SUPPLY CHAIN MANAGEMENT

THIRUVANANTHAPURAM

SPECIFICATION

LTCT operated 3Phase Energy meter

APPLICABLE TO KSEBL

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(ii) Amendments and History

Sec. #	***Rev. #***	***Date***	***History of Change***

1. PURPOSE

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **LTCT operated Three Phase Energy Meters** in a professional manner

2. SCOPE

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL. Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of single phase energy meters used in field by KSEBL

3. RESPONSIBILITY

Executive Engineer(M), Office of Chief Engineer, Supply Chain Management shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions

4. PROCEDURE FOR REVISION

Modifications if any, in the technical Specification will be incorporated as **Revisions** . Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev No. 0.1, 0.2 etc .**

A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev No. 1.0, 2.0 etc .**

All the details regarding the revisions (both minor and major) will be incorporated in "(**ii)-Amendments and history "** above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by Chief Engineer- SCM. Those who notice any discrepancy or have any suggestion regarding revision , may bring the matter to the attention of Chief Engineer -SCM in writing or through e-mail id: **cescm@kseb.in**

CONTENTS

TECHNICAL SPECIFICATION FOR LT CT OPERATED THREE PHASE FOURWIRE STATIC METERS (CLASS 0.5S) WITH LCD & TOD FACILITY AND 'S' CLASS CERTIFICATION AND DLMS COMPLIANCE

1. **SCOPE:-** This specification covers the design, manufacture, testing and supply of DLMS compliant & AMR compatible Category C, 3 phase, 4 wire, and accuracy class. 0.5S for kWh and class 1S for kVARh, -/5A LT CT operated static trivector meters with ToD register having ISI Marking, suitable for measurement of active kWh, reactive energy kVARh and apparent energy kVAh and kVA MD, kW MD at nominal frequency in the range of 47.5 Hz to 52.5 Hz in balanced as well as unbalanced load conditions.

2. **STANDARDS APPLICABLE:-**

Manual on Standardization of AC Static Electrical Energy Meters, Pub. No. 325 with latest amendments issued.

AC Static Transformer operated Whr. and VARhr. Meters , Cl.0.2S &0.5S	IS:14697/ 99 reaffirmed 2004
Degree of Protection	IS: 12063
Testing equipment for AC Electrical Energy meter	IS: 12346
Assembling Standard of Electronic components	ANSI/IPC-A-610
Data Exchange/ DLMS	IEC 62056- 21/ IS 15959:2011
EMC- Testing and measurement techniques, Surge immunity test	IEC:61000-4-5/2001-04
Basic environmental Testing procedures for electronic and electric items	IS:9000 and latest amendments thereof
	Guidelines on "Data exchange for electricity Meter reading, Tariff & Load control

3. SERVICE CONDITIONS:-

The meters to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions:

a) Maximum Annual Rainfall (mm)	5000
b) Average Annual Rainfall (mm)	3107
c) Specified operation range of temperature	0^0C to 55^0C
d) Limit of range of operation of temperature	10^0 C to 60 ^{0} C
e) Limit of temperature range for storage and transport	-10^0C to 70^0C
f) Relative humidity (%)	50-99
g) Average no. of thunderstorm days/annum (Isoceraunic level)	50

h) Average number of dust storm days per annum 5

i) Average number of rainy days per annum 120-140

j) No. of months during which tropical monsoon conditions prevail 5

k) Moderately hot and humid climate, conducive to rust and fungus growth.

4. CURRENT & VOLTAGE RATINGS:-

a)	Voltage rating	415V between phases and 240V between phase and neutral.
b)	Voltage variation	+15% to -30%
c)	Standard Basic Current I_b	5 A
d)	Rated maximum current I_{max}	200% of Ib
e)	Standard frequency	50Hz ± 5%
f)	Power Factor:	should work for zero to upf (lag or lead).

5. GENERAL REQUIREMENTS:-

5.1 The firm shall have valid BIS certification with 'S' Mark and ISO certifications 9001/9002/14001.

5.2 The standard reference temperature for performance shall be $27^{o}C \pm 2^{0}C$. If tests are made at a temperature other than that of reference temperature, the results shall be corrected by applying the appropriate temperature coefficient of the meter.

5.3 Unless otherwise specified, the meter should conform to all applicable clauses of standards specified above.

5.4 The meter should start registering the energy at 0.1 % of basic current.

5.5 The meter shall withstand and operate satisfactorily without loss of accuracy under the most hazardous tropical climatic conditions including that specified above.

5.6. Class of Accuracy

5.6.1. The class of accuracy of meter should be 0.5S for kWh meter and 1 for kVARh meter.

5.6.2 The meter should show the readings having an error less than the limits of permissible percentage for all values of current between 5% of basic current and of the maximum current for **all power factor as stipulated in standards** when it is under balanced loads and under reference conditions.

5.6.3 The accuracy shall not drift with time.

5.6.4 Due to the influence of self heating, the error should not exceed 0.2%.

5.6.5 The meter shall be able to carry for 0.5seconds a current equal to 20 times the maximum current and the variation in percentage error should not exceed 0.1%.

5.6.6 Voltage dips and interruptions shall not produce a change in register of more than 0.002 kWh/0.003kVAh.

5.6.7 The accuracy of the meter should not be affected with the application of abnormal voltage/ frequency generating device such as spark discharge of approximately 35 kV.

1. On any of the phases or neutral terminals
2. On any connecting wires of the meter (Voltage discharge with 0-10 mm spark gap) and
3. At any place in load circuit

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

5.6.8 In case any drift is noticed in the accuracy of the meter, which is beyond the permissible limits, the concerned meter shall be withdrawn from service and the manufacturer shall supply a new meter without any extra cost as a replacement (with in one month of receipt from KSEB), during the guarantee period. At any case the overall failure rate of meters should not be more than 2.5% of the quantity supplied. Delay in replacement, will be treated as per the clause specified for replacement of faulty meter.

5.7 Power Consumption:-

5.7.1 Voltage Circuit: The active & apparent power consumption of voltage circuit including power supply of meter at reference voltage, reference temperature & frequency shall not exceed 1.0 Watt & 4.0 VA per phase.

5.7.2 Current Circuit: The apparent power taken by current circuit at basic current, reference frequency & reference temperature shall not exceed 1.0 VA.

5.7.3 The apparent and active power consumption of each circuit of a meter at reference voltage/ current mentioned above is for reference frequency and reference temperature.

6. DESIGN AND CONSTRUCTIONAL REQUIREMENTS:-

6.1 Meters shall be designed and constructed in such a way that in normal conditions, working personal safety against electric shock and non effectiveness of excessive temperature are ensured.

6.2 Meters shall be projection type and shall have **IP51** degree of protection.

6.3 Direct Sunrays may be falling on the Energy Meter and it shall be designed to withstand the temperature.

6.4 Unless otherwise specified, features of meter should be that of insulating encased meter of protective class II as elaborated in clause 4.2.2.5.7 of the CBIP manual, Pub. No. 325 mentioned in this specification.

6.5 Design:-

6.5.1 All insulating materials used in the construction of the meter shall be substantially non-hygroscopic, non aging and of tested quality.

6.5.2 Parts and surfaces, which are subjected to corrosion, shall be provided with protective coating to achieve durable results.

6.5.3 The meter shall have a wireless design.

6.5.4 The meter shall have a Test Output, Operation Indicator, volatile & nonvolatile memory.

6.5.5 Meters shall be designed and constructed in such a way as to avoid introducing any danger in normal use under normal conditions, so as to ensure especially:

1. Personnel safety against electric shock
2. Personnel safety against effects of excessive temperature
3. Protection against spread of fire
4. Protection against penetration of solid objects, dust and water
5. Detection of fraud/ pilferage.

6.5.6 Meter shall be designed with application specific integrated circuit (ASIC) or micro controller; shall have no moving part; electronic components shall be assembled on printed circuit board using surface mounting technology (SMT).

6.5.7 Factory calibration using high accuracy software based test bench shall be used considering the error of standard in over all accuracy as per table 1 of IS 12346.

6.5.8. Assembly of electronic components shall be as per ANSI/IPC-A-610 standard.

6.5.9 Internal power supply circuit shall be designed using highly reliable components. Critical components such as metering ICs (ASIC), Microcontroller etc. shall be procured from STACK or IECQ registered suppliers.

