TECHNICAL SPECIFICATIONS

OF 3 PHASE

SMART ENERGY METERS WITH PP BOX

TECHNICAL SPECIFICATIONS FOR 3 PHASE 4 WIRE WHOLE-CURRENT SMART METERS WITH PP BOX

Technical Specification for Whole-Current A.C. Three Phase Four Wire Static Watt Hour Smart Meter of Accuracy Class 1.0 with Pilfer proof Box

Scope of Supply

This specification covers the following for Three Phase Four Wire, 10-60A Static Watt hour smart meters of accuracy class 1.0 with modular pluggable communication modules and integrated load control switches suitable to house three- phase smart meter.

Design, manufacture, testing at manufacturer works before dispatch, packing, delivery and submission of all documentation.

a) The meter shall have bidirectional communication capability through any of the communication technologies defined in IS16444.

b) ISI Marked smart meters with provision of TOD (Time of Day) tariff, suitable for measurement of energy (kWh & kVAh) and demand (kW &kVA).

c) The meter should have different Import and Export registers so that it can be used as net meter also with renewable generation resources.

d) The meter can function in both Post-paid and pre-paid mode; any mode can be enabled remotely.

e) Any accessories / hardware required for installation, commissioning and operation for the meter.

1. **Applicable Codes &standards**

The meters covered in this specification shall confirm to the latest editions and amendments of the relevant applicable Indian/IEC standards and shall confirm to the regulations of local statutory authorities, unless specified separately elsewhere in this specification.

S. No.	Standard	Description
1	Indian Electricity Act	IE Act 2003
2	CEA Metering Regulations:2006	Installation and operation of meters with latest amendments.
3	CBIP Manual (Pub no.-325)	Standardization of AC Static Electrical Energy Meters
4	RERC Regulation	On installation and operation of meters dated 29.05.2007.
5	IS- 16444 (Part 1): 2015	AC Static Watt hour Smart Meters, Direct Connected Class 1 and 2
6	IS- 13779: 1999	AC Static Watt-hour Meters, Class 1 and 2 – Specification
7	IS- 15884: 2010	Alternating current direct connected static prepayment meters for active energy (Class 1 and 2) – Specification
8	IS- 11448:	Application guide for AC Electricity meters
9	IS-15959 (Part 1): 2011	Data Exchange for Electricity Meter - Reading Tariff and Load Control - Companion Specification
10	IS-15959 (Part 2): 2011	Data Exchange for Electricity Meter - Reading Tariff and Load Control (Part 2) - Companion Specification for smart meter.
11	IS15707:2006	Testing Evaluation Installation and Maintenance of AC Electricity Meters.
12	IS 9000	Basic Environmental testing procedure for electrical and electronic items.
13	IEEE 802.15.4 U: 2016	Standard for Local and metropolitan area networks.
14	IEEE 1901-2010	Standard for Broadband Over Power Line Networks: Medium Access Control and Physical Layer Specifications.
15	IEEE 1901.2-2013	Standard for Low-Frequency Narrow band power Line Communications for Smart Grid Applications
16	IEC- 62052-11	Electricity metering equipment (AC) – General requirements, tests and test conditions: Metering equipment
17	IEC- 62053-21	Electricity metering equipment (A.C) – Particular requirements: Static meters for active energy (classes 1 and 2)
18	IEC- 61053-52	Electricity metering equipment (AC) – Particular requirements: Symbols

S. No.	Standard	Description
19	IEC 62053-61	Electricity metering equipment (A.C.) -Particular requirements: Power consumption and voltage requirements
20	IEC 62056-21	Electricity metering - Data exchange for meter reading, tariff and load control: Direct local data exchange.
21	IEC 62056-5-3	Electricity metering data exchange- The DLMS/COSEM Suit: DLMS/ COSEM application layer.
22	IEC 60068	Environmental Testing

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

(i) IS

(ii) IEC

(iii) CBIP technical report-325 (read with latest amendments).

In case of any difference between the provisions of these standards and the provisions of this specification, the provisions contained in this specification shall prevail.

NOTE: All kinds of tests, which are required for confirmation of above-mentioned standards, shall be carried out.

2. **Climatic Conditions for Installation**

The meters to be supplied against this specification should be capable of performing and maintaining required accuracy under extreme hot, cold, tropical and dusty climate and solar radiation typically existing in state of Andhra Pradesh (India). The meter shall be required to operate satisfactorily and continuously under the following tropical climatic conditions

S. No.	Parameter	Value
1	Maximum ambient air temperature	55 ^{O}C
2	Maximum ambient air temperature in shade	45 ^{O}C
3	Maximum temperature attainable by the meter	60 ^{O}C, exposed to sun.
4	Minimum ambient temperature	(-) 5 ^{O}C
5	Average daily ambient air temperature	40 ^{O}C
6	Maximum relative humidity	95 %

S. No.	Parameter	Value
7	Number of months of tropical monsoon condition	4 months
8	Maximum altitude above mean sea level	1000 meters
9	Average annual rain fall	10-100 cms
10	Maximum wind pressure	200 kg/sq.m
11	Isoceraunic level (days per year)	40
12	Seismic level (horizontal accn.)	0.30 g
13	Permitted noise level	45 Db

The weather of Andhra Pradesh is semi-arid type due to sea coast. The average **temperature** during the cooler months of December and January is 28°C, and in the summer months of May and June the temperature reaches 40°C. Most parts of the state in summer are hot and humid. Heavy winds and lightning also occurs during June to November at the time of cyclones.

3. Supply/Installation System Data

S. No.	Parameter	Value
1	Type of Installation	Outdoor
2	System	AC, Three Phase - 4 wire
3	Rated Frequency	50 Hz ± 5%
4	System Neutral	Solidly Earthed

4. General Technical Requirements

S. No.	Parameter	Requirement
1.	**Meter Type**	3- Phase, 4 wire Static Watt-hour Smart Meter, comprising of measuring elements, display, memory, load switch with pluggable bi-directional communication module all to be housed in meter.
2.	**Connection**	Whole current
3.	**Reference and operating Voltage**	Reference Voltage (Vref) – 240 Volt (Phase to neutral). Meter shall be operational with required accuracy from 60% of Vref to 120% of Vref. However, meter shall with stand with the maximum system voltage of 440 volts (for minimum 5 minutes).

S. No.	Parameter	Requirement
4.	**Rated Current**	a. **For Three Phase Four Wire 10-60A Meter**: Current rating Base Current (Ib) – 10 Amps. Maximum Current (Imax) – 60 Amps. Meter shall meet accuracy requirements, even if 120% of Imax carried continuously.
5.	**Starting current**	0.2 % of base current (Phase or neutral)
6.	**Operating Frequency**	50Hz ± 5%
7.	**Reference Conditions for testing the performance of the meter**	Vref: 240 V ± 1 % Frequency: 50hz ± 0.3% Temperature: 27^{0}C ± 2^{0}C
8.	**Accuracy Class**	1.0 shall comply accuracy requirements under IS 13779
9.	**Meter constant**	Imp/ unit (Bidder to specify meter constant)
10.	**Power Factor Range**	Zero lag to Zero lead
11.	**Meter category**	Meter shall comply D2 category of IS 15959 (Part 2).
12.	**Power Consumption**	Power consumption of the smart meter with Modular pluggable communication modules and load control switch shall be as per IS 16444 (Part 1)
	Power consumption in voltage circuit	Meter shall comply clause 6.10.1.1 of IS:16444 (Part 1) – 2015
	Power consumption in current circuit	Meter shall comply clause 6.10.1.2 of IS:16444 (Part 1) - 2015
13.	**Mechanical requirements**	Meter shall comply clause 12.3 of IS 13779.
14.	**Calibration**	Meter shall be calibrated through software at factory and modification in calibration shall not be possible at site by any means or external influence. However, configuration of parameter allowed for field reconfiguration shall be possible through wired or Over The Air (OTA) communication.
15.	**Insulation and Impulse test**	Meter shall comply with IS 13779.
16.	**Minimum Insulation resistance**	Minimum Insulation resistance at test voltage 500+/- 50 V dc Between frame & current, voltage circuits as well as auxiliary circuits connected together: 5 M Ohm Between each current (or voltage circuit) & each and every other circuit.: 50 M Ohm

S. No.	Parameter	Requirement
17.	**Influence of supply voltage**	Meter shall comply requirement of clause no. 4.4.2 of IS 15884
18.	**Short time over current**	Meter shall comply requirement of clause no. 4.4.3 of IS 15884
19.	**Immunity to phase and earth fault**	Meter shall comply requirement of clause no. 9.6 of IS 13779
20.	**Influence of Self Heating**	Meter shall comply requirement of clause no. 4.4.4 of IS 15884
21.	**Influence of heating**	Meter shall comply requirement of clause no. 4.4.5 of IS 15884
22.	**Environmental Condition**	Meter shall be suitable for environmental conditions as mentioned below
23.	**Temperature Range**	Operation range: -10OC to 60OC Limit range of operation: -25OC to 60OC Limit range of storage / transport : -25OC to 70OC
24.	**Relative Humidity**	0 to 96 %
25.	**Resistance against heat and fire**	The terminal block and Meter case shall have safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them as per IS 13779.
26.	**Resistance against Climatic influence.**	Meter shall comply requirement of clause no. 12.6 of IS 13779.
27.	**Energy measurement**	Fundamental energy + energy due to Harmonics.
28.	**kVAh Calculation**	Meter shall be programmed for "Lag as Lag, Lead as Lead, UPF as UPF configuration"
29.	**Initial start-up of meter**	Meter shall be fully functional within 5 seconds after reference voltage is applied to its terminals.
30.	**Sleep Mode**	No Sleep mode required.
31.	**Display**	Backlit LCD, minimum 8 digits.
32.	**Software and communication capability**	a) The bidder shall supply software for wired (CMRI/HHU and laptop) and remote (preferably web based; for AMI) connectivity. b) The bidder shall also provide required training of usage of software free of cost.
33.	**Communication Layer Protocol**	Should comply requirement of clause no. 9.3 of IS 16444 Part-1.
34.	**Alternative data retrieval**	In case of meter damage, data stored in meter memory (NVM) should be retrieved using a jig. Bidder need to be provide such jigs free of cost (1 jig on each 10000 meters). Jig should be designed such that NVM can be plugged easily on it for data retrieval.

