be carried out and routine tests certificates shall be submitted for approval of purchaser.

Type Tests:

The Energy meter offered shall be fully type tested at any accredited test laboratory as per IS 13779 relevant standards but test reports shall not be more than five years old from the date of opening of bid. The bidder shall furnish type test reports along with the bid.

Type Test Report 10-100A will cover these sub ranges 10-60A & 10-100A.

Direct Connected 3 ph- net Meter

Annexure 1

Tamper Logic threshold for 3Phase WC Meter for solar application

Compartment	Tamper Event	Occurrence	Time of Occurrence	Restoration	Time of Restoration
Voltage related	Potential Missing	Voltage < 60% of Vref AND current > 2% Ibasic	5 min	Voltage > 70% of Vref AND current - Ignore	5 min
	High Voltage	Voltage > 130% of Vref	5 min	Voltage < 110% of Vref	5 min
	Low Voltage	Voltage < 75% of Vref	5 min	Voltage >80% of Vref	5 min
	Voltage Unbalance	Vmax-Vmin> 20% Vmax Line current- ignore	5 min	Vmax-Vmin < 20% Vmax Line current- ignore	5 min
Current related	CT Open	Residual Current >10% Ib Ix< 1% Ib	5 min	Residual Current< 10% Ib Average Current >10% of Ib	5 min
	CT Bypass	Residual Current >10% Ib Ix>5% Ib	5 min	Residual Current >10% Ib Average Current >10% of Ib	5 min
	Overload current	Ix> 120 % Imax	5 min	Ix< 120 % Imax	5 min
	Current Unbalance	I _{max} - I _{min} > 30% of I _{max} Any phase current >10 % of I _{basic} V _{3x} >60 % Vref	5 min	I _{max} - I _{min} < 20% of I _{max} Any phase current >10% of I _{basic} V _{3x} >60 % Vref	5 min
Power failure	Power on/off	Actual voltage off	5 min	Power resume	Immediate
Other event	Neutral disturbance	In case meter is get affected by external signal injection (chopped DC, Chopped AC & Dc injection through diode) or both active.	30 sec	If neutral is restored and meter is in normal condition	90 Sec
	Magnet (As per CBIP 325)	Whenever meter sense abnormal magnetic field it shall record active and apparent energy at I max at UPF	30 sec	If magnet is removed and meter is in normal condition	30 sec
	Low Power Factor (Not phase wise)	Power Factor ≤ 0.5 Line Current >10% of I _{basic}	5 min	Power Factor > 0.5 Line Current >10% of I _{basic}	5 min
Non roll over event	Meter Top Cover Open (TC Open)	If meter top cover is opened	immedi ate	NA	NA

TECHNICAL SPECIFICATIONS FOR WHOLE CURRENT A.C. SINGLE PHASE SMART ENERGY METER

Scope

These specifications cover the design, manufacturing, testing, supply and delivery of AC whole current, single phase, 2 wires Smart Energy Meter with bidirectional communication facility & remote connect/disconnect switch. The meter shall communicate with Head End System (HES) on any one of the communication technologies mentioned in IS16444 Part 1, as per the requirement of the utility.

Basic Features

The Smart Meter would have the following minimum basic features-

- Measurement of electrical energy parameters
- Bidirectional Communication
- Integrated Load limiting /connect/disconnect switch
- Tamper event detection, recording and reporting
- Power event alarms as per IS 16444 Part 1
- Remote firmware upgrade
- Pre-paid features at MDM end (as per IS 15959 Part 2)
- TOD features
- Net Metering(kWh) features (optional as per requirement of utility)
- On demand reading

General standards applicable for meters

S. No.	Standard No.	Title
1	IS 13779 with latest amendments	AC Static Watt-hour Meter class 1 & 2
2	IS 15884 with latest amendments	Alternating Current Direct Connected Static Prepayment Meters for Active Energy (Class 1 and 2)-Specification
3	IS 16444 Part 1 with latest amendments	A.C. Static Direct Connected Watt Hour Smart Meter Class 1 and 2- Specification
4	IS 15959 Part 1 & Part 2 with latest amendments	Data Exchange for Electricity Meter Reading, Tariff and Load Control- Companion Standards

Communication

Meter shall have the ability to communicate with Head End System (HES) on any one of the communication technologies mentioned in IS16444 Part 1 (RF/PLCC /Cellular) in a secure manner. The selection of communication technology should be as per the site conditions and as per design consideration of AMI Implementing agency to meet the performance as per agreed Service Level Agreements (SLAs). In case of Cellular based meter, the meter shall accommodate SIM card/ e-SIM of any service provider. In case of Plug-in type communication module, the meter shall log communication module removal /non-responsive event with snapshot.