6.5.10 Suitable measure shall be taken in 'Phase' and 'Neutral' circuit to achieve isolation against external interference /electrical spikes.

6.5.11 The measurement by meter shall not get influenced by injection of high frequency AC Voltage/ chopped signal/ DC signal and harmonics on the terminals of the meter.

6.5.12 Complete metering system & measurement shall be immune to the external electromagnetic interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic fields and DC current in AC supply etc. The meter shall be designed in such a way that conducted, radiated or induced electromagnetic as well as electrostatic discharge due to the following disturbances do not damage or influence the meter:

a) Electrostatic discharges
b) Electromagnetically induced fields

c) Electromagnetic radiated RF fields
d) Electromagnetic conducted RF fields
e) Electrical fast transients/ bursts
f) Surges
g) Oscillatory waves

6.5.13 The meter's accuracy shall not be affected at all by magnetic field from all sides of the meter i.e. front, sides, top and bottom of the meter.

6.5.14 Power supply unit in the meter should be transformer less, preferably micro controller type to avoid magnetic influence.

6.5.15 Meter shall be with no external links between voltage and current circuit.

6.5.16 The meter shall be capable to withstand phase to phase voltage (440V) if applied between phase and neutral for minimum 5 min.

6.5.17 The meter shall record and display total energy including harmonic energy.

6.5.18 The meter shall not generate conducted or radiated noises, which could interfere with other equipment in the system.

6.5.19 Display parameters in the meter should not be accessible for reprogramming at site through any kind of communication.

6.5.20 While installing the meter, it should be possible to check the correctness of current and voltage connections to the meter with proper polarity. This may be available in the display of the meter for different ways the voltage and current are injected. For this purpose, **a suitable software for field diagnosis of meter connections with the help of the meter and CMRI should be supplied.**

6.5.21 Under normal conditions of use, electrical circuits and insulation shall not reach a temperature which might adversely affect the operation of the meter. The temperature rise at any point of the external surface of the meter should not exceed 20^0K with ambient temperature at 25 ^{0}C to 45 ^{0}C.

6.5.22 Meter shall withstand an impulse voltage of **10** kV $_{peak}$. The waveform and the generator characteristics used for testing shall be in accordance with IEC 62052-11, clause 7.3.2.

6.5.23 kVAh measurement should be the vector sum of active and reactive energy, even though the vector sum value tends to be the same as arithmetic sum value.

6.6 ToD Timings:-

6.5.1 There shall be provision for at least 6 (Six) TOD time zones for energy and demand. The number of time zones and timings of these ToD Zones shall be programmable.

6.6.2 Programming facility is to be adequately protected from misuse. Measures for protection incorporated should be elaborated by the manufacturer and it should be fool-proof.

6.6.3 The main control for this change shall be available on the computer located at the base station. If the meter is not connected to a base station computer, it should be possible to change with a CMRI/ Laptop with adequate password protection and also should be able to block the same facility if it is connected to a base station computer.

6.6.4 At present the meter should have set for three time zones such as

a. 6:00 hours to 18:00 hours
b. 18:00 hours to 22:00 hours
c. 22:00 hours to 6:00 hours

6.7 Manufacturing Process, Assembly, Testing:-

6.7.1 Meters shall be manufactured using latest and 'state of the art' technology and methods prevalent in electronics industry. All inward flow of major components and sub assembly parts (CT, PT, RTCs/Crystal, LCDs, LEDs, power circuit electronic components etc.) shall have batch and source identification.

6.7.2 Multi-layer 'PCB' assembly with 'PTH' (Plated through Hole) using surface mounted component shall have adequate track clearance for power circuits.

6.7.3 SMT component shall be assembled using automatic 'pick-and- place' machines with in process 7 stages, Re-flow Soldering oven, for stabilized setting of the components on 'PCB'. For soldered PCBs, cleaning and washing of cards, after wave soldering process is to be carried out as a standard practice.

6.7.4 Assembly line of the manufacturing system shall have provision for testing of sub-assembled cards. Manual placing of components and soldering, is to be minimized to items, which cannot be handled by automatic machine.

6.7.5 Handling of 'PCB' with ICs/C-MOS components is to be restricted to bare minimum and precautions to prevent 'ESD' failure to be provided.

6.7.6 Complete assembled and soldered PCB should under go functional testing using computerized Automatic Test Equipment.

6.7.7 Test points should be provided to check the performance of each block/ stage of the meter circuitry.

6.7.8 Testing at intermediate and final stage is to be carried out with testing instruments, duly calibrated with reference standard, with traceability of source and date.

6.8 Construction:-

6.8.1 Meter Base& Cover :-

6.8.1.1 The meter base & cover shall be made out of unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities which is unbreakable, corrosion resistant & inert to chemicals, flame retardant, immune to ultra violet radiation.

6.8.1.2 The meter case and cover should meet UV aging test as per ASTM standards.

6.8.1.3 The manufacturer shall indicate hardness, melting temperature and tensile yield strength of the material and necessary test certificate of the same shall be furnished.

6.8.1.4. The cover shall be transparent.

6.8.1.5. The base and cover shall be ultra-sonically/ **chemically** welded (continuous welding) so that once the meter is manufactured and tested at factory, it should not be possible to open the cover at site except the terminal cover.

6.8.1.6.The Manufacturer shall put **two** seals on meter body before dispatch. Polycarbonate or acrylic or holographic seals shall be used. Lead seals are not permitted at all.

6.8.1.7. The thickness of material for meter body should be 2mm minimum.

6.8.1.8. The bidder shall indicate hardness, melting temperature and tensile yield strength of the material used for the manufacture and necessary test certificate of the same shall be furnished.

6.8.1.9.The polycarbonate material used shall conform to the test requirement of heat deflection test as per ISO:75 and glow wire test as per the relevant Standard. The details are depicted in table below.

Sl. No.	Test	10% Glass filled non-transparent material for meter base & terminal block	Transparent material for meter cover & terminal cover
1)	UV aging for 200 Hrs as per ASTM:G53 (CL. No. 9.3)	4 Hours UV at 60°C, 4 Hours condensation at 50°C	4 Hours UV at 60°C, 4 Hours condensation at 50°C
2)	Boiling water test (10 MIN)	No softening & whitening & No change in colour. Shape, Size & dimensions	No softening & whitening & No change in colour. Shape, Size & dimensions
3)	Ball pressure test as per IEC-60596-10-2	125°C +/- 2°C	125°C +/- 2°C
4)	Flammability Test a) As per UL 94 or b) As per IS:11731 (Part-2) 1986	VO FVO	VO FVO

5)	Glow wire test IS:11000(Part-2/SEC-1) 1984 OR IEC PUB, 60695-2-12	960°C+/-15°C	650°C+/-10°C
6)	Heat deflection Temp. (HDT) HDT/Ae, 1.8 Mpa edge (100mm) As per ISO 75/Ae	132°C	125°C

6.8.1.10. Meter shall be provided with adequate shielding to withstand external magnetic influence from all directions as per latest amendments of CBIP 325 report.

6.8.1.11. The housing shall be provided with a keyhole on the top for fixing, which will not be accessible to the outsider after mounting and the terminal cover sealed. **The keyhole should be so constructed that it shall not affect the degree of ingress protection.**

6.8.1.12. Along with each meter, inside the packing, leaflet/ manual of meter shall be enclosed.

6.8.1.13. Display legend shall be printed or provide the sticker from inside, on the meter cover or terminal cover for providing information of the legend used to define the main measurement quantities, preferably CkWh, Zone wise Bill CkWh, Zone wise bill MD in kVA , CkVAh, bill PF etc.

6.8.2 Terminal Arrangement, Terminal Block and Cover

6.8.2.1 Terminals may be grouped in (a) terminal block(s) having adequate insulating properties and mechanical strength.

6.8.2.2 The terminal arrangement and connection diagram shall conform to IS: 14697. Terminal arrangement shall be marked on terminals as well as in the connection diagram. The diagram shall show the phase sequence for which the meter is intended.

6.8.2.3 Terminals shall be designed to carry I_{max} continuously and under this condition the temperature at the terminal block shall not exceed 70 ^{0}C with ambient temperature within operating temperature range as defined by IS 14697.