S. No.	Parameter	Requirement
35	**Electromagnetic compatibility (EMC)**	Meter shall be type tested for electromagnetic compatibility. Meter shall comply requirement of clause no. 4.5 and 5.5 of IS 15884. Meter shall operate within guaranteed accuracy as per CBIP325 against electrostatic discharge, electromagnetic HF field and fast transient burst.
36	**Limits of error due to influence quantities**	Meter shall operate within guaranteed accuracy as per IS 13779/ IEC62053-21/ CBIP325 for the accuracy class (most stringent standard to be followed) under and after influence of following:- a) Current Variation b) Ambient Temperature variation c) Voltage variation d) Frequency variation e) 10% third harmonic in current f) Reversed phase sequence g) Voltage unbalance h) Harmonic components in current and voltage circuit i) DC and even harmonics in AC current circuit j) Odd harmonics in AC current circuit k) Sub harmonics in AC current circuit l) Continuous (DC) "stray" magnetic induction of 67mT+/-5%. m) Continuous (DC) "abnormal" magneticinduction of 0.27T+/5%. n) Alternating (AC) "stray' magnetic induction of 0.5mT+/-5% o) Alternating (AC) "abnormal' magnetic induction of 10mT. p) External magnetic field 0.5T q) Electromagnetic HF fields r) Radio frequency interference s) DC immunity test. **Note:** APCPDCL reserves the right to formulate any other test method to check magnetic immunity/ logging of meter. Meter with logging provision will be preferred

5. Constructional Requirement

S. NO.	Parameter	Requirement
1.	**Meter Body**	a) The meter Case shall be made up of unbreakable high-grade flame-retardant poly carbonate with minimum thickness of 2 mm and of good di-electric & mechanical strength. Meter case and external terminal cover should be injection moulded in UV stabilized poly carbonate. The moulded meter case should not change in colour, shape, size, dimension when subjected to 72HRS on UV Test. It should with stand 650Deg C glow wire test and heat deflection test as per ISO 75. The External Terminal Block Cover shall be kept fully transparent. The **meter case and meter cover should be fully transparent, unbreakable UV stabilized poly carbonate** for easy reading of all the display values/ parameters and should not fade in course of time and become opaque causing inconvenient in course of time. b) Top cover and base should be fixed in such a manner that it shall be break to open and ultrasonically welded. c) The construction of the meter shall be such as to permit sealing of the meter cover, the terminal cover etc. independently. It should be ensured that the internal parts are not accessible for tampering etc., without breaking the meter cover and meter seals.
2	**Terminals and Terminal block**	a. The terminal block shall be of moulded type and shall be fixed to the extended portion of the meter base. The meter base shall cover the terminal block of its back and sides. It should be non- hygroscopic, non-ignitable and with material of good dielectric and mechanical strength. Extended terminal cover shall be provided, to ensure that the internal parts are not accessible for tampering etc. without breaking seals. A firm connection shall be established within the meter to energize the voltage circuit. The distance between the end terminal block and the ending of the extended terminal cover shall be a minimum of 2 inches. b. The terminals in the terminal block shall be of adequate length in order to have proper grip of conductor with the help of screw adjustable metal plates to increase the surface of contact and reduce the contact resistance. The screws and internal diameter of

S. NO.	Parameter	Requirement
		terminals of 3Ph 10-60A, meters shall be as per relevant standard and also suitable for 6 Sq .mm, 10 Sq.mm and 16 Sq.mm aluminum cables. The screws shall not have pointed ends at the end of threads. All terminals and connecting flat headed screws and washers should be of tinned plated brass material / nickel plated brass material. The terminal block should withstand glow wire test at 960 + 15 ºC and the terminal should withstand at least 135 ºC. as per IS. Terminals clearances and creep age shall be as per IS13779. c. Sufficient clearance shall be allowed between terminals. Further, the supporting webs between the two terminals of the terminal block should be sufficiently high to ensure that the two neighboring terminals do not get bridged by dust or it is not possible to have flash over between adjacent terminals of terminal block. d. The terminals shall be of suitable rating to carry 150% of Imax of 10-60A Operated and made of tinned plated brass material/ nickel plated brass material and shall be of replaceable type. The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Terminals shall be clearly marked for phase / neutral / outgoing etc. this marking shall appear in the connection diagram. e. All connection screws and washers should be tinned plated brass material / nickel plated brass material. The terminal screws shall not have pointed end at the bottom. All terminals will have two flat headed screws. The terminals shall be properly bound in the insulation. Sufficient clearance can be provided between terminals to avoid possible flash over. f. The terminal block shall have provision with double screws for fixing to the meter board. It shall not be possible to remove the meter from the hanging screw without removing the screws from the terminal block.
3	**Terminal Cover**	a. Material - UV stabilized transparent polycarbonate cover

S. NO.	Parameter	Requirement
		b. Provision of sealing at one point through sealing screw. c. The sealing screws shall be held captive in the terminal cover. d. The meter shall be supplied with extended terminal block cover (ETBC). The ETBC shall be extended by minimum 50mm below plane surface of the terminal block with suitable sealing arrangement of terminal cover for providing numbered double anchor polycarbonate lash wire seal, which shall be supplied loose by the bidder as per technical specification of Polycarbonate Seals. e. The terminal cover of the meter should be hinged either at the top or left side so that it opens from bottom to top or hinged at the left side so that it opens from right to left of the meter. f. Terminal cover should have provision for cable entry from bottom. g. Terminal cover shall have sufficient space for incoming and outgoing cable such that these can pass without stressing and damaging the terminal cover. h. Diagram of external connections should be embossed on clearly on inside portion of terminal cover. Meter terminals shall also be marked and this marking shall appear in the above diagram. i. Stickers of any kind will not be accepted. j. Extended terminal cover shall be provided, to ensure that the internal parts are not accessible for tampering etc. without breaking seals. k. The distance between the end terminal block and the ending of the extended terminal cover shall be a minimum of 2 inches.
4.	**Fixing Arrangement**	a) The meter shall have minimum three fixing holes, one at the top for mounting and two at the bottom, inside the terminal cover. b) The top hole shall be keyhole type on the back of the meter base so that hanging screw is not accessible after fixing of the meter and it shall not be possible to remove the meter from the hanging screw without removing the terminal cover and screws behind the terminal block cover.

S. NO.	Parameter	Requirement
		c) The lower fixing hole/s shall be provided under the ETBC. Any alternate better arrangement shall also be considered for acceptance. d) All the fixing holes shall be such designed that once the meter is mounted; the screw heads shall not be accessible. e) Manufacturer shall provide the appropriate fixing screws along with the meters.
5.	**Non-Flammability**	The terminal block, the terminal cover and the case shall ensure reasonable safety against spread of fire. They shall not be ignited by thermic over load of live parts in contact with them. To comply with this these parts shall fulfill the conditions of the glow wire test as per CBIP - 325.
6.	**Ingress Protection**	a) IP 51 or better as per IS 12063, but without suction in the meter. b) Meter shall comply requirement of clause 6.9 and 12.5 of IS13779.
7.	**Output device**	a) Meter shall have flashing LED visible from the front to represent energy recording. Resolution shall be such that satisfactory accuracy test can be conducted at the lowest load in less than 5 minutes and starting current test in less than 10 minutes. b) Meter shall have provision o n LCD for indicating communication status. c) Meter shall have indicator on LCD for displaying the status of load switch.
8.	**Real Time Clock (RTC)**	a) The meter shall have internal real time crystal clock to set date and time. b) The Real Time Clock (RTC) shall have long life (minimum 15Years); it should be with permanent Non- Rechargeable Battery. c) RTC shall have separate battery backup. d) Meter should have capability of Time synchronization through optical port/ remote communication with proper authentication.
9.	**Battery**	Lithium ion battery with guaranteed self-life of 10 years and capacity life of 15 years. In case battery removal or total discharge, it should not affect the working & memory of the meter.