Remote connect/disconnect/load limiting: Remote Connect/disconnect/Load control facilities would be as per IS 16444 part 1.

Other Specifications

Features	Minimum Requirement of Features
Applicable Standards	The meters shall comply with IS 16444 Part 1 for all requirements.
Reference Voltage	As per relevant IS (240 V)
Current Rating	5-30 A 10-60 A
Category	UC1
Starting Current	As per IS 16444 Part 1
Accuracy	Class 1.0 as per IS 16444 Part 1
Limits of error	As per IS 16444 Part 1
Operating Temperature range	As per IS 13779
Humidity	As per IS 13779
Frequency	As per IS 16444 Part 1
Influence Quantities	As per IS 16444 Part 1
Power Consumption of meter	As per IS 16444 Part 1
Current and Voltage Circuit	As per IS 16444 Part 1
Running at No Load	As per IS 16444 Part 1
Test output device	As per IS 16444 Part 1
Meter Display	As per IS 16444 Part 1
Name Plate & marking Meter Display	As per IS 16444 Part 1
Parameters to be measured	As per IS 16444 Part 1 / As per IS 15959 Part-2
Maximum Demand resetting	As per IS 15959 Part 2

Time of Use registers	As per IS 15959 part 2
Power Quality Information	As per IS 15959 part 2
LED/LCD Indicators	As per IS 16444 Part 1
Load Survey/Interval Data	As per IS 15959 part 2
Tamper/ Event Recording	As per IS 15959 part 2
Measuring Elements	As per IS 16444 part 1
Alarm	As per IS 16444 Part 1/ 15959 Part 2
Load Control	As per IS 16444 Part 1
Connect/Disconnect switch	UC1 (As per IS 16444 part 1)
Status of load switch	As per IS 16444 Part 1
Programmability	As per IS 16444 Part 1
Communication	As per IS 16444 Part 1
Data Exchange Protocol	As per IS 16444 Part 1
Remote Firmware upgrade	As per IS 15959 Part 2
Real Time Clock (RTC)	As per IS 16444 Part 1/ IS 15959 Part1 & Part 2
Data Retention	As per IS 16444 Part 1
Battery Backup	Meter shall be supplied with separate battery backupfor RTC.
First Breath (power on) and Last gasp (power off) condition detection and communication toHES	As per IS 16444 Part 1
Plug-in Communication Module	The Smart Meters shall have a dedicated sealable slot for accommodating plug-in type bi - directional communication module which shall integrate the respective communication technology (RF/PLCC/ Cellular) with the Smart Meters, leading to easy adaptability for network interfaces (WAN/NAN). The Plug-In module shall be field swappable/ replaceable.

Data display facility (auto/manual)

As per IS 16444. However minimum requirement should include the following: Data Display shall be in two modes-

1. Auto Scroll
2. Scroll with Push Button

The display parameters shall be:

- Auto Scroll
 - Display Check
 - Date and Time
 - Last Recharge Amount
 - Last Recharge Time
 - Current Balance Amount
 - Current Balance Time
 - Cumulative Active Energy kWh with legend.
 - Current calendar month MD in kW with legend.
 - Instantaneous voltage
 - Instantaneous Phase current
 - Instantaneous Load kW
 - Instantaneous average Power Factor

These parameters should be displayed on the Meter Display continuously for a period of 10 seconds on Auto scroll.

- Scroll with Push-button

All Parameters mentioned under Auto-Scroll mode should be displayed. Additionally, the following Parameters shall also be displayed:

- Internal diagnostics (display check)
- Meter Serial No.
- Cumulative Energy in kVArh Lag/ Lead with legend
- Cumulative Active Energy kWh ToD wise with legends.
- Cumulative Apparent Energy kVAh ToD wise with legends.
- Current month MD in kVAh with legends
- Last month cumulative kWh with legends
- Last month cumulative kVAh with legends
- Last month MD in kW with legends
- Last month Average Power Factor
- Current month Average Power Factor

Further, the Meter should display high resolution energy values with resolution of 3 digits before decimal and 2 digits after decimal in push button mode

The meter's display should return to default display mode (continues auto scroll) if push button is not operated for more than 10 seconds. (The order of display may be revised as per requirement of the utility). Meter display should not go into sleep mode during Power-On condition.

Anti-tamper features

The meter shall continue recording energy under tamper conditions as defined in IS 15959 Part 2 and would log the event and send alarm at Head End System after detection of the defined tamper features as per IS 15959 Part 2.