6.8.2.4 The terminal block base shall be of same material as meter case or any other superior industrial plastic material having sufficient thickness to cover its back and provide enough strength for the purpose of tightening of screws.

6.8.2.5 Clamping screws (used for tightening the connection to the meter) should be provided inside the terminal cover and should have metallic sleeve moulded within the block to avoid damage during tightening of the screws.

6.8.2.6 The terminal block shall have adequate insulating properties and mechanical strength. The terminal block shall be made from best quality non-hygroscopic, flame retardant polycarbonate material or any other superior industrial plastic material (capable of passing the flammability tests given in IS: 11731) with nickel-plated brass inserts for connecting terminals. The material shall be capable of passing the test given in ISO:75 for temperature of 135 ^{0}C and pressure of 1.8 MPa.

6.8.2.7 The termination arrangement shall be provided with an extended transparent terminal cover as per clause 4.2.2.4.2 of CBIP Manual on standardization of AC static Electrical Energy Meters and shall be sealable independently to prevent unauthorized tampering. The terminal cover of the meter shall be fully covered. Sealing provision shall be made against opening of the terminal cover. It is necessary to provide unidirectional screws with two holes for sealing purpose.

6.8.2.8 The terminals in the terminal block shall be of long socket type suitable for connection of cables with aluminium conductors along with suitable lugs (lugs to be provided by the supplier) having cross sectional area, with adequate length. Double screw arrangement shall be provided to achieve adequate termination. All terminals and connecting screws and washers shall be of tinned/ nickel plated brass material.

6.8.2.9 The terminal screws shall have size not less than M –4 and having **5.5** mm head dia. All terminals and connecting screws should be of Nickel plated brass materials.

6.8.2.10 Cage clamp design shall be provided for the Terminal block.

(OR)

Two screws should be provided in each terminal. The terminals in the terminals block shall be of adequate length in order to have proper grip of conductor with the help of two screws.

6.8.2.11 The screw shall not have pointed end of threads. The ends of screws shall be such as not to pierce and cut the conductor used. The internal diameter of terminal hole should be 5.5 mm minimum. The holes in the insulating material which form an extension of the terminal holes shall be sufficient in size to accommodate the insulation of 6mm^{2} weather proof Al conductor.

6.8.2.12 The terminal cover shall be transparent with minimum thickness **2 mm +/-0.2mm** and the material shall be same as that of meter case. It shall be of extended type and accommodate, in addition to the terminal block, a suitable length of external cable along with its insulation and suitable for wiring from the rear end of the meter board.

6.8.2.13 All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results.

6.8.2.14 The fixing screws used on terminal cover for fixing and sealing shall be held captive in the terminal cover. When the meter is mounted on the meter board, no access shall be possible to the terminals without breaking the seals of the terminal. It is necessary to provide unidirectional/ normal screws with two holes for sealing purpose.

6.8.2.15 The terminal block, terminal cover and meter case shall fulfill the test conditions for heat and fire resistance.

6.8.2.16. The clearance and creepage distance of the terminal block and those between the terminals and the surrounding parts shall not be less than 3 mm. Clearance of minimum 3 mm shall be provided between the incoming and outgoing terminals.

6.8.3 Sealing Arrangement

6.8.3.1. The Manufacturer shall put one seal ensuring traceability on left and right side of the meter body before dispatch. Polycarbonate or acrylic seals shall be used. Lead seals are not permitted at all. Provision for sealing by the utility shall also be there.

The manufacturer should supply three other seals, one for body, one for Optical Port and one for MD Reset button along with each meter. The seals shall have KSEB logo on one side and Bar-code, Serial number on the other side.

The seal provided by the manufacturer at factory shall be a coloured one and the two seals supplied extra shall be colourless. 5% extra colourless seals shall be supplied separately.

6.8.3.2 The seals should have serial numbers. A soft copy (in spread sheet compatible with open office calc / Microsoft excel) of the No. of the seal against the Sl. No. of each meter should be submitted to the consignee along with each lot of supply.

6.8.3.3 Terminal block (Meter Terminal Cover) shall be provided with separate sealing facility (at least two seals) which can be used by testing /commercial group of power utility as follows (a) One seal at left bottom (b) Next seal at right bottom

(OR)

Meter terminal cover shall be hinged to the left side of terminal block and there shall be provision for one seal to be put by utility at the central portion of the Meter Terminal cover.

The hinge, fixing screws used on terminal cover for fixing and sealing shall be held captive in the terminal cover. When the meter is mounted on the meter board, no access shall be possible to the terminals without breaking the seals of the terminal.

6.8.3.4 There shall be provision for sealing the optical port also.

6.8.4 Real Time Clock:-

6.8.4.1 The real time quartz clock (RTC) shall only be used in the meter for maintaining time (IST) and calendar. The time accuracy shall be as per provision of CBIP-325 Tech. report. Facility for adjustment of real time should be provided through CMRI with proper security.

6.8.4.2 RTC shall be pre-programmed for 15 Years Day/date without any necessity for correction. Maximum drift shall not exceed +/- 300 Seconds per year.

6.8.4.3 The uncertainty of setting initial time shall not be more than ± 30 seconds from Indian Standard Time as maintained by NPL, New Delhi.

6.8.4.4 The RTC shall have long life **(10** Years) non-rechargeable battery.

6.8.4.5 Time & date setting shall only be possible through Common Meter Reading Instrument (CMRI).

6.8.4.6 Synchronization of Energy Meter 'RTC' Time/Date shall be possible through password/ Key code enabled command from MRI/CMRI.

6.8.4.7 The RTC battery and battery for display in the case of power failure should be separate.

6.8.5 Testing on Site:-

6.8.5.1 The meter shall be provided with flashing LED to represent the pulse output for testing the meter by suitable testing equipment. The operation indicator must be visible from the front.

6.8.5.2 It shall be possible to check the accuracy of active/ reactive energy measurement of the meter on site by means of LED output. Resolution of the test shall be sufficient to enable the starting current test in less than 10 minutes and accuracy test at the lowest load shall be completed with desired accuracy within 5 minutes.

6.8.6 Display of Measured Values:-

6.8.6.1 Display parameters in the meter should not be accessible for reprogramming at site through any kind of communication. Communication ports provided shall be properly secured by hardware lock as well as software lock to prevent reprogramming. Provision for an external seal by the utility, shall be provided.

6.8.6.2 The push button shall be provided for manual scroll mode and it should be easily accessible for one from the front side of the meter body when the meter is installed. It should be possible to scroll Up and down using pushbutton in complete cyclic manner. It shall be possible to select Display modes / pages using pushbuttons. Separate push button shall be provided for upward/ downward scrolling.

6.8.6.3 The meter shall have 7 digits with parameter identifier and backlit Liquid Crystal Display (LCD). The size of digit should be minimum 10x5mm. The Dot Matrix type LCD is not acceptable. Display legend shall be readable. Backlit shall be provided for the display.

The explanation of the display legends for various parameters shall be provided as a separate sheet and supplied with each meter for easy identification in field.

6.8.6.4 LCD shall be suitable for temperature withstands of 70^0 C.

6.8.6.5. The meter should have a nonvolatile memory, so that the registered parameters will not be affected by the loss of power. The non-volatile memory shall have a minimum retention time of **10** years.