S. NO.	Parameter	Requirement
		RTC shall have separate battery backup.
10.	**Memory**	Non-volatile memory independent of battery backup, memory should be retained up to 10 year without any Auxiliary power.
11.	**Self-Diagnostic feature**	Meter shall have self-diagnostic for the following a) Date and RTC. b) Battery. c) Non-volatile memory. d) Display
12.	**Load Control Switch**	a) Smart meter shall be equipped with integrated load control switches to control flow of electricity to the load at the instance of connect/ disconnect commands as per functional need of the system. b) Three numbers load switches (01 in each phase.) c) Load switch shall be incompliance to IS 15884 and IS16444. d) Load switch for connect/ disconnect purpose shall be mounted inside the meter with suitable arrangement. e) The maker of the load switch should be Gruner / KG Technologies (German), OMRON or Equivalent make as per IS /IEC standards only and same shall be confirmed by the bidder during tendering.
13.	**Performance requirement for load switching**	Utilization category of the load switch shall be UC3 as per clause no. 4.6.6.2 of IS 15884
14.	**Communication module of meter for AMI**	a) Smart meter shall have provision of one no of plug-in communication modules (NIC card). b) As per clause no 1.2(b) of IS 16444 Part -1. Meter should have provision of communication module with both the variant mentioned in IS 16444 Part-1. This module should be able to connect WAN (as per the plugged module 4G / NBIOT) for two-way communication. c) Meter shall log communication module removal as an event.
15.	**Meter Sealing Arrangement**	a) Reliable sealing arrangement shall be provided to make the meter tamper evident and to avoid fiddling or tampering by unauthorized persons. b) Sealing should be in accordance with IS and CEA metering regulations with latest amendments.

S. NO.	Parameter	Requirement
		c) Approval shall be taken from APCPDCL for location of seals.
		d) In case of plug in communication module, sealing arrangement shall also be provided for the same.
16	**Sealing of Meter**	a. Proper sealing arrangement should be provided on the meter to make it tamper resistant and avoid mishandling by unauthorized persons. The construction of meter shall be such as to permit sealing of the meter cover in two locations i.e right & left apart from the terminal cover which is detailed elsewhere in the specification. b. The size of the sealing screw must be in such a way to provide one more APCPDCL security seal along with company seal in the same screw. The sealing screw should be unidirectional this is to ensure that internal parts are not accessible for tampering without breaking the seals. c. One number separate sealing arrangement to the MD Reset button and separate flap for RS 232 port shall be provided. d. Bidder shall provide patented seals as per CEA Regulation (2006) e. The holes for sealing wire shall be minimum 2mm dia.
17.	**Name Plate and marking**	Meter should have clearly visible, indelible and distinctly marked nameplate in accordance with of this specification.
18.	**Connection Diagram**	The connection diagram of the meter shall be clearly shown on the meter nameplate and shall be of permanent nature. Alternatively, connection diagram can be permanently embossed on the inside portion of terminal cover.

6. Functional Requirement

S. No.	Parameter	Requirement
1.	**Meter category**	Smart meter shall comply D2 category of IS 15959 (Part 2).
2.	**Security**	Advanced security outlined in clause 7.1.2 of IS 15959 (Part 1) shall be provided.

S. No.	Parameter	Requirement
3.	Encryption for data communication	As per clause 7.1 of IS 15959 (Part 2)
4.	Encryption/Authentication for data transport	As per clause 7.2 of IS 15959 (Part 2)
5.	Key requirement and handling	As per clause 7.3 of IS 15959 (Part 2)
6.	IP communication profile support	Meter shall support TCP-UDP/ IP communication profile for smart meter to HES. Please refer clause 8 of IS 15959.
7.	Self-Registration	a. Last mile network must support auto-registration and self- healing feature to continue operation using easiest possible available route in case of failure of any communication device. b. Meter once powered up with NIC card should be self- detected and its basic nameplate details & current readings should be transferred to HES.
	Instantaneous Parameters	Following parameters shall be continuously updated by the meter hardware/software as per internal sampling and computation t ime and last updated value shall be available for downloading asand when required i. Real time clock date and time ii. Current R Phase iii. Current Y Phase iv. Current B Phase v. Voltage R Phase vi. Voltage Y Phase vii. Voltage B Phase viii. Neutral Current ix. Signed power factor, R Phas x. Signed power factor, Y Phase xi. Signed power factor, B Phase xii. Three Phase Power Factor, PF xiii. Frequency, Hz xiv. Apparent power KVA xv. Signed Active power, kW (+Import,-Export) xvi. Signed Reactive Power Kvar (+Lag,-Lead) xvii. Number of Power failures xviii. Cumulative Power off Duration in Min. xix. Cumulative tamper count xx. Cumulative billing count xxi. Cumulative programming count xxii. Billing date

S. No.	Parameter	Requirement
		xxiii. Cumulative energy, kWH (Import) xxiv. Cumulative energy, kWH(Export) xxv. Cumulative energy, kVAh (While kWh Import) xxvi. Cumulative energy, kVAh (While kWh Export) xxvii. Cumulative kVArh lag (Import & Export) xxviii. Cumulative kVArh lead (Import & Export) xxix. Maximum Demand, kW(Import & Export) xxx. Maximum Demand, kVA(Import & Export) xxxi. Cumulative MD (Import & Export) xxxii. Load switch Function Status a) The parameters at S. No. (xviii) to (xxi) and (xxiii) to (xxvi) hold cumulative values at that instant from the date of manufacturing. b) All the above data shall be available for download as a separate entity. c) For S. No. 'xxx' smart meter shall return 1 if load switch is ON (connected) and 0 if load switch is off (disconnected) **Meter should be suitable for lag and lead tariff, satisfying the formula KVAH2= KWH2 +RKVAH2 for lagging and leading loads.**
9	**Parameters (Auto Scroll)**	(i) Real time (ii) Date (iii) Cumulative kwh (import & export), (iv) Cumulative Kvarh Lag (import & export). (v) Cumulative Kvarh Lead (import & export) (vi) Cumulative Kvah (import & export), (vii) Instantaneous Power Factor with sign (Lag or Lead) (viii) Maximum Demand kW with 15 minutes integration (import & export) (ix) No. of cumulative Tamper events. (x) Load switch Function Status a) All the above data shall be available for download as a separate entity. b) For S. No. 'x' smart meter shall return 1 if load switch is ON (connected) and 0 if load switch is off (disconnected) Meter should be suitable for lag and lead tariff, satisfying the formula KVAH2= KWH2 +RKVAH2 for lagging and leading loads.
10	**Display Parameters (Push Button)**	The display of following parameters shall be continuously scrolling one after another through

S. No.	Parameter	Requirement
		push button. The display shall have `ON' time of 10 seconds for each measured value for display cycling.

i) Real Time
ii) Date
iii) Instantaneous phase wise Line currents
iv) Instantaneous Phase to Neutral Voltages
v) Instantaneous Phase wise Power Factors
vi) Frequency
vii) Active, Reactive and Apparent Power
viii) Cumulative kwh (import & export),
ix) Cumulative Kvarh Lag (import & export).
x) Cumulative Kvarh Lead (import & export)
xi) Cumulative Kvah (import & export),
xii) Maximum Demand kW with 15 minutes integration

(import & export)

xiii) Cumulative tamper count
xiv) Cumulative MD reset Count
xv) Cumulative active Import & Export energy kWh for each calendar month for previous 6 months
xvi) Cumulative reactive import & export energy (Lag & Lead) each calendar month for previous 6 months
xvii) Cumulative apparent energy active import & active export for each calendar month for previous 6 months.
xviii) Average monthly PF with date and time for previous 6 months.
xix) Max. Demand KW (active import & export) with 15 min. integration with date and time for previous 6 months.
xx) No. of cumulative tamper events.
xxi) Magnetic interference indication.
xxii) Self Diagnostics (LCD Segment check & Battery check).
xxiii) For calibration purpose, High resolution reading for testing for both active import & export (Kwh, Kvarh Lag, Kvarh Lead, Kvah) should be displayed with a minimum of four decimal digits.
xxiv) For calibration purpose, High resolution reading for testing (Kwh, Kvarh Lag, Kvarh Lead, Kvah) should be displayed with a minimum of four decimal digits And

S. No.	Parameter	Requirement
		display persistent time shall be minimum of 10 minutes, incase dial test is set for shorter period than 10 min. by pressing push button, display can be shifted to other display parameters. xxv) Push Button for Up & Down facility to be provided
11.	**Load survey Data**	Parameters of load survey shall be measured and recorded as per IS 15959(Part 2) clause 18(Block Load profile parameters) at the end of each **30 min interval for last 90 days.** i. Real time clock date and time ii. Current, R phase iii. Current, Y phase iv. Current, B phase v. Neutral Current vi. Voltage, R Phase vii. Voltage, Y Phase viii. Voltage, B Phase ix. Active power (import & export), x. Reactive power (import & export), xi. Apparent power (import & export), xii. Block energy kwh (import & export), xiii. Block energy Kvarh Lag (import & export). xiv. Block energy Kvarh Lead (import & export) xv. Block energy Kvah (import & export), xvi. PF a) Voltages and currents are average values during the block period time. b) Energies are consumption during the block period. c) All parameters are stored at the end of capture period. d) The time stamp shall be at the end of capture period. e) Selective access shall be provided as per clause 11.3 of IS 15959 (part1).
12.	**Daily load profile**	Following parameters shall be measured and recorded at each midnight i.e. 00:00 hrs for last 60 days. i. Real Time clock- date and time ii. Cumulative kwh (import & export),