Type Tests & Test Certificates

Smart Meter shall be type tested for all the tests as per relevant parts of IS 16444 (latest versions) and certified by Indian Standard wise list of BIS recognized labs as available at <https://bis.gov.in/index.php/laboratorys/list-of-bis-recognized-lab/>. The number of sampling for testing of meters and criteria for conformity would be as per IS 16444 (as amended up to date). Necessary copies of test certificates shall be submitted as per agreement with the utility.

Routine & Acceptance Tests

The Factory Acceptance and Routine tests shall be carried out as per IS 16444 Part 1.

General & Constructional requirements

Meter shall be BIS marked as per IS 16444 Part 1. General & construction requirement shall be as per IS 16444/IS 13779

Meter base & cover - Meter base & cover shall be as per IS 16444 Part1 / IS 13779. The meter Base& cover shall be 'Break to open' design. The material for meter base and cover shall be made of high-grade polycarbonate.

The meter Base & cover shall be ultrasonically welded / Chemically welded or other suitable bonding technology and it will not be possible to remove the cover from the base without evidence of damage

Terminal block & cover - As per IS 16444 Part 1/IS 13779

Design

Voltage circuit, sealing arrangement, terminal block, terminal cover, and nameplate etc. shall be in accordance with IS-16444 Part 1(latest version).

The meter shall be compact and reliable in design, easy to transport and immune to vibration and shock involved in transportation and handling.

Name plate and marking

The name plate on the meter should be clearly visible, effectively secured against removal and indelibly/distinctly marked in accordance with relevant IS. In addition, "Name of the Utility", purchase order no. & year/month of manufacturing shall be provided on the name plate. The rating plate information shall be as per relevant IS.

Connection diagram: As per IS 16444 Part 1

Fixing arrangements

The meter shall be mounted type. The Meter should have three fixing holes, one at top and two at the bottom. The Top hole should be such that the holding screw is not accessible to the consumer after fixing the meters. The lower screws should be provided under sealable terminal cover.

Sealing arrangement:

Arrangements shall be provided for proper sealing of the meter cover so that access to the working parts shall not be possible without breaking the seal. The sealing arrangement and number of seals shall be as per relevant IS/ requirement of utility.

Meter box:

The Meter Box if required by util/ity/purchaser, would be provided as per requirement of the utility/ purchaser and the material of the Meter Box should be such that it does not hamper communications.

Packing

The meters shall be suitably packed for vertical/horizontal support to withstand handling during transportation. The meter shall be packed appropriately to ensure safe transportation, handling, identification, and storage. All packing materials shall be as per environment law in force. The primary packing shall ensure protection against humidity, dust, grease and safeguard the meter's performance until its installation. The secondary packing shall provide protection during transportation. The packing case shall indicate "Fragile in nature" and direction of placement of box. The packing shall indicate marking details like Manufacturer's name, S. No. of meters, quantity etc.

Transportation

- The meter shall be compact in design. The meter block unit 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.
- The meter should not be exposed to undue shock and mishandling during transportation.
- The stacking of box inside transport media should be such as to avoid their free movement.
- The packing should also be protected from rain and dust by transport media.
- The AMISP shall be responsible for any damage during transit due to inadequate or improper packing.

Testing and Manufacturing Facilities at Manufacturer's Place

The manufacturer shall have facilities of conducting Acceptance Testing as per IS 16444 Part 1.

Inspection

- The meters shall be sealed as per the mutual agreement of the supplier and the purchaser
- The utility/ purchaser may inspect the meter randomly as per sampling plan for acceptance test as per IS 16444 Part 1. The meters shall be tested for acceptance test as per IS 16444 Part 1

TECHNICAL SPECIFICATIONS FOR WHOLE CURRENT A.C. THREE PHASE SMART ENERGY METER

Scope

The specification covers the design, manufacturing, testing, supply, and delivery of AC whole current 3 phase 4 wires Smart Energy Meter with bidirectional communication facility suitable for Advanced Metering Infrastructure (AMI) with connect/disconnect switch. The meter shall communicate with Head End System (HES) on any one of the communication technologies mentioned in IS16444 Part 1, as per the requirement of the utility / authorized system integrator.