6.8.6.6 Following measuring parameters should be displayed:

Auto Scroll Mode (Display 1)

1. Self Diagnostic
2. LCD Segment Check
3. Real Date and Time
4. Instantaneous R-Phase Voltage(Phase to neutral voltage)
5. Instantaneous Y-Phase Voltage(Phase to neutral voltage)
6. Instantaneous B-Phase Voltage(Phase to neutral voltage)
7. Instantaneous R-phase Current
8. Instantaneous Y-phase Current
9. Instantaneous B-phase Current
10. Phase Sequence(Voltage and current) **(both should be displayed simultaneously)**
11. Instantaneous Power Factor
12. Instantaneous Active Power(KW)
13. Cumulative Forward KWH
14. Cumulative Forward KWH(TOD Zone1)
15. Cumulative Forward KWH(TOD Zone2)
16. Cumulative Forward KWH(TOD Zone3)
17. Rising Demand in kVA with Elapsed Time is required
18. Current Month MD in KVA (TOD Zone1)
19. Current Month MD in KVA (TOD Zone1)
20. Current Month MD in KVA (TOD Zone1)
21. History1:Cumulative Forward KWH(TOD Zone1)
22. History1:Cumulative Forward KWH(TOD Zone2)
23. History1:Cumulative Forward KWH(TOD Zone3)
24. History1:Maximum Demand in KVA(TOD Zone1)
25. History1:Maximum Demand in KVA(TOD Zone2)

26. History1:Maximum Demand in KVA(TOD Zone3)
27. History1: Billed Average Power Factor
28. Present Status of PT related tamper
29. Present Status of CT related tamper
30. Present Status of other tamper

Push Button Mode (Display 2)

1. LCD Segment Check
2. Self Diagnostic
3. Meter Serial Number
4. Real time and date
5. Instantaneous R-Phase Voltage(Phase to Neutral
6. Instantaneous Y-Phase Voltage(Phase to Neutral)
7. Instantaneous B-Phase Voltage(Phase to Neutral)
8. Instantaneous R-phase Current
9. Instantaneous Y-phase Current
10. Instantaneous B-phase Current
11. Phase Sequence(Voltage)
12. Connection OK
13. Instantaneous Power Factor
14. Supply Frequency
15. Instantaneous Active Power
16. Instantaneous Reactive Power
17. Cumulative Forward KWh(TOD ZONE1)
18. Cumulative Forward KWh(TOD ZONE2)
19. Cumulative Forward KWh(TOD ZONE3)
20. Cumulative Forward KWh
21. Cumulative Apparent Energy(KVAH)-TOD Zone1
22. Cumulative Apparent Energy(KVAH)-TOD Zone2
23. Cumulative Apparent Energy(KVAH)-TOD Zone3
24. Cumulative Apparent Energy(KVAH)
25. Cumulative Reactive Energy-kVArh Lag
26. Cumulative Reactive Energy-kVArh Lead
27. Current Maximum Demand in KW (TOD ZONE1) with date and time
28. Current Maximum Demand in KW (TOD ZONE2) with date and time
29. Current Maximum Demand in KW (TOD ZONE3) with date and time
30. Cumulative Current Maximum Demand in KW (Sum of all Billing MD is to be taken as Cumulative Current Maximum Demand in kW)
31. Current Maximum Demand in KVA (TOD ZONE1) with date and time
32. Current Maximum Demand in KVA (TOD ZONE2) with date and time
33. Current Maximum Demand in KVA (TOD ZONE3) with date and time
34. Cumulative Current Maximum Demand in KVA (Sum of all Billing MD is to be taken as Cumulative Current Maximum Demand in kVA)

35. Present Status of PT Related tamper
36. Present Status of CT related tamper
37. Present Status of other tampers
38. Last Occurrence Tamper ID
39. Date of Last Tamper Occurrence
40. Time of Last Tamper Occurrence
41. Last Restoration Tamper ID
42. Date of Last Tamper Restoration
43. Time of Last Tamper Restoration
44. CT Bypass Count
45. CT Open Count
46. Neutral Disturbance Count
47. R Phase PT Miss Count
48. Y Phase PT Miss Count
49. B Phase PT Miss Count
50. R Phase CT Reversal Count
51. Y Phase CT Reversal Count
52. B Phase CT Reversal Count
53. Magnetic Tamper Count
54. Cover open date
55. Cover open time
56. Power On & Off Duration
57. MD reset Counts or bill reset counts
58. History1:Billed Average Power Factor
59. History1:Cumulative Forward KWH(TOD Zone1)
60. History1:Cumulative Forward KWH(TOD Zone2)
61. History1:Cumulative Forward KWH(TOD Zone3)
62. History2:Cumulative Forward KWH(TOD Zone1)
63. History2:Cumulative Forward KWH(TOD Zone2)
64. History2:Cumulative Forward KWH(TOD Zone3)
65. History3:Cumulative Forward KWH(TOD Zone1)
66. History3:Cumulative Forward KWH(TOD Zone2)
67. History3:Cumulative Forward KWH(TOD Zone3)
68. History4:Cumulative Forward KWH(TOD Zone1)
69. History4:Cumulative Forward KWH(TOD Zone2)
70. History4:Cumulative Forward KWH(TOD Zone3)
71. History5:Cumulative Forward KWH(TOD Zone1)
72. History5:Cumulative Forward KWH(TOD Zone2)
73. History5:Cumulative Forward KWH(TOD Zone3)
74. History6:Cumulative Forward KWH(TOD Zone1)
75. History6:Cumulative Forward KWH(TOD Zone2)
76. History6:Cumulative Forward KWH(TOD Zone3)
77. History1:Billing Maximum Demand in kVA (TOD Zone 1)
78. History1:Billing Maximum Demand in kVA (TOD Zone 2)
79. History1:Billing Maximum Demand in kVA (TOD Zone 3)
80. History2:Billing Maximum Demand in kVA (TOD Zone 1)

81. History2:Billing Maximum Demand in kVA (TOD Zone 2)
82. History2:Billing Maximum Demand in kVA(TOD Zone 3)
83. History3:Billing Maximum Demand in kVA (TOD Zone 1)
84. History3:Billing Maximum Demand in kVA (TOD Zone 2)
85. History3:Billing Maximum Demand in kVA (TOD Zone 3)
86. History4:Billing Maximum Demand in KVA (TOD Zone 1)
87. History4:Billing Maximum Demand in KVA (TOD Zone 2)
88. History4:Billing Maximum Demand in KVA (TOD Zone 3)
89. History5:Billing Maximum Demand in KVA (TOD Zone 1)
90. History5:Billing Maximum Demand in KVA (TOD Zone 2)
91. History5:Billing Maximum Demand in KVA (TOD Zone 3)
92. History6:Billing Maximum Demand in KVA (TOD Zone 1)
93. History6:Billing Maximum Demand in KVA (TOD Zone 2)
94. History6:Billing Maximum Demand in KVA (TOD Zone 3)

High precision & History Mode (Display 3)

1. High Resolution Display Cumulative Forward kWh (2+4 digits)
2. High Resolution Display Cumulative kVArh Lag (2+4 digits)
3. High Resolution Display Cumulative kVArh Lead (2+4 digits)
4. High Resolution Display Cumulative kVAh (2+4 digits)

Note:- All Parameters shall be downloadable for analysis as per DLMS format.

6.8.6.7 Active cumulative energy and kVAh shall be displayed for 15 seconds & all other parameters shall be displayed for minimum 6 seconds including LCD check in auto display cycling and push button operation.

6.8.6.8. The maximum demand shall automatically be reset at 24:00 hours of the last day of each calendar month. Manual reset push button shall not be accessible without breaking the seal provided by the utility. MD reset shall be possible without any time restriction.

6.8.6.9. Integration period for kW Maximum Demand should be of 30 minutes real time based.

6.8.6.10. The meter shall be supplied with battery back up feature for displaying the parameters during power OFF condition. Battery life should be minimum fifteen years. Battery back up shall be provided internally.

6.8.6.11. kWh, kVARh and kVAh should have high resolution display to facilitate testing with desired accuracy within reasonable time. It shall be possible to read these high resolution values using CMRI.

6.8.6.12. The change from HR mode to Auto mode shall be after 30 minutes untouched/ unpressed condition, since HR mode is intended for testing purpose.

6.8.6.13. Meter should treat leading pf as Upf.

6.8.7. Anti tamper Features:-

6.8.7.1. The meter shall detect and register the active and reactive energy correctly only in forward direction under any one or combination of following tamper conditions:

a. Change of phase sequence when that of voltage and current are changed simultaneously.

b. Reversal of CT Terminals.

6.8.7.2. The meter should work accurately without earth.

6.8.7.3. The meter should work **accurately** even without neutral.

6.8.7.4. The meter should work in the absence of any one or two phases. It should show the readings accurately for the phases having connection.