S. No.	Parameter	Requirement
		iii. Cumulative Kvarh Lag (import & export). iv. Cumulative Kvarh Lead (import & export) v. Cumulative Kvah (import & export), a. Selective access shall be provided as per clause 11.3 of IS 15959 (part 1)..
13.	**Billing data**	a. At the end of each billing cycle, meter shall generate and store in memory the following parameters as per provisions provided in clause no. 14 of IS 15959 (Part2). i. Billing date ii. System power factor for billing period Import iii. Cumulative energy, kWh iv. Cumulative energy, kWh for TZ1 v. Cumulative energy, kWh for TZ2 vi. Cumulative energy, kWh for TZ3 vii. Cumulative energy, kWh for TZ4 viii. Cumulative energy, kWh for TZ5 ix. Cumulative energy, kWh for TZ6 x. Cumulative energy, kWh for TZ7 xi. Cumulative energy, kWh for TZ8 xii. Cumulative energy, kVAh xiii. Cumulative energy, kVAh for TZ1 xiv. Cumulative energy, kVAh for TZ2 xv. Cumulative energy, kVAh for TZ3 xv. Cumulative energy, kVAh for TZ4 xvi. Cumulative energy, kVAh for TZ5 i. xviii.Cumulative energy, kVAh for TZ6 ii. xix. Cumulative energy, kVAh for TZ7 iii. xx. Cumulative energy, kVAh for TZ8 iv. xxi. MD, kW v. xxii. MD, kW for TZ1 vi. xxiii.MD, kW for TZ2 vii. xxiv.MD, kW for TZ3 viii. xxv. MD, kW for TZ4 ix. xxvi.MD, kW for TZ5 x. xxvii. MD, kW for TZ6 xi. xxviii. MD, kW for TZ7 xii. xxix.MD, kW for TZ8 xiii. xxx. MD, kVA xiv. xxxi.MD, kVA for TZ1 xv. xxxii. MD, kVA for TZ2 xvi. xxxiii. MD, kVA for TZ3 xvii. xxxiv. MD, kVA for TZ4 xviii. xxxv. MD, kVA for TZ5 xix. xxxvi. MD, kVA for TZ6

S. No.	Parameter	Requirement
		xx. xxxvii. MD, kVA for TZ7 xxi. xxxviii. MD, kVA for TZ8 xxii. xxxix. Billing Power ON duration in Minutes(During billing period) xxiii. xl. Cumulative energy, kWh– export xxiv. xli. Cumulative energy, kVAh– export xxv. xlii. Cumulative energy, kvarh(QI) xxvi. xliii. Cumulative energy, kvarh(QII) xxvii. xliv. Cumulative energy, kvarh(QIII) xxviii. xlv. Cumulative energy, kvarh(QIV) NOTES b. Support for selective access shall be provided for billing parameters as per clause no 11.3 of IS 15959 (part1). c. The current cycle billing parameters shall be readable as the values of the latest billing period, on demand. This shall be in addition to the last Six billing period data, which shall be available in the profile buffer as the last six entries in the buffer. d. The captured attributes in case of Inter face Class 4 (Extended register) used for MD values will be attributes 2 and 5 (Value and Time stamp). e. 4 The Billing Date - Time format by default shall be HH:MM. f. Billing Date and Time shall be current date and current time. g. The parameter at S. No. (xl), (xli), (xliii) and (xliv) are applicable only for meter supporting 'import and export' energy measurement.
14.	**Billing period reset/ MD reset**	Auto 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
15.	**Billing period counter**	Cumulative billing period counter since installation and available billing periods shall be provided as per clause 11.2 of IS 15959 (Part 1).
16.	**Selective access of billing data**	By entry.
17.	**Billing period reset mechanism**	Auto reset at 24.00 Hrs of the last date of each calendar month for which minimum 30 years

S. No.	Parameter	Requirement
		calendar shall be programmed by the manufacturer
18.	**MD Registration MD Reset :**	Block / 30 min sliding window with 30 min integration period as per requirement. i. The meter should have provision for manual resetting of maximum demand ii. Resetting shall be possible through a hand held Common Meter Reading Instrument (CMRI) capable of communicating with the meter with the help of Lap Top. iii. Auto reset at 24.00 Hrs of the last date of each calendar month for which minimum 30 years calendar shall be programmed by the manufacturer. The cumulative KWh & Kvah should also be recorded at 24.00 Hrs. on the last date of each calendar month for previous six months. DIP shall be set at 30 minutes duration. DIP shall commence at the fixed time intervals of real time. MD recording of Block method is to be used. Necessary software is to be provided for changing DIP to 30minutes. The rising value of current demand with rising time should be held in the memory in the event of interruption (or) switching off power supply and it should not fall to zero on such instances. The meter shall have the following MD resetting options. (a) Automatic reset at 24.00 hrs. of last day of the calendar month. (b) Manual resetting arrangement (MD reset button) with sealing facility. (c) MD reset through authenticated transaction
19.	**Real Time Data Transfer with 30 min time block period (RTDT)**	30mins time block readings Voltages (R,Y,B) : To confirm rated voltage is being given to consumer end

S. No.	Parameter	Requirement
		Current (R,Y,B): To plot load flow chart in terms of Amperes Neutral Current: To check Single phase/Phase shifter operation KW: To plot load flow chart in terms of Kilowatts KVA: To plot load flow chart in terms of Kilo Volt Amperes KWH: To obtain actual load impact KVAH: To obtain actual load impact KVARH- Lead: To obtain actual load impact KVARH-Lag: To obtain actual load impact Average PF: To confirm rated capacitors are being installed by consumer KVA MAX: To find the maximum load impact Imax: To find the maximum load impact Vmax: To confirm rated voltage is being given to consumer end Vmin: To confirm rated voltage is being given to consumer end Frequency: To confirm rated Frequency is being given to consumer end
20.	**Push Services**	As per clause no. 6 of IS 15959 (Part 2) Smart meter is able to notify automatically event and messages to a destination client system in an unsolicited manner (without a request from a client) as per IS 15959 (Part2).
21.	**Periodic Push**	a. Meter shall be able to push following instantaneous parameters to HES at predefined intervals. i. Device ID ii. Push setup ID iii. Real Time clock- Date and time iv. Voltage R Phase v. Voltage Y Phase vi. Voltage B Phase vii. Current R Phase viii. Current Y Phase ix. Current B Phase x. Current Neutral xi. Signed Power Factor R Phase xii. Signed Power Factor Y Phase

S. No.	Parameter	Requirement
		xiii. Signed Power Factor B Phase xiv. Signed Power Factor Net xv. Apparent power KVA xvi. Active power Kw xvii. Cumulative Energy, Kwh (Import) xviii. Cumulative energy KVAH(Import) b. Other attributes as per IS 15959 (Part 2) i.e. Send Destination, Communication window, Randomization time interval, number of retries and repeat delay shall be decided in the event of manufacturing.
22.	**Event Push**	a. Meter is able to report HES, the status change of any of the events as per IS 16444. • Earth Loading • Influence of permanent magnet or AC/ DC electromagnet • Neutral disturbance- HF, DC or AC • Meter cover opening • Meter load Disconnected/ meter load connected • Power Outage • Power Restoration • Manual/ MRI reset
23.	**Reports**	The following reports are to be made available i. A report based on 30mins time block readings transferred within next one minute. ii. RTDT %: A report based on Real time data transfer as per 30mins time block readings within next one minute. iii. A report based on billing data. iv. A report based on events data. v. A report based on Load flow data. vi. Load curves based on the para meters of 30 min time block readings. vii. Any other reports required by the DISCOM from to time to time.
24.	**Name Plate Detail**	a. Meter Sl.No. b. Device ID c. Manufacture's name d. Firmware version for meter e. Meter type- (3P-4W) f. Category- (D2)

S. No.	Parameter	Requirement
		g. Current Rating- (10-60A) h. Meter Year of manufacture-YYYY
25.	**Programmable Parameters**	Following parameters can be programmed remotely by HES and locally by authorized device (CMRI, laptop) thru serial communication port via proper access writes. Every transaction shall be logged in non- volatile memory of the meter with date and time stamp. i. Real time clock, date and time ii. Demand integration period iii. Profile capture period iv. Single action schedule for billing dates v. Activity calendar for time zones vi. Load Limit(kW) vii. Enable/Disable load limit function a. Unit for demand integration period and profile capture period shall be in seconds. The demand integration period shall be 900s (Default) and programmable to 1800s. The profile capture period shall be 900s (Default) and programmable to 1800s. b. On change of time zone settings, the on-going billing cycle data will be generated and a new billing cycle shall be commenced as per new activity calendar. c. Programming of any of the parameters shall increment the 'Cumulative programmable count' value.

26.	**TOD Metering**	a. Meter shall be capable of doing TOD metering for KWH, KVAH and MD in KW and KVA in three tariff registers programmable for 3 seasons and six time zones.
		 • TOD Timings in six zones by default shall be as given below. However software has to be provided to change the TOD zones whenever required.
		     TOD 1 - 00.00Hrs. to 06:00Hrs.
		     TOD 2 - 06.00Hrs. to 10:00Hrs.
		     TOD 3 - 10.00Hrs. to 14:00Hrs.
		     TOD 4 - 14.00Hrs. to 18:00Hrs.
		     TOD 5 - 18.00Hrs. to 22:00Hrs.