Basic Features

The Smart Meter would have the following minimum basic features-

- Measurement of electrical energy parameters
- Bidirectional Communication
- Integrated Load limiting switch /relay
- Tamper event detection, recording and reporting
- Power event alarms as per IS 16444 Part 1
- Remote firmware upgrade
- Pre-Paid features at MDM end (as per 15959 part 2)
- TOD feature
- Net Metering(kWh) features (optional as per requirement of utility)
- On demand reading

General standards applicable for meters

S. No.	Standard No.	Title
1	IS 13779 with latest amendments	AC Static Watt-hour Meter class 1& 2
2	IS 15884 with latest amendments	Alternating Current Direct Connected Static Prepayment Meters for Active Energy (Class 1 and 2)-Specification
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4	IS 15959 Part 1 & Part 2 with latest amendments	Data Exchange for Electricity Meter Reading, Tariff and Load Control-Companion Standards

Communication

Meter shall have the ability to communicate with Head End System (HES) on any one of the communication technologies mentioned in IS16444 Part 1 (RF/PLC/ Cellular) in a secure manner. The selection of communication technology should be as per the site conditions and as per design requirement of AMI Implementing agency to meet the performance as per agreed Service Level Agreements (SLAs). In case of Cellular based

meter, the meter shall accommodate SIM card/ e-SIM of any service provider. The meter shall log the removal of the plug-in type communication module removal /nonresponsive event with snapshot.

Remote connect/disconnect/load limiting: Remote Connect/disconnect/Load control facilities would be as per IS 16444 part 1.

Other Specifications

Features	Minimum requirement of features
Applicable Standards	The meters shall comply with IS 16444 Part 1 for all requirements.
Reference Voltage	As per relevant IS
Current Rating	10-60 A
Category	UC1
Starting Current	As per IS 16444 Part 1
Accuracy	Class 1.0 as per IS 16444 Part 1
Limits of error	As per IS 16444 Part 1
Operating Temperature range	As per IS 13779
Humidity	As per IS 13779
Frequency	As per IS 16444 Part 1
Influence Quantities	As per IS 16444 Part 1
Power Consumption of meter	As per IS 16444 Part 1
Current and Voltage Circuit	As per IS 16444 Part 1
Running at No Load	As per IS 16444 Part 1
Test output device	As per IS 16444 Part 1
Meter Display	As per IS 16444 Part 1
Name Plate & marking Meter Display	As per IS 16444 Part 1
Parameters to be measured	As per IS 16444 Part 1 / As per IS 15959 Part-2
Maximum Demand resetting	As per IS 15959 Part-2
Time of Use registers	As per IS 15959 Part-2
Power Quality Information	As per IS 15959 Part-2
LED/LCD Indicators	As per IS 16444 Part 1
Load Survey/Interval Data	As per IS 15959 Part-2
Tamper/ Event Recording	As per IS 15959 Part-2
Measuring Elements	As per Is 16444 Part 1
Alarm	As per IS 16444 Part 1 / As per IS 15959 Part-2
Load Control	As per IS 16444 Part 1
Connect/Disconnect switch	UC1 as per IS 16444 Part 1
Status of Load switch	As per IS 16444 Part 1
Programmability	As per IS 16444 Part 1

Communication	As per IS 16444 Part 1
Communication Protocol	As per IS 16444 Part 1
Remote Firmware upgrade	As per IS 15959 Part-2
Real Time Clock (RTC)	As per IS 16444 Part 1 /IS 15959 Part 1 & Part 2
Data Retention	As per IS 16444 Part 1
Battery Backup	Meter shall be supplied with adequate separate battery backup for RTC.
First Breath (Power on) and Last gasp (Power off) condition detection and communication to HES	As per IS 16444 Part 1
Plug-in Communication Module	The Smart Meters shall have a dedicated sealable slot for accommodating plug-in type bi-directional communication module which shall integrate the respective communication technology (RF/PLC/ Cellular) with the Smart Meters, leading to easy adaptability for network interfaces (WAN/NAN).The Plug-In module shall be field swappable/ replaceable.

Data display facility (auto/manual)

As per IS 16444. However minimum requirement should include the following: Data Display shall be in two modes-

1. Auto Scroll
2. Scroll with Push Button

The display parameters shall be:

- Auto Scroll
 - Display Check
 - Date and Time
 - Last Recharge Amount
 - Last Recharge Time
 - Current Balance Amount
 - Current Balance time
 - Cumulative Active Energy kWh with legend.
 - Cumulative Apparent Energy kVAh with legend.
 - Current month MD in kW with legend.
 - Current month average Power Factor
 - Instantaneous voltage VRN
 - Instantaneous voltage VYN
 - Instantaneous voltage VBN
 - Instantaneous current IR
 - Instantaneous current IY
 - Instantaneous current IB

- Instantaneous current IN
- Instantaneous Load kW and kVA
- Instantaneous average Power Factor

These parameters should be displayed on the LCD/LED continuously for a period of 10 seconds on Auto scroll.