6.8.7.5. All the above tampers will be verified at basic current at reference voltage.

6.8.7.6. The potential link shall not be provided on terminal block outside the main meter cover.

6.8.7.7. Visual indication shall be provided to show tamper conditions stated above.

6.8.7.8. The meter shall comply all the test for external AC/DC magnetic field as per CBIP PUB No. 325 with latest amendments. Moreover, the magnetic influence test for permanent magnet of 0.5 T for minimum period of 15 minutes shall be carried out, by putting the magnet on the meter body. After removal of magnet, meter shall be subjected to accuracy test as per IS 14697/1999 (amended up to date).

6.8.7.9. In the event the meter is forcibly opened, even by **2mm displacement** of the meter cover, same should be recorded as tamper event with date & time stamping and the meter should continuously display that the cover has been tampered. This display shall toggle with the normal display parameter.

6.8.7.10. The meter should be capable of recording the occurrences of a missing potential and its restoration with date and time of first such occurrence and last restoration along with total number and duration of such occurrences during the above period for all phases.

6.8.7.11. The meter should detect CT polarity reversal and record the same with date and time of first such occurrence and last restoration along with total number and duration of such occurrences during the above period for all phases.

6.8.7.12. A general visual indication for any tamper should be provided for easy identification whether any tamper is present or not.

6.8.8 Self-diagnostic Tests:-

6.8.8.1 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:

a. Time and date on meter display
b. All display segments (all alpha numeric) on meter display
c. Battery
d. Self diagnostic (RTC, NVM information) on display

6.8.8.2 All display segments: "LCD Test" display shall be provided for this purpose.

7. OPERATIONAL REQUIREMENTS:-

7.1. Limits of Error:-

7.1.1. Short time over currents should not damage the meter. The meter shall perform correctly when back to its initial working condition and the variation of error shall not exceed ±0.2 %. Meter shall be able to carry a current equal to 20 I_{max} with relative tolerance of 0% to -10% for 0.5 sec.

7.1.2. Variation of error due to self heating shall not exceed ±0.2 % for active energy reading at upf and at 0.5 lag pf and for reactive energy for sin Φ =1 or 0 .866 shall not be more than ±0.5/±0.7 %.

7.1.3. Under normal conditions of use, electrical circuits and insulation shall not reach a temperature which might adversely affect the operation of the meter. The temperature rise at any point of the external surface of the meter shall not exceed 20 ^{0}K with ambient temperature at 25 to 45 ^{0}C.

7.1.4. Voltage dips and short interruptions shall not produce a change in the register of more than X units and the test output shall not produce a signal equivalent of more than X units; and X is given by,

$X=10^6 \, mV_n \, I_{max}$

Where m = No. of measuring elements

V_n = Reference Voltage in volts

I_{max}= Maximum current in amperes.

When the voltage is restored, the meter shall not have suffered degradation of its metrological characteristics.

7.1.5. Limits of variation in percentage error due to change in voltages, frequency, waveform, voltage unbalance and phase sequence reversal etc. shall not exceed the values given in the table below (in bracket, allowable limit for reactive energy is given.)

Influence quantities	Value of current (balanced unless otherwise stated)	Cos Φ Or Sin Φ	Limit of variation in percentage error for class **0.5** meter
Voltage Variation ± 10%	$0.05I_n \leq I \leq I_{max}$	1	±0.2(±0.4)
	$0.1I_n \leq I \leq I_{max}$	0.5 inductive	±0.4 (±0.8)
Voltage Variation between -20% and +20%	$0.05I_n \leq I \leq I_{max}$	1	±0.6 (±1.1)
	$0.1I_n \leq I \leq I_{max}$	0.5 inductive	±1.2 (±1.5)
Frequency variation ± 5%	$0.05I_n \leq I \leq I_{max}$	1	±0.2 (±0.4)
	$0.1I_n \leq I \leq I_{max}$	0.5 inductive	±0.2 (±0.4)
Harmonic components in the current and voltage circuit**	$0.5\ I_{max.}$	1	±0.5
Wave form: 10% third harmonic in current circuit**	$0.05I_n \leq I \leq I_{max}$	1	±0.1
Odd harmonics/ sub harmonics in current circuit**	$0.5I_n$	1	± 1.5
Voltage unbalance(due to interruption of one or two phases)	I_n	1	± 1.0 (± 2.0)
Phase Sequence Reversal	$0.1I_n$	1	±0.1(±0.2)
Stray DC magnetic induction of external origin	I_n	1	± 3.0 (± 3.0)
Abnormal DC magnetic induction of external origin	I_n	1	± 4.0 (± 4.0)*
Stray AC magnetic induction of external origin	I_n	1	± 1.0 (± 2.0)*
Abnormal (10mT) AC magnetic induction of external origin	I_n	1	± 4.0 (± 4.0)*
Abnormal (200 mT) AC magnetic induction of external origin	I_n	1	± 4.0 (± 4.0)*

Electro magnetic RF fields	I_n	1	± 2.0 (± 2.0)
Conducted disturbance , induced by radio frequency fields	I_n	1	± 2.0 (± 2.0)
Fast transient bursts	I_n	1	± 2.0 (± 4.0)
Damped Oscillatory wave immunity	I_n	1	± 2.0 (± 2.0)

* Subject to the conditions of note of Table 17 in the 'Manual on standardization of AC Static Energy Meters'

** Applicable only for active energy

7.1.6. Removal of neutral shall not affect the operation of meter.

7.2 Abnormality of Events:-

7.2.1. The meter should have features to detect the occurrence and restoration of the following abnormal events:

1) Missing potential and potential imbalance:-

The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of potential failure(one phase or two phases) and low potential, which could happen due to disconnection of potential leads (one or two), even at zero current. Meter shall also detect and log cases of voltage unbalance (**20% or more** for 5 Minutes.) Higher of the 3 phase voltages shall be considered as reference for this purpose. All potential missing cases shall be considered as power failure.

2) Current unbalance:-

The meter shall be capable of detecting and recording occurrence and restoration with date and time of current unbalance (30% or more for 15 minutes) Higher of the 3 phase currents shall be considered as reference for this purpose.

3) Current Reversal:-

The meter shall be capable of detecting and recording occurrence and restoration with date and time of reversal of current with phase identification for persistence time of 5 minutes. It should also possess a current reversal counter.

4) Power OFF:-

The meter shall be capable to record power OFF events in the meter memory. All potential failure should record as power off event. The meter shall keep records for the minimum 280 events. (Occurrence+Restoration). For above abnormal conditions the recording of events shall be on FIFO basis.

5) Current circuit short:-

The meter shall be capable of detecting and recording occurrences and restoration of shorting of any one or two phases of current, with date & time of occurrence and restoration.

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

7.2.3. The meter shall keep records for the minimum **280** events of abnormality (Occurrence +restoration). For above abnormal conditions, the recording of events shall be on FIFO basis. It shall be possible to retrieve the abnormal event data along with all related snap shots data through the meter optical port with the help of CMRI & downloaded the same to the base computer. All the information shall be made available in simple & easy to understand format.

Compartmentalized as follows:

a) Missing potential and potential imbalance	-	25
b) Current unbalance:	-	25
c) Current Reversal:	-	25
d) Magnetic tamper	-	26
e) Cover open	-	1
f) Power off	-	28
g) Current circuit short (may be treated as CT bypass)	-	25
h) Change of Phase and Neutral (Neutral disturbance)	-	25
j) Reversal of CT Terminals	-	25

8. Connection Diagram and Terminal Marking:-

8.1. Every meter shall be indelibly marked with a connection diagram showing the phase sequence for which it is intended and shall be clearly shown on the inside portion of the terminal cover and shall be of permanent nature. In case any special precautions need be taken at the time of testing the meter, the same may be indicated along with the circuit diagram.

8.2. Meter terminals shall also be marked and this marking should appear in the above diagram.

8.3. Stickers of any kind will not be accepted.

9. NAME PLATE DETAILS:-

9.1 Every meter shall have a nameplate clearly visible and indelible and distinctly marked in accordance with relevant standards. The following information shall appear on a nameplate preferably placed within the meter.

1. Manufacturer's name & trade-mark and place of manufacture.
2. Serial number (Serial Number should be in the name plate itself along with other details and should not be on the meter front cover)
3. Designation of type.
4. Number of phases and number of wires for which the meter is suitable.
5. Guarantee period.
6. Purchaser's name
7. Purchase Order No.
8. Principal unit in which the meter records.
9. Reference voltage & frequency in Hz.
10. Basic current and rated maximum current .
11. Meter constant (pulse rate of testing signal).
12. Reference Temperature
13. Class index.
14. Month and Year of manufacture
15. BIS & 'S' marking as per statutory requirement
16. All Inclusive Unit Rate in Rs.
17. "LTCT Meter".