S. No.	Parameter	Requirement
		TOD 6 - 22.00Hrs. to 24:00Hrs. b. Definition of time zones, seasonal profile and assignment of tariff registers shall be programmable remotely through HES and locally through CMRI with proper security as per provisions of CBIP-325. c. Above shall be implemented as per clause 9 of IS 15959 (Part 1).
27.	**Firmware upgrade**	a) As per clause 9 of IS 15959 (Part2) b) Smart meter shall support remote firmware up grade feature. c) Firmware upgrade shall be limited to the communication firmware only. Firmware upgrade shall use the Image transfer classes and mechanisms specified in IEC62056-6-2 and IEC62056-5-3.
28.	**Disconnection mechanism**	a) The Smart meter shall support disconnection (all the switches shall operate) on the following conditions as per clause 11 of IS 16444 (Part1): i. Over current (105 % of Imax in any phase for predefined persistence time.) ii. Load control limit(Programmable) iii. Pre-programmed tamper conditions (Factory programmed) iv. Disconnection signal from Head end system. v. Pre-paid meter disconnection functionality for pre payment mode. b) Load Control limits shall be programmable locally and remotely with access authorization access only. c) Meter shall use the disconnection control object as defined in clause 10 of IS 15959 (Part2). d) Relay for connect/disconnect shall comply all relevant requirements of IS15884.
29.	**Local reconnection**	1. The meter will try to reconnect the load up to predefined time, with predefined interval (Time and interval is programmable).

S. No.	Parameter	Requirement
		2. If the consumption is still more than the programmed limits, it will lock out and wait for 30minutes.
		3. If the consumption is still above the limit, the procedure defined above in 1 and 2 shall be repeated.
30.	**Reconnection mechanism**	Reconnection shall be done from HES except for over current and load control limit. In case of failure of communication / HES, reconnection shall be possible through Hand Held Device (CMRI) locally via proper security.

Reconnection in case of pre-payment meter shall be as per pre-payment profile and balance/credit availability in the meter. |
31.	**Load switch event logging**	Meter shall log switching operation with date time and other relevant parameters. This should comply the requirement of clause 11 of IS 16444 Part-1.
32.	**Outage Management**	The meter shall send abnormalities at the consumers' end like Power failure (Last Gasp), Power Restoration (First Breath) to HES.
33.	**Status of load switch**	Indication of status of relay i.e. connected/ disconnected should be available on display as well as through communication to HES. Connection and disconnection should be logged as events.
34.	**First breath and last gasp**	The meter should have "Last Gasp" and "First Breath" feature to facilitate sending alerts to the HES during fully powered off / On condition Shall comply with IS:16444.
35.	**On demand readings**	On request from HES
36.	**Schedule meter readings**	Programmable through HES

7. Anti-tamper and Fraud Detection Requirement

1	**Current Related**	a) Occurrence and restoration of following current related events shall be logged in meter memory as per table A19 of IS 15959 (Part 2) shall be logged in meter memory. b) For each occurrence event captured, the cumulative tamper count shall be incremented. c) Selective access shall be provided as per clause 11.3 of IS15959 (Part1).
2	**Power related**	a) Occurrence and restoration of following Power related events should be logged in meter memory as per table A20 of IS 15959 (Part2) shall be logged in meter memory. b) Only Real clock (date and time) and event code shall be captured. c) Selective access shall be provided as per clause 11.3 of IS15959 (Part1).
3	**Power On/ Off**	Meter shall detect occurrence and restoration of power off if the phase voltage is absent more than a threshold period.
4	**Voltage related**	a. Occurrence and restoration of following Voltage related events shall be logged in meter memory. b. For each occurrence event captured, the cumulative tamper count shall be incremented
5	**Low Voltage Logging**	Event shall be logged in memory along with Occurrence and restoration event data. Threshold should be below 180Volts. Manufacturer should explain behavior of meter below 120V.
6	**Protection against HV spark**	Meter shall continue to record energy or log the event, in case it is disturbed externally using a spark gun/ ignition coil. Upto 35 KV meter without NIC card should remain immune. Communication port shall also be immune upto 35KV with cover in place. The Meter shall comply to HV spark when Meter installed in field conditions.
7	**Others**	a. Occurrence and restoration of following events shall be logged in meter memory as per table A22 of IS 15959 (Part2) shall be logged in meter memory. b. For each occurrence event captured, the cumulative tamper count shall be incremented. c. Selective access shall be provided as per clause 11.3 of IS15959 (Part1).
8	**Neutral disturbance**	Meter shall log all events when AC/DC/ Pulsating voltage is injected in neutral circuit especially when it can disturb the recording of energy. Manufacturer should specify the method of testing of Neutral disturbance.

9	**External Magnetic Interference**	a) The meter shall either remain immune to tamper through application of external magnetic field (AC electro magnet or DC magnet) as per value specified in CBIP 325 or if the metering gets affected then meter shall record energy at Imax, rated voltage and unity P.F. as per CBIP 325 and same should also be logged as event with date &time.
		b) In case of abnormal permanent magnetic field, either meter shall remain immune or if the metering gets affected then meter shall record energy at Imax, rated voltage and unity P.F and it should also be logged as event with date &time.
		c) The meter shall be provided with built in logic/ indication and sensor to detect tamper beyond meter's magnetic immunity level and display of such occurrences. The meter accuracy or accuracy display shall not be affected by permanent magnetic field up to meter's magnetic immunity level.
		d) At the time of occurrence of magnetic tamper, meter should record tamper event with Imax, rated voltage and unity P.F and at the time of restoration it should logged with actual parameters
		e) Manufacturer should explain method of MD computation during magnetic interference.
10	**Non-rollover events**	a) Occurrence of following non-rollover events shall be logged in meter memory as per table A9 of IS 15959 (Part2).
		b) For each occurrence event captured, the cumulative tamper count shall be incremented.
		c) For these events, only date and time shall be captured.
		d) Selective access shall be provided as per clause 11.3 of IS 15959 (Part1).
11	**Top cover open**	Meter shall detect opening of top cover and this event shall be logged. Detection and logging mechanism shall work even when the meter is de-energized. Logic shall be defined.
12	**Connection Related Tamper Conditions**	The meter shall not get affected by any remote control device & shall continue recording energy under any one or combinations of the following conditions:
13	**I/C&O/G Interchanged**	Meter should record forward energy within limits of accuracy class 1.0.
14	**Event Logging**	Total number of events to be stored shall be minimum 20 for power On/ OFF event and not more than 50 for all other events in FIFO basis.
15	**Parameter Snapshot**	Captured parameters mentioned above are to be captured when event occurrence and restoration is logged as per table A11 of IS 15959 (Part 2).

		i. Date and time of event ii. Event code iii. Current R Phase - instantaneous current. iv. Current Y Phase - instantaneous current. v. Current B Phase – instantaneous current. vi. Voltage R Phase vii. Voltage Y Phase viii. Voltage B Phase viii. Power factor R Phase ix. Power factor Y Phase x. Power factor B Phase xi. Cumulative energy- kWh xii. Cumulative KVah
16	**Tamper Indication**	Appropriate Indications/Icons for all tampers should appear on the meter display either continuously or in auto display mode.
17	**Tamper Logics**	A logic sheet for tamper/ event detection and logging shall be submitted for APCPDCL approval. Following details should be provided for each tamper in tabular form a. Detailed Tamper logic a. Threshold values b. Persistence times c. Restoration time d. Event count

Tamper event details for Three phase Smart Meters

Table 2Tamper event details for 3 phase Smart Meters

Persistence Time for Occurrences	Persistence Time for Restoration	Threshold Value for Occurrence of Events	Threshold Value for Restoration of Events	Compartment Size
ESD/JAMMER = 0 Hr 02 Min 0 sec (ESD)	ESD/JAMMER = 0 Hr 02 Min 0 sec (ESD)	Immunity up to 8 KV with NIC and logging of value from 1 KV to 50 KV	Removal of ESD signal	25
Magnet = 0 Hr 10 Min 0 sec (MAG)	Magnet =0 Hr 10 Min 0 sec (MAG)	> 50 mT (permanent magnet) OR DC magnetic induction > 200 mT OR AC magnetic induction > 50 mT	< 50 mT (permanent magnet) OR DC magnetic induction < 50 mT or AC magnetic induction <50 mT	25
Meter Top Cover Open (TC Open)	Meter Top Cover Open (TC Open)	If meter top cover is opened	NA	05 (Stay put Type)
Potential Missing =0 Hr 10 Min 0 sec (PM)	Potential Missing =0 Hr 10 Min 0 sec	Voltage < 70% of V ref AND current > 2% Ibasic	Voltage > 80% of V ref AND current > 2% Ibasic	25
Voltage Unbalance =0 Hr 10 Min 0 sec (VU)	Voltage Unbalance = 0 Hr 10 Min 0 sec	20% or more between the phases and current > 2% Ibasic	Shall be less than 10 % between the phases and current > 2% Ibasic	25
CT Open (phase wise) = 0 Hr 10 Min 0 sec	CT Open (phase wise) = 0 Hr 10 Min 0 sec	Ir + Iy + Ib + In ≥ 10 % of Ibasic (vector Sum) AND Phase current < 1% of Ibasic with All current positive	Ir + Iy + Ib + In < 5 % of Ibasic. (vector Sum) AND Phase current > 10% of Ibasic with All current positive	25
CT Reversal =0 Hr 10 Min 0 sec (CTR)---- (*NOT Applicable for*	CT Reversal =0 Hr 10 Min 0 sec	Active current negative	Active current positive AND > 2 % Ibasic	25