- Scroll with Push-button

All Parameters mentioned under Auto-Scroll mode should be displayed. Additionally, the following Parameters shall also be displayed:

- Internal diagnostics (display check)
- Meter Serial No
- Cumulative Energy in kVAh Lag/ Lead with legend
- Cumulative Active Energy kWh ToD wise with legends.
- Cumulative Apparent Energy kVAh ToD wise with legends.
- Current month MD in kVA with legends
- Last month cumulative kWh with legends
- Last month cumulative kVAh with legends
- Last month MD in kW with legends
- Last month Average Power Factor

Further, the Meter should display High Resolution energy values with resolution of 3 digits before decimal and 2 digits after decimal in push button mode.

The meter's display should return to default display mode (continues auto scroll) if push button is not operated for more than 10 seconds. (The order of display may be as per the requirement of utility). Meter display should not go in to sleep mode during Power-On condition.

Anti-tamper features

The meter shall continue working under tamper conditions as defined in IS 15959 Part 2 and would log the event and send alarm at Head End System after detection of the defined tamper features as per IS 15959 Part 2.

Type Tests & Test Certificates

Smart Meter shall be type tested for tests as per relevant parts of IS 16444 (latest versions) and certified by Indian Standard wise list of BIS recognized labs as available at <https://bis.gov.in/index.php/laboratorys/list-of-bis-recognized-lab/>. The number of sampling for testing of meters and criteria for conformity would be as per IS 16444(as amended up to date). Necessary copies of test certificates shall be submitted as per agreement with the utility.

Routine & Acceptance Tests

The Factory Acceptance and Routine tests shall be carried out as per IS 16444 Part 1.

General & Constructional requirements

Meter shall be BIS marked as per IS 16444 Part 1. General & construction requirement shall be as per IS 16444/IS 13779

Meter base & cover - Meter base & cover shall be as per IS 16444 Part1 / IS 13779. The meter Base& cover shall be 'Break to open' design. The material for meter base and cover shall be made of high-grade polycarbonate.

The meter Base & cover shall be ultrasonically welded / Chemically welded or other suitable bonding technology and it will not be possible to remove the cover from the base without evidence of damage

Terminal block & cover - As per IS 16444 Part 1/IS 13779

Design

Voltage circuit, sealing arrangement, terminal block, terminal cover and nameplate etc. shall be in accordance with IS-16444 Part 1 (latest version). The meter shall be compact and reliable in design, easy to transport and immune to vibration and shock involved in transportation and handling

Name plate and marking

The meter should bear a name plate clearly visible, effectively secured against removal and indelibly/distinctly marked in accordance with relevant IS. In addition, "Name of the Utility", purchase order no. & year/month of manufacturing shall be provided on the meter name plate. The rating plate information shall be as per relevant IS.

Connection diagram: As per IS 16444 Part 1

Fixing arrangements:

The meter shall be mounted type. The Meter should have three fixing holes, one at top and two at the bottom. The Top hole should be such that the holding screw is not accessible to the consumer after fixing the meters. The lower screws should be provided under sealable terminal cover. The requisite fixing screws shall be supplied with each meter.

Sealing arrangement:

Arrangements shall be provided for proper sealing of the meter cover so that access to the working parts shall not be possible without breaking the seal. The sealing arrangement and number of seals shall be as per relevant IS/ requirement of utility.

Meter box:

The Meter Box if required, would be provided as per requirement of the utility/ purchaser and the material of the Meter Box should be such that it does not hamper communications.

Packing

- The meters shall be suitably packed for vertical/horizontal support to withstand handling during transportation.
- The meter shall be packed appropriately to ensure safe transportation, handling, identification and storage.
- All packing materials shall be as per environment law in force. The primary packing shall ensure protection against humidity, dust, grease and safeguard the meter's performance until its installation.
- The secondary packing shall provide protection during transportation.
- The packing case shall indicate "Fragile in nature" and direction of placement of box.
- The packing shall indicate marking details like Manufacturer's name, meters #s, quantity, etc.

Transportation

- The meter shall be compact in design. The meter block unit 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.
- The meter should not be exposed to undue shock and mishandling during transportation.
- The stacking of box inside transport media should be such as to avoid their free movement.
- The packing should also be protected from rain and dust by transport media.
- The AMISP shall be responsible for any damage during transit due to inadequate or improper packing.

Testing and Manufacturing Facilities at Manufacturer's Place

The manufacturer shall have facilities of conducting Acceptance Testing as per IS 16444 Part 1.

Inspection

- The meters shall be sealed as per the mutual agreement of the supplier and the purchaser
- The Utility/ purchaser may inspect the meter randomly as per sampling plan for acceptance test as per IS 16444 Part 1. The meters shall be tested for acceptance test as per IS 16444 Part 1