9.2 The Meter Serial No. shall be Bar Coded along with numeric No. The size of Bar Code shall not be more than 35 X 5 mm.

9.3 Stickers in any case will be not accepted.

10. DATA COMMUNICATION FACILITIES:-

10.1. Data architecture and communication protocols shall enable easy multi-vendor exchange of data without usage of any converting/ translating equipment. For this, the data structure adopted within the energy meter shall be on an internationally acceptable method. The data structure/ coding details shall be furnished to the Owner. All necessary software required for down loading the information to a user friendly Windows'/ LINUX based operating system of Base billing computer system through CMRI shall be furnished in required number of copies (On CD) without any additional cost to the purchaser.

10.2. The data transfer shall be highly reliable and fraud proof (No editing shall be possible on base computer by any means).The software shall have capability to convert all the data into ASCII format.

10.3. Energy meter shall have a galvanically isolated optical communication port with proper cover & sealing facility in front of the meter for data transfer to or from a hand held CMRI/ LAPTOP and a port for remote reading and both conforming to IEC 62056-21)

a) LOCAL COMMUNICATION PORT

The energy meter shall have a galvanically isolated IEC 1107 optical communication port with proper cover & sealing facility located in front of the meter for data transfer to or from a hand held Data Collection Device. The sealing provision should be available for optical port.

b) REMOTE COMMUNICATION PORT

Meter shall have an additional communication port (RS 232) in the form of RJ11 port to interface external modem for remote data collection. RS 232 (RJ11) port shall be preferably located under the terminal cover.

Both the ports will support communication on DLMS and should be accessible through a DLMS compliant HHU

Provisions for sealing both the ports are to be made available.

10.4 Meter reading during Power Off:- It should be possible to read the meter display visually and with MRI in absence of input voltages with help of battery backup.

10.5 DATA DOWNLOADING CAPABILITY:-

Meter shall support a minimum baud rate of 9600 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 companion standard.

11. Billing History and Load survey:-

11.1. The meter shall record the history of billing parameters, Cumulative kWh at the time of reset and kVA MD, for last 6 months.

11.2. Load survey parameters are kWh, kVARh, kVAh and MD (kVA), Voltage and current.

11.3. The logging interval for load survey shall be 30 minutes. Load survey data shall be logged for the last 60 days on time basis. This load survey data can be retrieved using CMRI/ Laptop/ any suitable equipment as and when desired and load profiles shall be viewed graphically or analytically with the help of meter application software. Whenever meter is taken out and brought to laboratory, the Load Survey data shall be retained for the period of actual use of meter. The meter application software shall be capable of exporting / transmitting these data for analysis to other user software in spreadsheet format.

12. Tests:-

12.1. The meter shall be tested with its base and cover in position; all parts intended to be earthed shall be earthed.

12.2. Before any test is made, the circuits shall have been energized for a time sufficient to reach thermal stability but not less than one hour.

12.3. T**he connection shall be done as** marked on the diagram of connections.

12.4. The voltage and currents shall be substantially balanced. Voltage between line and neutral or between any two lines shall not differ from the average by more than 1% and current in the conductors shall not differ more than 2% from the average current. The phase displacement of each of these currents from the corresponding line-to- neutral voltage shall not differ from each other by more than 2^0.

12.5. All tests are to be carried out under reference conditions as specified in IS 14697/1999 unless otherwise specified. Permissible tolerances will be as mentioned in the table.

12.6. During the tests for accuracy requirements, proper repeatability conditions shall be maintained. During type tests, repeatability at any test point determined on the basis of three readings at short intervals, shall be better than 1/5 th of the limit of percentage error under reference conditions. Manufacturer shall state the necessary number of pulses/ pulse counts for maintaining the repeatability condition.

12.7. Uncertainty of measurement of percentage error shall not exceed 1/5 th of the limit of percentage error for the given test point at reference conditions. If the uncertainty exceeds this limit, all the limits of percentage errors shall be reduced as described in CBIP 'manual on standardization of AC static energy meters' to make allowances for such uncertainty.

12.8. Unless otherwise specified, procedure for carrying out tests and the results of those tests shall conform to the relevant clause in Manual on Standardization of AC Static Electrical Energy Meters, Pub. No. 325, CBIP, and if it is not mentioned in the above manual, then to IS 14697/1999 (amended up to date) or CBIP Tech-Report 325 with latest amendments.

A) Type Tests:

12.9. Meter shall be fully type tested as per IS 14697/1999 (amended up to date), Manual on Standardization of AC Static Electrical Energy Meters, Pub. No. 325, CBIP, with latest amendments.

12.10. Requirement of results and the procedure for conducting tests which are not specifically mentioned in this document shall be same as that mentioned in the Manual on Standardization of AC Static Electrical Energy Meters, Pub. No. 325.

12.11. The Type Test Reports shall clearly indicate the design and constructional features of the type tested meters.

12.12. Separate Type Test Reports for each offered type of meters shall be submitted.

12.13. All the Type Tests shall have been carried out from Laboratories such as CPRI, Bhopal, ERDA, ERTL (East) or equally reputed and accredited by the National Board of Testing and Calibration Laboratories (NABL) of Govt. of India to prove that the meters meet the requirements of the specification.

12.14. Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.

12.15. Type test certificates rather than type test reports are preferred.

12.16. Type test certificate/ reports shall be submitted along with the offer and the same shall not be more than **24** months old on the date of opening tender. If the type test certificate/ reports are not with in the valid period, the offer shall be rejected.

12.17. In case the test certificate / reports partially is/ are not meeting the requirement tests are to be carried out at no extra cost in owners presence. The same should be assured at the time of bidding.

12.18. A test shall be carried out under reference voltage, rated frequency and cos Φ (Sin Φ) for active (reactive) energy meter with 5% of rated current and maximum continuous current. In each of these load conditions, 20 error tests are to be successively carried out at intervals of minimum 5 minutes. The variation in error expressed by the difference between the maximum and minimum of the errors so obtained in all these error tests shall not exceed the value corresponding to 1/5 th of the limit of percentage error at the test points.

12.19. Type tests shall be applied to three test specimens. All the specimens shall pass the type tests. In the event of one specimen failing, further three specimens can be taken.

12.20. Lists of tests to be carried are as follows:

Tests on Insulation Properties:-

1. Impulse Voltage Test
2. AC Voltage Test
3. Insulation Resistance Test

Tests on accuracy requirements

1. Test on limits of error
2. Test of meter constant
3. Test of starting condition
4. Test of no load condition
5. Repeatability of error test
6. Test of ambient temperature influence
7. Test of influence quantities

Tests on electrical requirements

1. Test of power consumption
2. Test of influence of supply voltage
3. Test of influence of short time over currents
4. Test of influence of self heating
5. Test of influence of heating
6. Test of abnormal voltage condition

Test for Electromagnetic Compatibility

1. Test of immunity to electrostatic discharge
2. Fast Transient burst test
3. Test of immunity to electromagnetic HF fields
4. Test of immunity to conducted disturbances induced by RF fields
5. Test of immunity to damped oscillatory waves
6. Test of immunity to surge
7. Radio interference suppression

Test of Climatic Conditions

1. Dry heat test
2. Cold test
3. Damp heat cycle test

Tests of Mechanical Requirements

1. Vibration Test
2. Shock test
3. Spring Hammer Test
4. Test of protection against penetration of dust and water (Degree of Protection)
5. Test on resistance to heat and fire

Routine and Acceptance Tests

12.21. Meters shall pass the entire acceptance and routine tests, as laid down in Manual on Standardization of AC Static Electrical Energy Meters, Pub. No. 325, CBIP, and also additional acceptance tests as prescribed in this specification. (3 to 8 meters from a lot more than 1000 will be selected randomly in the factory and will be tested for tamper events).