Persistence Time for Occurrences	Persistence Time for Restoration	Threshold Value for Occurrence of Events	Threshold Value for Restoration of Events	Compartment Size
Net meter Configuration)				
CT Bypass = 0 Hr 10 Min 0 sec (CTB)	CT Bypass = 0 Hr 10 Min 0 sec	Ir + Iy + Ib + In ≥ 10 % of Ibasic (vector Sum) AND Phase current > 10% of Ibasic with All current positive	Ir + Iy + Ib + In < 5 % of Ibasic. (vector Sum) AND Phase current >10% of Ibasic with All current positive	25
Current Unbalance =0 Hr 10 Min 0 sec (CU)	Current Unbalance = 0 Hr 10 Min 0 sec	Current difference > 30% between the phases AND Ir + Iy + Ib + In ≥ 10 % of Ibasic (vector Sum)	Current difference < 20% between the phases ANDIr + Iy + Ib + In < 5 % of Ibasic (vector Sum)	25
LowPower Factor = 0 Hr 10 Min 0 sec (LPF)	LowPower Factor =0 Hr 10 Min 0 sec	Power Factor ≤ 0.5	Power Factor > 0.7	25
Neutral Disturbance =0 Hr 10 Min 0 sec (ND)	Neutral Disturbance =0 Hr 10 Min 0 sec (ND)	Voltage >145% of Vref Current >10% Ib OR Frequency < 47 Hz OR Frequency > 52 Hz OR DC voltage / signal injection	Voltage <115% of Vref Current > 10% Ib AND Frequency > 47 Hz OR Frequency < 52 Hz	25
Power On Off = 0 Hr 10 Min 0 sec	Power On Off = 0 Hr 10 Min 0 sec	Actual Voltage off	Actual Voltage On	25
High Voltage = 0 Hr 10 Min 0 sec (HV)	High Voltage =0 Hr 10 Min 0 sec	Voltage > 130% of Vref	Voltage <110% of Vref	25
High Neutral Current =0 Hr 10 Min 0 sec (HNC)	High Neutral Current =0 Hr 10 Min 0 sec	Ir + Iy + Ib + In > 20% of Ibasic AND In > 10% of Ibasic	Ir + Iy + Ib + In < 10% of Ibasic AND In < 5% of Ibasic	25

Persistence Time for Occurrences	Persistence Time for Restoration	Threshold Value for Occurrence of Events	Threshold Value for Restoration of Events	Compartment Size
Temperature Rise = 0 Hr 30 Min 0 sec (TR)	Temperature Rise = 0 Hr 30 Min 0 sec (TR)	Temperature > 100 Degree C	Temperature < 80 Degree C	25 (Stay put type)
Over Load (If enabled) OL	Over Load = 0 Hr 30 Min 0 sec (TR)	>preset value (default value shall be 120%)	<preset value/default value	25

8.   Meter Display

The measured value(s) should be displayed on a Liquid Crystal display (LCD) register. The display should

have backlit capability for easy reading. When the LCD is placed at a constant temperature of $65^{\circ}C$ for a period of 30 minutes in operating condition and $80^{\circ}C$ for 30 minutes under de-energized / storage condition, it should not get deformed. Dot Matrix type LCD will not be acceptable.

	LCD Type	STN Liquid crystal with backlit
1.	**Viewing angle**	c) Display should have viewing angle 35 degree up & down from eye level. d) The display visibility should be sufficient to read the Meter mounted at height of 0.5 m as well as at the height of 2m.
2.	**Size of LCD**	Not less than 55x14 mm
3.	**Size of digits**	10x5 mm minimum
4.	**LCD Digits**	Total 8 digits
5.	**LCD language**	English
6.	**Display mode**	**Parameters (Auto Scroll)** Following parameters should be displayed in Auto scroll with programmable interval with 10 seconds (i) Real time (ii) Date (iii) Cumulative kwh (import & export), (iv) Cumulative Kvarh Lag (import & export). (v) Cumulative Kvarh Lead (import & export) (vi) Cumulative Kvah (import & export), (vii) Instantaneous Power Factor with sign (Lag or Lead) (viii) Maximum Demand kW with 30 minutes integration (import & export) (ix) No. of cumulative Tamper events. (x) Load switch function Status.
7	**Push Button**	**Display Parameters (Push Button) :** **Meter should be provisioned with push button for manual display.**

		The display of following parameters shall be continuously scrolling one after another through push button. The display shall have `ON' time of 10 seconds for each measured value for display cycling.

i) Real Time
ii) Date
iii) Instantaneous phase wise Line currents
iv) Instantaneous Phase to Neutral Voltages
v) Instantaneous Phase wise Power Factors
vi) Frequency
vii) Active, Reactive and Apparent Power
viii) Cumulative kwh (import & export),
ix) Cumulative Kvarh Lag (import & export).
x) Cumulative Kvarh Lead (import & export)
xi) Cumulative Kvah (import & export),
xii) Maximum Demand kW with 15 minutes integration (import & export)
xiii) Cumulative tamper count
xiv) Cumulative MD reset Count
xv) Cumulative active Import & Export energy kWh for each calendar month for previous 6 months
xvi) Cumulative reactive import & export energy (Lag & Lead) each calendar month for previous 6 months
xvii) Cumulative apparent energy active import & active export for each calendar month for previous 6 months.
xviii) Average monthly PF with date and time for previous 6 months.
xix) Max. demand KW (active import & export) with 30 min. integration with date and time for previous 6 months.
xx) No. of cumulative tamper events.
xxi) Magnetic interference indication.
xxii) Self Diagnostics (LCD Segment check & Battery check).
xxiii) For calibration purpose, High resolution reading for testing for both active import & export (Kwh, Kvarh Lag, Kvarh Lead, Kvah) should be displayed with a minimum of four decimal digits.
xxiv) For calibration purpose, High resolution reading for testing (Kwh, Kvarh Lag, Kvarh Lead, Kvah) should be displayed with a minimum of four decimal digits And display persistent time shall be minimum of 10 minutes, incase dial test is set for shorter period than 10 min. by pressing push button, display can be shifted to other display parameters
xxv) Push Button for Up & Down facility to be provided

8.	**Display indications**	Permanent Display on LCD a) Supply indication b) Appropriate indications/flags for all tampers and self-diagnostic features should be provided. c) Data Communication d) Relay Status
9.	**LED Blink (Pulse Indicator)**	a) For Active Power b) For Reactive Power

9. Software and Communication

1.	**Communication Ports**	Communication ports required in meter are as follows.
	Optical	Meter shall have one optical port. It should be compatible for data transfer over RS 232 standard.
2.	**NIC**	Meter shall have provision for pluggable and interchangeable NIC. That is in field based requirement. NIC can be changed without changing the meter.NIC shall support 4G/NBIOT
3.	**Integration**	It should be the responsibility of the bidder to ensure integration of meter into HES for remote communication through cellular network (4G/NBIOT).
4.	**Software and support**	a. The bidder shall supply following software including required training and manuals to use following software free of cost I. CMRI (Local communication): for HHU/CMRI Device and laptop. HHUs can be android or windows based. II. Software for firmware upgrade from remote and mass deployment. b. Bidder shall ensure integration of software with any of APCPDCL system during the life of meter free of cost. APCPDCL will provide all the required support for integration activity. c. The bidder should provide DLMS compliance for communication with the meter at Optical port and at HES.
5.	**Software for local communication (HHU/Laptop)**	The manufacturer has to provide software capable of downloading all the data stored in meter memory through CMRI.
6.		Along with software for traditional CMRI devices bidder shall also provide software for android or windows based HHUs.
7.	**Training**	Manufacture shall impart training to APCPDCL personnel for usage of software

8.	**Port protection**	All ports shall be optically isolated from the power circuit.
9.	**Operation**	Both optical port and NIC Card should work independently. Failure of one (including display) should not affect the working of other.
10.	**Communication protocol**	As per IS 15959 (Part 2). Other protocols shall not be acceptable.
11.	**Data transfer rate**	Communication ports should support data transfer rate of 9600 bps (minimum).
12.	**Data downloading cable**	a. Optical port should be provided with at least 1-mtr cable, having optical sensor at one end and USB 3.0 or higher connector on other end. Cable should be suitable for downloading meter data. b. Both meter and sensor should have mechanical arrangement, so as sensor can be fitted on meter without any tool and without any compromise on alignment and sensitivity.

10.   Name Plate

Meter shall have a nameplate clearly visible, effectively secured against removal and indelibly and distinctly marked with all essential particulars as per relevant standards. The manufacturer's meter constant shall be marked on the nameplate. In addition to the requirement as per IS, following shall be marked on the name plate.

1.	Meter Serial number. Serial number shall be printed in black Colour. Embossing is not acceptable.
2.	Size of the digit shall be minimum 5X3mm
3.	Bar code shall be printed along with serial number; The Size of Bar Code shall not be less than 35 x 5 mm. Stickers in any case will Not be accepted.
4.	BIS registration mark (ISI mark)
5.	'APCPDCL' insignia shall be printed above LCD display.
6.	Agreement Number & Date
7.	Manufacturers name and country of origin
8.	Model type / number of meter
9.	Month & Year of manufacturing
10.	Reference voltage / current rating
11.	The number of phases and the number of wires for which the meter is suitable. Graphical symbol as per IS 12032 can be used.
12.	Meter constant
13.	Class index of meter
14.	Reference frequency
15.	Guarantee period
16.	Communication technology with 4G/NBIOT
17.	Symbol of load switch
18.	For the use of : YSR Uchita Vyavasaaya Vidyut Padhakam

11. **Drawings of Meter, Name Plate Marking :** The name plate and meter drawing, meter sample shall be got approved from the APCPDCL within 15 days from the date of LOA and before commencement of manufacturing. The sample meter shall be supplied along with necessary accessories and soft ware for testing.

12. **Inspection:**

   i. The inspection may be carried out by the APCPDCL at any stage of manufacture. The manufacturer shall grant free access to the APCPDCL representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the APCPDCL shall not relieve the supplier of his obligation of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

   ii. All acceptance tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the Bidder and APCPDCL at the time of agreement. The Bidder shall afford the inspector representing the APCPDCL all reasonable facilities without charge, to satisfy him that the equipment is being furnished in accordance with this specification.

   iii. The supplier shall keep the APCPDCL informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

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

   v. APCPDCL representative will pick up samples at random @ 1 No. meter for every lot of 5,000 Nos. or part thereof. These samples will be tested for acceptance tests as decided by APCPDCL at NABL Accredited government Laboratory in the presence of representatives of supplier and APCPDCL as per relevant IS/IEC/CBIP and APCPDCL specifications at suppliers cost. The samples of subsequent lot shall be tested at different NABL Accredited government Laboratories. If the sample meter fails in the testing again two sample meters will be picked up at random and tested. If the meter fails in the above tests the entire lot will be rejected. If acceptance test fails in subsequent lots, the agreement will be terminated. All the expenses for testing of the meters shall be borne by the contractor.

13. **Quality Assurance Plan:**

   a) The Bidder shall invariably furnish the following information along with his bid, **failing which his bid shall be liable for rejection.** Information shall be separately given for individual type of material offered.

   (i) The structure of organization.
   (ii) The duties and responsibilities assigned to staff ensuring quality of work.
   (iii) The system for purchasing, taking delivery and verification of materials.
   (iv) The system for ensuring quality of workmanship.
   (v) The quality assurance arrangement shall conform to relevant requirements of ISO 9001 or 9002 as applicable.
   (vi) Statement giving list of important raw materials names of sub-suppliers for the raw materials, list of standards according to which the raw

materials are tested. List of test normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.

(vii) Information and copies of test certificates as in (i) above in respect of bought out accessories.

(viii) List of manufacturing facilities available.

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

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

(xi) Lists of testing equipment available with the bidder for final testing of equipment specified and test plant limitation. If any, vis-a-vis the type, special acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in schedule of deviations from specified test requirements.

b) The contractor shall within 30 days of placement of order, submit following information to the APCPDCL.

i. List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with offers.

ii. Type test certificates of the raw materials and bought out accessories if required by the APCPDCL.

c) The contractor shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing if required by the APCPDCL and ensure that the Quality Assurance requirements of this specification are followed by the sub-contractors.

d) The quality assurance programme of the contractor shall consist of the quality system and quality plans with the following details.

e) **Quality System:**

i. The structure of the organization

ii. The duties and responsibilities assigned to staff ensuring quality of work.

iii. The system for purchasing, taking delivery and verification of materials.

iv. The system for ensuring quality workmanship.

v. The system for control of documentation.

vi. The system for the retention of records.

vii. The arrangement for the contractor's internal auditing.

viii. A list of the Administration and work procedures required to achieve and verify Contract's quality requirements. These procedures shall be made readily available to the project Manager for inspection on request.

f) **Quality Plans:**

i. An outline of the proposed work and programme sequence.

ii. The structure of the contractor's organization for the contract.

iii. The duties and responsibilities assigned to staff ensuring quality of work.

iv. Hold and Notification points.

     v.   Submission of Engineering documents required by the specification
     vi.   The inspection of materials and components on receipt.
     vii.   Reference to the Contractor's Work Procedures appropriate to each activity.
     viii.   Inspection during fabrication / Construction.
     ix.   Final Inspection and test.

14. Acceptance and routine tests.

Meters

a)   Acceptance Tests:

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

    ii.   Magnetic induction of external origin (AC&DC).

    iii.   Tamper & Fraud protection as specified in this specification

    iv.   Voltage variation test as per this specification

    v.   Test of no load condition at 70% and 120% of rated voltage. The minimum test period shall be as per cl- 8.3.2 of IEC: 62053-21-2003.

    vi.   Test of DC components in AC circuits – The limits of variation in percentage error shall be 3.0% for class 1 meter at Imax/sq.root of 2 and UPF as per IS:13779.

    vii.   Diode injection test.

    viii. Accuracy test under the anti tamper conditions as specified in this specification.

    ix.   Test for least count.

    x.   Test for time taken for down loading data to CMRI & to BCS.

    xi.   Test on communication capability & software compliance.

    xii.   Verification of tamper logics and verification of display parameters.

    xiii.   Permanent magnet test.

    xiv.   Test of application of abnormal voltage/frequency generating devices as per this specification.

    xv.   Additional acceptance tests shall include Surge withstand (SWC), Lightning impulse and HF disturbance as per IEC 62052-11. For these specific tests, one sample meter per order from one of the offered lot shall be subjected to SWC/other semi-destructive tests. Meters after tests shall not be used.

    xvi.   For sampling plan for pre-dispatch inspection, maximum lot size of

    xvii. 10,000 meters shall be considered for acceptance test as per IS:13779/99.

    xviii. Effect of signal emitted by Mobile.

    xix.   Effect of signal emitted by TV / AC remotes

    xx.   Frequency variation test.

b) Routine Tests:

All the routine tests as stipulated in IS and in addition tamper and fraud protection tests as specified in the specification. shall be carried out and test certificates shall be furnished for approval of the APCPDCL.

c)   Test Reports / Test Certificate:

Record of routine test reports shall be maintained by the Bidder at his works for periodic inspection by the APCPDCL representative.

15.   Samples:
   i.   The Tenderer should supply ==**fifteen Nos**==. sample meters of each type as per Specification along with their tender offer for evaluation and testing the meters at NABL laboratory CPRI Bangloru at the cost of the bidder. Out of fifteen samples, one sample is to be submitted without welding. The software for CMRI & BCS and memory mapping including communication probe should be submitted along with offer for testing the sample meter.

   ii.   The sample meter shall comply with all tests in all respect to this specification. In case sample meters are found not conforming to the requirements both in hardware and software, the price bid of the offer shall not be opened and offer will be rejected.

   iii.   The time required for down loading the data as confirmed by the bidder will also be tested at testing lab.

   iv.   The Drawing for SMC board (to be supplied by the APCPDCL) to house the meter is enclosed with this specification.

16.   Technical deviations:

Any deviation in Technical Specification as indicated in the format shall be specifically and clearly indicated in the schedule of deviation format .

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

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

   c.   The marking on each package shall be as per the relevant Standards and shall also contain.

18.   Component Specification

S. No.	Component	Requirement	Makes & Origin
1.	**Current Element**	E-beam/spot welded shunts shall be provided in the phase element and CT in the neutral. Alternatively, both the current elements (phase & neutral) shall have shunts with proper insulation. The meters should be with the current transformers/shunt as measuring elements.	Any make or origin confirming to IS-2705 and other make i.e. Red bourne Engg/Isabelle.
2.	**Measurement of computing chips**	The measurement or computing chips used in the meter should be with the surface mount type along with the ASICs.	Analog Devices, Cyrus Logic, AMS, Atmel, Phillips, SAMES, NEC, Texas Instruments, Teridian-USA, Maxim USA, Renesas.
3.	**Memory chips**	The memory should not be affected by the external parameters like sparking, high voltage spikes or electrostatic discharges.	Atmel, National Semiconductors, Microchip, Texas Instruments, Phillips, ST Hitachi or Oki, Teridian, Renesas
4.	**Display modules**	a. The display modules must be well protected from the external UV radiations. b. The construction of the modules should be such that the displayed quantity should not be disturbed with disturbed with life of display. c. The display should be clearly visible over an angle of at least a cone of 70°. d. It should be trans-reflective FSTN or STN Type industrial grade with extended temperature range	<mark>**Genda, Haijing, Holtek, Bonafied**</mark> <mark>**Technologies Korea: Advantek, Truly Semiconductor, Success Hitachi, Sony, Tianma, RCL, Future S&T (Shenzen)**</mark>
5.	**Electronic Components**	The active and passive component should be of the surface mount type and are to be handled & soldered by the state of the art assembly processes.	National Semiconductors, Panosonik. Vishay, Yageo, Diotec Phycom, ON semiconductor, Koshin
6.	**Battery**	Lithium with minimum guaranteed life of 15 years.	Varta, Tedirun, Sanyo or National, Durocell, Maxwell Hitachi, Panasonic and Mitsubishi, Renata, Elegance.

S. No.	Component	Requirement	Makes & Origin
7.	**RTC and Micro Controller**	The accuracy of RTC shall be as per relevant IEC / IS Standards.	Phillips, Dallas Atmel, Motorola, Microchip. NEC or Oki. Renesas, Intersil, Analog Devices, Crysal: FRONTER ELECTRONICS, Roson Electronics.
8.	**PCB**	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm	
S. No.	**Component**	**Requirement**	**Makes & Origin**
9.	**Communication modules**	Communication modules should be compatible for the RS232 ports	National Semiconductors, Hitachi, Texas Instruments, Philips, HP, Agilent, silicon labs Ever light, Fairchild
10.	**Optical port**	Optical port should be used to transfer the meter data to meter reading instrument. The mechanical construction of the port should be such to facilitate the data transfer easily.	National Semiconductors, Hitachi, Texas Instruments, Siemens, Agilent, Philips, Hp, Everlight
11.	**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 incase the maximum voltage of the system appears to the terminals due to faults or due to wrong connections.	
12.	**Mechanical parts**	The internal electrical components should be of electrolytic copper & should be protected from corrosion, rust etc. The other mechanical components should be protected from rust, corrosion etc. by suitable plating/painting methods.	