12.22. Following routine tests are to be conducted on every product:

1. AC Voltage Test
2. Insulation Resistance Test
3. Test on limits of error
4. Test of meter constant
5. Test of starting condition
6. Test of no load condition

12.23. An acceptance test shall be carried out under the reference voltage, rated frequency and Cos Φ (Sin Φ) = 1 for active (reactive) energy meter sat 5% of rated current. Six error tests are to be carried out successively in the load condition at intervals of 5 minutes. The variation in meter error expressed by the difference between the maximum and minimum of the errors so obtained in all these error tests shall not exceed the value corresponding to 1/5 th of the limit of percentage error at the test points.

12.24. Following acceptance tests are to be carried out selected samples from a lot:

1. No load and starting conditions tests
2. AC Voltage Test
3. Insulation Resistance Test
4. Test on limits of error
5. Test of meter constant
6. Test of starting condition
7. Test of no load condition
8. Repeatability of error test
9. Test of power consumption

12.25. In addition to these acceptance tests following additional tests are to be conducted.

1) Other Acceptance Tests:

i) The meter shall withstand continuously for a period of at least 5 minutes at a voltage of 440 V between phase and neutral without damage/problems,

ii) Tamper conditions as stated in this specification.

(iii) Glow wire testing for polycarbonate material.

12.26. **Normal Sampling Plan**

For acceptance test, meters shall be selected at random from the lot, depending upon the size of the lot and the desired acceptance quantity level.

a) No load condition & starting condition:- While accepting the meters at TMR Divisions, the number of sample meters will be taken out from the lot for testing (lot means the total number of meters received in a Store out of inspected and approved lot by purchaser's representative under one approval letter) depending upon the size of the lot and will be taken random from the lot in accordance with the following table.

Lot size	Number of meters to be selected at random
Upto 300	8
301 to 500	13
501 to 1000	20
1001 and above	32

Selection of number of sample meters by the consignee per lot for testing is subject to vary as per the latest IS on sampling.

If the number of defectives found in the sample of 32 is less than or equal to 1, the lot will be considered. If the number of defectives is greater than or equal to 4, the lot will be rejected. If the number of defective is 2 or 3 a further sample of 32 meters will be taken and subjected to the tests. If the number of defectives in two samples combined is less than 4, the lot will be considered as conforming to the tests, otherwise rejected.

b) Tests of insulation resistance, Ac voltage test, Test of power consumption:-Tests of insulation resistance, Ac voltage test, Test of power consumption, test of meter constant/registration, limits of error and interpretation of test results and adjustment.

From the sample of meters which have been drawn according to above clause 'a' and those that have passed all test of a sample of 8 meters shall be tested, all of which shall pass for conformity to these tests. If any one of the meters fails the whole lot shall be declared not conforming to the requirements of these test.

c) Test of repeatability of Error:- Above tests shall be carried out on 3 samples selected from above meters under clause 'b' and shall be tested for repeatability of error test separately. If any one of the meters fails the whole lot shall be declared not conforming to the requirement of these tests

If any lot fails, test at factory or at any TMR, normal sampling plan will be adopted at TMRs and double sampling plan will be adopted for test at factory for all future samples. It is specified below.

12.27) **Double Sampling Plan:-**

Additional quantity if any in excess of 10000 Nos will be treated as a second lot and the samples will be selected as given below . At any case the maximum quantity of a single lot should not be more than 10000 numbers".

Generally applicable Double sampling plan as per IS 2500 (Part-I/2000)

Lot size	sample	Sample size	Cumulative sample size	Acceptance No.	Rejection No.
281 to500	1st	32	32	0	2
	2nd	32	64	1	2
501 to 1200	1st	50	50	0	3
	2nd	50	100	3	4
1201 to 3200	1st	80	80	1	3
	2nd	80	160	4	5
3201 to 10000	1st	125	125	2	5
	2nd	125	250	6	7

All sample of meters selected will be tested for no load condition, starting condition and limits of error.

12.29. For limits of error, minimum six metro-logical points as per table 15 & 16 of IS 13779 shall be selected and one point will be considered as one characteristic test. Any meter failing in any one of these tests shall be treated as non-conformity.

12.30. If the number of non-conforming meters found in the sample is less than or equal to acceptance number, the lot shall be considered to be conforming to these tests.

12.31. If the number of non-conforming meters is in between acceptance and rejection numbers, a further sample of meters will be taken and subjected to these tests. If the number of non-conforming meters in two samples combined is less than acceptance number of the second sample, the lot shall be considered as conforming to these tests, otherwise rejected.

12.32. From the sample meters passed the above mentioned three tests, a sample of at least 13 meters shall be tested for insulation resistance, AC Voltage and meter constant. All the meters shall pass for conformity to these tests. If any one of the meters fails in any of these tests, the whole lot shall be declared not conforming to the requirement of these tests.

12.33. After passing 12.32, Test for repeatability of error and power consumption shall be carried out on five samples that passed tests for no load condition, starting condition and limits of error. If any of the meters fails in any of these two tests, the whole lot shall be declared not conforming to the requirements of these tests and the lot shall be rejected.

12.34. Only on samples passed test of repeatability of error and power consumption, additional acceptance tests are to be carried out. All meters should pass all these tests; otherwise the lot will be rejected.

C) Pre dispatch Inspection:-

12.35 All Acceptance tests and Inspection shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the manufacturer and purchaser at the time of purchase.

12.36 The manufacturer shall offer to the inspector representing the purchaser, all the reasonable facilities, free of charge, for inspection and testing, to satisfy him that the material is being supplied in accordance with this specification. The Company's representative(s) / Engineer(s) attending the above testing will carry out testing on suitable number of meters as per sampling procedure mentioned in this document and additional acceptance test as per this specification on samples that have passed all the tests mentioned in clause 12.24 and 12.25 and issue test certificate approval to the manufacturer and give clearance for dispatch.

12.37 All the meters offered for inspection shall be in sealed condition. The seals of sample meters taken for testing & inspection will be opened & resealed after inspection.

12.38. KSEB has the right to ask the supplier to furnish new type tests Certificate of sample meters, in accordance with Clause 12.25, at supplier's cost, at any time after completing supply of 50% of the ordered quantity. The sample for these tests will be selected from the quantity of meters already supplied. If the selected meters fail in type tests, KSEB has the right to cancel the purchase order for the **unexecuted portion.**

D) Inspection after Receipts at Store:-

12.39 Testing as per clause 12.26 (normal sampling plan) will be done at TMRs. Physical inspection and sealing also will be done at TMRs. If requested in writing the Chief Engineer (SCM) may permit the suppliers representative to witness the test at TMRs.

12.40 If the sample/s selected, does not conform to the tests, lot will be rejected and no compensation will be given.

Physical verification:- The sample meters shall be verified for conformity of physical requirements such as RTC fail,push button fail, tamper indications, display fail, discrepancy in display, pulse fail, battery back ups, damaged body/ cover / terminal cover, non matching screws and threads, improper holes in sealing screws etc.

"On physical verification, if the samples selected vide clause No.12.26(a) are found to be defective, then, the clause No.12.28 should be read as "a sample of meters selected will be tested for no-load condition starting condition, limits of error and physical conditions."

12.41 **No: of resubmission & rejection at each TMR:-**

The supplier shall be permitted to replace rejected lot only once in each lot in each TMR. Further rejection of replaced quantity will lead to deduction of the same quantity from the purchase order quantity. If the total deducted quantity is more than 20% of the ordered quantity, the KSEBL reserves the right to cancel the purchase order and to blacklist the firm.

13. Guarantee

13.1. The Three Phase four wire CT operated meters with LCD and ToD facility should be guaranteed for a minimum period of five years from the date of acceptance of last part of the consignment by KSEBL.

13.2. The meter should have a design life not less than ten years.

13.3. The meter found defective within the above guarantee period shall be replaced by the supplier free of cost, within one month from the date of receipt of intimation. The intimation shall be either by hand or by registered post / courier with proper acknowledgement.

13.4. If defective meters are not replaced within the specified period as above, KSEBL shall recover an amount equivalent to the cost of meter plus 15% supervision charges from any of the bills of the supplier. If the meters are replaced , the amount recovered less the 15% Supervision charges , will be released to the supplier.

14. Quality Control:-

The purchaser has a right to send a team of experienced engineers for assessing the **progress of** manufacturing and quality at any time The team should be given all assistance and cooperation for inspection and testing at the bidder's works.