19.   Guaranteed Technical Particulars

The following guaranteed technical particulars shall be furnished in the format along with the bid without which the bid will be treated as non-responsive

Name of the Bidder………………………………………………………………

1. GUARANTEED TECHNICAL PARTICULARS FOR THREEPHASE – FOURWIRE 10-60A SMART ELECTRONIC ENERGY METER OF ACCURACY CLASS 1.0with PP Box

S. No.	Particulars	Bidders Remark
1.	**Makers Name & Company**	
	a) Meter Serial No.	
	b) Manufacturer Name	
	c) Firmware Version for meter	
S. No.	**Particulars**	**Bidders Remark**
	d) Firmware Version for communication module	
	e) Year of manufacturer	
	f) Software for smart meter remote configuration	
	g) Web Based Software for Meter Data	
2.	**Model**	
3.	**Type of Meter**	
4.	**System voltage with variations**	
5.	**Standard to which the meter conforms**	
6.	**Current**	
	a) Basic current (i$_b$)	
	b) Minimum starting current	
	c) Current overloading capacity	
	d) Short time over current	
	e) Maximum current I$_{max}$ continuously with accuracy	
7.	**Frequency with variations**	
8.	**Humidity**	
9.	**Temperature**	
10.	**Altitude**	
11.	**Class of index**	
12.	**Accuracy**	
	a) Current range	
	b) Voltage range	
	c) Frequency range	
	d) Temperature range	

S. No.	Particulars	Bidders Remark
	e) PF range	
13.	**Demand & integration Period**	
14.	**Specific Dynamic Range**	
15.	**Specified Working Range**	
16.	**Pulse output**	
17.	**Register (Electronic)**	
18.	**Internal Meter Multiplying Factor**	
19.	**Terminal Connection**	
20.	**Meter earthing**	
21.	**Power loss in each current circuit at basic current in VA & watt**	
22.	**Power loss in each voltage circuit at reference in VA & watt**	
S. No.	**Particulars**	**Bidders Remark**
23.	**Display device**	
	a) Type of display i.e. LCD	
	b) Character size of display digits	
	c) No. of display digits for data	
	d) No. of display digits for parameter identification	
	e) Life of display unit (guaranteed)	
	f) Method adopted for display overflow	
	g) Indication of healthiness of potential & current	
	h) Provision of Latching Relay connection /disconnection status	
	i) Meter cover open Tamper Event	
24.	**Maximum Demand**	
	a) Parameters available	
	b) Integration period	
25.	**Provision for MD reset**	
	a) Communication driven reset	
	b) Auto reset at 24:00 hrs at the end of each billing cycle	
	c) Type of MD computation	
26.	**Display parameters in auto scrolling mode**	
	a) LCD Check	
	b) Real time clock - Date and Time	
	c) Cumulative Energy – KWH (I&E)	
	d) Cumulative KVAH (I&E)	
	e) KW MD (I&E)	
	f) Average monthly signed power factor (I&E)	
	g) Tamper count	

S. No.	Particulars	Bidders Remark
27.	**Load Survey Parameters for last 60 days**	
	a) Real Time Clock- Date & Time	
	b) Current(IR)	
	c) Current(IY)	
	d) Current(IB)	
	e) Voltage(VRN)	
	f)Voltage(VYN)	
	g) Voltage(VBN)	
	h) Block Energy – KWH (Import)	
	i) Block Energy – KVAH (lag)	
	j) Block Energy – KVAH (lead)	
S. No.	**Particulars**	**Bidders Remark**
	k) Block Energy – KVAH (Import)	
	l) Block Energy – KWH (Export)	
	m) Block Energy – KVAH (Export)	
28.	**Programmable Parameters**	
	a) Real Time Clock - Date and Time	
	b) Demand Integration Period	
	c) Profile Capture Period	
	d) Single – action Schedule for Billing Dates	
	e) Activity Calendar for Time Zones etc.,	
	f) Time Zones script table	
29.	**MD integration**	
	a) Integration period of MD (Minutes)	
	b) Principle of operation	
30.	**Overall dimensions, weight & drawing**	
31.	**Reference standards**	
32.	**No. of digits displayed**	
33.	**Parameters read out by MRI / HHU**	
	a. Meter serial number, Model, Make	
	b. All parameters as specified in the bid document	
	c. Load Survey data.	
	d. Tamper events details of at least 140 records (in and out) with date and time	
	e. Self-diagnostic details (Real time calendar, low battery)	
34.	**Communication interface available**	
	a) For calibration	
	b) For data transfer	

S. No.	Particulars	Bidders Remark
35.	**Non-volatile memory retention time in absence of power**	
36.	**Provision for connectivity (RS 232)**	
37.	**Max error due to variation in**	
	a) Voltage Variation - 15% to + 10%	
	b) Voltage Variation - 40% to + 20%	
	c) Current 2% to 600% of rated basic current	
	d) Frequency - +/- 5%	
	e) Temperature - + 70c	
	f) PF (0.0 lag -UPF-0.0 lead)	
38.	**Anti-Tamper Features**	
S. No.	**Particulars**	**Bidders Remark**
39.	**Power Supply back up**	
	a) For sorting recorded values	
	b) For taking reading	
	c) For downloading data	
40.	**Measuring principle employed for**	
	a) KWH, KVAH	
	b) Maximum demand parameters	
	c) Power Factor	
41.	**Guarantee period offered for**	
42.	**Microprocessor**	
	a) Address in bits	
	b) Sampling rate	
43.	**Tamper and fraud proof provision for**	
	a) Meters	
	b) Software	
44.	**Sealing arrangement provided**	
	a) Meter body	
	b) Meter Terminal block	
	c) Communication Port	
45.	**Degree of protection against dust, moisture etc.,**	
46.	**Details of battery indication**	
	a) Guaranteed life of battery	
	b) Low battery indication	
	c) Internal battery	
47.	**Provision of real time clock**	
48.	**Self-diagnostic features**	
49.	a) Software Requirement	

S. No.	Particulars	Bidders Remark
	b) Meters ID, Time, Report dates as "HEADER" at the beginning of each type of data	
	c) Meter configuration consisting of the following : Meter data i.e., Serial No., Software version, Hardware version, Basic current, voltage, accuracy class & Pulse output	
	d) Software for Smart prepaid Metering, Billing, collection, Tariff, vending, POS, Database @ central server	
	e) Security for vending features.	
	f) Abnormal events occurrence data	
	g) Tamper data events, Voltage related , Current related, Power related, Transaction related, others, Non rollover events & control events	
	h) All display parameters values shall come in printout	
	i) Historical data of all cumulative parameters for previous 6 months @ reset	
50.	**Facilities for conducting acceptance test and routine test in factory with additional acceptance & other acceptance tests.**	

TECHNICAL SPECIFICATION FOR PILFER PROOF BOX TO HOUSE THE METER

i.   The box shall be weather proof made out of transparent Polycarbonate with flame retardant properties with IP 55

ii.   It shall be capable of withstanding temperatures of boiling water for 5 minutes continuously without distortion or softening. The thickness of the box shall not be less than 3.15mm on the load bearing side (i.e., back side of the box) and other sides, door and roof shall not be less than 3.0mm. The box shall have its roof tapering down to both sides for easy flow of water.

iii.   The Boxes shall generally comply with the provisions of IS 5133 and IEC60 695. The boxes shall be suitable for outdoor/indoor application. The outdoor box shall have its roof designed for easy flow of rain water without any stagnation on the box. The box shall be with good workmanship.

iv.   The dimensions of the box shall be such that there is a minimum clearance of 50 mm on all sides, 25mm clearance on the front and 10mm on the back of the meter then the meter is fixed in the box.

v.   Soft rubber gaskets shall be provided all around wherever required for protection against entry of dust and water.

        a) Colour: Fully transparent

        b) The contents of the box are as follows

vi.   **Internal hinges:** A minimum of 2 nos. internal hinges well protected against corrosion shall be provided. The hinges of the door should be concealed and they shall be fixed to the flanges provided to the base and cover of the box in such a manner that the door opens by a minimum of 120 degrees.

vii.   **Handle:** Suitable handle or knob shall be provided for opening of the box door.

viii.   **Fixing arrangement:** The meter base supports inside the box are raised by about 10 mm in the box for ease of wiring. While fixing the meter screws should not protrude outside. For fixing the box to wall or wooden board 4 nos. key holes of minimum 6 mm dia shall be provided at the four corners of the meter box. The meter is to be installed in the box and the box in the assembled condition shall have provision to fix it to a pole or on wall.

ix. **Latch:** The door shall be provided with a GI latch or a 'U' clamp to secure it with the base of the box.

x. **Sealing arrangement:** The box shall have provision for minimum 2 nos. seals to make it fully tamper resistant.

xi. **Inlet Outlet:** Suitable circular holes shall be provided on the left of the box for inlet/right side of the box for outlet with brass or fire resistance high grade engineering plastic glands securely fixed to the box on both sides by check nuts. The incoming and outgoing cables shall be clamped to the inside base of the meter box to ensure fixing of the cable. Cable glands shall be collapsible type so that there shall be no gap after tightening.

xii. **Printing:** The letters "APCPDCL" and the P.O. No. and date shall be engraved / etched on Metallic lable fixed on the top cover of the box. The name of the manufacture shall be engraved on the bottom half of the box. A blank sticker shall also be fixed on the meter box for use of field staff to indicate Service No. etc.

xiii. The fixing arrangements shall not be complex and it shall be easily approachable for connections when the door is open and is completely tamper resistant once it is sealed.