15. Minimum Testing Facilities Required at Manufacturer's End:-

15.1. The following Manufacturing and testing facilities shall be available.

i) The factory shall be completely dust proof.
ii) The testing rooms shall be temperature and humidity controlled as per relevant Standards.
iii) The testing and calibrating equipment should be automatic and all test equipment shall have their valid calibration certificates
iv) Should have duly calibrated Electronic reference standard meter of class 0.1 or better accuracy.
v) Power supplies used in testing equipment shall be distortion free with sinusoidal waveforms and maintaining constant voltage current and frequency as per the relevant Standards.
vi) Should have fully automatic Test Bench having in-built constant voltage, current and frequency source with facility to select various loads automatically and print the errors directly without human intervention

15.2. During the manufacturing of the meters following minimum checks shall be carried out.

a) Meter frame dimension tolerance shall be minimum.

b) The pressure coil shall be made totally encapsulated and care shall be taken to avoid ingress of dust and moisture inside the coil.

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

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

e) The current coil shall be made with the help of jigs and fixtures.

f) The potential coil shall be made with automatic computerized machine.

Manufacturer should possess fully computerized Meter Test Bench System for carrying out all routine and acceptance Tests **as per IS 14697/1999 (amended upto date)** including additional acceptance tests specified in this document. Routine test reports for each and every meter and acceptance test reports for samples selected shall be generated and submitted for the approval of lot. The list of testing equipment available in manufacturer's premise shall be intimated at the time of bidding. One copy of test report, approved data sheet and operating manual shall be despatched with the meter.

16. Quality Assurance Plan

16.1. The supplier shall invariably follow QAP furnished along with the bid.

16.2. Precautions taken for ensuring usage of quality raw material and sub component shall be as stated in QAP.

16.3. The manufacturer shall have a comprehensive quality assurance program at all stages of manufacture for ensuring products giving reliable, trouble free performance. The manufacturer's quality assurance plan submitted along with bid document, would be reviewed in detail by KSEBL and modifications, as felt necessary, suggested should be incorporated.

16.4. KSEBL reserves the right to carry out quality audit and quality surveillance of the systems and procedure of the quality management & control activities. The supplier shall provide all necessary assistance to enable KSEBL to carry out such audit & surveillance.

17. Component Specification:-

Sl. No.	Component Function	Requirement	Makes
1)	Measurement or computing chips	The measurement or computing chips used in the Meter should be with the Surface mount type.	USA: Anolog Devices, Cyrus Logic, Atmel, Philips Dallas, ST Germany:Siemens Texas, Japan : NEC, Freescale Renesas
2)	Memory chips	The memory chips should not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. Meter shall have non volatile memory (NVM). No other type of memory shall be used for data recording and programming.	USA: Atmel, National Semiconductors, Texas Instruments, Philips, ST, Japan : Hitachi Germany: Siemens **Renesas**

		(The life of the NVM is highest) There shall be security isolation between metering circuit, communication circuit, and power circuit.	
3)	Display modules	a) The display modules should be well protected from the external UV radiations. b) The display visibility should be sufficient to read the Meter mounted at height of 0.5 to 2m from ground level (refer 3.2 d for Viewing angle). The LCD and ToD facility display should have wide viewing angle of 45 degree to 60 degree cone up to 1m distance. c) The construction of the modules should be such that the displayed quantity should not disturbed with the life of display (PIN Type). d) It should be trans-reflective HTN (HTN – Hyper Twisted Nematic (120°)) or STN (STN – Super Twisted Nematic (160°)) type industrial grade with extended temperature range. HTN – Hyper Twisted Nematic (120°) STN – Super Twisted Nematic (160°)	Japan : Hitachi, Sony. L&G, Haijing Tinma (China) TEXAS **RCL, Yeboo, Truly**
4)	Electronic components	The active & passive components should be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	USA : National Semiconductors, Atmel, Philips, Texas, Instruments, BC Component Japan : Hitachi, Oki, AVZ Samsung, Japan : Panasonic, Germany : Vishay **NXP, Murata, AVX, ROHM, Yageo, Kernet, Onsemi, Epcos**

5)	Battery	Only non rechargeable battery should be used for RTC and for display both rechargeable and non rechargeable battery may be used. The RTC battery and battery for display in the case of power failure should be separate.	USA : Maxell Japan, Indonesia : Panasonic, Sony, Germany : Varta, France : Saft Elegance , Vitzro, Tekcell **Saft, Mitsubishi, Eterncell**

Sd/-

CHIEF ENGINEER (SCM)

GUARANTEED TECHNICAL PARTICULARS

Sl. No	PARTICULARS	REMARKS
1 (a) (b)	Type Model No.	
2	Standard/s to which the meter conforms	
3	Guarantee Period from the date of first Installation	
4	Rated Voltage:	
5	Basic Current(I_b):	
6	Maximum Current(I_{max})	
7	Frequency Range:	
8	Power Factor Range	
9	ISI mark	
10	Minimum Starting Current	
11	Accuracy class for kWh and kVARh	
12	Test Output device	
13	Operation indicator	
14	Power consumption in voltage and current circuit	
15	Limits of error at all Power factor of unity/0.5 at multiples of rated currents	
16	Change in error due to	
	Variation in Frequency	

	Variation in Temperature	
	Variation in Voltage	
	Variation in Current	
	Due to Single Phase current	
17	One minute Power frequency withstand Voltage	
18	Compliant to EMC & EMI	
19	Basic insulation level: Impulse withstand Voltage	
20	Current rating of the terminal	
21	External Magnetic Influence	
22	Maximum size of cable, which can be connected at terminals	
23	Terminals to be bi-metallic and suitable for Aluminum / Copper Cables	
24	Maximum number of ToD zones that can be programmed and are programmed	
25	Integration period for MD that is programmed and can be programmed	
26	Whether programming of ToD and MD integration period can be done in the field using CMRI or Laptop	
27	If so, whether the facilities are having adequate security and if so, detail it.	
28	ToD wise kWh andkVAh	
29	Whether phase wise kVAR ,KW & KVA, overall pf, MD reset count, frequency, time & date , RTC battery health parameters are available in	

	data collection?	
30	Terminal Block material	
31	Material for meter base and cover and whether the cover is transparent	
32	Material for terminal cover and whether the cover is transparent	
33	Resistance to Heat and Fire	
34	Details of meter case	
35	Degree of protection against dust and water	
36	Details of alpha-numeric LCD display	
37	Display parameters available in auto scroll mode and display time of each parameter	
38	Display parameters available in manual scroll mode and display time of each parameter	
39	High resolution display parameters	
40	No. of digits in the display	
41	Tamper protection features	
42	Whether test output provided	
43	Meter & Terminal Cover sealing	
44	Date of issue of Type Test Certificate/report	
45	Issuing authority of type test certificate/ reports	
46	Whether any changes in design from that type tested	
47	Whether all type tests were conducted and all are on same design	

48	Whether meter is designed with ASIC or microcontroller	
49	List of bought out items which are used in the manufacturing of the meter	
50	Standard followed in Assembly of electronic components	
51	Suppliers of metering ICs and microcontrollers	
52	Whether the suppliers are STACK or IECQ registered suppliers	
53	State of art technology used in the manufacturing and assembly	
54	Provision for testing sub- assembled cards	
55	Details of volatile memory used	
56	Whether terminal cover is an extended transparent terminal cover	
57	Minimum clearance and creepage distance of the terminal block and those between the terminals and the surrounding parts	
58	Whether RTC is pre-programmed	
59	Life of RTC battery	
60	Maximum drift of RTC per year	
61	Way of synchronisation of Energy Meter and 'RTC'	
62	Life of Battery for display parameters	
63	Whether meter terminals are marked	
64	Connection diagram is provided and whether it is a sticker?	
65	Name plate details and whether meter serial number and bar code is given in the name	

	plate	
66	Meter base and cover jointing method	
67	Method adopted to transform voltage and current to the desired low values	
68	Details of factory programmable parameters	
69	Details of user programmable parameters	
70	Data communication facilities	
71	Whether All necessary software for down loading the information through CMRI will be supplied without any additional cost?	
72	Whether Energy meter have a galvanically isolated optical communication port as per IEC 62056-21?	

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